Ref:	**NR/SMS/Part/C**
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NR/L3/SIG/10663

NR/SMS/Part/C

Technical Instruction

Issue date: 16th November 2023
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Technical Instruction TI 182 is attached to this standard/control document.

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

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

Jerry Morling

Network Technical Head Signalling

Technical Instruction

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Expiry date: 29th September 2025

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

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

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

Jerry Morling

Network Technical Head Signalling

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NR/SMS	Equipment
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TW02	Airport Trip Wires – Scotland

NR/SMS	Equipment
VS30	Vehicle Identification System

END

GENERAL

This apparatus forms part of the pilot scheme for Automatic Train Protection Systems.

Any maintenance or operating difficulties shall be reported to your SM(S) as corrective maintenance.

An ATP site can include:

a) ATP enclosure containing encoding equipment and ATP interface equipment, which is incorporated with existing signalling apparatus.

b) Beacon with disconnection box and cables.

c) Infill loop with TDA and RDA boxes and cables.

SERVICE A

1. ATP Enclosure

1.1 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the enclosure.

1.2 Check for security and signs of damage.

1.3 Dust and Examine interior.

1.4 Check the security of accessible terminals and cable glands and look for signs of water ingress.

1.5 Check the effectiveness of the door seal and ELDON latches and lock in keeping the door seal tight against the enclosure. Adjust as necessary.

1.6 Lubricate locks, latches & hinges.

1.7 Examine surge arrestors.

1.8 Examine earth connections. If in doubt, Test continuity and resistance.

1.9 Check the integrity of all lead seals and wire locking.

1.10 Check the two parameter plugs are securely chained to the enclosure.

2. Power Supply module

2.1 Check the green LED is lit on the front face of the power supply module.

This indicates that there is 110Vac input.

Any other indication means there is a fault condition and shall be investigated.

3. Beacon

3.1 Examine beacon, mounting and protection plate(s).

3.2 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the beacon, junction box and cables.

3.3 Check that the beacon and protection plate(s) are correctly aligned and positioned, Check that there is clearance between the protection plate(s) and the beacon.

3.4 Check all fixings for tightness.

3.5 Check the beacon disconnection box is properly fixed to the mounting stake and look for signs of water ingress.

3.6 Examine the terminals inside the disconnection box. Clean and Protect as necessary.

3.7 Examine cables and glands for security and damage.

3.8 Test the beacon signal level.

4. Infill Loop

4.1 Where practicable, Examine full length of loop cable. Pay attention to fixings and signs of stretching. Rectify minor sheath damage with self-amalgamating tape. Report damage that is more serious as corrective maintenance.

4.2 Remove any fire risks from the vicinity of the loop.

4.3 Examine the RDA and TDA boxes for damage, water ingress and security. Check the condition of the lid seal. Examine the terminals; Clean and Protect as necessary. Examine cable glands for security

4.4 At the TDA box, disconnect the loop cable from either t3 or t4 and measure the loop resistance. If the result is outside the range 340-400Ω, report it to your SM(S).

4.5 Test the loop signal level.

End

Includes:	ATP Fitted on the Chiltern Lines
Excludes:	ATP Fitted on the Great Western Main Line

General

Before removing any plug-in unit, anti-static precautions shall be taken. Either wear an approved earthing band or touch the bare metalwork of the associated rack or cabinet with your bare hands to discharge any static electricity within yourself.

When removing or inserting a board, do not touch the board, its tracking, or components.

Always use the handles provided. When not plugged into the operational ATP equipment, store boards in an anti-static bag or box.

An ATP site can include the following:

- Loop electronics unit (LEU).
- Loop.
- Simple signal interface or complex signal encoders, which are incorporated with the signalling apparatus.

SERVICE B

1. Loop

1.1 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the loop.

1.2 Remove vegetation as required.

1.3 Remove any metallic debris from the vicinity of the loop. Report any redundant rails in the 4ft, likely to damage the loop, for removal.

1.4 Examine full length of loop cable, paying particular attention to fixings, transposition covers and signs of chafing or damage.

1.5 Remove any ballast covering the loop.

2. Loop Electronics Unit (LEU)

All readings shall be taken using a digital voltmeter (DVM).

2.1 Examine the bonding connection between the LEU Housing and the signalling apparatus case and, if in doubt, test continuity and resistance using a DVM.

2.2 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the LEU.

2.3 Check the LEU for security and signs of damage. Report any damage as corrective maintenance.

2.4 Examine the cables and glands for security and damage.

3. Operational Checks

3.1 Observe the LEDs on the following boards; Check they are indicating as shown in Table 1:

Board	LED	State
Telegram Generator	1 and 2	Alternate Flashing
Telegram Generator TSR (if fitted)	1 and 2	Alternate Flashing
Modulator/Output	1	Steady illuminated

Table 1 - Indications

3.2 If the modulator/output LED is not illuminated or is flickering, then carry out NR/SMS/PartB/Test/029 (ATP Equipment (Chilterns) Loop Test) shall be carried out.

END

Includes:	AWS Permanent, Electro Magnets, Suppressed Magnets and PSR magnets maintained signal maintenance
Excludes:	Temporary ESR Magnets

General

If the AWS spark quench is fitted on the internal side of the electro-inductor feed links, check the electro-inductor is fully discharged before you touch the external side of disconnected links.

You can find more information about AWS equipment in NR/GN/SIG/19040.

SERVICE A

1. External Inspection

1.1 Remove debris from the area of the magnet and inductors.

1.2 Examine permanent magnets, electro-magnets and suppressor magnets for damage.

Arrange for repair or replacement where necessary as corrective maintenance.

1.3 Examine protection ramps and fixings. Components should be undamaged and secured to the sleepers.

1.4 Check the magnets are correctly aligned they should be approximately central to, and parallel with, the running rails.

1.5 Check the signal aspect is clearly visible from the magnet and is not being obscured (e.g. foliage).

1.6 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

1.7 If provided, check that the plug coupler is free from damage and securely latched.

SERVICE B

2. Full Inspection and Test

2.1 Examine the termination box and seal on electro- magnets and suppressor magnets.

2.2 Examine cable terminations. Clean and protect as necessary.

2.3 If a failure is reported with the AWS, check that the suppressed permanent and electro magnets are correctly wired for their relevant voltage operation as detailed in NR/SMS/PartZ/Z08 (Train Protection - Reference Values).

2.4 Check tail cable is not damaged and is securely terminated. Tail cables should be protected by orange pipe or secured to sleepers.

2.5 Gauge the top of the AWS magnet with respect to rail head (±12mm from rail level). This should be done by use of a line / bob weights and associated plastic gauge or rule.

2.6 Carry out NR/SMS/PartB/Test/024 (AWS Tests).

3. Disconnection Boxes (if Provided)

3.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

3.2 Refit the lid and (if provided) padlock, check they are fitted securely.

SERVICE RA Carry out service A of this SMS.

SERVICE RE Fix on failure.

END

Includes:	Vortok Depot Test Magnets
Excludes:	All other permanent magnets or electromagnets associated with automatic warning systems (AWS)

General

More information on this equipment can be found in the Vortok Depot Test Magnet Installation Manual.

Standard strength depot test magnets are coloured yellow. Extra strength depot test magnets are coloured green.

SERVICE B

1. Depot Test Magnet

1.1 Remove debris from the area of the magnet.

1.2 Examine the magnet for damage. Arrange for repair or replacement where necessary.

1.3 Examine the fixings. The equipment shall be secure.

1.4 Check the magnet is positioned correctly with respect to rail level.

1.5 Gauge the top of the magnet with respect to rail head (±1mm from rail level). This should be done by use of a line/bob weight and associated plastic gauge or rule.

To adjust the height of the magnet:

a) Loosen the magnet locking bolt.

b) Rotate the entire magnet assembly.

c) Tighten the locking bolt onto the nearest flat.

PERIODIC TASKS

2. Unit Calibration

2.1 Replace the magnet with a Vortok exchange unit.

Installation details are in the Vortok Depot Test Magnet Installation Manual

END

1. Working on Axle Counter Equipment

The Signaller at the monitoring signal box shall be informed before any work is done that affects the correct operation of the axle counter or can put it into a disturbed state.

For full evaluator testing, possession of the axle counter section and any signalling functions carried over the evaluator transmission links (if applicable) should be taken.

Results of all tests shall be recorded on the appropriate system's record card.

A standard Isolation/Re-set/Restoration form can be found under SMF/SG/0246.

2. Isolation of Axle Counters

Axle counters shall be isolated from the signalling equipment they are connected to before any work is carried out that disrupts their normal operation. This can only be done with the permission of the Signaller. Some systems might require the filling in of part A of the restoration form.

The isolation methods can vary depending on the type of axle counter; generally this is achieved by disconnection of the TPR link or data output from the evaluator.

The Signaller at the monitoring signal box is responsible for manual protection arrangements of the signalling during any period of isolation of the axle counter.

3. Re-setting and Restoration to Service of Axle Counters

This can vary depending on the type of axle counter system design but generally falls into four categories:

A. Technician
B. Co-operative
C. Signaller
D. Non co-operative (Scotland Only)

A: Technician

With this method, the Technician re-sets and restores to service the axle counter with permission of the Signaller. Some systems might require filling in of the restoration form.

B: Co-operative

With this method, the Technician re-sets and restores to service the axle counter in co-operation with the Signaller (both operating a function at the same time). Some systems might require filling in of the restoration form.

C : Signaller

With this method, the Signaller undertakes both re-setting and restoring the axle counter.

In all cases, the Signaller is responsible for confirming the axle counter section is clear before it is restored.

D : Non co-operative (Scotland Only)

Includes:	Newtonhill 113T, Dundee - Carnoustie 656T, 647T, Barassie Line 191T, Belmont - Kilkerran 669T
Exclude:	All Co-operative resets and other sites without co-operative resets

4. Release

4.1 Before starting work the Technician shall contact the Signaller and reach an agreement as to which track section he wishes to work on.

4.2 When the Signaller knows the track section to be clear and that no movement is authorised past the protecting signal, he can give authority to the Technician to work on axle counter.

4.3 On receipt of this authority, the Technician shall slip the disconnection link between the Axle Counter and the output TPR. This is to be recorded by both the Signaller and Technician.

5. Reset

5.1 Prior to final resetting of the axle counter the Technician shall obtain the assurance of the Signaller that the track circuit section is clear of traffic.

5.2 When the Technician has received verbal authority to reset the axle counter, he/she should follow the local procedure for resetting the axle counter evaluator. This normally requires the operation of a key operated switch and a push button switch.

5.3 Check the axle counter is fault free and can be Reset.

5.4 For AzL70 type axle counters, if the ‘G10’ LED is lit on the GRDFR card then press button T1 on this card, to extinguish the indication, before resetting is possible.

6. Adjustment

6.1 Usually, after the Axle Counter has been reset, the Technician then initiates restoration.

6.2 Before contacting the Signaller for permission to restore the track section, the Technician shall check that the axle counter is reset and in working order.

6.3 The Technician shall complete Part 3 of Form SMF/SG/0246 (Restoration of Axle Counter). This requires the Technician to give an assurance to the Signaller that the work is complete. The entry made shall be dictated to the Signaller, who will complete a similar form. The date and time of the message should be recorded.

6.4 The Technician shall contact the Signaller and request to carry out the restoration of the axle counter. The Technician should assist by establishing, where possible, that the section of line is clear.

6.5 The Signaller shall then complete Part 2 of his form and dictate this section to the Technician to restore the specified axle counter to permit movements over a specified section of line.

The Technician should record the dictated message in Part 2 of the form, noting date, time and the serial number that the Signaller has allocated to the form.

6.6 The Technician shall then restore the Axle Counter by reinstating the link between the Axle Counter and the output TPR.

6.7 When this is done, the Technician shall record on Part 3 of his form that the axle counter is restored, noting date, time and dictate the information to the Signaller. The Signaller should also make an entry in the Train Register at this stage.

6.8 During the restoration the Technician shall remain at the axle counter controls until advised by the Signaller that the equipment is properly returned to service.

6.9 The Technician's copy of the form shall be stored in a file adjacent to the axle counter equipment in the relay room. The Signaller's copy of the form should be sent to the Local Operations Manager.

6.10 The Serial Number allocated by the Signaller and details of the failure should be recorded on the Signalling Failure Report Form or given to Fault Control.

Form SMF/SG/0246 (Restoration of Axle Counter), is reproduced in Appendix A of this standard as specimen copies only:

Copies of Form SMF/SG/0246 (Restoration of Axle Counter) can be obtained, in book form.

Appendix B contains a process flowchart

7. Thales systems

On earlier Thales systems check after re-setting and restoration the ZIANZG card (if fitted) shows zero and the LED on the appropriate indicator shows 'section clear' (green).

If the evaluator-reset button is fitted with a lockable cover, it shall be fitted with a lock.

Information on co-operative isolation, re-setting and restoration of axle counters at particular locations can be found in NR/SMS/PartB/Test/30. Other equipment specific details can be found in NR/SMS/Appendixes.

8. Positioning of Rail contacts

The requirement is that whenever an axle counter head is being reinstated under SMTH and there is any possibility that the design parameters determining the required position have changed, or the position needs rechecking (e.g. after re-railing or slews), the necessary checks are carried out.

To determine the correct position, you shall be competent to read the signalling plan with respect to clearance requirements, overlap lengths, timing points, signal replacements etc, which might define the limitations of the acceptable area.

You shall know the technical constraints of the axle counter system unless these are determined by preformed cable lengths. You shall consult with the Track Engineer regarding any constraints resulting from welds, joints, or check rails.

You shall be competent to measure clearance points in accordance with GK/RT0011 Appendix A (1970mm between the running edges for the fouling point and 4880mm back to clearance unless it is a special, in which case there may be something in the records).

If you are in any doubt the position of rail contacts, ask your SM(S).

Appendix A: Forms

Network Rail

Axle Counter Isolation, Re-set and Restoration Form
SMF/SG/0246
Issue1.0
June 2007

Standard Maintenance Form

PART ONE	
Isolation of Axle Counter System from the Interlocking	
Due to the named maintenance activity I require the axle counter system to be isolated from the interlocking	
Signal Technician (Name)	
Axle Counter System	
Affected Track Section(s)	
Maintenance Activity	
Interlocking	
Signal Box	
Signaller's Name	
Counter Number*	
Date	
Time	
Signed (Signal Technician)	
Comments	
*: If provided	

Network Rail

Standard Maintenance Form

Axle Counter Isolation, Re-set and Restoration Form
SMF/SG/0246
Issue 1.0
June 2007

PART TWO	
Re-Set of Axle Counter System	
I have completed work on the axle counter system and require signaller permission to re-set as a precursor to restoration Note: A re-set of the axle counter system may be undertaken as part of preventative or corrective maintenance without restoration provided the system has been isolated from the interlocking	
Signal Technician (Name)	
Axle Counter System	
Affected Track Section(s)	
Maintenance Activity	
Interlocking	
Signal Box	
Signaller's Name	
Date	
Time	
Axle Counter Showing section(s) Clear?	
Signed (Signal Technician)	
Comments	

Network Rail

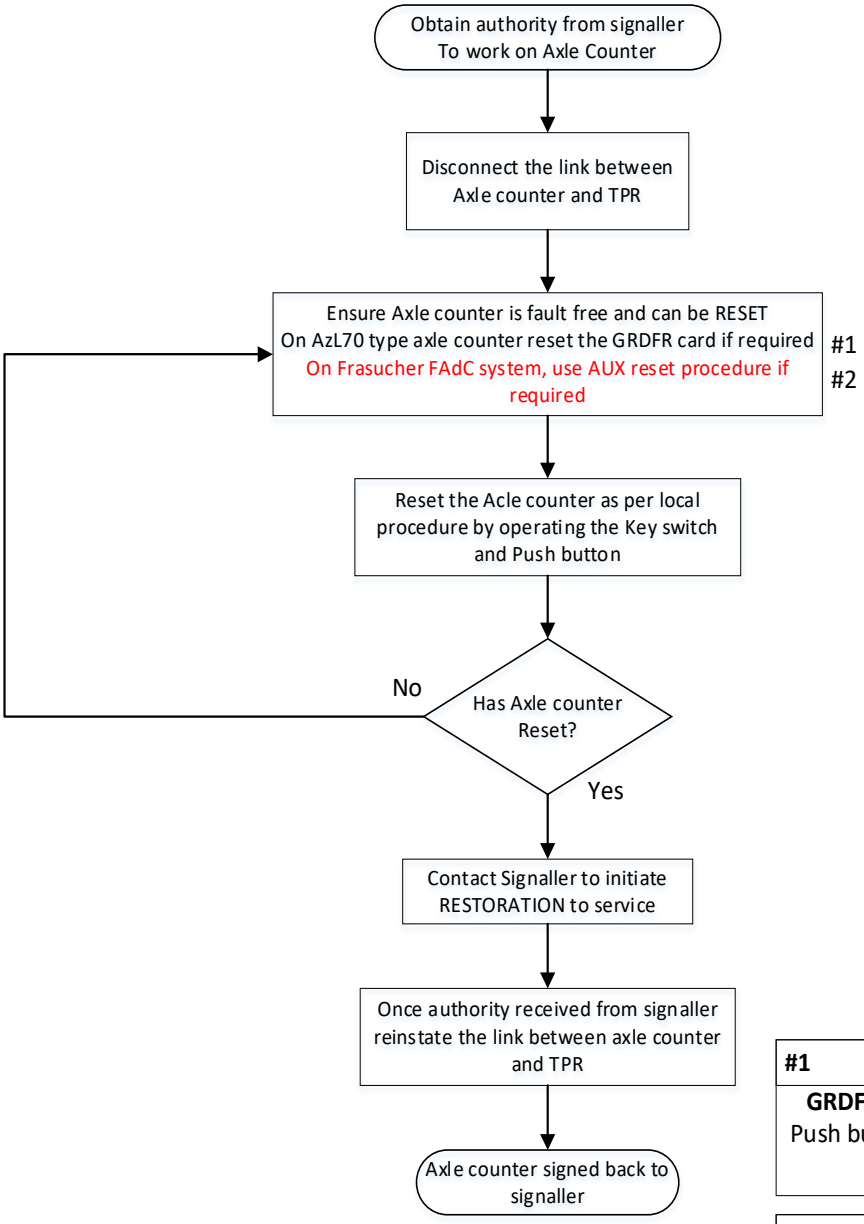
Standard Maintenance Form

Axle Counter Isolation, Re-set and Restoration Form
SMF/SG/0246
Issue1.0
June 2007

PART THREE	
Restoration of the Axle Counter System to the Interlocking	
I have completed work on the axle counter system, re-set the system to show track section(s) clear and now require signaller permission to restore the system. Before undertaking this process I have obtained assurance from the signaller that the track section(s) are clear of trains or vehicles	
Signal Technician (Name)	
Axle Counter System	
Affected Track Section(s)	
Maintenance Activity	
Interlocking	
Signal Box	
Signaller's Name	
Section(s) showing clear after restoration?	
Counter Number*	
Date	
Time	
Signed (Signal Technician)	
Comments	
*: If provided	

Appendix B: Flowchart

PROCEDURE FOR RESETTING AND RESTORING AN AXLE COUNTER WITHOUT CO-OPERATIVE RESTORE



#1	AZL 70
GRDFR Card reset procedure Push button T1 to reset count in flag	

#2	FRAUCHER
AUX Reset procedure Push both toggle buttons on relevant IO-EXB board to the left or right (depending on FMAto be resete) and hold for 1-2 seconds to reset count in flag	

END

Includes:	AzL70 Single Rail Contact 4 Wire TX System with EAK Lineside Junction Box and AzL70 Evaluator AzL70 Double Rail Contact 2 Wire TX System with EAK30 Lineside Junction Box and modified AzL70 Evaluator
Excludes:	All other types of Axle Counter

GENERAL

Make sure that metallic objects are kept away from the rail contacts as they can cause a false count.

Always take possession of the axle counter before adjusting the rail contacts.

If you have to reset the axle-counter, you shall follow the rules in NR/SMS/PartB/Test/030 (AzL Axle Counters : Isolate, Reset & Restore Procedures).

Measure and record all readings on the NR/SMS record card.

Always complete the tests on the lineside equipment before carrying out adjustments to the evaluator.

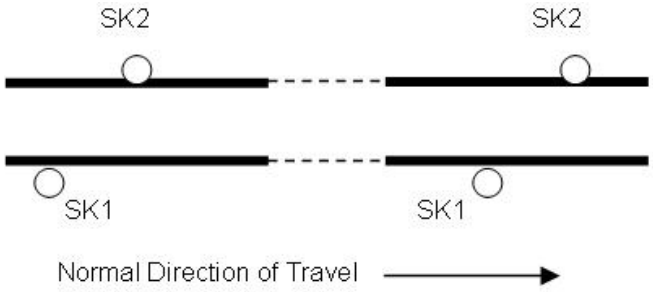


Figure 1 – Typical Layout of Single Rail Contact Type (SK11 Heads)

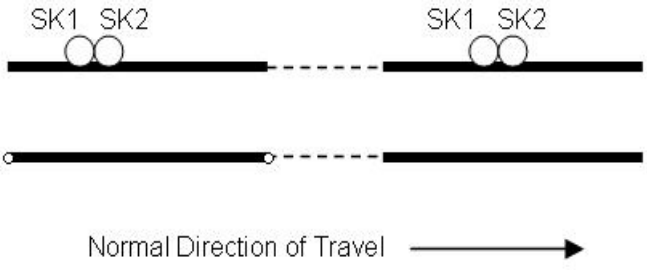


Figure 2 – Typical Layout of Double Rail Contact Type (SK30 Heads)

SERVICE A

1. Rail Contacts

1.1 Examine the count heads, rail insulations and bolts.

1.2 The TX head shall not touch the rail head. If a head or fixing is loose, check alignment NR/SMS/PartB/Test/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S) and tighten bolts NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

1.3 Examine all tail cables, connections and clamps.

1.4 Check the protection plates and flux plates are tight, if fitted.

2. Lineside Junction Box (Types EAK and EAK30)

2.1 Examine the lineside junction box including all cables and connections.

2.2 Check all terminals are tight.

3. Evaluator

3.1 Examine evaluator and mountings.

3.2 Check all terminals are tight.

3.3 Check wiring and terminations.

3.4 Measure the DC evaluator supply voltage at the bus bar checking that it is 60V (Limits 55V to 65V).

3.5 Measure the DC stabilised supply on the SIPL card between the 0v and 20v jacks checking that it is 20V (limits 19V to 21V).

3.6 Measure using a meter the voltages on the BUPL card with the +ve lead of the meter in jacks 1a, 1b, 2a and 2b in turn and the –ve lead of the meter connected to the 0v jack on the SIPL card checking that it is 5V DC (limits 4.5V to 5.5V).

3.7 Observe that the ‘FM’ (green) LED on the SIPL card is lit if the axle counter section is clear; conversely confirm the ‘BM’ (red) LED is lit if the section is occupied.

3.8 Where a meter is provided on the battery charger check that the battery charging rate is approximately 200mA.

SERVICE B

Possession of the system shall be taken before undertaking any work. Check that the section TPR links are disconnected before work is started.

4. Rail Contacts

4.1 Check torque settings of fixings NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

4.2 Single Rail Contacts Heads (SK11) Only:

a) Measure the distance between the count heads. Compare the distance with the last recorded.

4.3 If the distance has increased due to rail creep it shall be reported as corrective maintenance.

5. Lineside Junction Box – Type EAK (only)

5.1 Remove and examine cover, interior and connections. Do not remove cover if it is raining.

5.2 Check all terminals are tight.

5.3 Measure using a meter the voltages in Table 1:

Source	Meter +ve	Meter –ve	Volts	Limits
DC Supply	AL3/6	AL3/5	60V	55V to 65V
DC Stabilised	UG+	UG-	50V	48V to 54V
Signal Generator	AL1/3	AL2/2	75V	>75V
Channel 1 SK1	AL4/3	AL4/4	500mV	400mV to 600mV
Channel 1 SK2	AL4/1	AL4/2	500mV	400mV to 600mV

Table 1 – EAK Voltages

NOTE: *Adjustment of SK1 voltage can be achieved by R14 and SK2 by R2.*

5.4 Carry out NR/SMS/PartB/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S).

5.5 Grease fixing studs and replace cover.

5.6 Repeat sections 4 and 5 for each of the other count head(s) in the axle counter section.

6. Lineside Junction Box - Type EAK30 (only)

6.1 Remove and examine cover, interior, and connections. Do not remove cover if it is raining.

6.2 Check terminals are tight.

6.3 Check both green LEDs are illuminated.

6.4 Measure using the test switch box connected to the socket on the LtAnp board (plug goes in with cable entry at bottom) and a meter the voltages in Table 2:

Item	Meter Connection/ Switch Position	Voltage (DC)
Incoming supply	LTG1 yellow +ve, black –ve	+55V to 115V
Stabilised supply 1	red +ve, black –ve switch position. 3	+22V to +25V
Stabilised supply 2	red +ve, black –ve switch position. 4	+22V to +25V
MESSAB 1	red +ve, black –ve switch position. 10	+55mV to +200mV
MESSAB 2	red +ve, black –ve switch position. 12	+55mV to +200mV
PEGUE 1	red +ve, black –ve switch position. 11	+55mV to +200mV
PEGUE 2	red +ve, black –ve switch position. 13	+55mV to +200mV

Table 2 – LtAnp Board Voltages

6.5 Measure using a meter the transmitter outputs at terms 19/20 for SK1 and 21/22 for SK2:

a) SK1 35V to 49V AC @ 30 to 31.3kHz.

b) SK2 35V to 49V AC @ 27.4 to 28.6kHz.

6.6 Carry out NR/SMS/PartB/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S).

6.7 Disconnect the test switch box.

6.8 Grease fixing studs and replace cover.

7. Evaluator

7.1 Measure using a meter the voltages on the BUPL card with the +ve lead of the meter in jacks 1a,1b, 2a and 2b in turn and the –ve lead of the meter connected to the 0V jack on the SIPL card:

a) 5V DC (limits 4.5V to 5.5V).

If any BUPL card voltages in this test are below 4.5V with no wheel present, check the correct detection point equipment and line pair.

7.2 Adjust the BUPL card voltages (if necessary) by the top potentiometer on the ANP card for 1/2a and on the bottom potentiometer for 1/2b.

7.3 Check on the SIPL card that the FM (green) LED is illuminated. Using the test switch unit connected to test points 1a and 1b on the BUPL card and 0V on the SIPL card count in 10 axles.

7.4 Observe on the SIPL card that the 'FM' (green) LED is extinguished and the 'BM' (red) LED is illuminated and the TSR relay de-energises as soon as the first axle is counted in.

7.5 Observe on the FRMKTR card that the 'EIN' LED is illuminated and on the ZIANZG card 'AUS' LED is extinguished.

7.6 Change the connections on the test switch unit to test points 2a and 2b on the BUPL card leaving the other lead in the 0v on the SIPL card and count out 10 axles.

7.7 Observe on the ZIANZG card the 'AUS' LED becomes illuminated and on the FRMKTR card the 'EIN' LED is extinguished after the first axle is counted out.

7.8 Check the TSR relay remains de-energised and on the SIPL card the 'BM' (red) LED remains illuminated until the last axle is counted out.

7.9 When this has been achieved observe that on the SIPL card the 'FM' (green) LED illuminates as the 'BM' (red) LED extinguishes and the TSR relay energises.

7.10 If an oscilloscope is available check the interrogator signal on the BUPL card between the 3rd yellow jack (Abfr) and the 0V jack on the SIPL card. The signal appears as a square wave 10V to 12V amplitude with an equal mark-space ratio. The frequency is approx.1850Hz.

7.11 With a test lead (fitted with 4mm plugs at each end) connect jack 1a on the BUPL card to 0V jack on the SIPL card. Operate the reset plunger and observe that the system does not clear.

7.12 Remove the test strap and observe the system remains failed. Operate the plunger again and check the system clears. Repeat the test using the jacks 1b,2a and 2b on the BUPL card in turn.

7.13 Check the operation of the count indicator card (ZIANZG) by shorting together the test terminals. This causes all the segment displays to light (i.e. 888 is indicated).

7.14 Connect the counting test unit to jacks 1a and 1b on the BUPL card and the 0v jack on the SIPL card. Observe that the counter is reset, and the count is clear. Count in one axle and observe the following:

a) The TSR relay drops and the TZR relay picks.

b) On the SIPL card the green LED is extinguished, and the red LED is lit.

c) On the ZIANZG card LED's G1 and G3 are extinguished.

d) The total count shows 1.

7.15 Count in a further 9 axles and check the total count shows 10.

7.16 Transfer the test unit plugs to jacks 2a and 2b on the BUPL card leaving the other in the 0V jack on the SIPL card. Count out 1axle and observe the following:

a) The total count shows 9.

b) On the ZIANZG card LED G1 is illuminated.

7.17 Count out a further 9 axles and observe the following:

a) The total count is zero (display blank).

b) On the ZIANZG card all 3 LED's are lit.

c) On the SIPL card the green LED is lit, and the red LED is extinguished.

d) The TZR relay drops and the TSR relay picks.

e) The green 'Section Clear' indicator at the top of the rack is illuminated.

7.18 With the counter at zero briefly remove and replace the SVA card, observe the following:

a) The counter remains in a failed state and does not attempt to clear.

b) LED G12 on the UMO card is lit.

7.19 Operate the reset plunger and check the following:

a) The counter clears.

b) LED G12 on the UMO card is extinguished.

7.20 With the evaluator reset and showing clear disconnect the 110V supply to the BAUCH PSU, observe the system stays clear. Wait for two minutes and check the DC feed to the evaluator rack does not drop below 60V.

7.21 Reconnect the 110V supply and check that the DC feed to the evaluator rack rises and the system stays clear.

7.22 Check that all the covers are replaced on the front and back of the evaluator rack, locks are replaced on the reset buttons and the TPR links are restored.

7.23 After the axle counter is restored to the Signaller, if practicable observe the correct operation of the equipment with the passage of a train.

END

Includes:	AzL70/30 with EAK30 Lineside Junction Box and AzL70/30 Evaluator AzL70/30S with EAK30 Lineside Junction Box and AzL70/30S Evaluator
Excludes:	All other types of Axle Counter

GENERAL

Make sure that metallic objects are kept away from the rail contacts as they can cause a false count.

Always take possession of the axle counter before adjusting the rail contacts.

If you have to reset the axle-counter, you shall follow the rules in NR/SMS/PartB/Test/030 (AzL Axle Counters: Isolate, Reset & Restore Procedures).

All measurements shall be recorded on the record card.

Always complete the tests on the lineside equipment before carrying out adjustments to the evaluator.

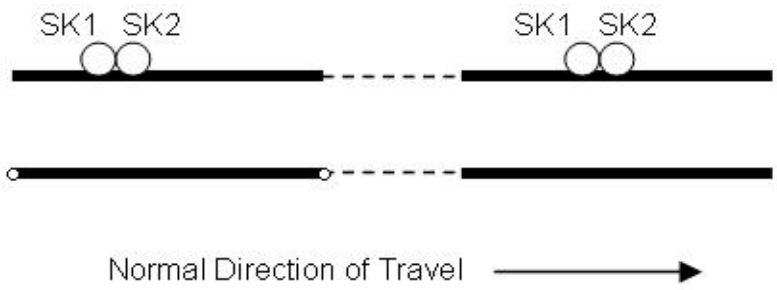


Figure 1 – Typical Layout of Double Rail Contact type (SK30 Heads)

SERVICE A

1. Rail Contacts

1.1 Examine the count heads, rail insulations and bolts. The Tx head shall not touch the rail head. If a head or fixing is loose, check alignment NR/SMS/PartB/Test/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S) and tighten bolts NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

1.2 Examine all tail cables, connections, and clamps.

1.3 Check the protection plates and flux plates (if fitted) are tight.

2. Lineside Junction Box

2.1 Remove and examine cover, interior and connections. Do not remove cover if it is raining.

2.2 Check terminals are tight.

2.3 Check both green LEDs are illuminated (flashing on 70/30S).

2.4 Using a test switch box connected to the socket on the LtAnp board (plug goes in with cable entry at bottom) and a meter, measure and record the following voltages:

With the meter connected to LTG1 (yellow +Ve, black –Ve):

a) Incoming supply +55V to 115V DC.

With the meter connected to the switch position terminals (red +Ve, black –Ve) measure and record:

b) Stabilised supply 1 (switch pos. 3) +22V to +25V DC.

c) Stabilised supply 2 (switch pos. 4) +22V to +25V DC.

d) MESSAB 1 (switch pos.10) +55mV to +1000mV DC.

e) MESSAB 2 (switch pos.12) +55mV to +1000mV DC.

f) PEGUE 1 (switch pos.11) +55mV to +1000mV DC.

g) PEGUE 2 (switch pos.13) +55mV to +1000mV DC.

2.5 Measure and record using a meter the transmitter outputs at terms 19/20 for SK1 and 21/22 for SK2:

a) SK1 35 – 49V AC @ 30kHz.

b) SK2 35 – 49V AC @ 29kHz.

2.6 Disconnect the test switch box, grease fixing studs, and replace cover.

3. Evaluator

3.1 Examine evaluator and mountings.

3.2 Check all terminals are tight.

3.3 Check wiring and terminations.

3.4 Measure and record the DC evaluator supply voltage at the bus bar check that the voltage is 60V (Limits 54V to 72V).

3.5 Measure and record the DC stabilised supply on the SIPL card between the 0V and 20V jacks check that the voltage is 20V (limits 19V to 21V).

3.6 Measure and record using a meter the voltages on the BUPL card with the +Ve lead of the meter in jacks 1a,1b,2a,2b in turn and the –Ve lead of the meter connected to the 0V jack on the SIPL card, check that the voltage is 5V DC (limits 4.7V to 7V.

3.7 Check that the G1 (green) LED on the SIPL card is illuminated if the axle counter section is clear; conversely check the G2 LED (red) is illuminated if the section is occupied.

3.8 Check (where a meter is provided on the battery charger) that the battery charging rate is correct for the number of detection points being fed.

SERVICE B

Possession of the system is essential. Check that the section TPR links are disconnected before work is started.

4. Rail Contacts

4.1 Check torque settings of fixings NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

5. Lineside Junction Box

5.1 Remove and examine cover, interior, and connections. Do not remove cover if it is raining.

5.2 Check all terminals are tight.

5.3 Measure and record using the lineside test switch box and a meter the incoming supply to terminals: LTG1 (yellow +Ve, black -Ve) check the voltage is +55V to +115V DC.

5.4 Measure and record the stabilised supplies (switch positions 3 and 4 on the lineside test switch box), check the voltage is +22V to +25V DC.

5.5 Measure and record the transmitter outputs at terms 19/20 for SK1 and 21/22 for SK2

a) SK1 35 – 49V AC @ 30kHz.

b) SK2 35 – 49V AC @ 29kHz.

5.6 Carry out NR/SMS/PartB/Test/042 (Axle Counters Dummy Wheel Test - AzL 70, 70/30, 70/30S).

5.7 Count Head Sites with Local Power Supply Only: Check that the evaluator is showing clear; disconnect the 110V supply to the BAUCH PSU and check that the system remains clear.

5.8 Wait approximately 2 minutes and measure the DC supply to the junction box. Check the reading is >60V.

5.9 Reconnect the 110V supply and check the DC supply to the junction box rises and the evaluator remains clear.

5.10 Grease fixing studs and replace cover.

5.11 Repeat steps 4 and 5 for the other count head(s) in the axle counter section.

NOTE: *The evaluator logic will now be out of step.*

6. Evaluator Voltages/Waveforms

6.1 Check that the counter is at zero and measure using a meter the DC voltage with the +Ve lead of the meter to the small yellow jacks on the BUPL card and the –Ve lead of the meter to the 0V jack on the SIPL card measure and record:

a) 2nd terminal (+7.5V) Limits +7V to +9V.

b) 4th terminal (Rel.F) Limits -13.5V to -16.5V.

c) 5th terminal (GR.2) Limits +19V to +21V.

d) 6th terminal (+5v) Limits +4.5V to +5.5V.

6.2 Measure and record using a meter the voltages on the BUPL card with the +ve lead of the meter in jacks 1a,1b, 2a,2b in turn and the –ve lead of the meter connected to the 0V jack on the SIPL card.

a) 5V DC (limits 4.7V to 7V)

Sections with 3 counting points, also measure 3a, 3b.

If any BUPL card voltages in this test are below 4.7V with no wheel present, check first the detection point equipment and line pair before adjusting the gain on the relevant LTV card.

Depending on the installation, if there are more than two Zp (e.g. one count in Zp and two count out Zp over a set of points) there will be a second LTV-A & DIS card for this Zp, see NR/SMS/Appendix/15 (General Information on the Thales Axle Counter Systems).

6.3 Adjust the BUPL card voltages (if necessary) by the S1 potentiometer on the LTV-E card for 1a/b and on the LTV-A card for 2a/b.

6.4 Check (if an oscilloscope is available) the interrogator signal on the BUPL card between the 3rd yellow jack (Abfr) and the 0v jack on the SIPL card.

The signal should appear as a square wave 10V to 12V pk-pk amplitude with a equal mark/space ratio. The frequency is approx.1850Hz.

7. Closed Loop Supervision Check

7.1 With a test lead, (fitted with 4mm plugs at each end) connect jack 1a on the BUPL card to 0V jack on the SIPL card.

7.2 Operate the reset plunger and observe that the system does not clear.

7.3 Check that the LED G2 on the DIS(1) card is illuminated.

7.4 Remove the test strap and observe the system remains failed. Operate the plunger again and check the system clears. Repeat the test using the jacks 1b, 2a, 2b on the BUPL card in turn noting the results are as follows:

a) Strap to 1b lights LED G1 on card DIS(1).

b) Strap to 2a lights LED G2 on card DIS(2).

c) Strap to 2b lights LED G1 on card DIS(2).

NOTE: *3a & 3b jacks if an extra LTV-A/DIS cards are fitted.*

8. Count Indication Card

8.1 If provided, check the operation of the count indicator card (ZIANZG) by shorting together the test terminals. This causes all the segment displays to light (i.e. 888 is indicated).

9. Evaluator Counting Check

The tasks in 9.1 to 9.4 require the use of a counting test unit, if this is not available tasks 9.5 to 9.8 shall be used (these require two test leads with 4mm plugs on each end). A ZIANZG card (if not fitted) is required for counting checking.

9.1 Connect the counting test unit to jacks 1a and 1b on the BUPL card and the 0V jack on the SIPL card. Observe that the counter is reset, and the count is clear. Count in one axle and observe the following:

a) The TSR relay drops and the TZR relay picks.

b) On the SIPL card the green LED is extinguished, and the red LED is illuminated.

c) The count direction indicator (LED G10 on the GRDFR card) lights after a short time.

d) On the ZIANZG card LEDs G1 and G3 are extinguished.

e) The total count shows 1.

9.2 Count in a further 9 axles and check the total count shows 10.

9.3 Transfer the test unit plugs to jacks 2a and 2b on the BUPL card leaving the other in the 0V jack on the SIPL card. Count out 1 axle and observe the following:

a) The total count shows 9.

b) On the GRDFR card LED G10 is extinguished.

c) On the ZIANZG card LED G1 is illuminated.

9.4 Count out a further 9 axles and observe the following:

a) The total count is zero (display blank).

b) On the ZIANZG card all 3 LEDs are illuminated.

c) On the SIPL card the green LED is illuminated, and the red LED is extinguished.

d) The TZR relay drops and the TSR relay picks.

e) The green 'Section Clear' indicator on the rack is illuminated.

9.5 Observe that the counter is reset, and the count is clear. Count in one axle by connecting the test leads to the listed plug points on the BUPL card in the following order:

Step	Action
1	Connect 1b to 0V
2	Connect 1a to 0V
3	Remove 1b from 0V
4	Remove 1a from 0V

Table 1 – Plug Points

9.6 Check the following:

a) The TSR relay drops and the TZR relay picks.

b) On the SIPL card the green LED is extinguished, and the red LED is illuminated.

c) The count direction indicator (LED G10 on the GRDFR card) lights after a short time.

d) On the ZIANZG card LEDs G1 and G3 are extinguished.

e) The total count shows 1.

9.7 Count in a further 4 axles using the steps described in 9.5 and check the count indicator in the ZIANZG card shows 5.

9.8 Count out one axle by connecting the test leads to the listed plug points on the BUPL card in the following order:

Step	Action
1	Connect 1a to 0V
2	Connect 1b to 0V
3	Remove 1a from 0V
4	Remove 1b from 0V

Table 2 – Plug Points

9.9 Check the following:

a) The total count shows 4.

b) LED G10 on the GRDFR card is extinguished.

c) LED G1 on the ZIANZG card is illuminated.

9.10 Count out the remaining four axles using the steps described in 9.8 then check the following:

a) The total count is zero (display blank).

b) On the ZIANZG card all 3 LEDs are illuminated.

c) On the SIPL card the green LED is illuminated, and the red LED is extinguished.

d) The TZR relay drops and the TSR relay picks.

e) The green ‘Section Clear’ indicator on the rack is illuminated.

10. Count Direction Memory Check

10.1 Using either the method listed in 9.1 (counting test unit) or 9.5 (test leads) count in 1 axle and wait until LED G10 on the GRDFR card lights.

10.2 Operate the reset plunger and check that the counter cannot be reset.

10.3 Press the small push button (T1) on the GRDFR card and observe that LED G10 extinguishes.

10.4 Operate the reset plunger and check that the counter resets and disconnect the counting test unit or remove the test leads.

11. Power Supply Interruption Check

11.1 With the counter at zero briefly remove and replace the SVA card, observe the following:

a) The counter remains in a failed state and does not attempt to clear.

b) LED G12 on the UMO card is illuminated.

11.2 Operate the GRDFR switch and the reset plunger, check the following:

a) The counter clears.

b) LED G12 on the UMO card is extinguished.

12. Standby Battery Check

12.1 With the evaluator reset and showing clear disconnect the 110V supply to the BAUCH PSU, observe the system stays clear.

12.2 Wait for two minutes and check the DC feed to the evaluator rack does not drop below 60V.

12.3 Reconnect the 110V supply and check that the DC feed voltage to the evaluator rack rises and the system stays clear.

13. Final

13.1 Check that all the covers are replaced on the front and back of the evaluator rack, locks are replaced on the reset buttons and the TPR links are restored.

13.2 Check with the Signaller that the axle counter is restored.

13.3 If practical, observe correct operation of the equipment with the passage of a train(s).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/AX15		
Axle Counter Thales AzLM		
Issue No: 09	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Thales AzLM
Excludes:	All other Axle Counter types

GENERAL

The Earth bonding shall be visually inspected before commencing any task.

Metallic objects shall be kept away from the counting heads as they can cause a false-count.

One axle counter evaluator (ACE) can have up to 32 detection points, one or more of these detection points can be shared with another evaluator therefore two ACEs can be affected by tests on one rail contact.

The SK30H & SK30K set-up procedure causes the associated sections (s) to become disturbed.

Always take possession of the axle counter before adjusting the count heads.

A tested ESD strap shall be used to prevent damage to PCB's.

Check the configuration of the rail contacts before undertaking any preventative or corrective maintenance and arrange in liaison with the Signaller the necessary possession arrangements. If this cannot be arranged, inform your SM(S) of the situation.

The Signaller is responsible for resetting the axle counter section.

You should complete the tests on the lineside equipment before carrying out adjustments to the evaluator.

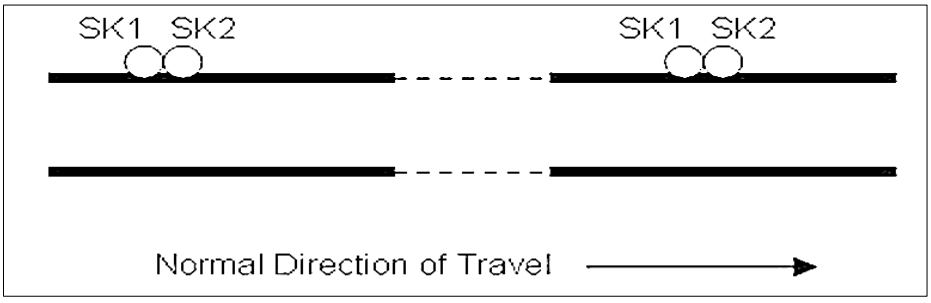


Figure 1 – Typical Layout of Rail Contacts (Type SK30H or SK30K)

Normally increasing Mileage (ARD Axle Counter Reference Direction), see Figure 1.

In the SK30K version the SK1 and SK2 is set via the ARD Plug in the EAK.
The molded TX cable is always connected to SK1 inside the rail sensor if the direction need to be change this can be achieved be adjusting the ARD plug (X600).

Test Equipment

German	English Translation	Part number	Spec
Prüfguppe bestehend aus: Prüfkoffer Messadapter mit diagno-sestecker Digitalvoltmeter	Test Unit consisting of: Test Case Test adapter with diagnostic plug Digital voltmeter	19982 28201	 0.00V to 300V ac/dc
Absenklehre	Dummy wheel	3JA 84532 AAAA	

Table 1 – Test Equipment Part Numbers

The dummy wheel 3JA 84532 AAAA is suitable for all rail contacts, Sk30, Sk30H and Sk30K.

The former dummy wheel 19982 3100x is **NOT** suitable for Sk30K rail contacts.

SERVICE A

1. Diagnostic System

This can be done either at the ACE or remotely.

1.1 Perform a diagnostic download from the system.

A download of the last 24 hours indicates if any other tests are necessary, particularly any data line quality tests.

1.2 Report any fault messages or alarms:

Drift warnings recorded by diagnostics can indicate movement of the rail contact.

1.3 Store the downloaded data separately from the computer. This can be done using an authorised NR memory stick or a CD / DVD. The files and device shall be suitably tagged / labelled and kept for a minimum of five years.

SERVICE B

2. Diagnostic System

This can be done either at the ACE or remotely.

2.1 Perform a diagnostic download on the system.

A download of the last 24 hours indicates if any other tests are necessary, particularly any data line quality tests.

2.2 Report any fault messages or alarms:

Drift warnings recorded by diagnostics can indicate movement of the rail contact.

2.3 Store the downloaded data separately from the computer. This can be done using an authorised NR memory stick or a CD / DVD. The files and device shall be suitably tagged / labelled and kept for a minimum of five years.

2.4 If no train has passed over each detection point during the previous 365 days. Carry out NR/SMS/PartB/Test/031 (Thales Axle Counter Reference Direction Function Test).

The rest of this service need not be completed if the requirements in Section 2 have been successfully completed. If the requirements have not been met then you shall continue with the remaining steps of this service.

3. Rail Contacts SK30H (if fitted)

3.1 Examine the rail contacts, rail insulations, mounting brackets and bolts for security and damage.

The TX head shall not touch the railhead.

If a head or fixing is loose, check the alignment, see NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (Azlm)) and tighten bolts, see torque values in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

Drift warnings recorded by diagnostics can be an indication of movement, see NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (Azlm)) for details of how to set up and adjust the count heads if drift warnings are received.

3.2 Examine all tail cables, connections, rail clamps (if fitted), and brackets for security and damage.

3.3 Check that the cables are clear of any heavy obstructions and protection arrangements are sufficient.

3.4 Check the Pirelli Python' shall be used to protect the cable from the rail contacts to the EAK.

3.5 Check the bung is fitted between the Pirelli Python and cable.

3.6 Check that the labelling on the cables is legible, secure, and intact.

3.7 Check the protection plates and flux plates (if fitted) are tight.

3.8 Check that pads and clips for three sleepers either side of the rail contacts are not damaged or missing.

Damaged or missing items might cause incorrect operation, report defects as corrective maintenance.

3.9 Check the area around the rail contacts (within 2m), check it is free of the following items:

a) P/way defects.

b) New/Scrap rails in the four/six foot or cess.

c) Metallic debris.

d) Traction bonds.

e) Excessive ballast.

Any problems that cannot be rectified shall be reported as corrective maintenance.

3.10 Measure using a approved meter the resistance between the Rx rail contacts and the running rail/M12 bolts. The reading shall be >2MΩ.

If the obtained reading is <2MΩ, the rail mountings will require cleaning or replacing as necessary.

4. Rail Contacts SK30K (if fitted)

4.1 Examine the rail contacts and bolts for security and damage.

If a head is loose, check the alignment, see NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (Azlm)) and tighten bolts, see torque values in NR/SMS/PartZ/Z03 (Train Detection – Reference Values).

Drift warnings recorded by diagnostics can be an indication of movement, see NR/SMS/PartB/Test/045 (Thales Axle Counters Dummy Wheel Test (Azlm)) for details of how to set up and adjust the count heads if drift warnings are received.

4.2 Examine all tail cables, connections, clamps, and brackets for security and damage. Check that the cables are clear of any heavy obstructions and protection arrangements are sufficient.

4.3 Check the 'Pirelli Python' shall be used to protect the cable from the rail contacts to the EAK.

4.4 Check that the labelling on the cables is legible, secure, and intact.

4.5 Check the protection plates and flux plates (if fitted) are tight.

4.6 Check that pads and clips for three sleepers either side of the rail contacts are not damaged or missing.

Damaged or missing items might cause incorrect operation, report defects as corrective maintenance. If the head is mounted over the sleeper this pad needs to be checked as well.

4.7 Check the area around the rail contacts (within 2m), check it is free of the following items:

a) P/way defects.

b) New/Scrap rails in the four/six foot or cess.

c) Metallic debris.

d) Traction bonds.

e) Excessive ballast

Any problems that cannot be rectified shall be reported to your SM(S).

5. Lineside Junction Box (EAK)

5.1 Examine the following items:

a) Clear Vegetation.

b) Security of the cover.

c) Earth bonding. If necessary, check against the signalling bonding plan.

d) Cable entries, glands, and ties. Unused cable entry points shall have blanking plugs fitted.

e) Cables connections, clamps brackets and protection. 'Pirelli Python' shall be used to protect the cable from the EAK to the rail contacts.

f) EAK identification.

5.2 Check all cables to and from the EAK are undamaged and clear of any heavy obstructions. E.G. new/scrap rails lying across the cable.

6. Axle Counter Evaluator (ACE)

6.1 Check the ACE diagnostics for potential failures or irregularities.

A 24 hour history download will determine if any other tests are necessary, particularly any data line quality tests.

6.2 Check the following for security and signs of damage:

a) PDCU and terminals.

b) DC/DC converter and terminals.

6.3 The ACE cabinet doors shall be left open (if fitted).

PT – PERIODIC TASK

7. Rail Contact Clamp (if fitted)

7.1 Check and examine the clamp is undamaged, correctly fitted and secure.

7.2 Visually check the “norlock” washers are fitted.

If the clamp is found to be loose the “Norlock” washers are possibly incorrectly installed.

When these are fitted correctly installed the chamfered faces face towards each other as shown in Figure 2.

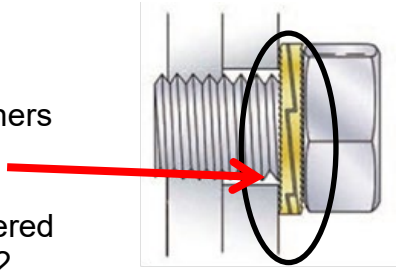


Figure 2

END

Includes:	Siemens AzS ZPD 43 trackside connection box DEK43 double wheel detector
Exclude:	Siemens AzS ZP43 V trackside connection box (see NR/SMS/PartC/AX29), ACE equipment and all other types of wheel detectors

GENERAL

Possession of the relevant track sections of the axle counter shall be taken before adjusting the connection box test levels.

A potential miscount or disturbance to the associated track sections could occur.

Keep switched on mobile phones and metallic objects away from the counting heads whilst undertaking maintenance as they can cause false counts/readings.

If you have to reset the axle counter, follow the appropriate resetting procedure with the Signaller.

More information on the outdoor equipment for Siemens axle counters can be found in NR/SMS/Part/Appendix/01.

SERVICE A

1. Double Wheel Detector (DEK 43)

1.1 Examine the wheel detector count heads, reduction plates and bolts for security and damage.

Reduction plates are fitted both sides of the rail for all types of flat bottom rail.

Only one reduction plate is fitted the receiver side for all types of bull head rail.

1.2 Check that the M12 securing nuts are tight by using the relevant torque wrench tool.

Item	Socket Side	Torque
Wheel detectors	19mm	40Nm to 50Nm

1.3 Check the area around the rail contacts (within 2m) is free of the following items:

a) P/way defects.

b) New/Scrap rails in the four/six foot or cess.

c) Metallic debris.

d) Traction bonds.

e) Excessive ballast.

Report any problems that cannot be rectified.

1.4 Examine all tail cables (protective flexible tubing), connections and clamps for security and damage.

1.5 If practical, observe the passage of a train across the wheel detector and report any excessive deflection in the rail as corrective maintenance.

Excessive deflection in the rail at the point where the wheel detector is fixed to the rail can cause damage to the wheel detector.

SERVICE B

2. Trackside Connection Box

The cover of the trackside connection box shall not be removed during wet conditions unless an alternative suitable cover is available.

Possession of the relevant track sections of the axle counter shall be taken before taking any reading and adjusting the connection box test levels.

If any values are found to be out of tolerance, there might be a fault. This shall be investigated and rectified before any adjustments are carried out.

2.1 Check the area around the trackside connection box is clear of excessive foliage or obstructions.

2.2 Check that the labelling on the trackside connection box is legible, secure, and intact.

2.3 Remove the trackside connection box cover and examine the interior and connections for damage or signs of moisture ingress. Rectify or report.

2.4 Check that all terminals and cards are undamaged and secure.

2.5 Check that both LED's labelled as LED3 are flashing and that no other LED's are illuminated or flashing.

2.6 Using a Fluke (compatible with TPWS) capable of measuring true RMS voltage and frequency, measure the readings at test points specified on the record card NR/SMS/PartR/AX28/RC/01.

If the readings are outside range in 2.9 to 2.11, calibration is required. (See Appendix A).

Any adjustment at the ZP43 shall be followed by adjustment at the Axle Counter Evaluator.

One wheel detector can affect more than one section.

2.7 Measure the incoming DC voltage.

Name	Terminals	Value	Range
Supply voltage	NS + & -	60V DC	30V to 72V

2.8 Measure the AC voltage.

Name	Terminals	Value	Range
Output voltage	NS + & -	Min 1.0V AC	0.48V to 1.8V

2.9 Set the meter for AC voltage and frequency, measure TX 1 & TX 2.

Name	Terminals	Value	Range
Frequency TX 1	6 & 7	43kHz	41.5kHz to 44.5kHz
Frequency TX 2	8 & 9		

2.10 Set the meter for mV AC voltage, measure receiver voltage UE1 & UE2.

Name	Terminals	Range	Comment
Receiver voltage	1 & 2	60mV to 150mV	For very small rail profiles, up to 200mV
Receiver voltage	3 & 4		

2.11 Replace the desiccant bag, replace the cover.

APPENDIX A - ZPD 43 Calibration Procedure

1. Make arrangements with the Signaller for possession of the relevant axle counter sections.

   One wheel detector can affect more than one section.

2. Check that DEK43 is idle and that there are no wheels or other metallic objects in its proximity.

3. Check that switch S1 is set to “FR”.

4. Press the T3 and T4 “KAL” buttons at the same time and hold until the L4 LED for each channel lights up, then release both buttons.

   The L3 LEDs will illuminate immediately.

5. After a few seconds the L4 LEDs extinguish, and the L3 LEDs start to flash.

   This indicates that calibration has been completed.

6. Conduct Steps 2.6 to 2.11 above.

7. A delay of 10 seconds is required before attempting re-calibration, if the LED display in Clause 5 indicates that calibration was not successful.

8. If any adjustments are made at the ZP43 wheel detection equipment the VESBA card values for the effected sections at the Axle Counter Evaluator shall be checked

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/AX29		
Siemens AzS ZP 43 V Wheel Detector Equipment		
Issue No. 04	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Siemens AzS ZP43 V trackside connection box, DEK43 double wheel detector
Exclude:	Siemens AzS ZPD 43 trackside connection box (see NR/SMS/PartC/AX28), ACE equipment

GENERAL

Possession of the relevant track sections of the axle counter shall be taken before adjusting the connection box test levels.

A potential miscount or disturbance to the associated track sections could occur.

Keep switched on mobile phones and metallic objects away from the counting heads whilst undertaking maintenance as they can cause false counts/readings.

If you have to reset the axle counter, follow the appropriate resetting procedure with the Signaller.

More information on the outdoor equipment for Siemens axle counters can be found in NR/SMS/Part/Appendix/01.

SERVICE A

1. Double Wheel Detector (DEK 43)

1.1 Examine the wheel detector count heads, reduction plates and bolts for security and damage.

Reduction plates are fitted both sides of the rail for all types of flat bottom rail.

Only one reduction plate is fitted the receiver side for all types of bull head rail.

1.2 Check that the M12 securing nuts are tight by using the relevant torque wrench tool.

Item	Socket Side	Torque
Wheel detectors	19mm	40Nm to 50Nm

1.3 Check the area around the rail contacts (within 2m) is free of the following items:

a) P/way defects.

b) New/Scrap rails in the four/six foot or cess.

c) Metallic debris.

d) Traction bonds.

e) Excessive ballast.

Report any problems that cannot be rectified.

1.4 Examine all tail cables (protective flexible tubing), connections, and clamps for security and damage.

1.5 If practical, observe the passage of a train across the wheel detector and report any excessive deflection in the rail as corrective maintenance.

Excessive deflection in the rail at the point where the wheel detector is fixed to the rail can cause damage to the wheel detector.

SERVICE B

2. Trackside Connection Box

The cover of the trackside connection box shall not be removed during wet conditions unless an alternative suitable cover is available

Possession of the relevant track sections of the axle counter shall be taken before adjusting the connection box test levels.

If any values are found to be out of tolerance, there might be a fault. This shall be investigated and rectified before any adjustments are carried out.

2.1 Check the area around the trackside connection box is clear of excessive foliage or obstructions. Rectify or report as corrective maintenance.

2.2 Check that the labelling on the trackside connection box is legible, secure and intact.

2.3 Remove the trackside connection box cover and examine the interior and connections for damage or signs of moisture ingress. Rectify or report.

2.4 Check the cable entries and glands. Unused cable entry points shall have blanking plugs fitted.

2.5 Check that all terminals and boards are undamaged and secure.

3. Setting up and adjustment of ZP43 V wheel detector equipment

3.1 Both switches on the band-pass filter board shall be set to on. See Figure 1.

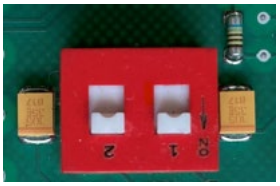


Figure 1

All measurements and any adjustments made shall be recorded on the record card.

3.2 Details of the PEGA test box can be found in NR/SMS/Part/Appendix/01.

If the readings are outside range, adjust as required.

Any adjustment at the ZP43 shall be followed by adjustment at the Axle Counter Evaluator.

3.3 Check that there are no wheels or other metallic objects in the proximity of the wheel detectors.

3.4 Set the switch on the ZP43 V adapter to ZP43E/M and connect it to the PEGA 1211 test box.

3.5 Insert the ZP43 V adapter into slot 2 of the trackside connection box.

3.6 Turn on the PEGA 1211 test box and select operating mode ZP 43 with the mode button and confirm with the OK button.

3.7 Select all further test options using the arrows and the OK button.

3.8 Select U60 on the test box and measure the incoming DC voltage.

Name	Function	Value	Range
Supply voltage	U60	60V DC	30V to 72V

3.9 Select U24 on the test box and measure the operating DC voltage.

Name	Function	Value	Range
Operating voltage	U24	22V DC	21.3V to 22.4V

3.10 Select FS on the test box and measure the frequency.

Name	Function	Value	Range
Wheel detector frequency	FS	43kHz	42.8kHz to 43.2kHz

If the frequency is not within the range adjust the rotary switch on the backplane until the frequency is within range.

3.11 Select UE1 on the test box and measure the receiver voltage 1 then select UE2 and measure the receiver voltage 2.

Name	Function	Range	Comment
Receiver voltage	UE1 & UE2	60mV to 150mV	For vary small rail profiles, up to 200mV

If the receiver voltages are out of range and there is not excessive rail wear the wheel detector might require replacement.

3.12 Select UR1 on the test box and measure the standard voltage.

Name	Function	Value	Range
Standard voltage 1	Ur1	5.5V DC	5.3V to 6.0V

If the voltage is not within the range adjust the potentiometer on the bottom of the generator board until the voltage is within range.

3.13 Select UR2 on the test box and measure the standard voltage.

Name	Function	Value	Range
Standard voltage 2	Ur2	5.5V DC	5.2V to 5.9V

If the voltage is not within the range adjust the potentiometer on the top of the generator board until the voltage is within range.

3.14 Select F1 on the test box and measure the frequency F1

Name	Function	Value	Range
Frequency F1	F1	3.60kHz	3.55kHz to 3.65kHz

If the frequency is not within the range adjust the potentiometer on the bottom of the generator board until the frequency is within range.

3.15 Select F2 on the test box and measure the frequency F2

Name	Function	Value	Range
Frequency F2	F2	6.52kHz	6.42kHz to 6.62kHz

If the frequency is not within the range adjust the potentiometer on the top of the generator board until the frequency is within range.

3.16 Select UL on the test box and measure the output voltage.

Name	Function	Value	Range
Output voltage	UL	Min 1.0V AC	0.48V to 1.8V

3.17 Replace the desiccant bag, replace the cover.

3.18 If any adjustment are made at the ZP43 wheel detection equipment the VESBA card values for the effected sections at the Axle Counter Evaluator shall be checked

END

Includes:	AzSM (E) ACE equipment
Exclude:	DEK43 double wheel detector and trackside connection box (see NR/SMS/AX29)

Possession of the relevant track sections of the axle counter shall be taken before adjusting the connection box test levels.

Make sure switched on mobile phones and metallic objects are kept away from the counting heads whilst undertaking maintenance as they can cause false-counts/readings.

If you have to reset the axle counter, you shall follow the appropriate resetting procedure with the signalman.

More information on the outdoor equipment for Siemens axle counters can be found in NR/SMS/Part/Appendix/01

SERVICE B

1. Evaluator Computer

1.1 Examine evaluator computer and cabinet earthing for damage and security.

1.2 Examine the connection of cable shields to earth for security.

1.3 Check that the fan the operating voltage is present.

The green LED at the front of the fan should be illuminated.

1.4 Check the fan speed is O.K.

The red LED at the front of the fan should be extinguished.

1.5 Check that when the blue button is pressed, the red LED illuminates. Check that the fan fault has been registered on the S&D computer and then clear the appropriate fault from the log.

1.6 Check and if necessary clean or exchange the filter mats.

1.7 Measure using the PEGA 1121 test box in turn, ZAN card values between jacks (with heads fitted):

- Voltage U1 = 3.0 V DC ± 0.10 V DC (socket 5 & 7)
- Frequency f1 = 3.60 kHz ± 0.05 kHz (set at the counting head) (socket 4 & 6)voltage
- Voltage U2 = 3.0 V DC ± 0.10 V DC (sockets 12 &14)

- Frequency f2 = 6.52 kHz ± 0.10 kHz (set at the counting head) (sockets 11 & 13)

All Zero volt jack sockets are common across all ZAN cards. Use a Zero volt jack socket that is not next to the jack socket from which the reading is required.

If any value is found to be out of tolerance, there could be a fault with the cable system or the ZAN card and this should be investigated/rectified before any adjustments are carried out.

1.8 Check that there are no permanently illuminated RED LEDs on any of the Evaluator core components.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/AX31		
Siemens AzS 350U Axle Counter Evaluator		
Issue No: 04	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	AzS 350U ACE equipment
Exclude:	Siemens AzS ZP 43 V trackside connection box, Siemens AzS ZPD 43 trackside connection box, DEK43 double wheel detector

GENERAL

Possession of the relevant track sections of the axle counter shall be taken before adjusting VESBA card levels.

When inserting and removing test probes from the U, F and 0V test sockets on the VESBA card care shall be taken to avoid contact between the probe and the metal front plate or any other connected test probe.

Take care not to inadvertently press on the red push button on either VAU card, as this will reset the processor, which will place all sections to occupied.

A potential miscount or disturbance to the associated track sections could occur.

Keep switched on mobile phones and metallic objects away from the counting heads whilst undertaking maintenance as they can cause false-counts/readings.

If you have to reset the axle counter, follow the appropriate resetting procedure with the Signaller.

Before measuring or adjusting any VESBA card values the ZP 43 V or ZPD 43 wheel detection equipment values shall be checked (see NR/SMS/PartC/AX28 (Siemens AzS ZP 43 D Wheel Detector Equipment) or NR/SMS/PartC/AX29 (Siemens AzS ZP 43 V Wheel Detector Equipment).

If any value is found to be out of tolerance, there could be a fault with the cable system or the VESBA card.

Investigate this possibility as corrective maintenance before any adjustments are carried out.

More information on the outdoor equipment for Siemens axle counters can be found in NR/SMS/Part/Appendix/01.

SERVICE B

1. Evaluator Computer

1.1 Examine evaluator computer and cabinet earthing for damage and security.

1.2 Examine the surge arrester earthing.

1.3 Using a Fluke (compatible with TPWS) capable of measuring true RMS voltage and frequency, measure in turn the VESBA card values between the test points specified on record card NR/SMS/AX31/RC01.

a) Set meter for DC Voltage measurement (Ur1):

- Meter +ve to U (top right test point).
- Meter -ve to 0V(either in middle row).

Name	Function	Value	Range
Standard voltage	Ur1	3V DC	2.9V to 3.1V

If the voltage is not within range, adjust using the upper potentiometer.

b) Set meter for Frequency measurement (F1):

- Meter +ve to F (top left test point).
- Meter -ve to 0V (either in middle row).

Name	Function	Value	Range
Frequency	F1	3.60kHz	3.55kHz to 3.65kHz

If the frequency is not within range, the ZP 43 V or ZP D 43 wheel detection equipment values shall be checked (see NR/SMS/PartC/AX28 (Siemens AzS ZP 43 D Wheel Detector Equipment) or NR/SMS/PartC/AX29 (Siemens AzS ZP 43 V Wheel Detector Equipment).

c) Set meter for DC Voltage measurement (Ur2):

- Meter +ve to U (bottom right test point).
- Meter -ve to 0V (either in middle row).

Name	Function	Value	Range
Standard voltage	Ur2	3V DC	2.9V to 3.1V

If the voltage is not within range, adjust using the lower potentiometer:

d) Set meter for Frequency measurement (F2):

- Meter +ve to F (bottom left test point).
- Meter -ve to 0V (either in middle row).

Name	Function	Value	Range
Frequency	F2	6.52kHz	6.42kHz to 6.62kHz

If the frequency is not within range, the ZP 43 V or ZP D 43 wheel detection equipment values shall be checked (see NR/SMS/PartC/AX28 (Siemens AzS ZP 43 D Wheel Detector Equipment) or NR/SMS/PartC/AX29 (Siemens AzS ZP 43 V Wheel Detector Equipment).

1.4 Check that there are no permanently illuminated red LEDs on either of the VAU boards.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/AX40		
Frauscher Advanced Axle Counter		
Issue No: 08	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Frauscher RSR 123 wheel sensors used in both the Frauscher Advanced Axle Counters and for Supplementary Train Position Axle Counter Sections
Excludes:	All other applications of the RSR 123 wheel sensors

General

More information on the outdoor equipment for Frauscher Advanced Axle Counters can be found in NR/SMS/Appendix/07 (General Information on the Frauscher Advanced Axle Counter).

Information relating to fault finding and fault codes can be found in NR/SMTH/Part10/FF10 (Faulting Guide: Frauscher Advanced Axle Counter).

East Suffolk Line (Only)

On the East Suffolk Line, the supplementary axle counters are uniquely identified on site with the AEB cards fitted with magenta labels (shown circled red in Figure 1).

Figure 1 – Magenta Labels

They are configured with Supervisor Track Sections (STS) and Count Head Check (CHC).

The main interlocking control axle counting sections are acting as STS to the train position axle counter sections for the level crossings. The CHC is set to 100.

A record card is available, but completion of a card might not be required if the system being maintained has built data recording capabilities.

PERIODIC TASK 1

1. Alerts and Alarms

1.1 Review all alerts and alarms generated where FAMS is fitted. Arrange for corrective actions to be undertaken and inform your SM(S) of actions which require immediate and 28-day interventions.

1.2 Where FAMS is not available, review the errors generated within FDS and report any issues identified to your SM(S).

PERIODIC TASK 2

2. Remote Occupancy Detection Test

Observe that all sensors in the system have been traversed by a track vehicle or a PB200 testing plate within the last two years.

This can be verified by looking at the FDS or FAMS or equivalent downloads. Where the download does not prove the successful passage of an on-track vehicle, a work order shall be raised to carry out NR/SMS/PartB/Test/037 – Frauscher: RSR123 Wheel Sensor Occupancy Detection Capability Test, for each of the sensors which have not been traversed.

PERIODIC TASK 3

Rail Sensor Height Check

3. Mechanically

3.1 Measure the distance between the wheel sensor top surface and top of rail (distance “A” as shown in Figure 2). This shall be between 40 and 45mm. Adjust height if required. The measurement shall be consistent along the entire length of the wheel sensor.

It is recommended to adjust measurement A between 43 and 45 mm (optimal range).

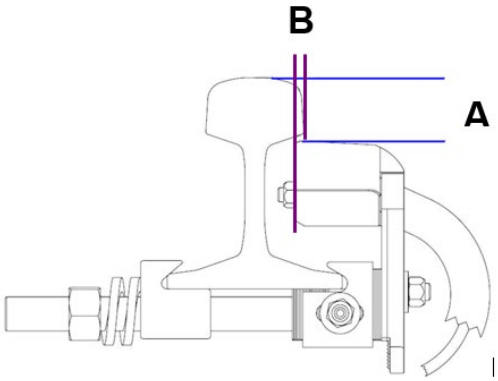


Figure 2 – Maintenance Measurements

NOTE: *Measurement “B” is not checked during maintenance, but only after replacement or installation of a wheel sensor*

3.2 Measure the distance between the wheel sensor inside edge and inside edge of the of rail head (distance “B” as shown in Figure 2). The wheel sensor is positioned slightly below and under the head of the rail. The measurement shall be between 0mm and 6mm. Adjust as required. The measurement shall be consistent along the entire length of the wheel sensor.

If the position of the RSR123 has been changed it shall be electrically re-calibrated using the correct SMS Part B Test.

END

Includes:	Frauscher wheel sensor RSR123
Excludes:	All other types of wheel sensor

A record card is available, but completion of a card might not be required if the system being maintained has built data recording capabilities.

SERVICE B

1. Wheel Sensor Calibration Checks

If RSR123 sensors are used for axle counter applications then carry out one of the methods in Clauses 1.1, 1.2 or 1.3.

1.1 Frauscher Diagnostic System (FDS) or Frauscher Active Monitor System (FAMS)

a) If required, start the web browser on the laptop, enter the IP address and log in.

b) Using the FDS, check the status of the life-signals for both wheel sensor systems are received. Figure 1 shows the life-signal ok (ringed in blue) Figure 2 shows the life-signal failed (ringed in red)

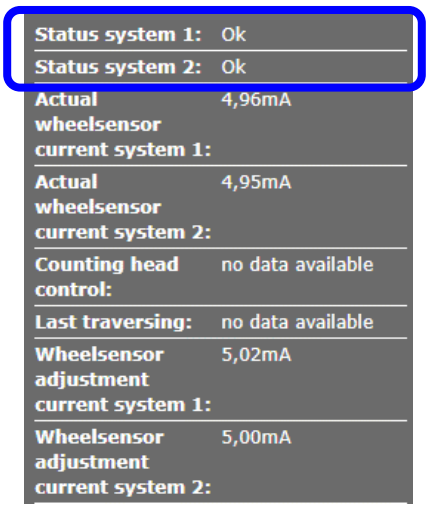


Figure 1 - life-signal ok

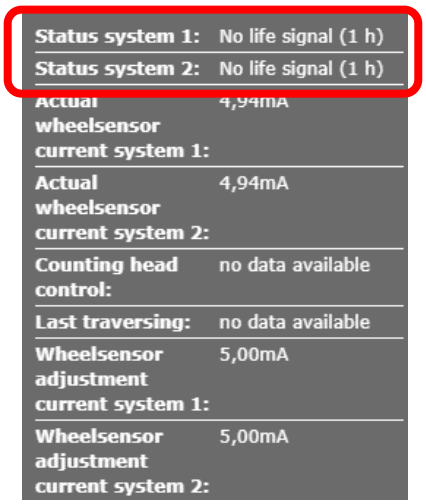


Figure 2 - life-signal failed

c) Check that the readings are within the range.

- *System 1: 5mA ± 5% (4.75mA to 5.25mA).*
- *System 2: 5mA ± 5% (4.75mA to 5.25mA).*

d) If the life-signals are missing and/or the voltages are out of range, this shall be reported to Fault Control.

1.2 Advanced Service Display (ASD)

Use only the correct, isolated and undamaged Advanced Service Display cable. There is no galvanic separation and no protection against overvoltage between the Serial Interface of the AEB and the electronics of the AEB board.

Before checking the sensor system currents with the indoor equipment, confirm that the associated mounted wheel sensor is in an undamped state.

a) Connect the laptop to the AEB by using the serial interface between the AEB and the USB port, with the advanced service display cable.

b) Check if the life-signals for both wheel sensor systems are received.

c) Check the current on the AEB for wheel sensor system 1.

d) Check the current on the AEB for wheel sensor system 2.

e) Check that the readings are within the range:

- *System 1: 5mA ± 5% (4.75mA to 5.25mA).*
- *System 2: 5mA ± 5% (4.75mA to 5.25mA)*.

f) If the values are not within the stated range check position of the wheel sensor RSR123 as described in NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3.

g) If the position of the RSR123 is correct, adjust wheel sensor as described in NR/SMS/PartB/Test/040 (RSR123 Wheel Sensor Adjustment - associated with AEB Boards).

h) Recheck if the life-signal and currents as per steps b) to e).
i) If the life signal is still missing and/or the currents are out of range, replace the wheel sensor as described in NR/SMTH/Part04/AX40 (Replace a Frauscher wheel sensor RSR123).

1.3 Advanced Evaluation Board (AEB)

a) Plug the multi-meter into the 2mm test sockets on the AEB and check if the life-signals for both wheel sensor systems are received.

NOTE: *The voltage should alternate from 0.5 V for 4 seconds to 0.51 V for 2 seconds. If the voltage is constant at 0.5 V no life-signal is present.*

b) Measure the voltage on the AEB for wheel sensor system 1.

c) Measure the voltage on the AEB for wheel sensor system 2.

d) Check that the readings are within the range:

- *System 1: 500mV ± 5% (475mV to 525mV).*
- *System 2: 500mV ± 5% (475mV to 525mV).*

NOTE: *The measured voltage complies with the wheel sensor system current via a 100 Ω shunt (100 mV therefore complies with 1 mA wheel sensor system current).*

e) If the values are not within the stated range check position of the wheel sensor RSR123 as described NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3.

f) If the position of the RSR123 is correct, adjust wheel sensor as described in NR/SMS/PartB/Test/040 (Frauscher : RSR123 Wheel Sensor adjustment – associated with AEB Boards).

g) Recheck if the life-signal and voltages as per steps a) to d).
h) If the life signal is still missing and/or the voltages are out of range, replace the wheel sensor as described in NR/SMTH/Part04/AX40 (Replace a Frauscher wheel sensor RSR123).

PERIODIC TASK 1

2. Mechanical and visual check of wheel sensor RSR123

2.1 Examine the wheel sensor mounting plates and bolts for heavy soiling, security and external damage.

2.2 Check the area around the rail contacts (within 2m) are free of such items as:

- Visible P/way defects.
- Metallic debris.
- New/scrap rails in the four/six foot or cess.
- Traction bonds.
- Excessive ballast.

Any problems that cannot be rectified shall be reported as corrective maintenance.

2.3 Observe exposed tail cables (protection tube), plug couplers and connections for security and damage.

PERIODIC TASK 2

3. Head Sensor Security

There are two variants of the Frauscher Rail Claw, confirm which is fitted before proceeding.

GS02 Rail Claw Only

3.1 Check the rail sensor securing nuts are tightened to correct torque values using an approved torque wrench tool as follows:

a) Figure 3 Allen Screws to 25Nm

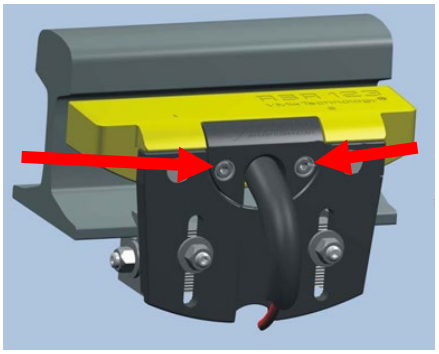


Figure 3 - Allen Screws

b) Figure 4 M10 nuts to 15Nm (Checked during installation/replacement only)

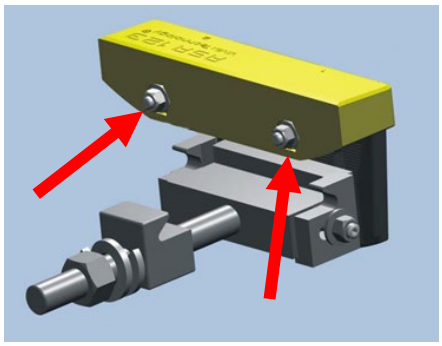


Figure 4 - M10 Nuts

c) Figure 5 M12 nuts to 40Nm.

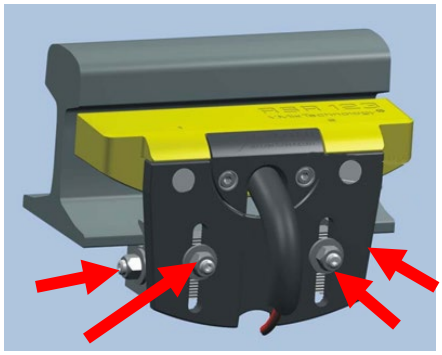
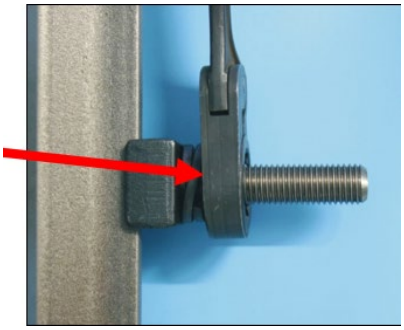


Figure 5 - M12 Nuts

Figure 6 – Rail Claw Nut

d) Figure 6 The Rail claw nut shall be tightened until the ends of the spring washer touch the main body of the washer, at this point the nut shall be tightened a further 360°.



GS04 Rail Claw Only

3.2 The GS04 Rail Claw has GS04 marked in the centre of the mounting plate for identification purposes.

3.3 Check the rail sensor securing nuts are tightened to correct torque values using an approved torque wrench tool see Figure 7 for details.

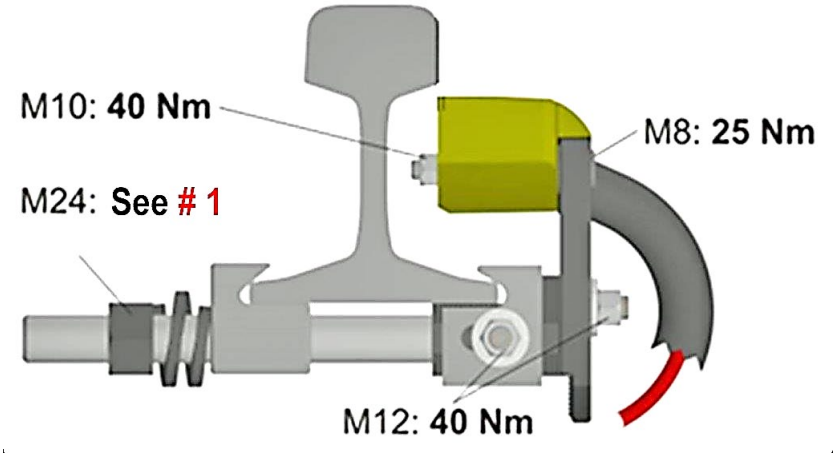


Figure 7 – Rail Claw Torque Values

#1 The rail claw nut shall be tightened until the ends of the spring washer touch the main body of the washer, at this point the nut shall be tightened a further 360°.

END

Includes:	Input / Output Extension Board IO-EXB used for data transmission with DUAL inputs
Excludes:	Input / Output Extension Board configured with QUAD outputs

This check is not necessary if QUAD outputs are used.

This test is required when using the IO-EXB for data transmission.

The responsible designer, who configures the IO-EXB, has to provide information as to whether the check is carried out automatically by the system, or whether the check has to be carried out by the maintenance personnel.

In this case, the designer has to give proper instructions how the check shall be carried out.

SERVICE C

1. Input / Output Extension Board (IO-EXB)

Provide switching states for both of the inputs used as shown in the Table 1.

Input 1	Input 2	Output 1	Output 2
HIGH	HIGH	HIGH	HIGH
LOW	HIGH	LOW	LOW
HIGH	LOW	LOW	LOW
LOW	LOW	LOW	LOW

Table 1 – Input / Output Extension Board (IO-EXB)

Providing of the switching states as described above guarantees that both inputs are operating correctly.

It is also necessary to check each of the two outputs used, to determine whether it is able to enter failsafe state.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/AX51		
Siemens Axle Counter ACM 100 (ACM Module and WSD Wheel Detector)		
Issue No: 03	Issue Date: 03/03/2018	Compliance Date: 31/05/18

Includes:	ACM 100 (ACM module and WSD wheel detector)
Excludes:	All other Axle Counter systems

Do not remove the ID-Plug unless faulty or replacing the ACM100 module.

Do not press any buttons on the front of the ACM100 module without permission from the signaller.

Keep switched on mobile phones 3m away from the counting heads whilst undertaking maintenance as they can cause false-counts/readings.

Keep metallic objects at least 20cm away from the counting heads. The movement of metallic objects including tools, steel toe-cap boots and jewellery across the upper surface of the counting heads can cause occupation of the track sections.The wheel detector is very sensitive.

If you have to reset the axle counter, the appropriate resetting procedure with the signaller shall be followed.

All wires of the connecting cable to the wheel detector can be subject to interference voltages. Do not touch live parts. This is particularly to be observed when working on the junction box (attaching wires, performing checks).

SERVICE B

1. Wheel Detector (WSD)

1.1 Examine the WSD, mounting plates and bolts for security and damage.

1.2 Check that the M12 securing nuts are tight (45 Nm) by using the appropriate torque wrench tool with 19mm socket.

1.3 Clean any loose metallic and other deposits from the surface of the WSD.

1.4 Check the area around the rail Wheel Sensor (within 2 m) is free of the following items:

a) P/way defects.
b) New/scrap rails in the four/six foot or cess.
c) Metallic debris.
d) Traction bonds.
e) Ballast in contact with the plastic housing of the wheel sensor.

1.5 Examine all tail cables (protective flexible tubing), connections, and clamps for security and damage. Resecure or replace as required.

1.6 Check that the distance from the top of the rail head and the top surface of the wheel sensor is 45mm (tolerance +0mm/-2mm) using the adjustment gauge as shown in figure 1. If the distance is outside of this tolerance, adjust the height of the wheel sensor to the correct value.

The adjustment gauge shall be placed on the wheel sensor with the green steel plate upper most. Otherwise the track sections might become occupied.

For an accurate measurement, place a straight edge across both the rail head and adjustment gauge.

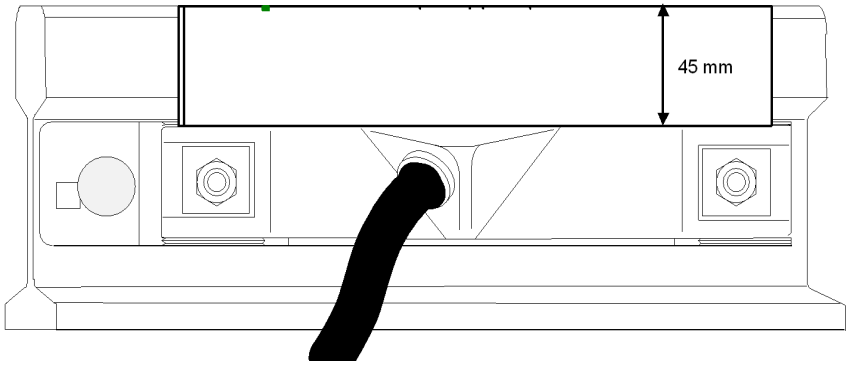


Figure 1 – Gauge position to check the WSD height

1.7 If using a rail clamp rather than rail web mounting, also check the distance from the rail (see figures 2, 3 and 4).

Figure 2 – Too close to the rail

Figure 3 – Too far away from the rail

Figure 4 – Correct position

If the distance is out of this range, adjust the position to the correct distance as shown in Figure 4.

1.8 Recalibrate and test the wheel sensor [Test038]

1.9 If practical, observe the passage of a train across the wheel detector and report any excessive deflection in the rail as corrective maintenance.

Excessive deflection in the rail at the point where the wheel detector is fixed to the rail can cause damage to the wheel detector.

2. ACM Module, PSU, UPS and Ethernet Switch

2.1 Examine the components for damage or signs of moisture ingress. Rectify or report as corrective maintenance.

2.2 Check that all connections to the ACM100 module, PSU, UPS and Ethernet Switch are undamaged and secure.

2.3 Check for RED or flashing LEDs on ACM100, PSU and UPS modules. Refer to NR/SMS/Appendix 13 for LED normal and fault state details. In case of any LED fault indication status, rectify or report as corrective maintenance.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/AX99		
Trains Entering Terminal Stations System (TETS)		
Issue No: 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Siemens - RSE Wheel detector (TETS System Richmond only)
Excludes:	All other types of wheel detector and sensor

Protection / Possession arrangement shall be taken before commencing work on any track sections

System Description

The Siemens Wheel Detector is a switching device which responds to the presence of wheel flanges of passing trains. It is used within the speed control system at Richmond as part of the LUL Trains Entering Terminal Stations system it consists of the following parts:

- A sensing head / tail cable assembly which is mounted to the inside web of one of the rails, known as the RSE Wheel Sensor (Fig 1)
- Disconnection box mounted in the cess, known as the Cable Junction Box.
- An evaluator interface PCB which is installed in the relay room, known as the ARS4.
- A power supply unit.

Fig 1 – RSE Wheel sensor

The rail mounted sensor and its control circuitry are connected via the cable junction box by a single twisted pair, screened cable.

Maintenance equipment

- M13 Ring spanner
- Flat-bladed Screwdriver (large)
- M13 Torque Spanner (range 70-80Nm)
- Adjustable Sliding Set Square
- Multimeter with voltage internal resistance greater than 50Kohms per volt.

SERVICE B

1. RSE Wheel sensor Assembly

1.1 Remove all fire risks, e.g. waste paper, oily rags, etc. from the vicinity of the sensing head and the tail cable.

1.2 Remove any metallic or other conductive debris from the vicinity of the sensing head.

1.3 Check that the sensing head and mountings are clear of the ballast and check that no other obstacles are able to foul the space between the top of the sensing head, and the position of the wheel flanges of passing trains.

1.4 Check that where the tail cable is routed underneath the sensor, that it does / will not get trapped between the sensor and ballast during the passage of traffic.

1.5 Clean the sensing head of dirt and debris particularly any build-up of brake dust or rail swarf with the relevant approved cleaning agent.

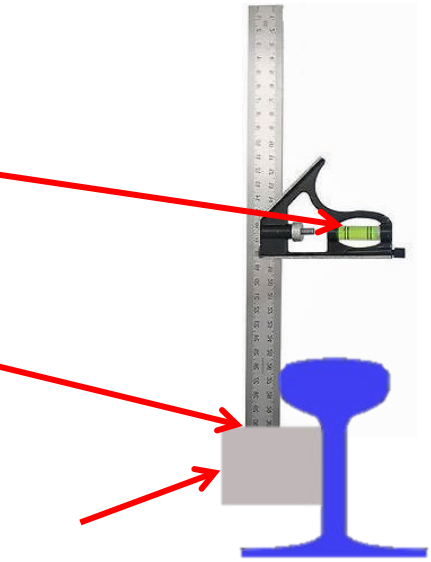
1.6 Examine the sensing head fixings to the rail. Check that they are secure and that there is no evidence of movement/vibration.

1.7 Examine the sensing head for damage (damage can indicate an incorrect height setting of the sensor), Damage, which is assessed as being able to affect the functionality or reliability of the equipment, shall be reported to your SM(S) who shall arrange for the replacement of the sensing head.

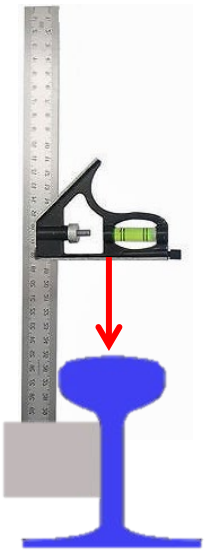
1.8 Check the height setting of the sensing head with the use of an adjustable sliding set square as follows:

At locations where conductor rails are in use an insulated shield shall be placed over the live rail adjacent to the Sensor head before checking the sensor head height.

- Keeping the bubble level
- Place the end of the rule square down onto the sensing head



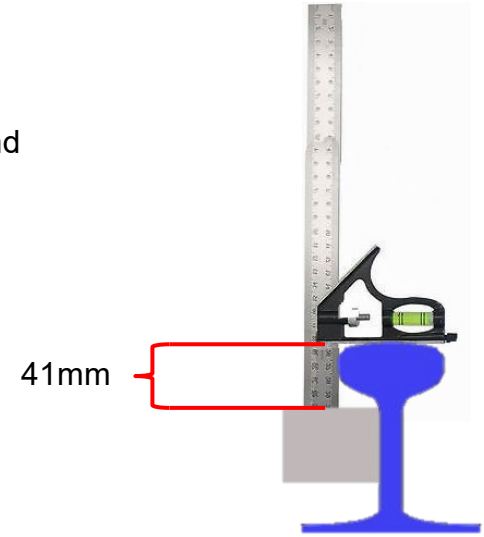
Sensor Head



- Slide the body of the square down onto the rail head.

- Measure the vertical height from the top surface of the sensing head to the top of the rail at both ends of the sensing head

- The sensing head should be positioned parallel to the rail top and the height dimension at either end should be 41mm +/-1mm.



1.9 If the sensor height setting requires adjustment, then this shall be undertaken as follows:

- At the outside web of the rail slacken the two M13 fixing nuts which secure the sensing head to the rail.

- On the sensing head, slacken the two M13 adjusting nuts which secure the sensing head to the circular adjustable cams.

- By using a flat bladed screwdriver into the slots provided on the ends of the adjusting bolts on the sensor, turn the bolts slightly until the sensing head is adjusted to the correct setting.

- If the adjusting bolts (or the fixing bolts) turn continuously in the anti-clockwise direction, without the height setting being changed, then stop.

This means that the bolts are unscrewing from the circular adjusting cams and will eventually come out. To remedy, re-tighten all the bolts .and adjust the sensor height by hand and proceed as follows.

- Tighten all the nuts and recheck the height position at both ends of the sensing head. Adjusting nuts and fixing nuts shall be tightened to a torque of 70-80Nm Where separate locking nuts are used, screw them down by hand and then using a spanner give a further quarter to half turn. Where self-locking nuts are used e.g. Nylocs, or spring/crinkle washers, these shall be replaced with new items when adjustments are made and shall not be used more than once.

1.10 Examine the tail cable and gland to the sensor for general condition and security. Check that the tail cable is routed and secure in order to be clear of the rails and to prevent damage by passing traffic or on-track maintenance machines.

* 1.11 Check the operation of the wheel sensor by placing a metal spanner close to the running edge of the rail above the middle of the sensor head or await the passage of a train over the sensor and check that:

- Either, the current through the sensor measured at the ARS4 board reduces from the undamped value (between 5.5 - 8.0mA) to the damped value (between 0.0 - 1.0mA) and subsequently returns to its previous value upon removal of the switching medium.

- Or, the applicable LED on the ARS4 front panel indicates (by extinguishing / darkening) that the wheel detector has correctly operated.

1.12 Check the condition of the rail at the sensor mounting position for the following:

- Excessive burring of the rail top over onto the running edge of the rail; this can permanently activate the sensor.

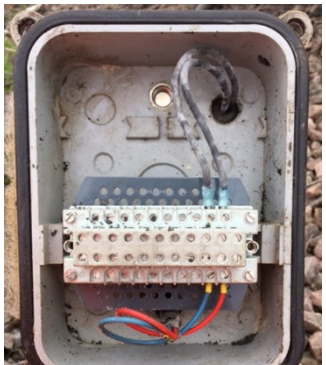
- Excessive side wear (max. 15mm) of the running edge, this may allow the wheel flange to pass to the side of the wheel detector and not be detected.

A Permanent Way “053 Gauge” can be used for this purpose

- The condition of the area adjacent to the mounting holes in the rail web for corrosion and cracking.

1.13 Any deficiency shall be reported to the SM(S)

2. Cable Junction Box



2.1 Check the cable junction box for general condition and damage and that all mountings are secure.

2.2 Check that the connecting cables to the junction box are secure and that they are properly supported. Check the security of protective hose cable clips.

2.3 Check the lid fastening and seal arrangement and clean the interior of tl1e junction box. Check the terminations for security and evidence of corrosion and protect if necessary.

2.4 Clean the outside of the cable junction box.

3. ARS 4 Evaluation Unit

The evaluation unit PCB's are static sensitive devices and should be handled accordingly.

3.1 Check the PCB's for general condition and security within the holder. Defects shall be reported to the SM(S) who shall arrange for replacement.

3.2 For each wheel detector controlled by the ARS board measure and record the following checks on the appropriate record card:

- Press the relevant test button (marked T1, T2,T3, T4) and check that the applicable LED (marked L1, L2, L3, L4) on the ARS 4 front panel indicates (by extinguishing/darkening) that the circuitry has tested satisfactorily (see Fig 4b.).

- Press the relevant test button (marked T1, T2, T3, T4) and check the switching of the output voltage (1.5 - 4.5V DC) to the follower relays as the test button is pressed. (See fig 4a).

Channel 1 – Measure the voltage across terminals B2 and B6, then press the test button T1 and measure the voltage across terminals B4 and B6. The voltage seen on the second set of terminals should be same as that on the first set.

Channel 2 - Measure the voltage across terminals Z10 and Z14, then press the test button T2 and measure the voltage across terminals Z12 and Z14. The voltage seen on the second set of terminals should be same as that on the first set.

Channel 3 - Measure the voltage across terminals B18 and B22, then press the test button T3 and measure the voltage across terminals B20 and B22. The voltage seen on the second set of terminals should be same as that on the first set.

Channel 4 - Measure the voltage across terminals Z26 and Z30, then press the test button T4 and measure the voltage across terminals Z28 and Z30. The voltage seen on the second set of terminals should be same as that on the first set.

For details of terminal locations see fig 4a - ARS 4 Terminations.

3.3 Alternatively, if the relevant track circuit can be "dropped', check that the follower relay operates when the relevant test buttons are pressed.

	Termination Points		
B2	Z2		D2
B4	Z4		D4
B6	Z6		D6
B8	Z8		D8
B10	Z10		D10
B12	Z12		D12
B14	Z14		D14
B16	Z16		D16
B18	Z18		D18
B20	Z20		D20
B22	Z22		D22
B24	Z24		D24
B26	Z26		D26
B28	Z28		D28
B30	Z30		D30
B32	Z32		D32

(Termination points are located at the base of the card)

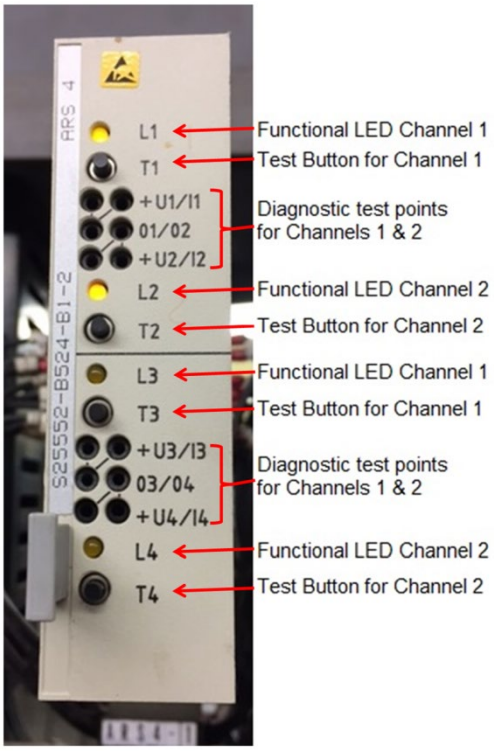


Fig 4a - ARS 4 Terminations

Fig 4b - ARS 4 Front Panel

4. Power Supply

4.1 Dust and examine the power supply unit.

4.2 Examine earth connections checking they are in good working order.

4.3 Examine terminations, clean and protect as necessary.

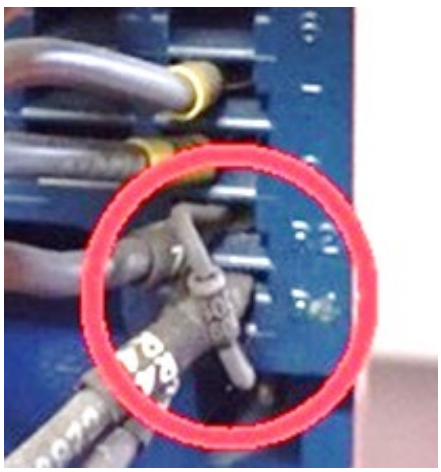
4.4 Examine cable and wiring to the power unit for general condition and for protection along its route.

4.5 Measure the 50VDC (nominal) supply voltage to the evaluation unit (ARS 4).

This should measure between 45-72VDC.

5. Diode

5.1 Check local diagrams to identify any relays fitted with diodes (as shown in the diagram to the right). Visually examine the diode across the interface relay coil to check that it appears to still be connected.



END

Includes:	TASS Balise and Balise Mounting Assembly
Excludes:	Any other type of Balise

A damaged or displaced balise assembly which is affecting the safe passage of trains, or a risk to personnel, shall be removed immediately to a secure location and the Signaller advised.

If the bracket is damaged, then protective gloves shall be worn when removing the item.

Figure 1 - TASS Balise assembly installed using the rapid fixing kit

TASS is an abbreviation for 'Tilt Authorisation and Speed Supervision'. It consists of trainborne equipment and Balises (trackside TASS beacons).

The Balise and Mounting Bracket assembly shall be exchanged for a completely new unit when Balise replacement is required.

Such units shall be assembled in a controlled environment away from the trackside and issued to site as required.

Balises have been manufactured to withstand extreme conditions and the electronics inside are sealed to protect them from the environment, thus improving reliability.

During maintenance visits, if damaged units are found, they are to be removed and returned to the supplier.

Under no circumstances should any type of repair to a Balise and Mounting Bracket assembly be attempted on site.

Replacement of the Mounting Bracket assembly as a component separate from the Balise is permitted if this is necessary to make good any minor damage or to facilitate a change of track fastening type.

There is no need to periodically check the Balise with the Telegram Reading Tool.

A Balise failure affecting the telegram data is identified and protected by the trainborne TASS system and reported by the driver.

SERVICE B

1. Balise Assembly

1.1 Check that the Balise and fastenings are securely positioned.

If the balise is displaced or if fastenings are loose or are becoming loose, report it as corrective maintenance.

1.2 Remove metallic and other debris and combustible material from the proximity of the Balise.

1.3 Remove any ballast that is impacting on the Balise. Especially underneath, to prevent the unit being put under mechanical stress, which can result in cracking or de-lamination?

1.4 Check the 14 character identifier is intact on both the Balise and mounting assembly and that the two identifiers are identical and correct and match the Balise records.

If defaced, illegible or incorrect, report it as corrective maintenance.

1.5 Examine the Balise assembly. If any signs of damage, tampering, or vandalism are visible report it as corrective maintenance

1.6 Examine the Balise connector cover. If missing or any signs of tampering or vandalism report it to your SM(S).

END

Includes:	Ansaldo Eurobalise
Excludes:	TASS Balise and all other Balises

General

There is no requirement to periodically check the Balise with the Telegram Reading Tool if a JRU train download is scheduled. Any issues are identified and recorded by the train borne equipment.

This excludes locally controlled level crossing & Temporary Speed Restriction (TSR) Balises.

This record of failure is also reported via the Radio Block Centre to SAM, as an ERROR.

DAILY SERVICES

1. Messages

1.1 Check SILAM for any Balise "ERROR" messages received from trains during the previous 24 hours or since the last check.

1.2 Where a Balise or Balise group display an ERROR message the actions in Table 1 shall be taken.

Some Balise groups are likely to display ERROR messages routinely due to their positioning in relation to shunting, reversing and terminating moves.

Where this is suspected to be the cause of an ERROR message, inform the SUPERVISOR who shall decide what action is to be taken.

Balise	ERROR	Action
Odometry and Awakening	2 or more messages in any 24-hour period	Report as a failure of equipment
	3 or more failures in any 7-day period	
	7 or more failures in a 28-day period	
Text Message Balise Odometry Balise with a Text Message	Single failure to read. *Note: - when a driver fails to receive a message from a Balise he is required to report this failure to the Signaller.*	Inform the Signaller
Stop Balise	A Balise containing stop data is linked to others in the group, should a single Balise fail to be read the train is tripped automatically. If more than one Balise in the group fails, this should be found using the daily service.	The cause of the train being tripped shall be investigated. Inform the Signaller who should report the failure.

Balise	ERROR	Action
Automatic Wheel Diameter Calibration Balise	Packet 4 using M_ERROR to show a “Balise consistency linking” error. (O)	Report as an equipment failure
All Balise Groups	Where errors of more than one Balise group are associated with a particular Engine NID number and all other trains read the Balise correctly	Report the event as an on-board failure to the ICC including details of the location of the Errors, the Engine NID, the Unit or Locomotive Number and the service Headcode.

Table 1 - Balise Group Error Messages

REGULAR TASK

2. JRU download

2.1 Perform a JRU train download for analysis.

SERVICE B

3. Llanbadarn Locally Controlled Level Crossing Balise

3.1 Check with the Balise Programming Tool that each Balise in the group is operating correctly by reading the stored message over the air gap.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/BA16		
KVB Balise		
Issue No: 02	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

GENERAL

Obtain the Signallers permission for work which interferes with the signalling equipment.

Details of the use of the KVB tester can be found in SMS Appendix 23.

SERVICE B

1. REB/Location Case Checks (Switchable Balises Only)

1.1 Check LED indications are correct on both the microprocessor and power supply cards as follows:

a) Green LED on AHT card, normally illuminated, indicates presence of 5V power supply.

b) Green LED on UCS card, normally illuminated, indicates card working correctly.

c) The yellow LED on the UCS card is normally not iluminated unless indicating “presence train “ or initialization under way following a rack re-energisation. In initialization stage is within 30 seconds.

1.2 With the UCS maintenance card connected verify that that no errors are present in the encoder memory record log.

All faults shall be investigated. Details of each fault shall be passed to the SM(S).

Additional information on fault finding can be found in NR/SMTH/Part10/FF26 (Faulting Guide : KVB Balise).

1.3 Erase the “Failure Memory”.

Additional information on the KVB test set can be found in SMS Appendix 23.

2. Trackside

2.1 Check the balise (signal and marker) are in good condition (e.g. no sign of impacts or damage).

2.2 Check that the balise and support plates are securely fixed and free from damage.

2.3 Check distribution boxes are secure, free from damage and water ingress.

2.4 Check ballast clearance under the balise is between 5 and 10cm.

2.5 Remove all debris, fire risks and potential hazards.

2.6 Check the BCB encoding plug (fixed signal balise) or the cable plug coupler (switchable signal balise) is securely fixed and free from damage.

2.7 Carry out NR SMS/PartB Test 209 Section 1 – Balise Test.

2.8 Carry out NR SMS/PartB Test 209 Section 2 – Presense Train Test

PERIODIC TASK

3. Replace BCC Plug

3.1 Swap the in service BCC plug of the encoder rack with a correctly coded replacement.

This task shall be carried out using NR/SMTH/Part04/BA13 – Replace a KVB Encoding Plug.

3.2 With the UCS maintenance card connected verify that that no errors are present in the encoder memory record log.

All faults shall be investigated. Details of each fault shall be passed to the SM(S).

Additional information on fault finding can be found in NR/SMTH/Part10/FF26 (Faulting Guide : KVB Balise).

END

Includes:	All Swing Bridges listed in the table
Excludes:	Banavie (Canal) See BR12

GENERAL

The Signal Engineer is responsible for the Signallers panel. This incorporates controls and indications for the Bridge operation. The signalling interlocking also has inputs and outputs to and from the Bridge control gear. There is always some control and indication circuitry that involves both plant and signalling responsibility and a suitable boundary point for those circuits will have been agreed.

Swing Bridges are located at:

Goole	Swing
Hull River	Swing Bridge
Keadby (Canal)	Draw Bridge
Keadby (River)	-
Selby	Swing Bridge
Oulton Broad	Swing Bridge
Reedham (River)	Swing Bridge
Somerleyton (River)	Swing Bridge

Keadby (River) Bridge is also known as King George V Bridge, Althorpe. This used to be a drawbridge but is now permanently fixed. While there is no rail alignment detection at this bridge, the Signal Engineer is responsible for the navigation lights which are light proved and indicated in Keadby Gate Box. At all other bridges, the navigation lights are a plant responsibility.

Signallers of Swing bridges have the following indications of the state of the bridges:

GREEN: Bridge Home, Bridge Bolts in, Rail Alignment Detected.
YELLOW: Bridge Home, Bridge bolts in, but no Rail Alignment Detection.
RED: Bridge Not Home (Bridge Open).

The Rail alignment Detection is proved in all signals leading over the bridge. It is more sensitive than the bridge bolts and there might be cases where the bridge bolts can go home but Rail Alignment cannot be obtained. Where rail alignment detection cannot be obtained, but the Plant Engineers bolts have been detected home, a yellow indication is given to the Signaller. Local instructions generally allow trains to pass over the bridge at low speed after cautioning.

Oulton Broad, Reedham (River), Somerleyton (River) have “Spagnoletti needle” indicators in the Signal box/cabin (see Appendix B).

SERVICE A

1. Point Machine and Fittings

1.1 Carry out maintenance to the point machine driving the rail Alignment Detection in accordance with the relevant NR/SMS/PartC/PCxx series Service A, for hydraulic machines use NR/SMS/PartC/PB11 Service A. Also see NR/SMS/PartC/PA01 & NR/SMS/PartC/PF02 for the rodding and cranks.

2. Rail Alignment Detectors

(Goole, Keadby Canal, Hull & Selby) - refer to Appendix A.

(Oulton Broad, Reedham, & Somerleyton) - refer to Appendix B.

2.1 With the detector blade normal, gauge the tolerance between each side of the blade and inner faces of the detector block, the total of which shall not be more than 8mm (5/16”), if a limit switch is provided or 12mm (1/2”) without.

2.2 Gauge the blade width to confirm wear is not taking place on the blade. The width shall be 25mm (1”) (Goole, Keadby Canal, Hull, & Selby)or 70mm (2 3/4”) (Oulton Broad, Reedham & Somerleyton), the acceptable tolerance being 3mm (1/8”). If these tolerances are exceeded advise your SM(S) as the blade requires replacing.

2.3 Gauge rail ends with a straight edge, measure any misalignment and record.

2.4 Where provided, measure the distance between the limit switch operating arm roller (at the point of contact with the detector blade) to the unoperated central position:

If these measurements are not within ± 4mm (5/32”) then the roller has worn excessively below its normal 19mm (3/4”) diameter and the lever arm shall be renewed.

If subsequently the settings above are not obtainable the complete switch and existing arm shall be replaced.

2.5 With the detector plunger reversed (withdrawn) check that the limit switch operating lever (if fitted) has self-restored to the un-operated centre position at 90° to the plane of the detector blade (0° to the switch).

2.6 If fitted, examine limit switch contact assembly, special attention being given to the moving contact tension springs. Excessive wear of the contact requires the fixed and moving contacts to be replaced with new assemblies.

2.7 If a limit switch is fitted, operate lever arm with the detector blade and observe the contact assembly for correct operation and engagement of the lever arm in the blade bevel. Confirm that the roller rotates.

2.8 Examine terminations clean and protect as necessary.

2.9 Examine cables to limit switches and confirm they are not chafing at gland entries.

2.10 Lightly lubricate moving parts and bearings of limit switch (if fitted) with mineral oil. Confirm correct tension is available upon the operating lever whilst observing the operation, by hand, of the mechanical linkage.

2.11 Test for correct operation of 'IN' and 'OUT' indications by operation from the cabin. The 'coarse' normal and reverse proving of the blade shall make within 12mm (1/2") of the end of the travel. The blade shall not be withdrawn to a position further than flush with the detector side edge of the first guide block on the adjacent bridge mounting.

2.12 Apply lithium-based grease to grease nipples and detection plunger.

2.13 Apply mineral oil to stud connections, screw threads, and lid fixing screws.

2.14 Repeat 2.1 to 2.13 for all remaining detectors.

2.15 Test by operation from bridge cabin or signal box.

3. Bridge Indications

(Goole, Keadby Canal, Hull, Selby Oulton Broad, Reedham & Somerleyton).

3.1 In the Signal box, if practical, observe the Bridge indications through a complete opening and closing cycle of the bridge. If it is not practical to observe a complete cycle, then function test the rail alignment detection and check that the signalling interlocking releases and subsequently locks the bridge operating controls and the indications for those parts of the cycle are correctly displayed.

3.2 The Anglia bridges have an indication "bridge home". In addition to 3.1 examine the brass rod, internal contacts and springs on the bridge and check they are operating correctly. Clean as necessary.

4. Navigation Lights

(**Keadby River Bridge Only)**

4.1 Test operation of lamp proving by making a disconnection. Check Signal Box receives "light out" alarms and correct indications.

SERVICE B

5. Point Machines and Fittings

Carry out maintenance to the point machine driving the rail Alignment Detection in accordance with the relevant NR/SMS/PartC/PCxx series Service B, for hydraulic machines use NR/SMS/PartC/PB11 Service B. Also see NR/SMS/PartC/PA01 & NR/SMS/PartC/PF02 for the rodding and cranks.

6. Wedges

(Goole, Hull & Selby Oulton Broad, Reedham & Somerleyton Only)

6.1 Function Test the operation of each limit switch on the bridge by monitoring with an AVO meter on the limit switch circuit while the bridge is operated.

6.2 If any adjustment, repair, or renewal of a limit switch is required it shall always be done in conjunction with the E&P Engineer.

7. Emergency Release

7.1 Where provided, test operation of emergency release and key token pilot working facilities.

8. Electrical Disengager (Goole only)

Electrical Disengagers are unique to Goole Swing Bridge. They are large plug and socket connectors mounted on the open edge of the bridge carrying the Signalling controls and indications to adjacent signals and signal boxes. They are required to disengage and separate before the bridge can move.

When the Disengagers separate, electrical power is maintained on the bridge by a UPS that is provided by the E&P Engineer.

8.1 Wipe and examine disengager and mechanical connections.

8.2 Examine bearings, turned pins and spilt pins in disengager mechanical connections for excessive wear or slackness.

8.3 Examine cables and confirm that they are not chafing, especially at gland entry.

8.4 Clean and examine individual contact pins.

8.5 Lubricate with contact fluid.

8.6 Apply mineral oil sparingly to disengager guide pins, disengager slides and mechanical connections. Remove any surplus.

8.7 Apply lithium-based grease to grease nipples.

8.8 Test Disengagers from the Signal box for correct operation.

9. Overhead Cable Route

9.1 Examine suspender fastenings as necessary.

9.2 Lubricate centre pin and shackles on swing span termination with mineral oil.

9.3 Examine cable sheath for signs of chafing.

APPENDIX A - Goole, Keadby Canal, Hull & Selby

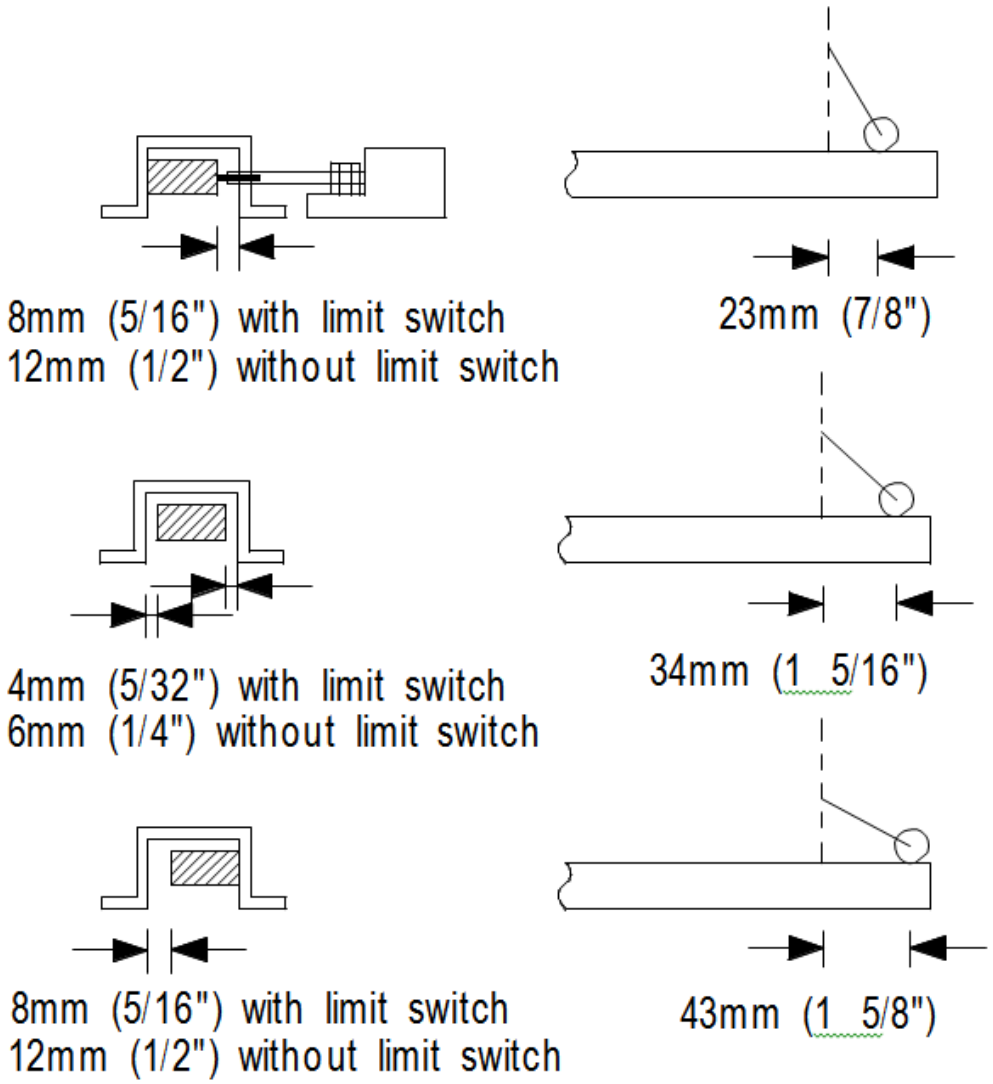


Figure 1 – Limit Switch Measurments

APPENDIX B - Oulton Broad, Reedham, & Somerleyton

Figure 2 – Typical Indications

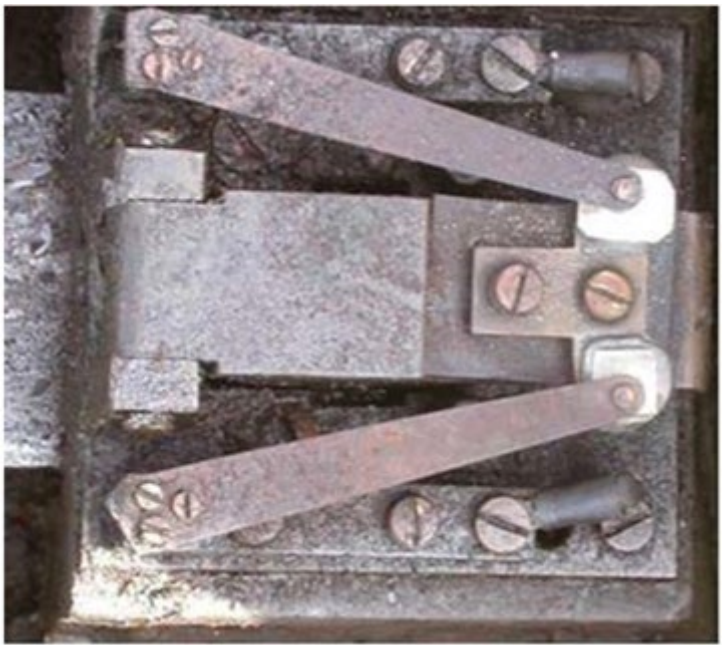


Figure 3 – Bridge Bold Detection

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/BR12		
Swing Bridges - Banavie		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Banavie (Canal) Swing Bridge
Excludes:	All Other Swing Bridges

GENERAL

The Signal Engineer is responsible for the Signallers panel. This incorporates controls and indications for the Bridge operation. The signalling interlocking also has inputs and outputs to and from the Bridge control gear. There is always some control and indication circuitry that involves both plant and signalling responsibility and a suitable boundary point for those circuits will have been agreed.

Signallers of Swing bridges have the following indications of the state of the bridges:

GREEN: Bridge Home, Bridge Bolts in, Rail Alignment Detected.
YELLOW: Bridge Home, Bridge Bolts in, but no Rail Alignment Detection.
RED: Bridge Not Home (Bridge Open).

The Rail alignment Detection is proved in all signals leading over the bridge. It is more sensitive than the bridge bolts and there may be cases where the bridge bolts can go home but Rail Alignment cannot be obtained.

Where rail alignment detection cannot be obtained, but the Plant Engineers bolts have been detected home, a yellow indication is given to the Signaller. Local instructions generally allow trains to pass over the bridge at low speed after cautioning.

SERVICE A

1. Point Machine and Fittings

1.1 Carry out maintenance to the point machine driving the rail Alignment Detection in accordance with the relevant NR/SMS/PCxx series Service A, for hydraulic machines use NR/SMS/PB11 Service A.

1.2 Carry out NR/SMS/PA01 & PF02 for the rodding and cranks

1.3 Carry out NR/SMS/LV31 for the circuit controllers.

2. Rail Alignment Detectors

Refer to Appendix A

2.1 With the detector blade normal, gauge the tolerance between each side of the blade and inner faces of the detector block, the total of which shall not be more than 8mm (5/16”), if a limit switch is provided or 12mm (1/2”) without.

2.2 Gauge the blade width to confirm wear is not taking place on the blade. If these tolerances are exceeded advise your SM(S) as the blade requires replacing.

2.3 Gauge rail ends with a straight edge, measure any misalignment and record.

2.4 Where provided, measure the distance between the limit switch operating arm roller (at the point of contact with the detector blade) to the unoperated central position:

If these measurements are not within ± 4mm (5/32”) then the roller has worn excessively below its normal 19mm (3/4”) diameter and the lever arm shall be renewed.

If subsequently the settings above are not obtainable the complete switch and existing arm shall be replaced.

2.5 With the detector plunger reversed (withdrawn) check that the limit switch operating lever (if fitted) has self-restored to the un-operated centre position at 90° to the plane of the detector blade (0° to the switch).

2.6 If fitted, examine limit switch contact assembly, special attention being given to the moving contact tension springs. Excessive wear of the contact requires the fixed and moving contacts to be replaced with new assemblies.

2.7 If a limit switch is fitted, operate lever arm with the detector blade and observe the contact assembly for correct operation and engagement of the lever arm in the blade bevel. Confirm that the roller rotates.

2.8 Examine terminations clean and protect as necessary.

2.9 Examine cables to limit switches and confirm they are not chafing at gland entries.

2.10 Lightly lubricate moving parts and bearings of limit switch (if fitted) with mineral oil. Confirm correct tension is available upon the operating lever whilst observing the operation, by hand, of the mechanical linkage.

2.11 Test for correct operation of ‘IN’ and ‘OUT’ indications by operation from the cabin. The ‘coarse’ normal and reverse proving of the blade shall make within 12mm (1/2”) of the end of the travel. The blade shall not be withdrawn to a position further than flush with the detector side edge of the first guide block on the adjacent bridge mounting.

2.12 Apply lithium-based grease to grease nipples and detection plunger.

2.13 Apply mineral oil to stud connections, screw threads, and lid fixing screws.

2.14 Repeat 2.1 to 2.13 for all remaining detectors.

2.15 Test by operation from bridge cabin or signal box.

3. Bridge Indications

3.1 In the Signal box, if practical, observe the Bridge indications through a complete opening and closing cycle of the bridge. If it is not practical to observe a complete cycle, then function test the Rail Alignment detection and check that the signalling interlocking releases and subsequently locks the bridge operating controls and the indications for those parts of the cycle are correctly displayed.

SERVICE B

4. Point Machines and Fittings

4.1 Carry out maintenance to the point machine driving the rail Alignment Detection in accordance with the relevant NR/SMS/PartC/PCxx series Service B, for hydraulic machines use NR/SMS/PartC/PB11 Service B.

4.2 Carry out NR/SMS/PartC/PA01 & NR/SMS/PartC/PF02 for the rodding and cranks.

4.3 Carry out NR/SMS/PartC/LV31 for the circuit controllers.

5. Overhead Cable Route

5.1 Examine suspender fastenings as necessary.

5.2 Lubricate centre pin and shackles on swing span termination with mineral oil.

5.3 Examine cable sheath for signs of chafing.

APPENDIX A - Rail Alignment Detector Tolerances

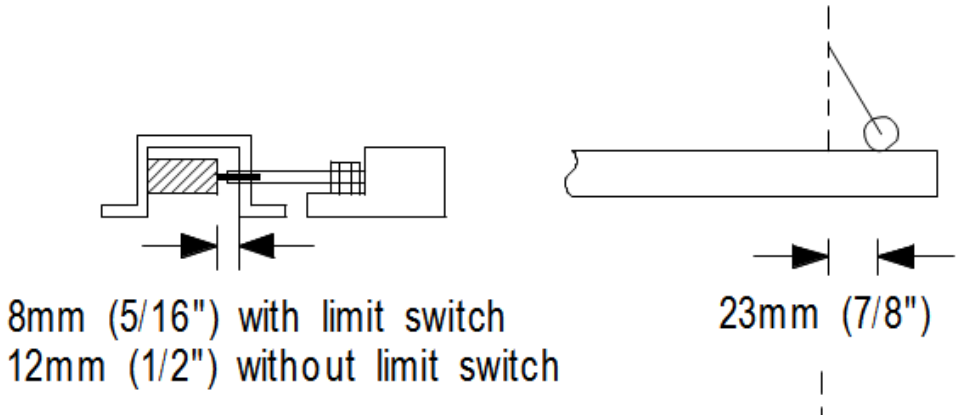


Figure 1 – Rail Alignment Detector Tolerances

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/BR20		
Bridge Navigation Lights (Keadby - King George IV Bridge)		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Keadby - King George IV Bridge
Excludes:	All other Navigation Lights (Lanterns)

GENERAL

The Navigation lights are manufactured by Pelangi, Part No PA2835 DRG PL2212 Assembly.

All Navigation lights are LED lanterns manufactured by Pelangi Type No PL83.

There are eight lanterns on the bridge:

There are six duplicated LED units on (NE)Red, (NC)Green, (NW)Yellow, (SE)Red, (SC)Green, (SW)Yellow [all with “TOP” and “BOTTOM” lanterns], and two single LED units for (NORTH)Yellow, (SOUTH)Yellow navigation lanterns.

SERVICE B

1.1 Check that the light unit is undamaged, secured to the bridge structure and correctly aligned.

1.2 Examine the tail cable and cable entry glands.

1.3 Examine the internal wiring and terminations. Protect as necessary inclusive of disconnection boxes.

1.4 Check that all the LED’s are lit and visually check the quality of the aspect corresponds to the diagrams.

1.5 Record all LED voltages at the corresponding disconnection boxes NR/SMS/PartR/T021/RC05 (Signal – LED).

1.6 Clean the exterior of the LED light units.

1.7 Disconnect each LED in the control case and check the corresponding LED extinguishes and the NAV LIGHTS ECR de-energises check the functionality of the NAV LIGHTS EK with monitoring SB, repeat all other LED’s (Due to the restricted access on the bridge it is acceptable to disconnect the individual LED’s in the signalling location).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/CA02		
Air Main System		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Main Air Systems
Excludes:	All other Air Systems

The air main pump is the responsibility of the Plant Engineer and falls within the scope of the legislation on pressure vessel testing. Staff required to work on this equipment shall be specially authorised.

Air mains for point operation typically operate at 60 psi (Bar 4.14). Care should be taken when connecting or adjusting sections of pipe / hose.

The air main for the section concerned shall be isolated before replacement parts are fitted.

SERVICE A

1. External

1.1 Inspect the visible air main throughout the full length, including cross track routes and connections.

a) Check pipes, joints, supports and fixings.

b) Remove, where practicable, fire risks, physical obstructions.

c) Check cover plates and air main protection. Repair leaks where practicable (e.g. tighten joints).

1.2 Report outstanding defects as corrective maintenance, e.g.

a) Subsidence, collapses.

b) Outstanding leaks.

c) Mechanical damage.

1.3 Release fluid contaminants using the air main bleed point (where provided).

END

SERVICE A

1. Primary Cells (if Fitted)

Carry out NR/SMS/PartB/Test/058 (Primary Cell Test).

Continually loaded cells should be replaced if their obtained readings indicate they can fail before the next maintenance visit. See NR/SMS/PartC/EL00 (Electrical Equipment – General).

1.1 Check the number of cells is correct.

2. Secondary Cells (if Fitted)

NOTE: *This service is not required if the batteries are "Maintenance Free"*

2.1 Clean and examine all exteriors and cases.

2.2 Check the level of electrolyte - top up with distilled/ionised water as necessary.

NOTE: *This task should be completed after Clause 4.1 if being done together with a SERVICE B.*

SERVICE B

3. Batteries & Cells – General (Includes "Maintenance Free" Batteries)

3.1 Check warning signs (e.g., No Smoking) and P.P.E. signs (Goggles, Gloves etc).

3.2 Clean and examine batteries, cells, straps and terminations (use insulated box spanner).

3.3 Protect terminations as necessary.

Arrange for defective cells to be replaced. If a cell in a crate is found to be faulty, replace the whole crate.

4. Lead Acid Cells (If Fitted)

4.1 Test the specific gravity on each cell is a minimum of 1.220.

Specific gravity measurements are to be taken before any top up of the cell with distilled water, as this could give a false reading.

Readings below this value can indicate that the cell is reaching the end of its life and should be reported to your SM(S).

5. Secondary Cells

5.1 Check that there is enough ventilation over the top of the cells.

5.2 Check that the correct number and type of cells along with the correct charger are fitted according to the diagram.

Changes might have been made during corrective maintenance. More details are in NR/SMS/PartC/EL00 (Electrical Equipment – General).

5.3 Carry out NR/SMS/PartB/Test/055 (Secondary Cell Test).

6. Final Checks

6.1 Before leaving site, check that covers, doors and locks are properly fitted and secure.

END

Includes:	TEML41, when configured as Remote Control System, Panel Multiplexer, Train Describer, Fault Reporting System or Network Interface Processor Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other TEML 41 configurations and Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

NOTE: *DC voltages can still be present on internal and external connections with the 110v supply turned off.*

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

Remote Control System

The Remote Control System is typically is made up of 4 sub-systems:

- Remote Interlocking Indications Processor (RIIP).
- Remote Interlocking Controls Processor (RICP).
- Panel Processor (PP).
- Signal Controls Processor (SCP).

The RIIP and RICP are located at the field (Interlocking), and the PP and SCP (Office) at the Control Centre.

The SCP send controls to the RICP, the RIIP sends indications to the PP. The PP also send indications to the SCP and Train Describer.

Panel Multiplexer (PMUX)

A PMUX forms the interface between Signaller's controls and an SSI interlocking.

Train Describer (TD)

A TD provides the Signaller with train identification information and passes this information to interested systems (SMART and other TD's).

Fault Reporting System (FRS)

An FRS provides centralised fault reporting for a number of systems.

Network Interface Processor (NIP)

A NIP provides the interface between a Train Describer and an Automatic Routing System (ARS).

Power Supplies

Most power supplies are duplicated, and when in normal service perform 'Power Sharing'. The power supplies are 'diode fed' to parallel them together.

This is achieved on the back plane for the 5V logic and communications supplies, and on the distribution blocks for the Input/Output supplies.

To correctly test the power supply levels, only one supply shall be turned on when testing the voltage level, this also makes sure that a single power supply can operate the system if one of a duplicated pair fail.

Voltage tests shall be carried out on the Backplane for 5v levels and distribution blocks for Input/Output supplies.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies

7.1 For systems with A and B supplies measure the DC output from each PSU unit, if the measured voltage is out of tolerance it shall be adjusted or replaced.

Supply	Volts	Limits	Ripple	Test Point	Systems
Logic 'A'	+5V	5.1V to 5.25V	< 50mV	5V1 and 0V1	ALL
Logic 'B'	+5V	5.1V to 5.25V	< 50mV	5v2 and 0V2	ALL
Comms 'A'	+5V	5.1V to 5.25V	< 50mV	5CB1 and 0V1	ALL
Comms 'B'	+5V	5.1V to 5.25V	< 50mV	5CB2 and 0V2	ALL
Alarm 'A'	+24V	23.5V to 24.5V	< 50mV	Alarm Common Terminals	ALL
Alarm 'B'	+24V	23.5V to 24.5V	< 50mV	Alarm Common Terminals	ALL

Supply	Volts	Limits	Ripple	Test Point	Systems
Input 'A'	+24V	23.5V to 24.5V	< 50mV	Input Common Terminals	RIIP, PP, SCP, FRS
Input 'B'	+24V	23.5V to 24.5V	< 50mV	Input Common Terminals	RIIP, PP, SCP, FRS
Output 'A'	+12V	11.5V to 12.5V	< 50mV	Output Common Terminals	SCP & PP
Output 'B'	+12V	11.5V to 12.5V	< 50mV	Output Common Terminals	SCP & PP
Output 'A'	+50V	11.5V to 12.5V	< 50mV	Output Common Terminals	RICP
Output 'B'	+50V	11.5V to 12.5V	< 50mV	Output Common Terminals	RICP
Modem 'A'	-5V	-5.1V to -5.25V	<50mV	-5CB1 and 0V1	RIIP, RICP, PP, SCP, TD
Modem 'B'	-5V	-5.1V to -5.25V	<50mV	-5CB2 and 0V1	RIIP, RICP, PP, SCP,TD

Table 1 – Voltage Limits

8. Fault Terminal

For systems with an FRS:

8.1 Enter 'PFLTS' <RTN> and investigate any reported faults. Also look at the FRSPC fault history and assess any 'recurring' faults.

For systems with dedicated fault terminals:

8.2 Enter 'PFLTS' <RTN> on each Technicians Terminal and investigate any reported faults.

9. General Observations

9.1 Check the Processor 'Active' LED has a discernible 'flicker'.

9.2 Check the Active Communications channels Red/Green LED's active during message transmission.

9.3 Check the Status Card 'Flash' LED pulsing 1sec on, 1 sec off.

10. Final

10.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

10.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

11. Equipment Cubicles

11.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

12. Control and Interface Equipment

12.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

12.2 If provided, disconnect and clean all keyboards as necessary.

12.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

12.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

12.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

12.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

13. System Change – Over

This test shall be carried out during ‘Engineering’ hours.

13.1 Ascertain which system is ‘Master’ by looking at the Status Card.

13.2 Turn the changeover key towards the ‘Slave’ indication on the status card.

13.3 Verify the system is fully operational (Communications, Input and Outputs).

13.4 Check that No Faults are reported on FRS or connected Technicians Terminal.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

System Status Panel (RIIP, RICP, PP, SCP)		
LED	**Normal State**	**Failed State**
SPA Fail	Extinguished	System Processor 'A' Failed
SPB Fail	Extinguished	System Processor 'B' Failed
Comms A Fail	Extinguished	Communications channel 'A' failed between Interlocking and Control Centre
Comms B Fail	Extinguished	Communications channel 'B' failed between Interlocking and Control Centre
TEML41 Fault	Extinguished	System Fault – See Technicians Terminal or FRS

Table 2 - System Status Panel (RIIP, RICP, PP, SCP) Indications

System Status Panel (FRS)		
LED	**Normal State**	**Failed State**
SPA Fail	Extinguished	System Processor 'A' Failed
SPB Fail	Extinguished	System Processor 'B' Failed
Comms A Fail	Extinguished	Communications channel 'A' failed between FRS and FRS PC
Comms B Fail	Extinguished	Communications channel 'B' failed between FRS and FRS PC
TEML41 Fault	Extinguished	System Fault – See Technicians Terminal or FRS

Table 3 - System Status Panel (FRS) Indications

System Status Panel (PMUX, TD, NIP)		
LED	**Normal State**	**Failed State**
SPA Fail	Extinguished	System Processor 'A' Failed
SPB Fail	Extinguished	System Processor 'B' Failed
TEML41 Fault	Extinguished	System Fault – See Technicians Terminal or FRS

Table 4 - System Status Panel (PMUX, TD, NIP) Indications

END

Includes:	DM11 systems configured as a TDM remote control system or a panel / train describer multiplexer. Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

A remote-control system involves the transmission of data between locations called office and field.

An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

A panel/train describer multiplexer forms either the interface between the Signaller's controls and a SSI interlocking or an interface between a relay interlocking and a train describer.

The DM11 in either TDM or PMUX/TDMUX configurations consists of a 38U high cubicle incorporating a 6U high TDM or PMUX/TDMUX rack, dual auxiliary AC to DC power units and internal cabling.

The processor modules operate in a control and standby configuration, the changeover and alarm unit that is either on the Signaller's panel or in the cubicle controls this.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. DM11 Cubicle (TDM & PMUX/TDMUX)

10.1 In liaison with the Signaller, force a changeover to the standby processor using the switch on the changeover and alarm panel.

a) Check that the standby processor is now in control and the previous control processor is in standby by observing the ‘Sel’ LEDs on the 68P processor modules.

b) Return the changeover switch to the middle (Auto) position on systems that have an automatic changeover facility.

10.2 Check that any alarms raised have been cleared and no faults have been introduced to the system.

a) LED indications shall be as in Appendix B (Table 2).

b) The audible alarm needs to be acknowledged by means of the acknowledgement switch on the changeover panel.

10.3 Measure using a meter and/or oscilloscope the following DC voltages and AC ripple on the 6PP power supply test points as detailed in the Table 1 below:

Supply	Volts	Limits	Ripple
Logic	5V	4.7V to 5.5V	<50mV
Logic	7V	6.5V to 7.5V	<50mV
Interface	12V	11.5V to 12.5V	<50mV

Table 1 - DC Voltages

10.4 Plug a Technicians terminal or laptop PC into the engineering port of the processor module (Port A) and check the external channel ‘ack’, ’nak’ and ‘no-response’ counts using the PCCZ (Print Channel Count & Zero) command.

a) Check that the sum of the ‘nak’ and ‘no-response’ counts is less than 10% of the ‘ack’ count.

b) If the count is greater, this could be an indication of a problem on the telecoms line. A note should be made of this so that trends can be analysed.

11. DM11 Cubicle (TDM Only)

11.1 Measure using a meter the modem Tx and Rx levels: -35dBm.

a) Check the obtained level against those previously obtained.

Investigate any significant variations.

11.2 Check that the spare program proms and database disks are available and current for all the systems.

11.3 Measure using an oscilloscope the 48V DC output to the TDM power supplies.

11.4 Check that the obtained waveform is as in Appendix A (Figure 1). If the lower limit of the waveform is less than 38V, replace the PSU.

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - Waveform

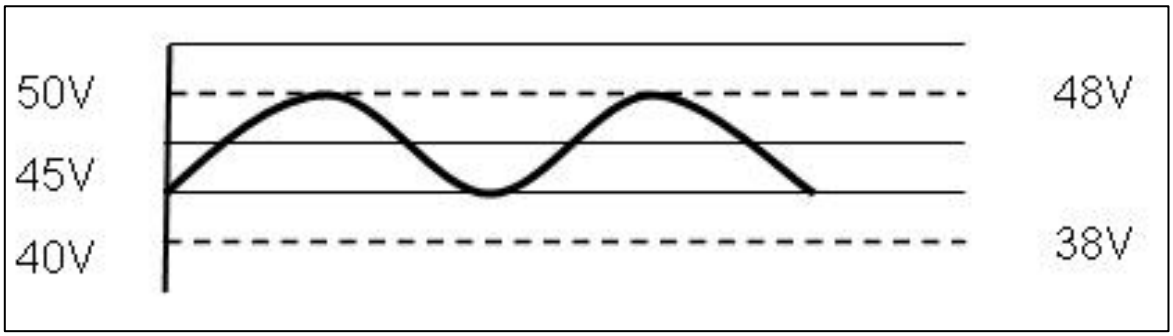


Figure 1 - Waveform Example of PSU Output

APPENDIX B - LED Indications

Indication	Location	State
Interface	6PP Power Supplies	Illuminated
Logic		
Watchdog 'WD'	68P Processor Modules	Illuminated
Available 'Av'		
Selected 'Sel'	68P Processor Modules	Illuminated (Controlling processor)
		Extinguished (Standby Processor)
Scan (x2)	6SI Configured I/PModules	Flashing
Scan	6S0 Configured O/P modules	Flashing (Controlside)
		Extinguished (Standby side)

Table 2 - LED Indications

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/CS04		
Control System - Delphin 1024/256		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Delphin 1024 and 256 systems configured as a remote control TDM system (RC/TDM), a panel and interlocking interface unit (PIIU), a panel multiplexer (PMUX), a crossing interface processor (XIP), or a train describer multiplexer (TDMUX), Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

System Configurations

The remote-control time division multiplexer (RC/TDM) system is used in applications requiring a one to one relationship between inputs and outputs at each end of the system.

The panel and interlocking interface unit (PIIU) is used in applications that require indications meshing and/or route ring processing between a control centre and an interlocking.

The panel multiplexer (PMUX) system forms the interface between the Signaller's controls and an SSI interlocking.

The crossing interface processor (XIP) forms the interface between level crossing controls/indications and the computer based interlocking driving the level crossing control relays.

The train describer multiplexer (TDMUX) system forms the interface between an interlocking and a train describer.

Always check you know the configuration of the Delphin 1024 system you are working on, see the notes on system types in NR/SMS/PartC/IC00 (VDU Based Control Systems General) & NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General).

Not all of the tests in this SMS can be relevant for each system configuration therefore only the tasks relevant to system configuration should be undertaken. If you are in doubt, ask your SM(S).

Delphin 1024

The Delphin 1024 system consists of an 8U high EMC sub rack incorporating a 6U high euro rack.

Each controller crate is fitted with dual power supplies and processor modules (CMP-A/B) that can access/scan common input modules, (CMI) and common output modules (CMO).

On the RC/TDM and PIIU configurations each processor module is fitted with a serial link to communicate with its corresponding field/office counterpart.

The processor modules operate in a control and standby configuration, the changeover and alarm module (CCO-A /CCO-B) controls this.

The CCO-A/CCO- B provides both an automatic and manual changeover along with (where implemented) an equipment fault alarm (EFA).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Visual Checks

In cases where a single PIIU is used as an interface between a Crossing Control Panel or a Mimic Control Panel and a Modular Control System (MCS), carry out task 7.1 to 7.10 and 9.

However, in cases where two PIIUs are used as an interface between a Control Panel and an interlocking, follow tasks 8.1 to 8.9 and 9.

For system indications refer to Appendix A.

7.1 Check that the interface and logic indication LEDs on the CPW power are lit.

7.2 Check that all module power (Pwr) indication LEDs are lit. This should be checked for all of the following modules:

a) CMP-P1.

b) CCO.

c) CMM-A.

d) CMI.

e) CMO.

7.3 Where fitted, check that the power LEDs on the modems is lit.

7.4 Where fitted, check that the DCD LEDs on the modems are lit.

7.5 Check that the Watchdog (WD) LED is flashing and Available (Av) LED is lit on both CMP-P1 modules.

One of these modules shall be selected as being in control and this can be indicated by the 'Sel' LED being lit on the selected module.

7.6 For PIIUs with a field end, check that the same CMP-P1 module is in control at both the office and the field. (Field/Office PIIU only).

7.7 Check that both the scan LEDs are lit on all configured input modules.

7.8 Check that the scan LED representing the CMP-P1 selected as being in control is either on or flashing on the configured CMO modules. Note: either state is acceptable, both scan LEDs off is not.

7.9 Check that the power LED's are lit for any other external power supplies where these have been supplied.

7.10 Where fitted, check status of surge protector units and take action as follows:

a) Green lit only – Full protection – No action.

b) Green and Red lit – Reduced protection – Replace unit within one week.

c) Red lit only – No protection – Replace unit immediately.

7.11 Where modems are fitted, plug a Technician's terminal or laptop into the engineering port of the 'online' processor module (RS232C Port 'A' on the front of the CMP-P1) running 'monitor' program, or run hyper terminal set-up to 4800baud, no parity, 8 data bits and 1 stop bit.

7.12 Check the external 'ack', 'nak' and 'no response' counts using the PCCZ (Print Channel Count and Zero) command.

7.13 Check that the sum of the 'nak' and 'no response' counts is less than 10% of the 'ack' count. If it is greater, this points to a telecoms problem.

7.14 Record this detail on the record card, so that the trend can be analysed.

7.15 Update the date and time by using the DATE and TIME commands.

8. System Status (RC/TDM & PIIU systems only)

For system indications refer to Appendix A.

8.1 For systems that have office and field units, these tests are to be carried out on both units.

8.2 Where modems are fitted, plug a Technician's terminal or laptop into the engineering port of the 'online' processor module (RS232C Port 'A' on the front of the CMP-P1) running 'monitor' program, or run hyper terminal set-up to 4800baud, no parity, 8 data bits and 1 stop bit.

8.3 Check the external 'ack', 'nak' and 'no response' counts using the PCCZ (Print Channel Count and Zero) command.

8.4 Check that the sum of the 'nak' and 'no response' counts is less than 10% of the 'ack' count. If it is greater, this points to a telecoms problem and should be reported to your SM(S) as corrective maintenance.

8.5 Record all details on the record card.

8.6 If required, update the date and time by using the DATE and TIME commands.

9. System Changeover (all systems)

Liaison with the Signaller.

9.1 Before proceeding, check for faults by ensuring the fault light on either processor is not illuminated.

9.2 At the office end, force a changeover to the standby CMP-P1 module using the 'Auto' switch on the front panel of the CCO module.

9.3 Check that the standby CMP-P1 module is now in control by ensuring that the 'Sel' LED is illuminated. The CMP-P1 module that was previously in control should now be in standby mode.

This can be checked by confirming that the 'Sel' LED is extinguished and the 'WD' LED is still flashing.

9.4 Check that the scan LEDs on the CMO modules now represents the newly selected processor module.

9.5 Check that the changeover switch is returned to the auto position and that any alarms that can have been raised have been cleared by using the Alarm/Ack switch on the CCO module. Confirm that no faults have been introduced onto the system by checking the EFA LED is out.

9.6 Check that no system faults have occurred.

9.7 On PIIU and RC/TDM systems use the logger system, on PMUX and TDMUX systems check the fault LED.

9.8 Record all details on the card. This includes the date and time of the changeover.

10. Final

10.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

10.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

11. Equipment Cubicles

11.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

12. Control and Interface Equipment

12.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

12.2 If provided, disconnect and clean all keyboards as necessary.

12.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

12.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

12.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

12.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

13. System Measurements (all systems)

The different system configurations cannot have all the same components; readings are to be taken as fits the system.

13.1 Check that any alarms raised have been cleared and no faults have been introduced to the system.

13.2 Check the LED indications are correct see Appendix A for details.

The audible alarm needs to be acknowledged by means of the acknowledgement switch on the CCO-A/CCO-B module.

13.3 If provided, measure using a meter, the following DC voltages on power supply test points:

Test Point	Voltage (dc)
7VL logic	between 6.5V & 7.5V
12VIF interface (on CPW-A)	between 11.5V & 12.5V
24VIF interface (on CPW-D)	between 23V and 25V

Table 1 – Test Point Voltages

If any are outside the specified range, the CPW-A requires changing.

13.4 If provided, measure the modem levels at the line termination points:

Cable Pair	Values
Transmission (Tx)	nominal -13dBm
Receive (Rx)	between -13dBm and -30dBm

Table 2 – Modem Levels

13.5 If provided, measure the voltages on external power supplies:

Supply	Voltage (dc)
External 12V	between 10.5V & 13.5V
External 24V	Between 21.5V & 26.5V
External 48V	Between 44V& 63V

If any are outside the specified range, the power supply requires changing.

13.6 If provided, check that the logger and archive PCs are powered up.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

Not all module types are fitted to every system and there can be more than one module type.

Modules	Function	LED(s)
CPW	Interface and logic	Illuminated
CMP-A/B	Module power (Pwr)	Illuminated
CCO		
CMM-A		
CMI		
CMO		
DCD	Modems	Illuminated
CMP- A/B[#1]	Watchdog (WD)	Flashing
	Available (Av)	Illuminated
	Selected (Sel)	Illuminated on one module only
CMI (configured)	Scan	Illuminated
CMO (configured)	Scan	Flashing # 3
		Extinguished # 4
External PSUs [# 2]	Power	Illuminated

1: For RC/TDM & PIIUs with a field end, check that the same CMP-A/B module is in control at both the office and the field end.

Check that the scan LED representing the CMP-A/B selected as being in control is either on or flashing on the configured CMO modules.

Either state is acceptable, both scan LEDs off is not and shall be investigated.

2: As provided.

3: Controlling module.

4: Standby module.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/CS05		
Control System - Sapphire T48		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Sapphire T48, Communication Processor, MCS Concentrator MCS, Train Describer (TD), SpadAlert and Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Before working on system use an ESD wrist strap connected to the Earth Bonding Point on the cubicle.

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The Sapphire T48 is a communications processor system that interfaces to computer-based interlocking's (e.g. VHLCs) and a Signaller's panel via a Delphin1024 PIIU. The comms processor receives all controls from a Delphin1024 PIIU via dual serial links.

The system can process this data and transfer these controls, based on the rules within its database, to the remote interlocking's (VHLCs). All indications data from the remote interlocking's is passed by the comms processor to the Delphin1024 PIIU, which drives the panel indication lamps.

When configured as a train describer, the database configures the SapphireT48 channels for use as a stepping Dual TD or as an Information TD. It can also be used as an interface between a Modular Control System and as SPAD alert system.

Refer to the GETS maintenance manual for each system configuration for more information.

System Configuration

Always check you know the configuration of the Sapphire T48 system you are working on, see the notes on system types in NR/SMS/PartC/IC00 (VDU Based Control Systems General) & NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General).

Not all the tests in this SMS are relevant for each system configuration therefore only the tasks relevant to system configuration should be undertaken. If you are in doubt, ask your SM(S).

Sapphire T48 Communications Processor

The Communications Processor is a system in a signal box that interfaces to computer-based interlocking's like VHLCs and a Signaller's panel via a Delphin1024 PIIU.

The Comms Processor receives all Controls from a Delphin1024 PIIU via dual serial links.

The system can process this data and transfer these controls, based on the rules within its database, to the remote interlocking's (VHLCs). All indications data from the remote interlocking's is passed by the Comms Processor to the Delphin1024 PIIU, which drives the panel indication lamps.

Sapphire T48 MCS Concentrator

The MCS Concentrator is a system in a signal box that interfaces to a number of Signaller's MCS systems and uses the data to provide information to Supervisors or Maintainers Workstation positions.

This allows the supervisor to view maps on his single workstation that are on the various Signallers' MCS workstations and acknowledge relevant alarms.

Sapphire T48 MCS

The MCS is a system in a signal box that interfaces to a number of Interlocking's, either SSI or Relay (via the Delphin1024) and the Signaller's Workstations.

The SapphireT48 consists of a duplicated system with automatic changeover. There are two identical processing elements labelled A and B within the 8U crate, whichever side is online is referred to as the Control side and the other as the Standby.

When the SapphireT48 is cold started, the element labelled A boots up first and takes 'Control', thus it is the default 'Control' side.

The 'Control' side scans its watchdog inputs and those of the 'Standby' side; if it has stopped pumping its own watchdog and the 'Standby' is pumping its watchdog an automatic changeover should occur.

The 'Standby' then becomes the 'Control' and vice versa. However, to prevent continual switching under certain fault conditions further automatic changeovers are prevented until a manual reset has taken place.

Sapphire T48 Train Describer (TD)

The TD consists of a system in a signal box connected to a Signallers Panel Display system and Signalling Input systems.

The TD system receives all signalling and train movements from TD Multiplexers and SSIs via dual serial links.

The system can process this data and step trains according to the rules within its database and display this on the panel displays and Operator Control Units and interface with other adjacent TDs for boundary steps.

The TD database configures the SapphireT48 channels for use as a stepping Dual TD or as an Information TD.

Sapphire T48 SPADAlert

The SpadAlert consists of a system in a signal box connected to an MCS system.

The SpadAlert system receives all signalling and train movements from the MCS Control Equipment (CE) via a dual link.

The system can process this data and any alarms generated shall be sent to the control equipment for displaying on the workstations and recording on the logger PC. A SpadAlert system can only be connected to a single MCS CE.

WEEKLY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. System Status

7.1 Check that the indications LED's on the DPW-A Power Supply Modules are lit, ON.

7.2 Check that all the module power 'Pwr' indications, LED's are lit, ON, i.e. check the DCP-K2/K4, DSS-A, DMS and DMX modules.

7.3 Check that the Watchdog 'WD' LED on the 'Comms' section of both processor modules, DCP-K2/K4, are lit, ON and one of the processors is in control, selected ('Sel' LED is lit, ON)

7.4 Check that the time on the DRC-A module is accurate.

7.5 Check that the peripheral units (Technicians' terminal and workstation) are functional.

7.6 On the Technician's terminal select the processor that is in control and confirm that all the links are OK by using the FLTS (Link Fault Status) command.

7.7 Check the external channel 'ack', 'nak' and 'no- response' counts using the PCCZ (Print Channel Count and Zero) command. Check that the sum of 'nak' and 'no-response' counts is less than 10% of the 'ack' count.

If it is greater this can point to a problem on the link, and should be reported to your SM(S).

On systems without a Technicians' terminal, a laptop computer can be connected to the system.

8. System Changeover

In liaison with the Signaller.

8.1 Before proceeding, check that the fault light on either processor is not illuminated.

8.2 Manually force a changeover to the standby processor by momentarily pushing up the processor modules 'select' switch. Check that the 'select' switch is returned to the auto position.

On some system configurations this is achieved by switching the select switch to 'Disable' on the on-line processor to bring the standby processor on-line, then switching to 'Auto'. If you are in doubt, ask your SM(S).

8.3 Check that the standby processor is now in control, selected ('Sel' LED is lit, ON) and the other processor is now in standby, not selected ('Sel' LED is not lit, OFF).

8.4 Check that any alarms raised have been cleared and that no faults have been introduced to the system. Depending on the system configuration, these alarms can be on the Signaller's panel.

Repeat Step 7.6 on the processor that is now in control.

Record all details on the card. This includes the date and time of the changeover.

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

10. Equipment Cubicles

10.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

11. Control and Interface Equipment

11.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

11.2 If provided, disconnect and clean all keyboards as necessary.

11.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

11.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

11.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

11.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

12. System Measurements

12.1 Measure using a meter the voltages on the DPW-A test points:

Supply	Voltage (DC)
6V	Between 5.5V & 6.5V
5V	Between 4.75V & 5.25V

Table 1 – Supply Voltages

If any are outside the specified range, the DPW-A requires changing.

13. System Maintenance

13.1 On systems provided with a hot spares crate, check the modules are functional and check that the Program and Database is current.

13.2 Check that the spare Program and Database disks are available and current for all the systems by comparing with the labels on the SapphireT48 Processor Modules (DCP-K2) or by using the ISSU command on the Technician's terminal.

TD Systems Only:

13.3 Check that the peripheral units (OCUs, Display Distributors, and Displays) are functional by checking with the relevant Signaller.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Older type MCS systems, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	MCS systems based on a Delphin 1024 or a Sapphire T48 platform and all other Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Control and Interface Equipment

4.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

4.2 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

5. Workstation Map Display Projector(s) (Where Provided)

Refer to the manufacturer's manual for cleaning and adjustment instructions.

5.1 Check all the air filters, clean as necessary.

5.2 Check the projector lens, clean as necessary.

5.3 Check the projected picture, adjust as necessary.

6. Control Equipment Cubicle

The following procedure checks that the 'standby' control equipment is serviceable by forcing a manual changeover. It shall only be carried out during light traffic periods in liaison with the Signaller.

6.1 Check the LED indications in auxiliary changeover crate one.

The select LED on the front of the 3AC-AX module connected to one of the controller crates will be illuminated. This indicates that this is the control system; the other system is the standby.

The watchdog LED's are illuminated on the 3AC-AX modules for both controller crate A and B.

6.2 List all the current faults using the 'EFAS' and 'FLTS' commands on the fault logger.

If any indication is not correct or if faults are logged for either the control or standby equipment, follow the fault-finding procedures in the maintenance manual before proceeding.

6.3 Press the select switch on the standby 3AC-AX module in the auxiliary changeover crate one to manually select the standby system. Observe the systems switch over.

6.4 List all the current faults using the 'EFAS' and 'FLTS' commands on the fault logger. Compare with the previous listing and investigate any differences.

6.5 Record the results in the system logbook.

7. Dual Workstation Changeover (Where Provided)

These tests should only be carried out during light traffic periods in liaison with the Signaller.

These tests should be repeated for each workstation with a 10 minute gap between each changeover. This is to check that the system recovers and any faults arising can be identified and cleared.

7.1 Check that the Signaller's keyboard and tracker ball are working correctly and that all the screen displays are OK.

7.2 Check that a standby workstation PC is serviceable by forcing a manual changeover as detailed in section 6.

7.3 Observe the workstation monitors for the correct display and observe a few operations of the keyboard and tracker ball.

a) List all current system faults using the 'EFAS' and 'FLTS' commands on the fault logger.

b) Check for any workstation malfunctions.

7.4 Record the results in the system logbook.

8. Power Supplies

8.1 Using a meter and/or oscilloscope measure the DC voltages and AC ripple on all the auxiliary changeover controller modules (control/slave 3AC- AX/SX) using the monitoring points on the front panels:

System	Limits	Ripple
7V Logic	6.5V to 7.5V	<50mV
+12V Interface	+10.8V to +13.2V	
-12V Interface	-10.8V to -13.2V	

Table 1 - Voltages Auxiliary Changeover Controller Modules

8.2 Using a meter and/or oscilloscope Measure the DC voltages and AC ripple on the power supply voltages on each control equipment crate power supply module (6PP-N):

System	Voltage	Ripple
5V Logic	4.5V to 5.5V	<50mV
+12V Interface	+10.8V to +13.2V	
-12V Interface	-10.8V to -13.2V	

Table 2 - Voltages Control Equipment Crate

NOTE: *Replace any module with readings outside the ranges detailed in 8.1 & 8.2.*

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

10. Equipment Cubicles

10.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

11. Control and Interface Equipment

11.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

11.2 If provided, disconnect and clean all keyboards as necessary.

11.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

11.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

11.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

11.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

Periodic Task

15. Routine Replacement

These tasks are applicable only to the earlier versions of GETS Modular Control Systems not the Delphin 1024 or Sapphire T48 based systems.

NOTE: *The tasks can be undertaken by Technical Support staff and/or equipment specialists, your SM(S) will advise you.*

15.1 Replace the following equipment cooling fans on each PC with new units of the same type. Check after replacement that each fan works correctly

- PC front air intake (x2).
- Internal PC processor fan.
- PC power supply.

15.2 Replace on each PC the internal clock and Bios chip battery with a new battery of the same type.

15.3 Replace on each PC the hard disk drive (HD) with a new HD of the same type.

15.4 Workstation Map Display Projector(s): Where provided, arrange for each projector to be sent to an approved service centre for servicing and fan replacement.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/DE11		
Detonator Placer		
Issue No: 03	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Machine operated and mechanical operated detonator placers
Excludes:	All Other types of detonator placers

SERVICE A

1. All Detonator Placers

1.1 Check all detonators are in date. Replace any that have passed their expiry date.

Disposal of expired detonators shall be in accordance with current environmental policy.

2. Machine Operated Detonator Placer

2.1 Reference should be made to the following NR/SMSs for details of maintenance on this equipment:

a) NR/SMS/PartC/SG95 (Semaphore Signal Machine (BP, GRS, & SGE).

b) NR/SMS/PartC/SG96 (Semaphore Signal Machine (WRSL)).

3. Mechanical Operated Detonator Placer B.S. type

3.1 Examine the following items:

a) Split pins.

b) Holding down bolts. Tighten where necessary.

3.2 Examine and brush/wipe the following items:

a) Casing.

b) Roller.

c) Straight crank.

d) All Connections.

3.3 Lubricate with mineral oil the following items.

a) Roller shaft.

b) Crank pin.

c) Lid hinge.

4. Mechanical Operated Detonator Placer Clayton Type

Exterior

4.1 Examine the following items:

a) Split pins.

b) Holding down bolts.

c) Tighten where necessary.

4.2 Examine and brush/wipe the following items:

a) Body.

b) Connections.

c) Lever quadrant.

4.3 Lubricate with mineral oil the following items.

a) Turned pins in connections.

b) Lever centre pin.

Interior

4.4 Examine split pin in jaw pin.

4.5 Examine and wipe the following items:

a) Operating arm.

b) Operating bar.

c) Gear wheel.

d) Lower jaw and jaw fixing screw. Tighten where necessary.

4.6 Lubricate with lithium based grease.

a) Cam face.

b) Operating bar.

c) All grease nipples.

4.7 Lubricate trigger pin cam fixing bolt and jaw pin with mineral oil if grease nipples are not fitted.

5. Final (All Types)

5.1 Test by operation from the signal box.

END

Any deficiency or failure, which could affect the safe running of trains or the integrity of the signalling system shall be reported to the Signaller immediately and escalated as a fault.

1. Hazards Associated with Electrical Supplies

The Electricity at Work Regulations 1989 requires precautions to be taken against the risk of death or injury from electricity in work applications.

2. Principle – Live Working Prohibition

No work, other than taking electrical measurements is permitted on live equipment if:

a) The working voltage is 175V or more, or the short circuit current can exceed 25A.

AND

b) This is on exposed conductors or terminals, which can be touched by the person doing the work.

3. Exceptions

Where there is an instruction permitting the work, which details the procedures to be followed, the training required and the tools to be used, live work may be undertaken. In such circumstances, the following standards apply:

a) The person carrying out the work shall be accompanied.

b) Use the specified tools.

c) The insulation of hand tools should be inspected before use.

d) Use the specified PPE (e.g. rubber gloves, mats and eye protection).

4. Taking Measurements Where the Voltage or Current Can Exceed the Above Limits

The following precautions shall be followed:

a) Staff shall be accompanied.

b) The measuring instrument shall be the type approved for the work.

c) If using an unfused meter, HRC fused leads shall be used.

d) Prods shall be fitted with finger barriers

e) Bare metal at the prod ends should not exceed 2mm.

f) The use of crocodile clips and clip on prods is prohibited.

g) Meter leads and prods shall be carefully checked for security and insulation prior to use.

5. High Voltage Insulation Testers

These testers (e.g. Megger) can be used where the voltage they produce exceeds 175V as the short circuit current is restricted to a safe level.

6. Isolation

Before work starts on electrical equipment, it shall be isolated unless:

a) The working voltage is less than 175V and the short circuit current cannot exceed 25A.

OR

b) The work does not involve exposed terminals or conductors that can be touched by the person doing the work.

OR

c) It is unreasonable for the circuit to be isolated.

7. Local Disconnection of Equipment

Where the person doing the work can verify that the equipment is not reconnected and is not electrically live; no additional precautions are required.

Options include removal of plug and socket, links, fuses or operation of switches.

If the person doing the work cannot verify that the equipment cannot be reconnected, PROTECTIVE ISOLATION shall take place.

8. Protective Isolation

This shall always be employed for work on 650V power supplies. The following procedure applies:

a) Until the equipment has been proved to be isolated, it shall be assumed to be live.

b) Identify all necessary disconnection points using the diagrams.

c) Isolate the equipment from the rest of the system using switches fuses or links.

d) Fuses, links, and locking off keys are retained by the person doing the work.

e) A notice worded 'Danger Work In Progress – Do Not Reconnect' shall be secured by each isolation point.

f) Where possible, switches shall be locked off using a personal key. Where this is not possible, a personal padlock may be used to secure the equipment housing. Alternatively, a reliable person shall be stationed at the disconnection point to check that no one reconnects the supply other than the person doing the work. This person shall not have any other duty and shall not leave his/her post.

g) Before starting work, the circuit shall be tested for no voltage present. This shall include a check that any capacitors have been discharged

h) Shift changeover shall be planned to confirm that the person responsible for the isolation is clearly identified.

i) Only the person responsible for the isolation may restore it.

Where work involves more than one team, a multi-user lock off device shall be employed where possible.

Where the work is pre-planned, involves more than one team and it is not possible to provide protection as described above, a permit to work system shall be employed.

9. Touch Potential Risk

There is a risk where metallic items (location cases, metallic fences, concentrators, lever frames etc) do not have equipotential bonding and are connected to different earths.

Under certain fault conditions this can lead to an electric shock if the two items having different earths are touched simultaneously.

It is advisable if the earth bonding on an asset is unknown not to touch metallic items that are physically separate at the same time.

10. Signalling Circuit Insulation Testing

Insulation testing of signalling circuits detects deterioration or failure of the insulation of wires, cables or other circuit components. This function can be achieved by continuous monitoring or periodic testing.

10.1 Continuous Monitoring – SSI Trackside Functional Modules (TFMs)

An SSI TFM provides continuous monitoring of its outputs; any feed on an output which should not be there causes the unit to go into a safe operating mode.

No additional testing (e.g. busbar earth test) is required for equipment connected directly to an SSI TFM output.

Where an SSI TFM operates a relay, earth testing to NR/SMS/PartB/Test/051 (Busbar Earth Tests) or NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD) : Testing and Calibration) shall be required to the supply busbars.

TFM inputs are not continuously monitored. If you are in doubt, ask your SM(S).

10.2 Continuous Monitoring – Earth Leakage Detectors (ELDs)

An ELD provides continuous monitoring of all equipment connected to a busbar against any extraneous connection to earth. It does not detect problems that are not associated with a connection to earth (e.g. core to core insulation).

ELDs require to be calibrated correctly to provide correct monitoring; details in NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD) : Testing and Calibration) shall be followed.

10.3 Periodic Testing – Busbar Earth Testing

Where continuous monitoring is not provided, busbar earth testing is required to test the insulation of signalling circuits connected to busbar under test.

As per the monitoring provided by ELDs this test does not detect problems that are not associated with a connection to earth.

10.4 Periodic Testing – Cable Insulation Testing

This tests individual conductors for insulation from each other (e.g. multi core cable) and also from earth.

It is more onerous than busbar testing and requires the conductors to be disconnected from their associated circuits, therefore only the conductors are tested, not the associated equipment. Details of the test are in NR/SMS/PartB/Test/054 (Cable Insulation Tests).

10.5 Earth Testing and Earth Looping Testing

Earthing on incoming mains power supplies from an external source (e.g. fed from a consumer unit, 240V and above) is the responsibility of the E&P function.

This usually means that the earthing for equipment and relay rooms that have these power supplies fed into them has been installed and is maintained by E&P.

Earthing for signalling power supplies (110V and below), trackside locations, and equipment/relay rooms that do not have an incoming mains power supply from an external source (e.g. incoming 240V or above is fed from another equipment/relay room or trackside location) is usually installed and maintained by signalling.

The correct testing of these signalling earths requires specialist equipment, if you suspect there are any deficiencies with the earth itself or the continuity of the looping; you should report it as corrective maintenance NR/SMS/PartA/A02 (Preventative and Corrective Maintenance). The SM(S) shall arrange for the earth to be tested to the current standards.

11. Hazards Associated with Secondary Cells

11.1 General Precautions and Prevention of Explosions

Alkaline and lead acid cells give off explosive gas during the charging cycle.

Always observe safety directives and local instructions and, before starting work, check good circulation of air to disperse accumulated gases.

Open doors and check ventilation. Enforce air circulation by wafting or fanning where ventilation seems poor. NEVER tap cells to check electrolyte level or loosen battery connections whilst the cells are on charge or discharge and gassing.

DO NOT use hydrometers or distilled water top up bottles that have been used for the maintenance of alkaline cells on acid cells and vice-versa. Acid destroys alkaline cells and alkaline destroys acid cells.

Plastic cases have to be cleaned using a damp cloth. Dry cloths can cause a build-up of static electricity.

Connections shall be tight and properly made to avoid sparking and to maintain good conductivity.

Do not use excessive force. Use Insulated Box Spanners.

Short Circuit Risks

The outer case of steel cased cells is live. Never allow tools or metallic objects to rest across the cells as this might cause sparking and damage.

Care should be taken not to short out any cells during testing/maintenance as this might result in a short circuit current high enough to cause splashes of molten metal and possible explosion.

Use Insulated tools and test leads.

Beware of rings, watches with metal straps or any other jewellery you might be wearing.

The physical size of the cell is not necessarily indicative of its power. The 5Ah Cyclon cell can produce 200A and should be treated with as much care as larger cells.

11.2 Action in Case of Accident

EYES – Immediately wash liberally with water, following the instructions on the eyewash bottle and seek immediate medical attention.

SKIN – Rinse liberally with water and seek medical attention.

CLOTHING – Remove contaminated clothing as soon as possible.

SPILLAGE – Swill down spillage with water as soon as possible.

NOTE: Never swill down spillage in substations where there is high tension electrical equipment. Report the situation.

11.3 Secondary Cells – General

The rate of charging is dependent on the size and type of cell.

Whilst the function of lead acid and alkaline cells is similar, the chemical composition is different. Both types usually require regular topping up. Use only distilled or de-ionised water and do not over-fill.

Some cells are sealed (e.g. Cyclon) and do not require topping up.

The tops of cells should be kept clean, terminations of unsealed cells being protected with petroleum jelly.

Inter-cell connectors should be kept clean and firmly fitted.

Bare metal straps should be protected with petroleum jelly. Replace corroded or defective straps.

If a cell has to be moved, check straps and terminations before moving to check they do not break or become disconnected.

11.4 Secondary Cells – Installation

Connections are the correct polarity, tight and straps serviceable.

The bottom gland retaining nuts of Alkaline cells are torqued by the manufacturer and should not be altered.

Transit stoppers should be removed; vent caps free to open and electrolyte the correct level.

11.5 Disposal of Cell Material

Cells are to be disposed of as per the NR Environmental Policy.

11.6 Charging Rates

Constant Voltage Chargers (CVC) are set to the correct voltage per cell connected.

Match the correct charger to the number and type of cells. No adjustment is possible.

Non-constant Voltage Chargers require the charging rate to be set to give the minimum trickle charge necessary to keep the battery in a fully charged state under normal operating conditions.

Where intermittent peak loads occur, a slightly higher charging rate might be required.

Continual overcharging of a battery should be avoided as this produces excessive quantities of explosive gas.

11.7 Power Off Circuitry

The operation of a battery charger is usually proved in the circuitry of some automatic level crossings. You should always liaise with the monitoring point before switching the charger on or off.

To prove charger operation, switch off the battery charger and connect a voltmeter across the terminals of one cell.

Switch on the charger and observe the voltage reading slowly increase, which indicates that the charger is working.

11.8 Cyclon Cells

These are ‘sealed for life’ cells therefore topping up is not required.

Only a CVC to BR spec 1875, 955 or 928 (or equivalent) shall be used to charge Cyclon Cells, otherwise overheating occurs.

11.9 ALCAD Vantage Cells

Vantage cells are of a ultra-low maintenance type, if correctly set up and maintained they should only require topping up approximately every ten years.

Only a CVC to BR spec 1875, 955 or 928 (or equivalent) shall be used on Vantage cells.

These cells are pressurized. When topping up, slowly remove pressure vent cap to release pressure.

Do not place the filler neck into the cell. Position over vent cap opening and inject distilled water, observing the level on external fill lines.

11.10 Primary Cells

CEGASA air alkaline cells are a replacement for the SAFT air saline cells which have gone out of production. CEGASA cells have a more stable voltage-over-time characteristic (the voltage does not gradually reduce with age) therefore the cell voltage cannot be used as an indication of the remaining capacity of CEGASA cells.

There is no test available to routinely check battery capacity on CEGASA cells, replacement of them should be based on experience of typical battery life.

The capacity of the new CEGASA cells is at least as good as the old SAFT cells but can be affected by extreme low temperatures and high humidity.

Cells should be replaced at the same intervals as they were in the past taking into account the cell capacity (e.g. if a GEGASA 200Ah cell is used to replace a SAFT 100Ah cell it can be expected to have double the life).

12. Hazards Associated with Cables & Wiring

Problems and Hazards associated with cables and wiring are described in detail in NR/L3/SIG/19012 (SIGTAN 12). Technicians should be aware of the dangers when working in the vicinity of wiring and electrical terminations:

a) To check that metal tools do not come into contact with circuit components.

b) To avoid damaging insulation materials.

Certain sites are subject to wire degradation and should be looked for during maintenance visits. This manifests itself in two forms, dry degradation, or wet degradation.

12.2 Dry Wire Degradation

This causes the inner rubber insulation to lose elasticity, thus becoming dry and crumbly. If the wire is not disturbed, the outer PCP cover continues to convey a visual impression of good condition.

Bending or twisting affected wires might cause the insulation to break, therefore exposing the bare conductor.

Wiring in the vicinity of heat sources or in a warm, dry environment is particularly vulnerable. Brittle and cracked wiring shall be reported.
Wet Wire Degradation

This occurs where the inner rubber turns to a sticky liquid, which runs out of the PCP cover if the wire is vertical.

Report wiring that show signs of bulging, sponginess and leakage.

12.3 The Management of Affected Sites

The labelling and detailed working restrictions of these sites are specified in standard maintenance procedures.

Rodent damage and chafing (sharp metallic corners) These shall be reported to your SM(S)

12.4 Cable Clamps

These should be properly fitted to prevent snagged cables causing a short circuit. See Figure 1.

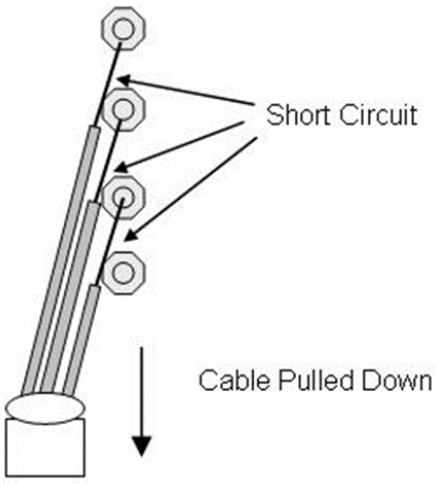


Figure 1 – Short circuits caused by cable being unsupported

12.5 Binding Posts

These are often found in locations and relay rooms as a space saving method of terminating cables without a disconnection point.

Wrong side failures have been caused in the past where a link has incorrectly been fitted to a pair of binding posts and has strapped out a circuit contact.

To prevent this from happening, red dome nuts should be fitted to all binding posts. This indicates that a link **SHALL NOT BE FITTED**.

If it is necessary to remove a cable core terminated on a binding post, only one dome nut of a pair should be removed at any one time.

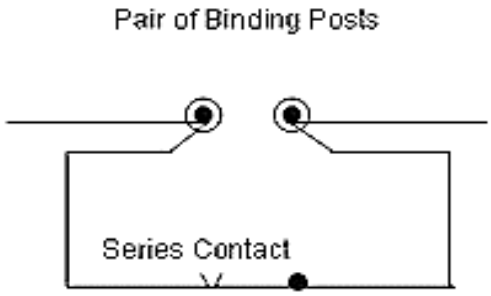


Figure 2 – Use of Binding Posts

12.6 Un-Terminated and Disconnected Wires

These shall be fully disconnected at both ends and suitably insulated or preferably removed to prevent the risk of short circuit. The methods of insulation are listed below:

a) ENDCAPS - May be used as a permanent insulation when the wire is cut as a blunt end.

b) BOMBTAILS - May be used as a permanent insulation with the wire cut away from any apparatus.

The following temporary insulation methods may be used for a maximum of 12 weeks:

a) End Caps (with wire stripped).

b) Squeeze on Sleeves.

c) Expandable Sleeves.

d) Bomb Tails (wire not cut away).

e) Plastic bags.

13. Shelf Type Relays

These and similar equipment might be a hazard where horizontally mounted terminals are fitted. This might result in a short circuit if a metallic object is dropped into the terminals. This risk may be minimized by fitting the terminals with insulated caps.

14. Hazards Associated with Relays

14.1 Relay Bases.

BR spec 829 relay bases can be found in 3 colours:

a) Black.

b) Blue.

c) White/Cream.

Black bases are made from a phenolic resin (which is dark brown) with carbon added to make it a black colour.

Blue bases are made from an epoxy resin (which is colourless) with a pigment added to make them blue.

White/Cream bases are made from a melamine resin which is naturally white/cream in colour.

14.2 Silver Migration

Black relay bases are made of phenolic resin; because of this they are susceptible to silver migration. This happens when under certain conditions the phenolic resin can become conductive by the movement of metallic silver from plated conductors over and into the base.

To overcome this problem blue bases, made out epoxy resin were used. The cost of making these bases out of this material was very high so another material was sought; this has led to the current White/Cream bases made from melamine resin.

Black phenolic bases are usually found in older installations. Lineside apparatus cases and unheated relay rooms present the greatest risk and elimination of black bases is targeted at these sites.

Heated relay rooms might also be affected.

Relay base changing and visual sampling programs form part of the maintenance schedule. Precise details should be obtained from your SM(S).

Full details of the technical requirements are contained in NR/L2/SIG/11107.

14.3 Relay Servicing

Relay servicing programs should form part of the annual maintenance plan. Details of servicing requirements are contained within the relay servicing plan.

Some relay functions have a mandatory servicing frequency of 10 years maximum, unless exempted by a risk analysis. These are:

a) Timer relays (BR937, 946, 947, 962, AEI-GS AS).

b) Magnetically latched or magnetic stick relays (BR935, 936).

c) Relays used in biased or polar circuits (BR932, 961, Tyers G1, Shelf type).

d) Track relays (BR938, 939, 966F2, 968, VT1, Shelf type).

e) Vane relays (WSL VL1), and

f) Searchlight signal mechanisms (WSL B5, SGE LN).

Recently serviced relays are labelled with the date of their servicing.

Many existing relays are labelled with the next servicing date, which might not correspond with the current servicing frequency.

Always refer to the relay servicing program for planned replacement.

Relay shelf life is three years. Relays past this shelf life shall be tested prior to placing into service. More details on relay servicing can be found in NR/L2/SIG/11129.

14.4 Timer Relays

These are tested every 12 months to make sure that that the time setting is maintained within acceptable tolerances.

When thermal timers are tested, make sure that enough time has elapsed before repeating a relay timer test to confirm that a true reading is not affected by warm heating elements.

14.5 UPS Testing

Carry out NR/SMS/PartB/Test/057 - Clause 1.3 – This specifies testing to check that the UPS can maintain the load for 50% of the expected hold up time.

Some level crossing UPSs have a hold up time of 24 hours, which would require UPS tests lasting 12 hours.

To enable such testing to be completed within a standard working day, the following reduction has been agreed by the Level Crossings Engineer:

a) At sites with long hold up times such as Level Crossing the 50% figure quoted may be reduced to 20%.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/EL12		
Platform Plungers and Pull Wires		
Issue No: 04	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	TRTS, RA, CD and TRTS Pull Wires
Excludes:	All other types of Plunger and Pull Wires

GENERAL

Platform plungers and pull wires provide indications to train crew relating to the operation of trains.

They shall only be operated by Signal Technicians with permission of the Signaller to prevent any unauthorised train movements.

Platform plungers and pull wires are usually located in an area accessible to the general public.

They shall not be left unattended in an unsecured state.

SERVICE B

1. External Inspection

1.1 Check the unit is securely mounted, clean as necessary.

1.2 Check that doors, latches, and locking devices are effective.

1.3 Check that water seals are effective.

1.4 Check that tail cables are correctly routed, secure, and not damaged.

1.5 Check and lubricate hinges, locks, and latches.

1.6 Check that external labelling is fitted, clean, and legible.

2. Internal Inspection

2.1 Check the tail cables and internal wiring are secure and correctly terminated. Protect as necessary.

2.2 Examine the insulation for damage and degradation.

2.3 Check the internal labelling is fitted, clean, and legible.

2.4 Examine the switches and plungers.

2.5 Observe, if operated by Operating Staff, that the associated indications correctly illuminate.

3. Pull Cord Assemble (TRTS Pull Cord type Only)

3.1 Examine the following on the pull cord assembly:

a) Wire and thimbles.

b) Eyelets.

c) Connection to rotary switch.

3.2 Replace the wire if it is damaged or corroded.

3.3 Examine the following on the rotary switch assembly:

a) Operating arm.

b) Spindle.

c) Switch unit fixings.

d) Connecting lug and pin.

e) Mounting bracket.

f) Cable gland.

3.4 Check that the adjustable stop is tight (two lock nuts).

3.5 Lubricate the micro-switch spindle and lug connection.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/EL13		
Dispatch Interface Unit LED Indicators		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Dispatch Interface Unit fitted at, London Bridge
Excludes:	All other types of Dispatch Interface Unit LED Indicators

GENERAL

Asset Identification Image

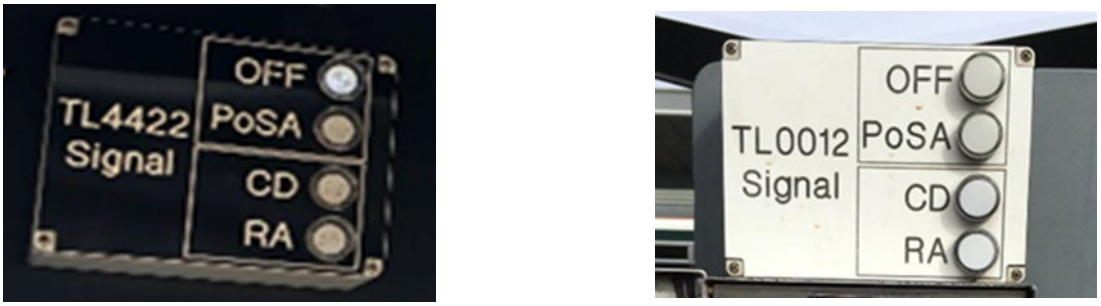


Figure 1 – Dispatch Interface Units

There are no routine maintenance services on this asset.

PERIODIC TASK

1. Replacement of the Indicator LED's

1.1 Carry out NR/SMTH/Part04/EL24 - Replace an Encapsulated LED Indicator on each off the LED Indicators.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/EL21		
Trackside Apparatus Case		
Issue No: 15	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	Apparatus Case, Location Cases, Relay Cabinets, Equipment Cupboards, Stump Boxes
Excludes:	Dorman integrated Lightweight Signal [iLS], Modular Signalling Equipment Housings, Ansaldo Peripheral and Temperature Controlled Locations.

Always ‘test before touch’ any Functional Supply Points and any associated metal work.

General

Check any record cards for any entries since your last visit.

Where alterations are being carried out, your SM(S) should have briefed you on the work and the effect on planned maintenance.

If you find evidence of project work that you have not been told about, contact your SM(S).

Cable Locations

Sections 1 to 3 and 7 to 10 are not required for trackside location cases which only contains cable terminations.

PERIODIC TASK ONE

For all Busbars monitored by a busbar monitoring device and maintained using the II RADAR system to remotely monitor condition.

Earth fault investigation is required as a result of an alarm.

1. Remote Maintenance

1.1 Log in to the system and search for required asset.

1.2 Confirm the location ID using Ellipse number.

1.3 Check that the Device Health status is OK, and the logger has been receiving data within the last 24 hours as a minimum.

1.4 Check that there is data available for the last 24 hours.

1.5 Check that the Earth Loop Resistance is within usual tolerance for the site (this could be a specified maximum for the site).

If any of the checks in 1.1 to 1.5 are not correct, investigate as per local processes before continuing onto the next steps.

1.6 Steps 1.1 to 1.5 shall be completed before moving to the next step.

1.7 For each busbar, check for Voltage (Vs) alarms or alerts. Where the reading falls outside of tolerance report the details to your SM(S).

NOTE: *The normal tolerance for signalling power supplies is +/- 10% of nominal voltage; variances to tolerances might be specifically authorized by the SM(S)*

1.8 For each busbar, check for Resistance alarms or alerts.

NOTE: *The II RADAR alert and alarm thresholds are set in accordance with the levels specified in NR/SMS/PartZ/Z07 – Section 3.3.*

If a Red Earth is alarming, this is below the safety minimum limit and shall be treated with high priority. Check to confirm that a fault report has been raised, if not refer to local processes of managing earth faults below the reportable limit. For any other alarms, report to your SM(S) as per local processes.

1.9 Review all Red Earth alarms, that have occurred since the last maintenance visit was undertaken, and confirm that the correct actions have been taken.

1.10 Confirm the are no alerts or alarms before moving to the next step.

1.11 Compare the values to those of the last service. Where the trend is worsening significantly from previous results, report to your SM(S).

1.12 Confirm there are no outstanding issues found in Steps 1.1 to 1.10.

1.13 Any outstanding issues shall be reported to SM(S).

SERVICE A

2. Power Supplies

2.1 Measure the power supply and busbar voltages (±10% of rating) for all signalling supplies.

Your SM(S) shall advise you if current readings are required. Current readings should only be taken if this is practical to do so.

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment – General) on hazards associated with electrical supplies.

Investigate any significant variation from previous records.

3. Earth Tests

3.1 If fitted, carry out NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD) Function Test).

3.2 Investigate ELD fault indications and record any faults on the record card.

3.3 Carry out NR/SMS/PartB/Test/051 (Busbar Earth Tests) on each power supply not continually monitored (excluding earth return circuits).

3.4 Rectify any earth fault found in steps 3.1 to 3.3 that is above the reportable limit.

Report to your SM(S) the problem and any difficulties in rectifying it. Failure to rectify shall be reported to your SM(S) for necessary remedial action. The report shall be made within 24 hours.

3.5 If any earth fault is found with the voltage below the reportable voltage, NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values), but the trend is worsening significantly from previous results, report to your SM(S).

Make the report within 24 hours. Your SM(S) shall decide if any further action is required.

SERVICE B

4. External Inspection

4.1 Check cases are accessible, and the doors are not obstructed.

Remove or report excessive foliage or obstructions.

4.2 Check for fire risks around the location(s) remove or report any possible risks.

4.3 Check (if provided) that any guardrails and staging are secure.

4.4 Examine case steelwork and doors for corrosion, damage, obstruction, and security.

4.5 If provided, check door seals.

4.6 Check case numbers are clearly labelled.

4.7 Check locks are fitted and in good order.

4.8 If provided, check the earthing continuity between the location(s) and the earth rod.

4.9 Check that all connections are secure, and the earth rod is secure in the ground.

In SIMIS-W areas check that the protective sleeve is in place if the earth cable passes under the track.

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment – General) on earthing. Report any earthing problems as a corrective maintenance item.

4.10 Check that any safety/warning labels/signs are correctly displayed and legible.

These can include No Smoking, Wear PPE No Mobile Phones etc.

4.11 Lubricate locks and hinges.

5. Internal Inspection

5.1 Check that the location ventilation is in order. If heating is provided, check that it is switched on and working correctly.

In damp locations and where black relay bases are still fitted, it is important that the heater is working correctly.

5.2 Check site copy diagrams are available, properly stored and fit for purpose.

Submit a request for replacements as required.

Report to your SM(S) any handwritten or temporary alterations to the site copy.

5.3 Check internal equipment for signs of contamination, damage or failure.

5.4 Remove any dirt/infestation.

5.5 Check that any cable entry openings are suitably sealed to prevent rodent entry.

5.6 Check internal case fittings, racks, shelves, and backboards.

5.7 Dust equipment as necessary.

5.8 Check equipment is correctly labelled.

6. Cables, Wires and Terminations

6.1 Examine cables and wires for damage particularly in ducting and where they pass above a heater, transformer, or any other heat source. Report any damage as a corrective maintenance item.

Take immediate action on any exposed conductors. Damage includes any new wet/dry degradation. Rodent damage can occur to wiring in ducting which is not immediately visible.

6.2 Check that wire degradation signs are in place if this is present in the apparatus case.

NOTE: *The examination of cables and wires for changes in wire degradation and the related timescales are now covered by NR/L2/SIG/11655 (Management of Cable and Wire Insulation).*

6.3 Check cables are secure and free from damage/chafing/rodent damage.

Cable clamps should be fitted to check that short circuits cannot occur if the cable is pulled from outside the case.

6.4 Examine cables and cable termination points for signs of new wet or dry wire degradation.

6.5 Check cable cores for degradation and damage especially if located above a heat source.

6.6 Where applicable, check terminals for security, corrosion, arcing and risk of short circuit/disconnection. Protect 2BA/0BA terminals as necessary.

6.7 Check potheads. Examine terminations and fixings. Clean and protect as necessary.

6.8 On 2BA/0BA terminals, check that red dome nuts are fitted as required. On WAGO terminals, check that red insulation stops are fitted as required.

6.9 Check un-terminated cores or wires are correctly insulated.

6.10 Report any temporary insulated, unterminated cables and wires to the SM(S).

Un-terminated cables and wires shall only remain insulated with temporary insulation (silicon sleeves) for a maximum of 12 weeks. If not terminated, they shall be permanently insulated.

6.11 Check any ‘red straps’ that are installed are secure and labelled.

6.12 Carry out NR/SMS/PartB/Test/054 (Cable Insulation Tests) on the following lineside cables, which are not monitored by an ELD or BMD.

a) Cables containing single cut safety critical circuits.

b) Safety critical reed circuits.

c) Earth return circuits.

d) Double cut lineside cables, If not monitored by a busbar test.

The number of cores to be tested shall be, all spare cores or 10% of the cable capacity, which ever is greater.

Cable insulation testing shall be carried out at one end of the cable only.

6.13 Power Cables are managed by E&P Staff under NR/L3/SIGELP/50001.

7. Rack/Shelf Mounted Equipment

7.1 If not managed by a relay re-servicing database, check a sample of relays to see they are within their Service date. Report any missing labels to your SM(S).

Details on relay servicing which could be carried out as a separate exercise can be found in NR/SMS/PartC/EL00 (Electrical Equipment – General). Your SM(S) is to advise you.

Service track circuit relays at 10 yearly intervals.

TC relays on TI21 installations are not covered by this requirement. TC relays on other types of frequency track circuits are. See NR/L2/SIG/11129 for further details.

7.2 Examine a sample of phenolic (black) relay bases (1% or 1, whichever is greater) and contact spacers for signs of silver migration or similar contamination following removal of the relay(s).

NOTE: *Where the spades are not silver plated this task need not be carried out. If you are unsure your SM(S) will advise you if this task is required.*

Your SM(S) can tell you specific relays to be examined. Report any silver migration found. More details on relay bases can be found in NR/SMS/PartC/EL00 (Electrical Equipment – General).

7.3 Check equipment for security and signs of damage, degradation, moisture, overheating, and cover distortion.

7.4 If provided, check for oil leakage from AC track circuit capacitors.

7.5 Check relay terminal shrouds are fitted.

7.6 On Thermal Relay Timers, carry out NR/SMS/PartB/Test/061 (Relay Timer Test).

8. Local Policy Requirement 1

8.1 On Non-Thermal Timers**, c**heck the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.

8.2 Check that the seals on timer relays are crimped.

9. Data Links

9.1 Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

9.2 Carry out NR/SMS/PartB/Test/089 (SSI Datalink Test).

This test might not be required under certain circumstances:

a) on interfaced SSI.

b) or, when monitored remotely.

c) or, if scheduled against another work group.

Your SM(S) will advise you.

10. Power Supplies (Transformers / Rectifiers, TFU etc)

10.1 Examine earth connections.

10.2 Examine terminations.

10.3 Check for signs of overheating.

10.4 Check protective shrouding/covers are fitted and undamaged and that warning signs are correctly displayed (i.e. all equipment rated >175V).

10.5 Carry out NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD) Calibration Test.

10.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests) applicable equipment controlled by the Trackside Apparatus Case if not undertaken as part of the individual equipment SMS.

11. Final Check

11.1 Before leaving site, check that covers, doors and locks are properly fitted and secure.

END

Includes:	Equipment Rooms, Relay Rooms, Interlocking Rooms
Excludes:	Control & interface systems and associated cubicles, SSI equipment and Ansaldo equipment.

Always ‘test before touch’ any Functional Supply Points and any associated metal work.

General

Where alterations are being carried out, your SM(S) should have briefed you on the work and the effect on planned maintenance.

If you find evidence of project work that you have not been told about, contact your SM(S).

Before leaving site, check that access points are secured to prevent unauthorised access.

SERVICE A

1. General Inspection

1.1 Check and complete the site Logbook or Site Attendance Record Card.

Particular attention should be paid to any entries made since the last maintenance visit.

1.2 Check and record the equipment room temperature on arrival in the Logbook or on the Site Attendance Record Card.

The normal temperature ranges are between 15 – 20ºC.

1.3 Check (if fitted) that air conditioners (coolers) are switched on and working during the summer (April to September).

Check if they are controlled by thermostats, if they are then they should be left switched on all year round.

1.4 Check (if fitted) that heaters are switched off during the summer. If both heating and cooling are fitted and controlled by thermostats, check that the controls for this are working correctly.

Heaters and coolers should not be both on at the same time. If heating is turned on/up whilst you are working in the room, return the controls to their original setting when leaving Report any problems to your SM(S).

1.5 Report any sign of structural deterioration or forced entry to your SM(S). Check the interior roof/ceiling tiles for any signs of damp/damage.

1.6 Check for fire risks around the location and the existence of excess vegetation.

Remove or report any possible risks as a corrective maintenance item.

1.7 On portable equipment rooms check that the skirt around the bottom of the location is effective.

1.8 Check that security locks, lighting, and ventilation are in order.

1.9 Check that any safety/warning labels/signs are correctly displayed and legible.

These can include No Smoking, No Mobile Phones, Wire Degradation Classification etc.

1.10 If provided, check the earthing continuity between the signalling earth points and the earth rod. Check that all connections are secure, and the earth rod is secure in the ground.

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment – General) on earthing. Report any earthing problems as a corrective maintenance item.

1.11 Remove any dirt/infestation.

1.12 Check cable entries are sealed to deter rodents, where practicable.

1.13 Check racks and equipment are secure and not damaged or contaminated.

1.14 Check site copy diagrams and (if provided) O&M manuals for electronic equipment are available and fit for purpose. Submit a request for replacements as required. Report to your SM(S) any handwritten or temporary alterations to the site copy.

1.15 Check time clock settings (e.g. AWCU). Remember BST & GMT.

1.16 Examine a sample of cables and wires for damage.

Your SM(S) can tell you which cables and wires to look at.

Immediate action shall be taken on any exposed conductors.

Damage includes any new wet/dry degradation. Rodent damage can occur to wiring in ducting which is not immediately visible.

2. Emergency Control and Technicians Indication Panels

2.1 Turn the panel on and check for the correct operation of the indications.

2.2 Check control/indication panel faceplate. In particular note and report:

a) Worn or illegible artwork.

b) Damaged panel sections.

c) Obvious faulty buttons/switches.

d) Faulty indications/lamps.

2.3 Dust and wipe panel faceplates with a cloth moistened with detergent or non-abrasive cleaner, as necessary.

2.4 Turn the panel off.

3. Power Supplies

3.1 Check warning signs are clearly displayed.

3.2 Dust and check power supply equipment.

Transformers, rectifiers, chargers, circuit breakers, fuses, links, switch-gear, bus-bars, connections etc: Investigate any signs of overheating/ arcing. Locks and latches shall be secured.

3.3 Check earth connections and cable terminations.

3.4 Check (>175V) that equipment covers, and safety labels are fitted and that rubber matting/ gauntlets are available.

3.5 Measure the power supply and busbar voltages (±10% of rating) for all signalling supplies.

Your SM(S) shall advise you if current readings are required. Current readings should only be taken if this is practical to do so.

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment – General) on hazards associated with electrical supplies.

Investigate any significant variation from previous records.

3.6 Check power and standby system indications Uninterruptible Power Supplies (UPS) and Static Invertors.

3.7 Check spare fuses are available.

4. Earth Tests

4.1 If fitted carry out NR/SMS/PartB/Test/053 (ELD Function Test).

Investigate ELD fault indications and record any faults on the record card.

4.2 If an ELD is not fitted, carry out NR/SMS/PartB/Test/051 (Busbar Earth Tests) on each power supply not continually monitored (excluding earth return circuits).

4.3 Rectify any earth fault found that is above the reportable limit.

4.4 Record any faults in the site log book or record card.

Report to your SM(S) the problem and any difficulties in rectifying it. Failure to rectify shall be reported to your SM(S) for necessary remedial action. The report shall be made within 24 hours.

4.5 If any earth fault is found with the voltage below the reportable voltage NR/SMS/PartZ/Z07 (Earth Leakage – Reference Values) and the trend is worsening significantly from previous results, report to your SM(S).

The report shall be made within 24 hours. Your SM(S) shall decide if any further action is required.

5. Batteries & Cells General

5.1 Check warning signs (e.g. No Smoking) and P.P.E. signs (Goggles, Gloves etc).

5.2 Clean and examine batteries, cells, straps and terminations (use insulated box spanner).

5.3 Protect terminations as necessary.

Arrange for any defective cells to be replaced If a cell in a crate is found to be faulty, the whole crate shall be replaced.

6. Primary Cells

6.1 Check that there is ventilation over the top of the cells.

6.2 Carry out NR/SMS/PartB/Test/058 (Primary Cell Test) if required.

Continually loaded cells shall be replaced if their obtained readings indicate they could fail before the next maintenance visit. See NR/SMS/PartC/EL00 (Electrical Equipment – General).

7. Secondary Cells

7.1 Check that the correct number and type of cells along with the correct charger are fitted according to the diagram.

Changes could have been made during corrective maintenance.

More details are in NR/SMS/PartC/EL00 (Electrical Equipment – General). Report as corrective maintenance any discrepancies.

7.2 Clean and examine all exteriors and cases.

7.3 Check the level of electrolyte - top up with distilled/ionised water as necessary.

8. SSI Equipment (if applicable)

8.1 Examine the modules, connectors, cables for security and signs of overheating, arcing, or damage.

8.2 On the SIGNAL module (if fitted), observe that the following red indicators are illuminated:

a) Power.

b) System.

c) Rx data.

d) Outputs.

8.3 On the POINTS module (if fitted), observe that the following red indicators are illuminated:

a) Power.

b) System.

c) Rx Data.

d) Points X.

e) Points Y.

8.4 On the LONG DISTANCE TERMINAL, observe that the following red indicators are illuminated:

a) Power, System.

b) PCM TX Clock.

c) PCM Rx Clock.

d) PCM Rx Line.

e) Data From SSI.

f) Data To SSI.

g) Data To PCM.

8.5 On the DATA LINK module, observe that the red power indicator is illuminated.

If any of the indicators have failed but the equipment is still functioning correctly, make a note in the system logbook and inform your SM(S).

It is not necessary to renew modules for indicator faults only.

9. WESTLOCK Trackside Equipment (Zone controller) (if Applicable)

9.1 Check captive screws are tight on the PM, RSA and SOM110 Modules.

9.2 Where a 24V DC Power Module is fitted, observe that all the system “Healthy” indicators are illuminated, as follows:

Modules	Indication	Status
24 V DC Power supply	DC OK	Green Steady
24 V DC Buffer module (if Fitted)	Status	Green Steady
24 V DC Buffer module (if Fitted)	Diagnosis	Off
24 V DC Buffer module (if Fitted)	Check input Voltage	Off

Table 1 - DC Power module indications

10. Final

10.1 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

11. General Inspection

11.1 Check racks, shelves, and backboards. Dust equipment as necessary.

11.2 Check equipment is correctly labelled.

11.3 Sweep the floor and clean windows if required.

12. Power Supplies

12.1 Liaise with the Signaller before interrupting power supplies.

12.2 Check power panel voltmeters and ammeters.

Most panel meters are provided for indication purposes only and where practicable the indication shall be compared with a reading on a calibrated meter.

If the power supply is disconnected for any other maintenance reason you shall make sure the needle returns to zero.

12.3 Where an alternative supply is provided (main/standby) change over the load to the alternative supply.

a) Check the standby supply takes the load, without any system failures.

b) Change load back to the main supply.

c) Check that the standby supply is available before changing over.

12.4 Carry out NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD): Testing and Calibration).

12.5 Carry out NR/SMS/PartB/Test/056 (Avel-Lindberg Static Inverter Tests).

12.6 Carry out NR/SMS/PartB/Test/057 (Uninterruptible Power Supplies (UPS) Tests.

12.7 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests) on applicable equipment controlled by the Equipment/Relay Room, if not undertaken as part of the individual equipment SMS.

13. Cables & Cable Terminations

13.1 Check cables are secure and free from damage/chafing/rodent damage.

Cables shall be secure enough to prevent a movement, which can lead to a short circuit.

13.2 Examine cables and cable termination points for signs of new wet or dry wire degradation.

13.3 Check cable cores for degradation and damage especially if located above a heat source.

13.4 Where applicable, check terminals for security, corrosion, arcing and risk of short circuit/ disconnection. Protect 2BA/0BA terminals as necessary.

13.5 Check pot heads. Examine terminations and fixings clean and protect as necessary.

13.6 On 2BA/0BA terminals, check that red dome nuts are fitted as required.

On WAGO terminals, check that red insulation stops are fitted as required.

13.7 Check un-terminated cores are correctly insulated.

13.8 Where cable core diversions are in place: check ‘red straps’ are secure and labelled.

13.9 Carry out NR/SMS/PartB/Test/054 (Cable Insulation Tests). Test lineside cables containing single cut safety critical circuits, safety critical reed circuits and earth return circuits which are not monitored by an ELD.

The number of cores to be tested shall be, all spare cores or 10% of the cable capacity, whichever is greater.

13.10 Carry out NR/SMS/PartB/Test/054 (Cable Insulation Tests). Test double cut lineside cables not monitored by a bus bar test or ELD.

The number of cores to be tested shall be, all spare cores or 10% of the cable capacity, whichever is greater.

13.11 Power Cables are managed by E&P Staff under NR/L3/SIGELP/50001.

14. Internal Wiring

NOTE: *The examination of cables and wires for changes in wire degradation and the related timescales are now covered by NR/L2/SIG/11655 (Management of Cable and Wire Insulation).*

14.1 Check wiring is correctly routed, and free from insulation damage (e.g. chafing/wire ties/rodent damage).

Wires should be physically supported in ducting and away from metal corners.

Wire lacing shall not be tight.

Plastic ties shall have the serrated edge outermost.

Ducting should be in good condition and support the wiring.

14.2 Check that un-terminated wires are correctly insulated.

15. Relays and Rack Mounted Electrical Apparatus

15.1 Check all plug-in units and rack or shelf-mounted apparatus for security and signs of damage, degradation, moisture, overheating, and cover distortion.

15.2 If not managed by a relay re-servicing database, check a sample of relays to see they are within their service date.

Report any missing labels to your SM(S).

Details on relay servicing which can be carried out as a separate exercise can be found in NR/SMS/PartC/EL00 (Electrical Equipment – General).

Track circuit relays shall be serviced at 10 yearly intervals.

TC relays on Ebitrack200 installations are not covered by this requirement, other types of frequency track circuits are. See NR/L2/SIG/11129 for further details.

15.3 Examine a sample of phenolic (black) relay bases (1% or 1, whichever is greater) and contact spacers for signs of silver migration or similar contamination following removal of the relay(s).

Your SM(S) can tell you specific relays to be examined. Report any silver migration found. More details on relay bases can be found in NR/SMS/PartC/EL00 (Electrical Equipment – General).

15.4 If provided: Check for oil leakage from AC track circuit capacitors.

15.5 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

15.6 If provided, test audible alarms.

15.7 Shelf Type Relays check that terminal shrouds are fitted, where necessary.

15.8 Check that the seals on timer relays are crimped.

15.9 On Thermal Relay Timers, carry out NR/SMS/PartB/Test/061 (Relay Timer Test).

16. Local Policy Requirement

16.1 On Non-Thermal Timers**, c**heck the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/061 (Relay Timer Test) on non-thermal timer relays as directed.

17. SSI Datalinks (if applicable)

17.1 Check the Datalink cables entering the location are securely clamped.

17.2 Check that the terminations on the line termination units and surge arrestor units are secure, including confirmation that the termination strap between 3 and 8 is in place.

17.3 If the line termination resistors are separate external units, check the resistors are present and intact.

17.4 Note the mod state of the DLMs. Mod state 1 DLMs should be phased out in all locations and immediately at where DLMs are used as back to back repeaters.

A WAIF shall be raised if Mod state 1 is found and cannot be replaced immediately.

17.5 Confirm that the actual wire length of the current loop wiring (red/white twisted) between DLMs and the associated TFM is less than 5m.

Check that the current loop wiring is secure in the cable containment and that is clear from wiring that is likely to generate noise (eg point machine controls, level crossing barrier machine feeds etc).

Where over length loops or parallelism to noise are found, inform your SMS to arrange for remedial action.

17.6 Where recent alterations have been carried out (new version of location case prints since last maintenance visit), check the location wiring diagrams to confirm that the design calls for a strap between p and k (highlighted in figure 1) on the data link module plug (unless there are two data link connections to the DLM.

If the design omits this, inform your SMS for the situation to be further investigated.

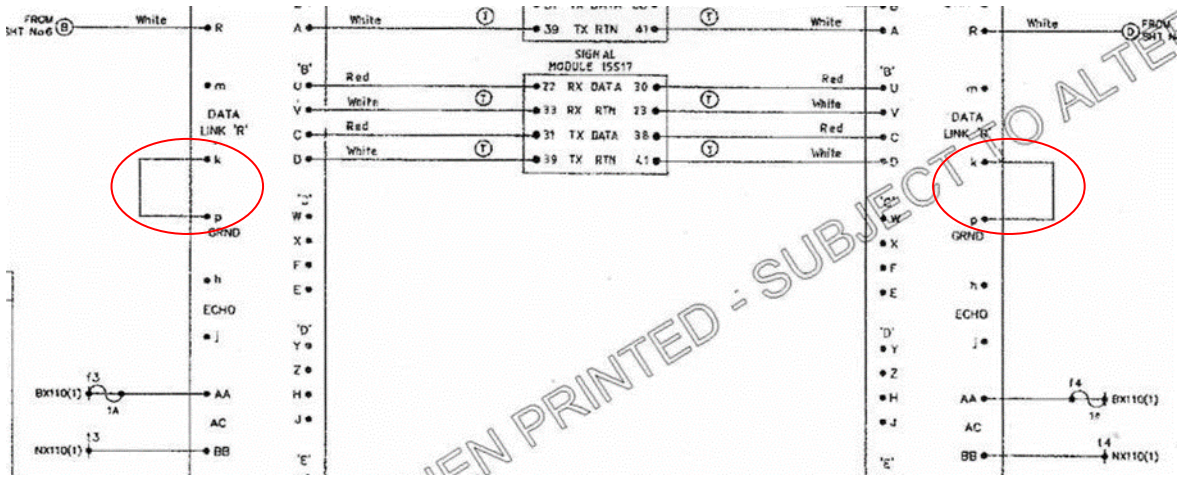


Figure 1 - SSI data link module wiring

17.7 Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

17.8 Carry out NR/SMS/PartB/Test/089 (SSI Datalink Test).

This test might not be required on interfaced SSI, ask your SM(S).

18. WESTLOCK Trackside Equipment (Zone Controller) (If fitted)

18.1 Remove and test each Surge Suppression Cassette using a surge Cassette Test Unit.

If the Surge Suppression Cassette fails rectify using NR/SMTH/Part04/WL07 (Replace a Siemens Zone Controller Module).

19. Lead Acid Cells (If Fitted)

19.1 Test the specific gravity on each cell is a minimum of 1.220.

Specific gravity measurements shall be taken before any top up of the cell with distilled water as this could give a false reading.

Readings below this value can indicate that the cell is reaching the end of its life and should be reported to your SM(S).

20. Secondary Cells

20.1 Carry out NR/SMS/PartB/Test/055 (Secondary Cell Test).

21. Final

21.1 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

22. Emergency Control Panel

22.1 If possible and with the operating arrangements in place, test the correct operation of the emergency panel and associated switch boxes.

NOTE: *On some routes this task is carried out by the operational staff as part of their duties, if this is the case S&T staff are not required to complete this test. If you are unsure seek clarification from your SM(S).*

Reliability Centred Maintenance

Includes:	Equipment, Relay and Interlocking Rooms with double cut lineside circuits.
Excludes:	Ansaldo Equipment cases / rooms

SERVICE RA: Carry out Service A of this SMS.

SERVICE RB: Carry out Service B of this SMS.

SERVICE RE: Carry out Service A and B of this SMS.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/EL32		
Electronic Equipment Cabinet		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Any electronic equipment cabinets (located in an equipment room), which do not have an associated SMS which contains cabinet maintenance as a task. Such as: ElectroloGIX.
Excludes:	Any electronic equipment cabinets (located in an equipment room), which have an associated SMS, which contains cabinet maintenance.

SERVICE B

1. Electronic Equipment Cubicles

1.1 Before working on cabinet confirm if the use of an ESD wrist strap connected to the Earth Bonding Point on the cubicle is required.

1.2 Visually confirm the cabinet earth bonding is connected and undamaged.

1.3 Clean the exterior surfaces.

1.4 Dust the interior of equipment cubicles using a dry lint free cloth.

1.5 Check (if provided) cubicle cooling fans are working, and any filters are clean. Rectify as necessary.

1.6 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure and undamaged.

2. Spares (if provided)

2.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

2.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested by your SM(S), test the operation of the cards/units in the test rack.

3. Final

3.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

3.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Ansaldo signalling equipment only
Excludes:	All other types and makes of signalling equipment and associated enclosures

The infra-red light used for transmitting data in the fibre optic system is not visible. Do not look into the end of a fibre or directly into the open connectors of a fibre optic card while the card is plugged into a working system as the intensity is enough to cause permanent eye damage.

Field Isolation Unit (FIU) switches shall only be operated with the agreement of the Signaller. Lineside equipment, e.g. points, could be isolated from the Signaller's control.

Disconnecting a PC mouse from a 'live' system might disrupt the system operation.

A PC mouse shall only be replaced with the prior agreement of the responsible manager.

The affected PC shall be powered down before replacement.

A vital key board may be replaced without the need to power down the system. However, the prior agreement of the responsible manager is still required.

MSSCC AUT System, Maintenance Procedures

The majority of the equipment used in the AUT system, including the network equipment, clustered servers, and disk array is classed as specialist Information Technology equipment.

Familiarity with Windows NT, UNIX, LINUX, the tools required to manage the disk storage system and network configuration is essential.

The maintenance of the AUT System addressed in this SMS is restricted to preventative maintenance only. For further information refer to the Manchester South Signalling System O&M manuals.

REGULAR CHECKS 1

1. Interlocking/Control Rooms

1.1 Check the resistance to earth of those cables identified in Monitored Cables

More details can be found in NR/SMS/Appendix/02.

NOTE: *If a point cable is indicated as having a low insulation value the operation of the associated point heater(s) should be checked.*

1.2 Check the operating times of each set of points using maintenance terminal.

1.3 Check the life of each signal lamp using the lamp life monitoring system. Arrange replacement, as necessary. More details can be found in NR/SMS/Appendix/02.

1.4 Check the voltages of each track circuit using maintenance terminal.

1.5 Check that the event recording data is preserved.

1.6 Check the number of weekly alarms (both primary and secondary) for each data backbone and take action as required.

REGULAR CHECKS 2

2. Peripheral Location/Distributed Peripheral Location

2.1 Check the cable resistance to earth of VIO Fed Cables. More details can be found in NR/SMS/Appendix/02.

2.2 Check all the displays on 48V power supplies are operative.

2.3 Check the Field Device Controller watchdog indicators are illuminated as required.

2.4 Check the LED at each fuse holder is illuminated (rack mounted 48v DC/DC converter).

2.5 Check each fibre optic connection on fibre optic cards (vital hub, non-vital hub and FOA cards) for damage, correct connection, and minimum bend radius of optical fibre.

2.6 If applicable, NR/SMS/PartB/Test/171 (Earth Monitoring Integrity Test) Record details and results of the circuits tested.

2.7 If applicable, check the SECAP Insulation Monitor Alarms.

Alarms are monitored / displayed on the SCADA system. More details can be found in NR/SMS/Appendix/02.

2.8 Where fitted, check the temperature control thermostats and heating devices are set correctly and operative This is important especially during periods of extreme ambient temperatures.

2.9 Check all the fans in Peripheral Post modules are operative.

The Green LED adjacent to fan power supply switch indicates status of power supply not confirmation of fan operation.

2.10 Check each fan filter and clean if required.

3. Interlocking Room

3.1 Check the Interlocking Unit watchdog indicators are illuminated as required.

3.2 Check each fibre optic connection on fibre optic cards (vital hub, non-vital hub, PCs, and FOA cards) for damage, correct connection, and minimum bend radius of optical fibre.

3.3 Check the cable insulation status. Record details of any cables with deteriorating values for remedial action.

AUT dedicated ELD monitoring system.

3.4 Check that all the fans in Central Post are operative.

3.5 Check each fan filter. If necessary, clean as required.

3.6 Check that the thermostat in interlocking cubicle is set correctly and is operative.

3.7 Dust the keyboard(s). Hold the keyboard(s) upside down when dusting.

3.8 Clean the desk mounted VDU screen(s) in accordance with manufacturer's instructions.

3.9 Check the mouse/cursor co-ordination.

3.10 Check the ART monitor status.

4. AUT (Local Area Network (LAN) Equipment)

4.1 Check all the equipment in the LAN Rack is switched ON.

4.2 Check that all the cables are connected.

4.3 Check that each fibre optic connection on fibre optic cards for damage, correct connection, and minimum bend radius of optical fibre.

4.4 Check the green LED indications adjacent to the ports on the network hub for each item of connected equipment (AUT Servers, Communication Servers, ACC ART1 and ART2, Maintenance Terminal etc) are illuminated.

5. Maintenance Desk

5.1 Check the computer is switched ON and the keyboard and mouse are connected and working correctly.

5.2 Check the Alarm Log window is present and displays the last relevant events for the Audible Alarm.

5.3 Check that the clock corresponds with the Anthorn clock. This was formally called the 'Rugby' clock.

6. Control Room

6.1 Dust the keyboard(s). Hold the keyboard(s) upside down when dusting

6.2 Clean the desk mounted VDU screen(s) in accordance with manufacturer's instructions.

6.3 Check the mouse/cursor co-ordination.

6.4 Check the cube screens (wall display) for colour and image. Arrange remedial action as necessary. More details can be found in NR/SMS/Appendix/02.

7. AUT Desks (Primary and Secondary)

7.1 Check the workstation PC is switched on, the computer monitors are switched on, and the mouse and keyboard are connected and working correctly.

8. AUT Audible Alarms

8.1 Check that the loudspeakers on the AUT Desks are connected and switched on.

8.2 Wait for a relevant event and check the operation of the audible alarm function.

SERVICE A

9. Peripheral Location/Distributed Peripheral Location

9.1 Dust the equipment.

9.2 Check cables/connections (where accessible) and the switches on Adaptation Units.

10. Interlocking Room

10.1 Dust the equipment and Wipe glass door panels (equipment cubicles).

10.2 Clean (if necessary) monitor screens in accordance with manufacturer's instructions.

10.3 Check cables/connections (where accessible).

11. Control Room

11.1 Dust equipment.

11.2 Clean (if necessary) monitor screens in accordance with manufacturer's instructions.

11.3 Check cables/connections (where accessible).

11.4 If necessary, Wipe the cube screens (wall display) More details can be found in NR/SMS/Appendix/02.

SERVICE B

12. Peripheral Location/Distributed Peripheral Location

12.1 Carry out NR/SMS/PartB/Test/171 (Earth Monitoring Integrity Test). Record details and results of the circuits tested.

13. Stand-by Signallers Desk

Testing the standby system shall only be undertaken during engineering hours, when traffic delays are not incurred.

13.1 Check that the standby system takes over in the event of the main system shutting down.

13.2 Check associated monitoring indicator(s) are activated (if applicable).

13.3 Check associated monitoring indicator(s) are de-activated when main system is re-instated (if applicable).

14. ART and AUT Uninterruptible Power Supply (UPS)

14.1 Maintain in accordance with manufacturer's instructions.

15. External

15.1 Test the cable resistance to earth of Other Tail Cables. NR/SMS/PartB/Test/051 (Busbar Earth Tests) *or* NR/SMS/PartB/Test/054 (Cable Insulation Tests) as required.

More details can be found in NR/SMS/Appendix/02.

END

Includes:	Modular Equipment Housing (MEH), Object Controller (Axle Counter) [OC(A)], Object Controller (Interface) [OC(I)], Object Controller (Points) [OC(P)], Object Controller (Signal) [OC(S)], Feeder Pillar Power Box 1 (PB1), Power Box 2 (PB2) Power Box 3 (PB3), Axle counter Power box (PR1W) and Lockout Enclosure
Excludes:	All other types and makes of signalling equipment and associated enclosures

General

Visible light is used for transmitting data in the fibre optic system and is emitted within a tiny beam size; however, the intensity can cause permanent eye damage.

Do not look into the end of a fibre or directly into the open connectors of a fibre optic termination or use magnifying equipment to observe the light.

Anti-static precautions shall be taken when required.

It should be noted that there is no fixed lighting provided in the Lineside Compact Housings.

Further information regarding the system is available in Siemens Rail Modular Signalling Manuals.

Check any record cards for any entries since your last visit. Where alterations are being carried out, your SM(S) should have briefed you on the work and the effect on planned maintenance.

If you find evidence of project work that you have not been told about, contact your SM(S).

Before leaving site, check that access points are secured to prevent unauthorised access.

SERVICE B

1. General Maintenance

External

1.1 Check MEH, OC & PB are accessible and the door(s) are not obstructed.

1.2 Remove or report excessive foliage or obstructions as a corrective maintenance item.

1.3 Check for fire risks around the MEH, OC & PB(s). Remove or report any possible risks.

1.4 Check (if provided) that any guardrails and staging are secure. Also examine fixing bolts that secure the housing to the structure and / or foundations.

1.5 Examine MEH, OC and PB metalwork and door(s) for corrosion, damage, obstruction, and security.

1.6 Report any signs of forced entry to your SM(S).

1.7 Check lockable handle and locks are in good order and free from corrosion and damage etc.

1.8 Check the earthing continuity between the MEH, OC and PB and the earth point.

Check that all connections are secure.

1.9 See the notes in NR/SMS/PartC/EL00 (Electrical Equipment - General) on earthing. Report any earthing problems as a corrective maintenance item.

1.10 Check that any MEH, OC and PB identity numbers, safety / warning labels / signs are correctly displayed and legible.

These can include No Smoking, Wear PPE, No Mobile Phones etc.

Internal

1.11 Remove any dirt / infestation.

1.12 Check equipment is correctly labelled and that warning signs are correctly displayed (i.e. all equipment rated >175V).

1.13 Check that the silicone gasket fitted to the inside of all door(s) are free of dirt and damage and no signs of water ingress are present.

1.14 Check site copy diagrams are available, properly stored and fit for purpose.

1.15 Submit a request for replacements as required. Report to your SM(S) any handwritten or temporary alterations to the site copy.

1.16 Check equipment for signs of overheating, contamination, damage or failure.

1.17 Check MEH lighting is working correctly.

1.18 Advise your SM(S) if defective.

1.19 Check MEH thermostat is set correctly and that heating and fan are working correctly where provided.

1.20 Advise your SM(S) if defective.

1.21 Lubricate locks and hinges.

1.22 Before leaving site, check that covers, doors and locks are properly fitted and secure.

2. Technicians Facility (Local) [TF(L)]

2.1 Check the correct time and date are displayed, report to your SM(S) if this is not the case as incorrect date / time is indicative of a wider system fault.

2.2 Check the TF(L) for any outstanding faults. Rectify or report, any corrective actions required shall be logged with ICC/NRIFC.

2.3 Check that data logging is being undertaken correctly by analysis of a sample of information.

3. MEH, OC Surge Protectors, PB Surge Suppression Units

3.1 Check MEH & OC Surge Protectors are serviceable by viewing the colour of the varistor discs.

Report any failed as a corrective maintenance item.

Pink: Serviceable
Grey: Failed

Replace any failed surge protector unit immediately. Report to SM(S) any change.

Figure 1 – Surge Protector

3.2 Check PB Surge Suppression units are serviceable by viewing the colour displayed the small window.

Report any failed as a corrective maintenance item.

Green: Serviceable
Red: Failed

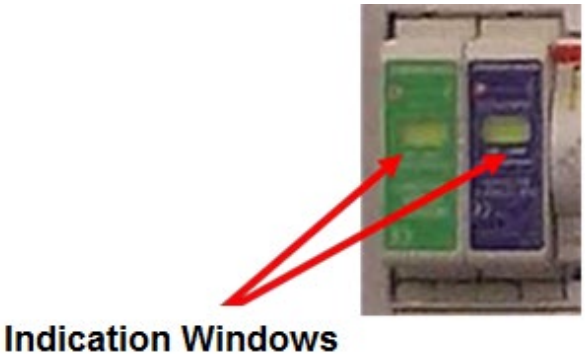


Figure 2 - Surge Suppression units

Replace any failed surge protector unit immediately. Report to SM(S) any change in the Indication windows.

4. Feeder Pillar

This equipment is rated at 230V AC and shall only be maintained by Technicians in areas where agreement has been reached with the E&P engineer to allow this practise.

4.1 Check the terminal cover plates, three position changeover switch MCBs are present, secure and free of damage and distortion.

4.2 Check the surge suppression unit indication windows: white indicating it is serviceable, and red when is has been subjected to a voltage surge.

Figure 3 – MCB Units

4.3 Measure the Incoming DNO (Distribution Network Operator) voltage at the test points (Arrows A).

Measure the Incoming Gen (Generator) power supply at the test points (Arrows B), if the generator supply is in use.

Measure the Outgoing Feeder Power Supply at the test points (Arrows C). All of the voltage should fall between 207Va.c. and 234Va.c.

Figure 4 – Feeder Power Supply

NOTE: *Terminals are provided on the Feeder Pillar for measurements to be carried out. These are located behind a protective cover which shall be refitted at the end of measurements.*

5. Power Boxes [PB]

NOTE: *Terminals are provided on the PB Switch Rack for measurements to be carried out. These are located behind a protective cover which shall be refitted at the end of measurements.*

5.1 Check the terminal cover plates, power switch knobs and MCBs levers' are present, secure and free of damage and distortion.

NOTE: *in the MEH, MCBs are provided in association with barrier and other equipment and are distributed around the room. Refer to wiring details for positioning.*

5.2 Measure the power supply and busbar voltages for all equipment & logic supplies and check they are within the range as indicated in NR/SMS/PartZ (Index – Useful Values).

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment – General) on hazards associated with electrical supplies Investigate any significant variation from previous records.

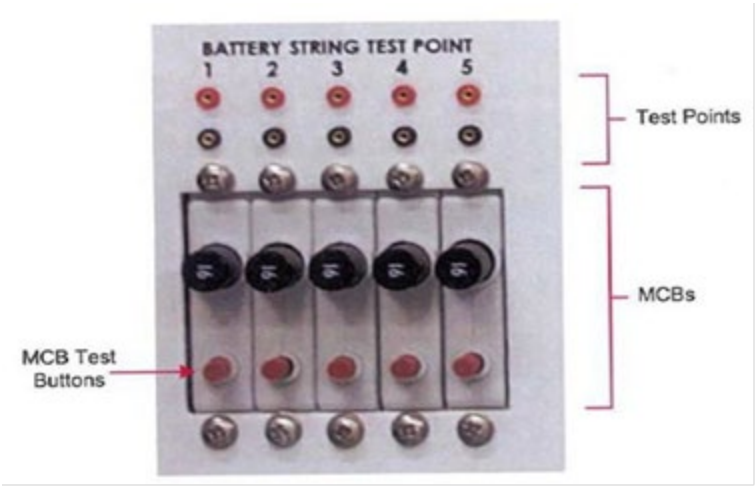
6. Power Box [PB] Battery Packs.

NOTE: *Terminals are provided on the front of the Battery Pack to enable voltage measurements to be taken.*

6.1 Check all MCBs are in their normal (fully in) position.

6.2 Press the red MCB test button and check the MCB trips. Press the black button to reset. Repeat this process for each MCB in turn.

6.3 Using the test point check each battery string has an output between 20V – 30V dc.



6.4 Repeat steps 6.1 to 6.3 for each Battery Pack.

7. Lockout devices

NOTE: *Liaison with the Signaller is required.*

7.1 Check both the switch label and local boundary diagram(s) are clean legible and secure. Clean as necessary.

7.2 Where practical, test operation of the lockout function.

a) Patrolman's lockout (LOD-P) NR/SMS/PartB/Test/174 (Patrolman's Lockout Device Test).

b) Signalling lockout (LOD-K) NR/SMS/PartB/Test/176 (Lockout Device Test).

7.3 Examine the unique key(s). Report the requirement for a replacement if worn as a corrective maintenance.

8. Audible Warning Control Unit

8.1 Check time clock settings (e.g. AWCU). Remember BST & GMT.

SERVICE C

9. Wiring and Cables

9.1 Check wiring and fibre optic patch cords are correctly routed, and free from insulation damage (e.g. kinking / chafing / wire ties / rodent damage) particularly those not in ducting and where they pass above a heat source. Report any damage as a corrective maintenance item.

Immediate action shall be taken on any damaged fibres or conductors. Damage includes any new wet/dry degradation. Rodent damage can occur to wiring in ducting which is not immediately visible.

Ducting should be in good condition and support wiring.

9.2 Check that cable entry apertures and rodent protection is intact and cables are secure by their associated clamping supports. Check cables are free from damage/ chafing/ rodent damage.

The cable clamping should be fitted such a way that short circuits cannot occur if the cable is pulled from outside.

9.3 Check that all cabling plug couplers are free from damage, secure.

NOTE: *Secure means hand tight, the use of tools to tighten the nuts on the Harting plug coupler is not allowed*

9.4 Check that all configuration plugs, logic supply, and surge arrestors are free from damage and their securing clip is engaged correctly. Also check that the seal on the addressing module is intact.

9.5 If required, examine cables and wires for changes to degradation; report any changes as a corrective maintenance item

NOTE: *To gain access to the OC(S) TPWS wiring and OC(P) relay wiring it will be necessary to remove these modules using NR SMTH test plans.*

Similarly, if you are required to inspect the wiring within a PB, access to the wiring requires the removal of all modules and isolation of the entire PB from the incoming supply. Your SM(S) will plan and advise you on either of these tasks.

More information on wire degradation can be found in NR/L2/SIG/11655.

9.6 Check that any un-terminated wires are correctly insulated.

10. Relays

10.1 If not managed by a relay re-servicing database, check a sample of relays to see they are within their service date.

10.2 Report any missing labels to your SM(S).

10.3 Check equipment for security and signs of damage, degradation, moisture, overheating, and cover distortion.

11. Final

11.1 Record details of your maintenance visit and record any other work undertaken in the site logbook or record card.

SERVICE D

12. Batteries

12.1 The batteries within the Power Boxes have an operational life and shall be replaced every 10 years.

The condition of each battery is affected by many factors but typically it is most dependent on when the battery has degraded to 80% of the manufacturers rated capacity.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/EL37		
Location Case - Temperature Controlled Location (TCL)		
Issue No. 01	Issue Date: 03/03/2018	Compliance Date: 31/05/2018

Includes:	Ansaldo Location Case - Temperature Controlled Location (TCL)
Excludes:	All other Location Cases

PERIODIC TASK

1. External Inspection

1.1 Check TCL is accessible and the doors are not obstructed.
Remove or report excessive foliage or obstructions.

1.2 Check for fire risks around the TCL, remove or report any possible risks.

1.3 Check (if provided) that any guardrails and staging are secure.

1.4 Examine TCL and doors for corrosion, damage, obstruction, and security.

1.5 Check TCL identification number(s) are clearly labelled.

1.6 Check locks are fitted and in good order.

1.7 Remove fan cover, check the fans are free from obstruction and the fan alarm panel is operating.

2. Internal Inspection

2.1. Check on the Technician Terminal for any faults.

2.2. Check TCL for signs of contamination, damage or failure.

2.3. Remove any dirt/infestation.

2.4. Check that any cable entry openings are suitably sealed to prevent rodent entry.

2.5. Check that wire degradation signs are in place if this condition has been identified at the TCL.

2.6. Check site copy diagrams are available and properly stored.
Submit a request for replacement as required.
Report to your SM(S) any handwritten or temporary alterations to the site copy.

2.7. Replace the two air filters on the doors.

End

1. General

Logging systems are of two basic types, event loggers, and condition monitoring systems.

Event loggers log digital events such as the change of state of a relay.

Condition monitoring systems generally record measured values continuously or at predefined intervals. Hybrid systems may exist which do both types of logging. Further details of condition monitoring are given in Appendix A.

2. Time Setting

If the system time on a logger used for event logging is more than 5 minutes out, it shall be corrected.

The displayed time on all recorders or loggers should always be set to GMT (Greenwich Mean Time).

This can also be called UTC (Universal Time Constant).

Note that if the time system is controlled by the Anthorn (formally Rugby) transmitter, alterations to the time along with setting to GMT in BST periods will not be possible.

3. Sites with Remote Access

At sites with remote access the A Service is un-necessary provided that the system time and event logging are checked at least quarterly.

The system time shall be verified to within 5 minutes of the correct time, noting that this may be BST or GMT. Logging of data shall also be checked, either manually or by automated programme, by downloading the last hour's data and confirming that the logger is logging.

4. Passwords

These are usually required for interrogating a logger. Area Technical Support may assist with lost passwords.

5. Records of Adjustments

Records should be made in the site log book of required adjustments to time or other system parameters that, if repeated and excessive, might indicate the need for system overhaul. Any such trend should be reported to your SM(S).

APPENDIX A - Condition Monitoring Equipment

1. Definitions

Indirect Measurement:	Measurement acquired without direct electrical contact e.g. using a current clamp.
Instrumentation Engineering:	The methodology for the use of monitoring and test equipment as specified in NR/GI/U033 (Use of monitoring and test equipment).

2. General

Condition monitoring equipment acquires data from on-track and lineside assets and may include a combination of analogue, serial and digital data sources. Measurements are acquired by indirect measurement and follow Instrumentation Engineering methodology.

One or more of the following methods can be used:

a) Analogue measurements acquired from sensors, e.g., current transducers; the default input range for analogue inputs is 4 to 20mA.

b) Serial data streamed from diagnostic ports e.g., RS232 or RS485.

c) Digital state monitoring, e.g., spare contacts of signalling relays.

The data acquired from the inputs is processed by the data collection unit (DCU) and transmitted to the remote server either by the mobile network using an internal modem and external antenna or the Fixed Telecom Network via an Ethernet port. Received data is processed and stored by the monitoring system and provides a record of recent and historical asset condition.

Server end functionality includes:

a) Display and trending of asset data.

b) Alarms and alerts when assets operate out of tolerance.

Approved types of DCUs are typically designed to mount into the space of a BR930 style relay to enable fitment into standard signalling equipment racks and are approved to be powered directly from 110Vac signalling supplies.

The devices require to be configured to correctly to acquire data and to communicate to the remote server; further information regarding configuration may be found within the Manufacturers' User Manuals. See appendix B to E for further information regarding approved types of DCU.

3. Maintenance Requirements

DCUs are designed to require minimal maintenance and should be replaced on failure only*. However, Technicians should take the opportunity to check device indications and dust / clean as the opportunity arises e.g., during routine maintenance of the equipment rooms and housings.

*Failure is indicated by a 'heart-beat' alarm raising in the monitoring system when a device does not communicate for an extended period, typically 6 hours.

Where condition monitoring equipment is powered from a secured power supply (e.g.110Vac derived from 650Vac supply) internal batteries, where fitted, are not critical to normal operation and do not require be routinely tested or renewed. By exception, where the monitoring application specifically requires a standby power source, special arrangements shall be required to periodically test the standby or to replace batteries following the manufacturer's instructions.

APPENDIX B - Findlay Irvine DCU390M

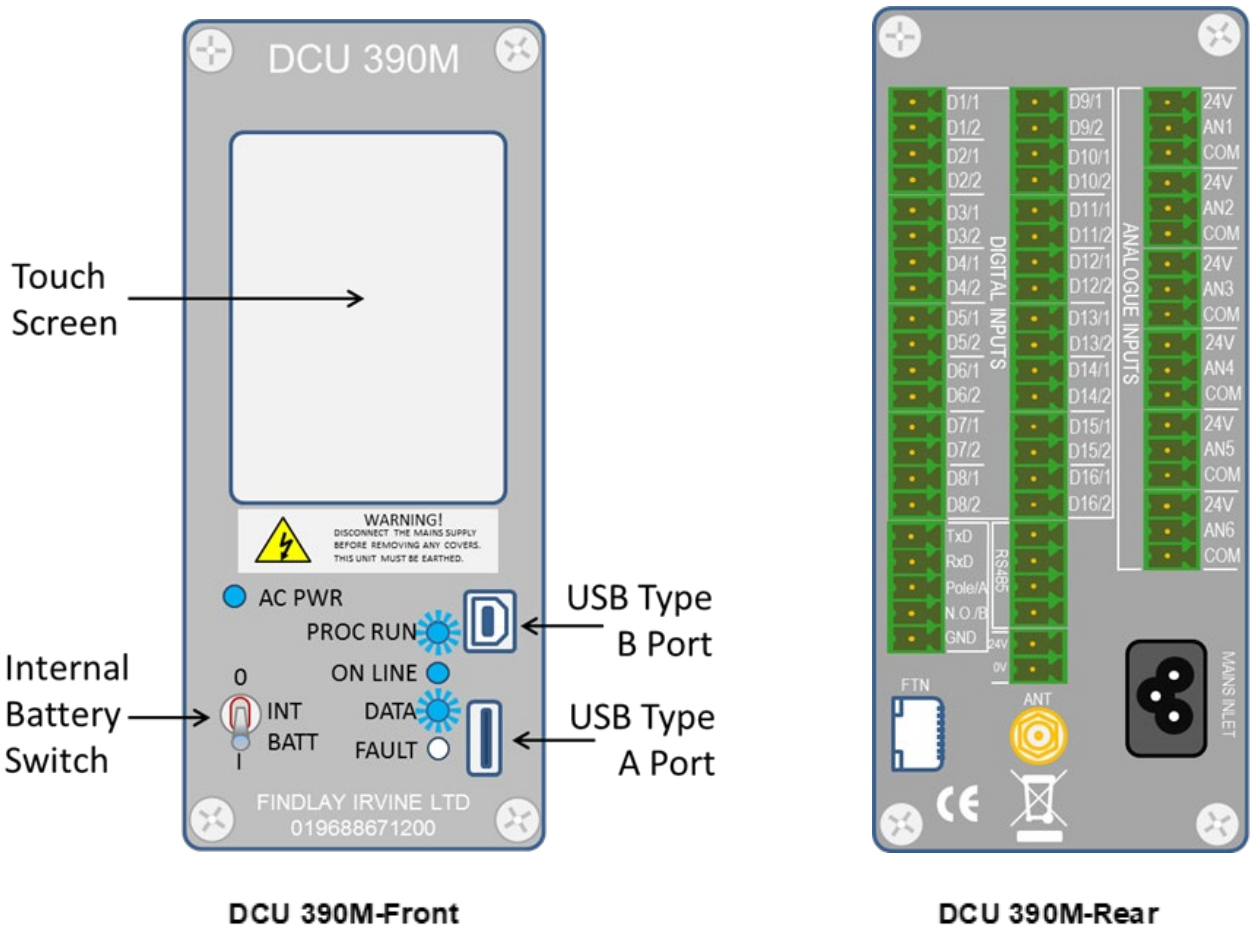
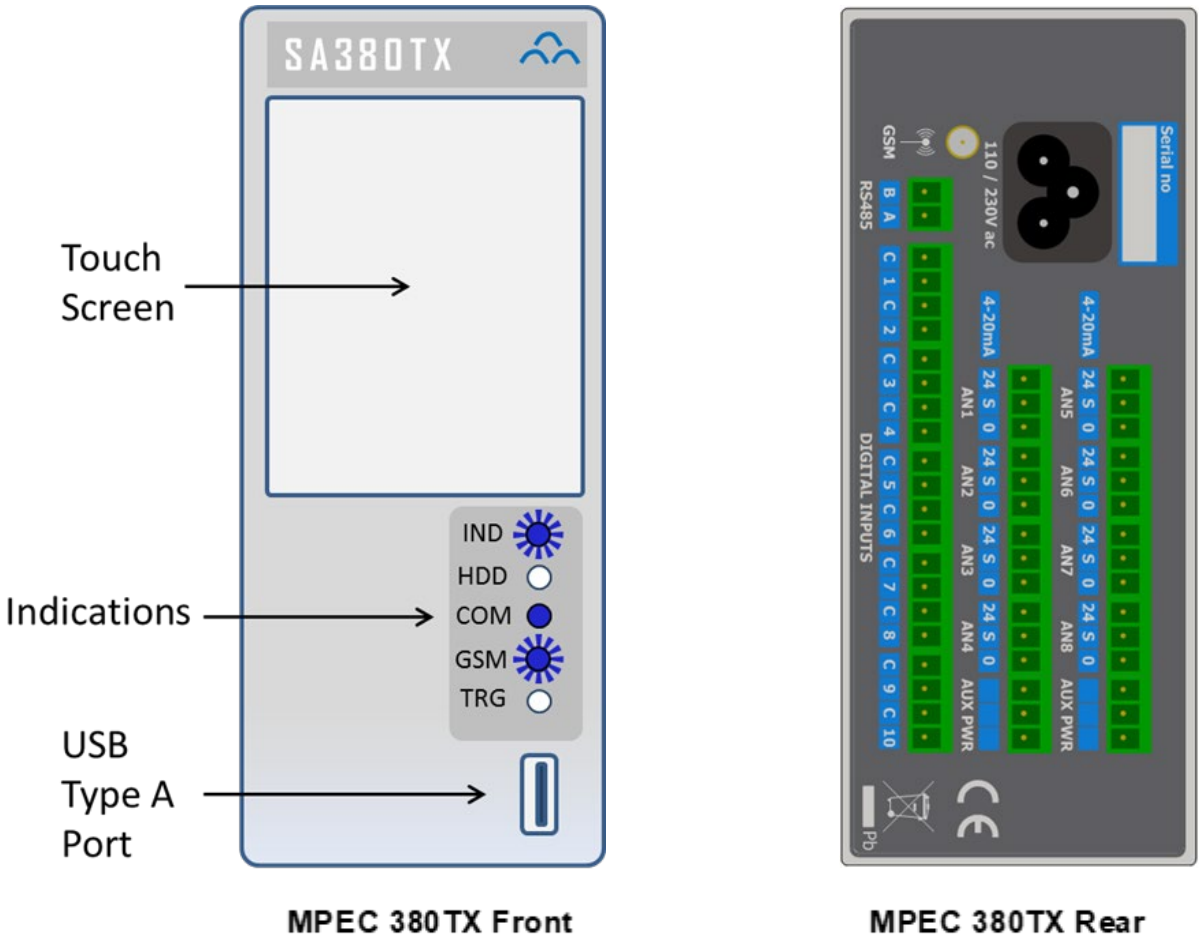


Figure 1 - DCU 390M Unit

Findlay Irvine DCU 390M Normal Indications		
LED	Normal Indication	Description
AC PWR	ON	Indicates unit is correctly powered from AC Supply
PROC RUN	FLASHING	DCU main processor running correctly
ON LINE	ON	Unit connected to II via GPRS or FTN
DATA	INTERMITTENT	Lit when data acquired from inputs (Digital Signal Processor)
FAULT	OFF	Lit in the event a Digital Signal Processor Fault is detected

Table 1 – Indication Meanings

APPENDIX C - MPEC 380TX



MPEC 380TX Front

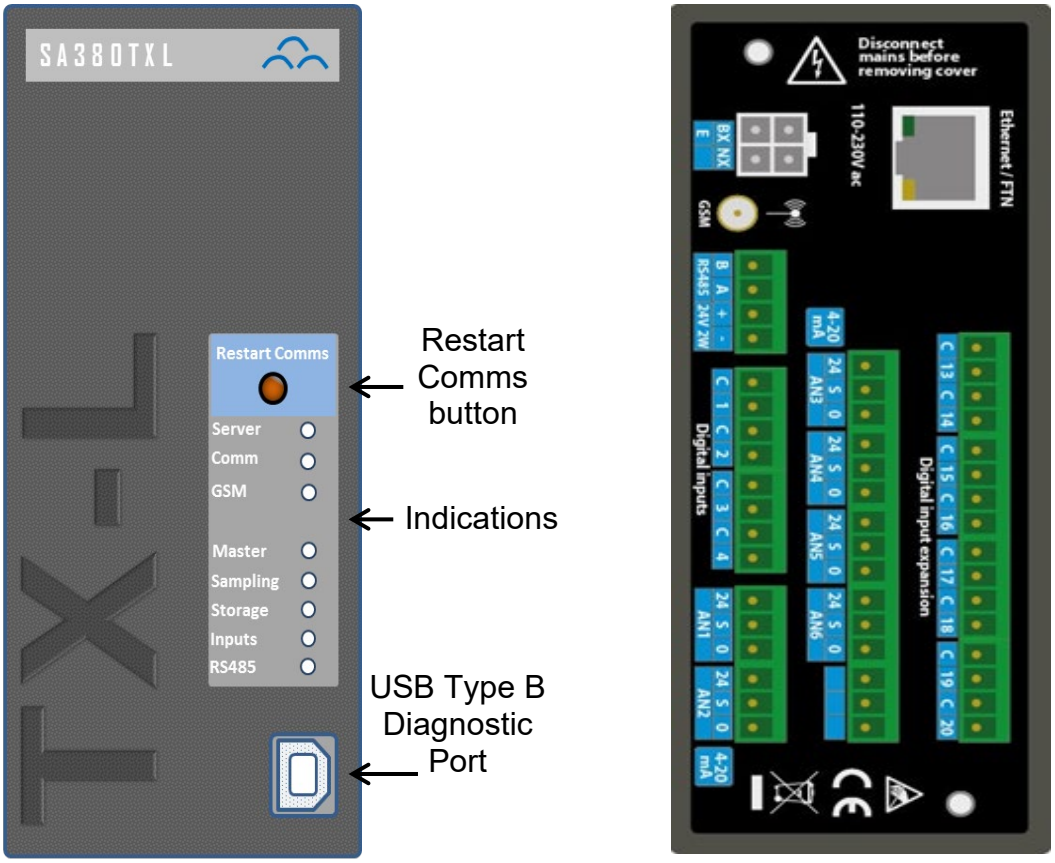
MPEC 380TX Rear

Figure 2 - MPEC 380TX Unit

MPEC 380TX Normal Indications		
LED	Normal Indication	Description
IND	FLASHING	Indicates unit processor is running correctly
HDD	INTERMITENT	Lit with Hard Drive Activity
COM	ON	Lit when unit is connected to Remote Server
GSM	FLASHING	Flashes when connected to local network
TRG	INTERMITENT	Lit when a data event is being recorded

Table 2 - Indication Meanings

APPENDIX D - MPEC TX-L



MPEC TX-L Front **MPEC TX-L Rear**

Figure 3 - MPEC TX-L Unit

TX-L Logger Normal Indications		
LED	Normal Indication	Description
Server	Steady On	Connected to the Central Data Server
Comm	Steady On	Connected to the GSM Network
GSM	Steady On	Modem Powered On
Master	Slow Flash (1 sec)	Device Operating Normally. (Fast flash 0.25s, Steady On or Off indicates processor fault)
Sampling	Intermittent Blink	Data processing activity
Storage	Intermittent Blink	Data Read / Write from database
Input	Intermittent Blink	Analogue or Digital Input change detected
RS485	Intermittent Blink	Data transmit / receive on RS485 port

Table 3 - Indication Meanings

APPENDIX E - ATLAS MINI-LOGGER

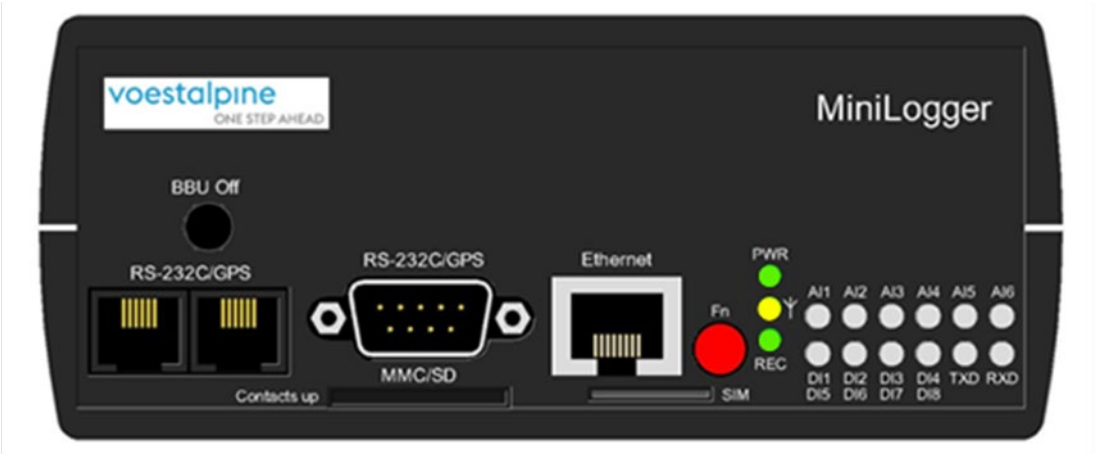


Figure 4 - Atlas Mini-Logger Front #

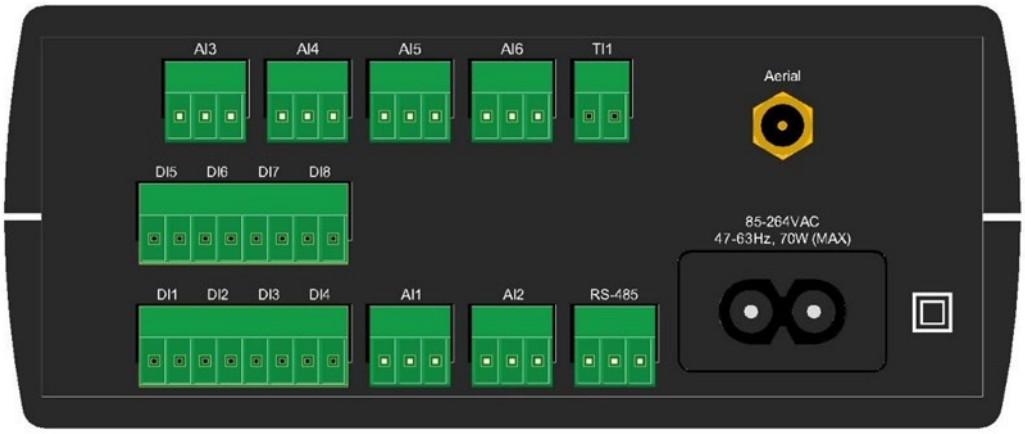
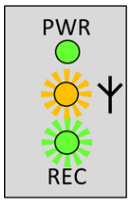


Figure 5 - Atlas Mini-Logger Rear #

NOTE: *#The device shown is typical example of the Atlas Mini-Logger. Variant models are in use with different arrangements of inputs and indications; however, the basic functionality of devices is similar.*



Atlas Mini-Logger Normal Indications		
LED	Normal Indication	Description
PWR	ON	Indicates the unit is powered correctly from an AC source
ANTENNA	FLASHING	Correctly connected to remote server
REC	FLASHING	Unit is logging data correctly

Table 4 - Normal Indications

APPENDIX F - MINI-LOGGER – 2

Figure 6 – ATLAS MINI-LOGGER – 2 FRONT

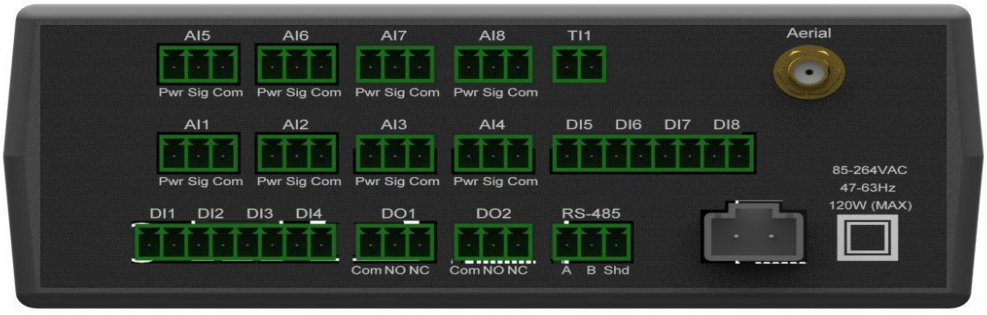
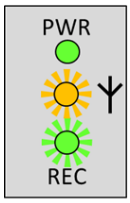


Figure 7 – ATLAS MINI-LOGGER – 2 REAR



Atlas Mini-Logger - 2 Normal Indications		
LED	Normal Indication	Description
PWR	ON	Indicates the unit is powered correctly
ANTENNA	FLASHING	GPRS/3G Status LED to indicate • Off = Modem Powered Off • On = Modem on, not registered onto the network • Slow flash = Modem on, registered onto the network • Quick flash = Modem on, registered onto the network and communications in progress
REC	ON	Unit is logging data correctly (LED will flash when data is stored to the internal SD card)

Table 5 – Normal Indications

APPENDIX G - RML6

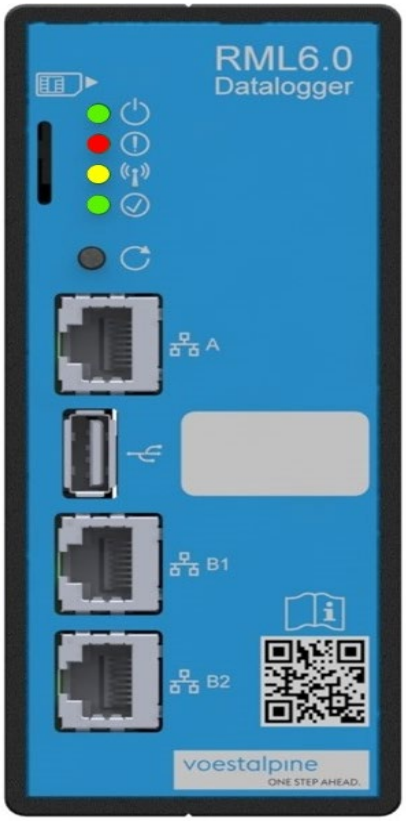


Figure 8 – RML6 Front

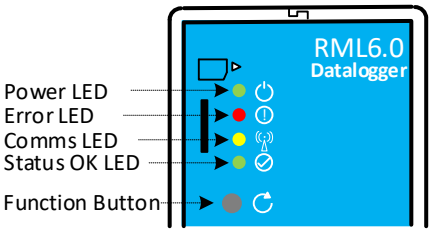


Figure 9 – RML6 LED Explanations

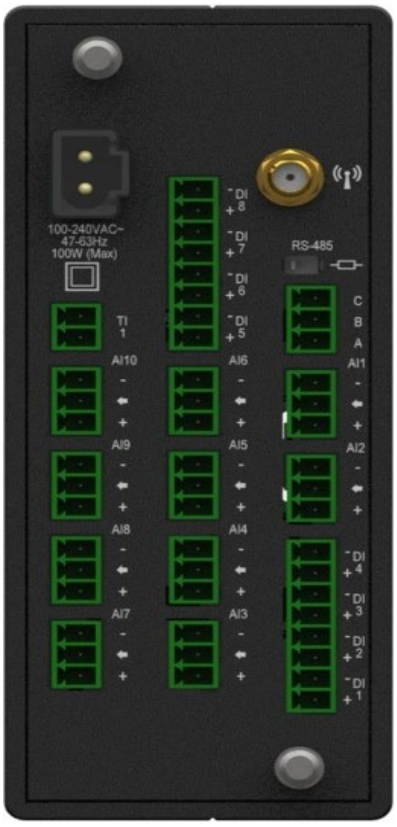


Figure 10 – RML6 Rear

RML6 - Normal Indications		
LED	Normal Indication	Description
PWR	ON	Indicates the unit is powered correctly
Error	OFF	Indicates the unit is operating normally and no error detected by the RML6 (LED is lit when an error is detected)
COMMS	FLASHING	GPRS/4G Status LED to indicate • Off = Modem Powered Off • On = Modem on, not registered onto the network • Slow flash = Modem on, registered onto the network • Quick flash = Modem on, registered onto the network and communications in progress
STATUS	ON	Unit is logging data correctly (LED will flash when data is stored to the internal SD card)

Table 6 – Normal Indications

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/ER11		
Instead Signaling Event Recorder		
Issue No: 04	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Instead 3, Instead 64, Instead 64 Active
Excludes:	All other types of Instead Event Recorder

General

Record any work undertaken on the record card or site log book.

SERVICE A

1. Visual Checks

1.1 Check that the 'Recording' indication is flashing and the fault indication light is not lit.

1.2 Check the displayed time and date are correct. Note that the time is always stated in GMT

SERVICE B

2. Full Test

2.1 Dust the top of the unit and wipe the clear front panel.

2.2 Run the self-test routine, observe that there are no faults indicated.

2.3 Remove the floppy disk from the unit. Using the special cleaning disk provided, run the disk drive cleaning routine. Remove the cleaning disk when completed.

2.4 Check the removed disk on a computer using the 'Instead/Sentinel' office software.

Check all functions operating correctly.

This may be done on site or alternatively the disk can be returned to a central office for this operation.

2.5 If the disk has been interrogated on site, replace it back into the unit. If the disk is to be removed from site for interrogation, insert a blank formatted 720kB disk into the unit (On the Instead 64 Active use a formatted 1.4MB disk).

Check that both disks are marked with the site name, the date and time of removal is marked on the recovered disk and the date and time of installation are marked on the new disk. Check that recording continues on the new disk.

2.6 Record the work done on the event recorder record card or the site logbook.

PERIODIC TASKS

3. Battery Replacement

3.1 Replace the unit's internal 'Cyclon' battery pack.

NOTE: *The battery pack replacement is a workshop job that will require temporary removal from site. See details in NR/SMS/PartC/ER00 (Logging Systems - General).*

3.2 Replace the unit's internal dry battery used for backup of the clock. Reset the time and date (time to GMT).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/ER12		
Westrix signaling event recorder		
Issue 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Westrex signaling event recorder

SERVICE A

1 Westrix Host Logger Equipment Cubicle

1.1 Visually check the integrity of all connections.

1.2 Check that green 'Power ON' LED indicators on both logger PCs are illuminated.

1.3 Check Radio clock module status using its LCD setup/diagnostic panel.

1.4 Close Host Logger Equipment Cubicle door.

2 Westrix S3 Baseplates

2.1 Electro-static precautions shall be observed where physical contact with S3 equipment can occur.

2.2 Visually check the integrity of all connections.

2.3 Check that the operational status LED indicator displayed on each S3 module is as follows:-

- Power Supply Module (FPS400-24) green
- Data Input Module (DIP-1) green
- Scanner Module (Scanner-1) green

3 Westrix Technicians Terminal

3.1 Visually check the integrity of all connections.

3.2 Power up monitor screen and Check monitor and keyboard for correct operation.

3.3 Investigate and clear any outstanding fault messages.

3.4 Power down monitor screen.

SERVICE B

4 Equipment Cleaning and Inspection

4.1 Clean Technicians Terminal monitor and housing using a proprietary dry anti-static screen cleaner.

4.2 Check that the Technicians Terminal PC cooling vents are clear and its internal fan is operating quietly.

4.3 Clean Host Logger Equipment Cubicle door with a dry lint free cloth with door closed.

4.4 Check that Host Logger PC cooling vents are clear and internal fans are operating quietly.

4.5 Carefully dust the interior faceplates and blanking panels with a dry lint free cloth.

4.6 Close Host Logger Equipment Cubicle door.

5 Periodical Tasks

Technical support staff and/or equipment specialists could manage these tasks separately.

5.1 Replace each Host Logger PC hard disk drive (HD) with a new HD of the same, or a compatible, type.

5.2 Service/replace Host Logger PC cooling fans.

5.3 Replace Host Logger PC Lithium ion coin cell.

5.4 Service/replace Technicians Terminal PC cooling fans.

5.5 Replace Technicians Terminal PC Lithium ion coin cell.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/ER15		
ACIC Signalling Event Recorder		
Issue No. 03	Issue Date: 04/03/17	Compliance Date:31/05/17

Includes:	Alpha and IMP based Portable Loggers and Interlocking Monitoring Systems
Excludes:	

General

Renewed USB sticks will be automatically formatted by the standard Windows 2000 or Windows XP operating system, they will operate regardless of capacity but their size must be sufficient for the site concerned. Record any work undertaken on the appropriate record card or site log book

SERVICE A

1. Visual Checks

1.1 Alpha based systems only

Check that the Alpha Units LED indicators are illuminated
Power steady and RS485 flashing.

1.2 IMP based systems only

Check that the Solartron IMP LED indicators are illuminated for correct operation
Power illuminated but no other LED illuminated.

1.3 Check correct time is displayed. Note that the time is always stated in GMT

1.4 Open the most recent hour of data and verify that logged functions are being recorded.

SERVICE B

2. All Units

2.1 Clean all external surfaces using a lint free cloth and a mild detergent. Do not use any solvents.

2.2 Check the integrity of input connections by checking they are connected and secure.

3. Interlocking Monitoring System

3.1 Check that the processor and rack fans are clear of obstructions and dust that may restrict the airflow, and are running correctly, Rectify as necessary. Clean filters as necessary.

3.2 Carry out the UNINTERRUPTIBLE POWER SUPPLY TESTS (057))

4. Portable Logger

4.1 Check the hard disk for sufficient space until the next 'Service B', archive the old data and then delete the relevant directories to free up space as necessary. For Interlocking Monitoring Systems and Portable Loggers with the full interlocking software, at the end of each year at 2 Minutes after midnight a new year's set of files are automatically created. For other ACIC Portables these will have to be created manually.

4.2 Check modem for correct operation by dialling in.
This may be done visually on modems with LED indicators, accessed by removing the back panel.

A slow flashing LED indicates normal (modem not in use), a fast flashing LED indicates modem connected and a continually illuminated LED means no service available.

PERIODIC TASKS

5. Battery Replacement (All Systems)

5.1 Release 4 screws securing the back facing panel to gain access to Motherboard and replace the lithium cell.
This task must only be carried out when the system is isolated from the equipment it is monitoring.

The battery type is CR2032.
This should also be carried out if the clock display loses time or there is a BIOS failure.

6 Associated UPS System (Where Fitted)

6.1 Replace the batteries in the associated UPS system The UPS documentation will give the suggested periodicity for replacement.

6.2 Carry out the UNINTERRUPTIBLE POWER SUPPLY TESTS (057).

End of Periodic Task

Reliability - Centred Maintenance

SERVICE RE Carry out service A and B of this SMS

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/ER16		
ADT Signalling Event Recorder		
Issue No. 2	Issue Date: 04/03/17	Compliance Date:31/05/17

Includes:	Alpha 933 and Solartron IMP based Wall Mounted and Rack Mounted Event Loggers
Excludes:	All other logger types

General

Renewed USB sticks will be automatically formatted by the standard Windows 2000 or Windows XP operating system, they will operate regardless of capacity but their size must be sufficient for the site concerned. *Record* any work undertaken on the appropriate record card or site log book

REGULAR CHECKS

1. System logging

1.1 At sites with remote access and as locally agreed, either manually or by automated programme, download the last hour's data and check that the logger is logging.

SERVICE A

2. Visual Checks

2.1 <u>Alpha 933 based systems only</u>

Check that the Alpha Units LED indicators are illuminated.

Power steady and RS485 flashing.

2.2 <u>Solartron IMP based systems only</u>

Check that the Solartron IMP LED indicators are illuminated for correct operation.

Power illuminated but no other LED illuminated.

2.3 Check the correct time is displayed. Note that the time is always stated in GMT

2.4 Open the most recent hour of data and verify that logged functions are being recorded.

SERVICE B

3. Clean and Visual Inspection

3.1 Clean all external surfaces using a lint free cloth and a mild detergent. Do not use any solvents.

3.2 Check the cabinet earth bonding is secure at the Door, Cabinet Side, Side Panels (Rack Mounted system only), Rear Mounting Plate, and Gland Plate.
Visually check the integrity of connections.

4. PC Case Fan/Filter

4.1 Remove the front panel fan cover and Check that the PC fan is running. Rectify as necessary. Replace both the fan and filter unit together.

4.2 If the fan was not replaced, remove the filter cover and either Clean (plastic bubble type) or fit a new filter.

4.3 UNINTERRUPTIBLE POWER SUPPLY TESTS (057).

PERIODIC TASKS

The following tasks are to be carried out by suitably competent staff. These tasks must be carried out when the PC has been fully disconnected.

5. Motherboard CPU & PSU Fans & Battery Replacement

5.1 Remove the 6 securing screws and remove the PC cover to access the motherboard.

5.2 Replace the following:

- CPU heat sink fan.
- The fan in the rear of the PC PSU
- The lithium battery cell.
- See CD containing PC manual for type.

6 Associated UPS System (Where Fitted)

6.1 Replace the batteries in the associated UPS system The UPS documentation will give the suggested periodicity for replacement.

6.2 Carry out UNINTERRUPTIBLE POWER SUPPLY TESTS (057).

End of Periodic Task

Reliability - Centred Maintenance

SERVICE RE Carry out service A and B of this SMS

End

GENERAL

Detailed instructions for this recorder are provided in the user manual that is supplied with each recorder.

Record any work undertaken on the appropriate record card or site logbook.

SERVICE A

1. System Operation

Service A may be carried out remotely if the facility is available.

NOTE: *Touching the logger front screen will cause the display to light.*

1.1 Check that the time shown is correct.

NOTE: *the time is always stated in GMT.*

1.2 Open the most recent hour of data using the touchscreen and verify that logged functions are being recorded.

SERVICE B

2. Inspection and Test

2.1 Check that all logger cable connectors are pushed fully home, and that the logger housing is secure.

2.2 Carry out NR/SMS/PartB/Test/057 (Uninterruptible Power Supplies Test).

NOTE: *Where no external UPS is provided, the test period should be a maximum of three hours.*

PERIODIC TASKS

3. UPS System (Where Fitted)

3.1 Replace the batteries in the associated UPS system.

NOTE: *The UPS will need to be placed in by-pass and the batteries isolated from the supply.*

The UPS documentation will give the suggested periodicity for replacement.

3.2 Carry out NR/SMS/PartB/Test/057 (Uninterruptible Power Supplies Test).

4. Internal Inspection & Battery Replacement

These tasks are to be carried out by the manufacturer or a servicing agent approved by the manufacturer.

These tasks should only be carried out when the logger has been fully disconnected.

4.1 Replace the internal battery in accordance with the manufacturer's procedure.

4.2 Fully inspect and functionally test the logger in accordance with the manufacturer's procedure.

SERVICE RE Carry out service A and B of this SMS.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/ER21		
DOS Based Trackwatch Data Logging System		
Issue No. 03	Issue Date: 04/03/17	Compliance Date:31/05/17

Includes:	DOS based Trackwatch Max, Trackwatch LX & Trackwatch Lite systems that use IMPs to collect digital event data
Excludes:	Windows based and Atlas Technology based Trackwatch products

Anti-static precautions are required when working on the Trackwatch Controller Internal Circuitry.

General

This system uses Solartron IMP units to interface with signalling functions and gather data, which is then forwarded to the Trackwatch Controller using an S-Net connecting system. The Trackwatch Controller provides time, date, and storage for the logged data, and has facilities for local and remote interrogation and retrieval. Certain systems may have Modbus devices connected as well as or instead of IMPs, for maintenance of these refer to manufacturer's documentation.

Record any work undertaken on the appropriate record card or site log book.

Equipment

A suitable multimeter and portable VDU and keyboard or laptop PC with pc anywhere installed (and on logger) are required.

SERVICE A

1. UPS & IMPs

1.1 Check the LEDs on the IMP units are lit as appropriate for normal working, note that the Power LED should always be lit, investigate and rectify as required.

SERVICE B

2. Trackwatch Controller

2.1 Connect VDU to the output socket at rear of Trackwatch Controller. Connect the portable VDU and keyboard or laptop PC to the Trackwatch Controller.

This provides either an 110V isolated supply (no other 110V supply is to be used) or 230V.

A cross-over Ethernet cable must be used.

2.2 Investigate and rectify any faults indicated in upper window of display.
Note that some faults may need to be dealt with at the next task, when logging is stopped.

2.3 At sites not implementing Service A, stop the logging and inspect the last hour's data and system health file to check the logger is working correctly.

2.4 Enter directory C:\EVA and use DOS commands to copy the entire directory to the floppy disk, Check the floppy disk now has the directory.

2.5 Delete the Watchdog log file and Check that the hard disk has sufficient spare capacity for all data up to the next Service B, if in doubt ask your SSM.

2.6 This task should be performed only If the system is running slow or there are system performance issues:

Run DOS commands 'SCANDISK' then 'DEFRAG' and Record any bad sectors in the log book.

2.7 Check the system date & time by entering directory C:\ALTAIR and running the command 'TIME'.

Note that the time is always stated in GMT

2.8 Test the system Watchdog by exiting the program and leaving it running at "Exit Yes/No" screen. Time the system to check that it automatically reboots in under two minutes.

2.9 Replace the floppy disk, labelling the removed one and returning it to your SSM.

2.10 Restart the Trackwatch Controller and check the screen for error messages, press F6 for a health check, before removing the portable VDU and keyboard or laptop PC.

2.11 Check that main fan is rotating.

3. Equipment Cubicle

3.1 Clean the air intake filters and check any air vents are clear of any obstructions.

3.2 Clean the cubicle exterior with a suitable non- abrasive cleaner.

3.3 Dust the cubicle interior with a dry lint free cloth.

3.4 Where provided, Carry out the UNINTERRUPTIBLE POWER SUPPLY TESTS (057).

3.5 Visually Check cables and connections.

4. System Filters

4.1 Switch off Trackwatch Controller.

4.2 Replace filter gauze at the front of the Trackwatch Controller with manufacturers approved part

TN6 type uses RS part number 184-5141.

4.3 Using an air duster, Clean the power supply grid at the rear of the Trackwatch Controller.

4.4 Switch on Trackwatch Controller.

PERIODIC TASKS

5. Trackwatch Controller Internal Circuitry

5.1 Switch off Trackwatch Controller, then disconnect, and remove it from cabinet or other housing.

5.2 In a suitable workshop environment with electrostatic protection remove outer case.

5.3 Blow away any dust that has built up on the circuit boards with an air duster.

5.4 Replace processor cooling fan.

5.5 Replace system internal battery (5 yearly).

5.6 Refit outer case.

5.7 Refit in cabinet and reconnect all cabling, fit portable VDU and keyboard.

5.8 Switch Trackwatch Controller on and Observe the start-up routine.

5.9 Investigate any error messages and Rectify.

5.10 Remove portable VDU and keyboard.

6. Associated UPS System (Where Fitted)

6.1 Replace the batteries in the associated UPS system
The UPS documentation will give the suggested periodicity for replacement

6.2 Carry out the UNINTERRUPTIBLE POWER SUPPLY TESTS (057).

End of Periodic Task

Reliability - Centred Maintenance

SERVICE RE Carry out service A and B of this SMS

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/ER22		
Atlas Data Logging System		
Issue No: 04	Issue Date: 04/06/2022	Compliance Date:03/09/2022

Includes:	Any Voestalpine, Atlas system including the Mini logger, Mini logger 2 & RML6 used for logging data acquired through digital, analogue, or serial interfaces
Excludes:	External equipment such as sensors, cabling, and isolation devices

General

Atlas, logging systems can be configured to log digital and analogue functions, and combinations of these. There are several models to accommodate different numbers of monitoring channels and asset types. Table 1 places these types into three categories:

Logger Description	Category
PC card rack-based system (Atlas)	Rack Atlas Systems
Mini Logger: Lite, Serial, Analogue, Plus, VTI, HVI	Legacy Mini loggers
Mini Logger 2 & RML6	Web based Loggers

Table 1 – Logger Categories

The sensors used by analogue systems, and any cabling, fastenings and external isolation required to connect such sensors, are subject to separate and additional maintenance requirements.

Test Equipment (Atlas – Rack Atlas) & (Legacy mini loggers)

A multi-meter and laptop computer with a terminal emulator.

Test Equipment (Web based)

A multi-meter and laptop computer with a compatible web page browser.

SERVICE A

1. Visual Checks (Atlas – Rack Atlas) & (Legacy mini loggers)

1.1 Observe that all indications are illuminated for normal working.

NOTE: *Rack Atlas and Mini Loggers channels indications need to be triggered to turn on its indications.*

1.2 Check Rack Atlas display for error messages and for correct time.

NOTE: *The time is always stated in GMT.*

1.3 Open the most recent hour of data and verify that logged functions are being recorded.

Mini Logger Only (Legacy mini loggers)

1.4 Visually check that the system and its connections are suitably secured to prevent accidental electrical contact with other signalling systems.

2. Visual Checks (Web based loggers)

2.1 Observe that all indications are illuminated for normal working.

2.2 Visually check that the system and its connections are secured to prevent accidental electrical contact with other signalling systems.

SERVICE B

NOTE: *The tasks in this service are optional for the Mini Logger connected to a central server.*

3. Interrogation of System (Atlas – Rack Atlas) & (Legacy mini loggers)

3.1 Connect the PC to the Atlas using either the Ethernet or Null modem connections and run 'Hyper-Terminal' to establish a valid connection.

NOTE: *The Ethernet cable must be of the 'cross-over' type.*

3.2 Log on to the Atlas using your password.

3.3 Type the word 'STAT' and press the return key. Rectify any faults indicated in the PC display.

3.4 Check that any media cards are installed in the Atlas using the PC on-screen menu.

3.5 Remove the media card from the front of the Atlas. Push the card into the slot and release.

It should pop up sufficiently to enable removal.

3.6 Insert the media card into the PC and copy the contents to the laptop memory, then check for correct copying.

3.7 Refit the media card in the Atlas.

NOTE: *When the media card is re-inserted, the logger may start to bleep. This indicates the internal and external cards are syncing data. This bleeping will cease once both cards have the same data. Some newer style loggers only have one internal media card. Steps 3.5 to 3.7 can be ignored in this case.*

3.8 Log off from the Atlas logger and disconnect the PC.

3.9 Check the Atlas display for error messages and rectify any faults identified.

4. Interrogation of System (Mini Logger 2 & RML6)

4.1 Connect the PC to the Mini logger or RML6 using an Ethernet Cable and open a web page using the integral IP address 169.254.201.100 to establish a valid connection.

4.2 Select “Mini Logger Status” from the web page menu.

4.3 Rectify any faults indicated on the web page.

4.4 Click on the Voestalpine Logo to return to the menu.

4.5 Select “Mini Logger Diagnostics” and check the Loggers Date and Time, using the tab on the web page. Correct if needed.

You are prompted for your Voestalpine Password.

NOTE: *Passwords can be obtained from the user manual or your local Technical Support.*

5. System Cubicle or Housing

NOTE: *This section is not applicable to the Mini Logger*

5.1 Check the air vents are clear of any obstructions, clean or renew any filters as necessary.

5.2 Clean cubicle exterior with a suitable non-abrasive cleaner.

5.3 Dust cubicle interior with a dry lint free cloth.

6. Power and Connections

6.1 Carry out the NR/SMS/PartB/Test/057 (Uninterruptible Power Supplies Test).

6.2 Visually check all cables and connections are secure.

7. PERIODIC TESTS

7.1 Using eye protection, remove the Atlas from housing, open system cover and using an air duster carefully blow away any dust from the interior.

7.2 Replace the system internal battery.

7.3 Re-fit system cover and secure with screws, re-fit Atlas into housing and secure.

7.4 Reconnect all associated cabling, attach screen and keyboard, and switch the system on.

7.5 Observe the start-up routine and check that the program is launched using the system Autoexec file.

7.6 Observe the system messages at the top of the screen; Check that no system errors occur during boot-up.

7.7 Remove the screen and keyboard

End of Periodic Task

Reliability - Centred Maintenance

SERVICE RE Carry out service A and B of this SMS.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/ER23		
Relay Alert Data Logging System		
Issue No: 01	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Balfour Beatty Rail Ltd. Relay^{ALERT} data logging system
Exclude:	All other logging/event recording systems

Take anti-static precautions when working on the RelayALERT Data Logging System.

General

Detailed instructions for this data logger can be found within the user manual provided at each site where a logger has been installed. System icons can be found in Appendix A.

Relay^{ALERT} data logging systems can be configured to log digital functions. There are two sizes of housing to accommodate different numbers of monitoring channels. A master Relay^{ALERT} alongside a maximum of 7 slave data loggers can be configured to measure a total of 3072 channels.

SERVICE B

1. System Operation

The checks specified in this section are only applicable to the Relay^{ALERT} master logger unless the slave is specifically referenced. Where there is a single data logger present, consider this unit to be the master.

1.1 Touch logger screen to illuminate then proceed with the tests listed below.

1.2 Functions being logged by the data logger should appear on the screen of the master data logger as they change state.

NOTE: where one or more slave loggers have been installed, the functions being logged by these will also appear on the screen of the master logger.

1.3 Check the correct time is displayed along the bottom of the screen.

NOTE: the time is always displayed in UTC.

1.4 Open the most recent hour of data and check that logged functions have been recorded.

1.5 To check the ability to retrieve data from the external storage:

a. Click remove memory stick on the data logger screen and wait for the logger to instruct you it is safe to remove the memory stick

b. Remove memory stick from the data logger

c. Insert into a laptop and review the log.txt file for the current date – this will be located within WWW\Current Date

d. Check the file opens and contains logged events

e. Remove USB memory stick from laptop/computer and reinsert into data logger.

This applies to slave loggers only.

1.6 Check the IND light is flashing steadily showing connection to the master data logger

2. Inspection and Test

2.1 Check all data and power cables are connected securely and are fully inserted to both the data logger and the breakout board.

2.2 To check the health of the internal UPS follow UNINTERRUPTIBLE POWER SUPPLY TESTS (057)

NOTE: The test period should be for a minimum of 30 minutes and a maximum of 3 hours.

Whilst this test is being carried out on a master data logger observe the change in state of the icon on the bottom of the screen in accordance with Appendix A.

PERIODIC TASK

3. Internal Inspection and Battery Replacement

3.1 Periodic replacement of the data logger battery should only be carried out by the manufacturer or an approved agent and in accordance with the manufacturer's procedure.

It is recommended the battery should be replaced every 5 years.

This task shall only be carried out when the data logger has been disconnected from mains power and fully shutdown.

APPENDIX A

	**Relay^{ALERT} data logger icons**
	Icon when memory stick inserted
	Icon when memory stick removed
	Icon when mains power connected
	Icon when mains power removed

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/GF01		
Ground Frames		
Issue No: 05	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Power Ground Frame, Mechanical Ground Frame
Excludes:	Points, Signals and Connections

SERVICE A

1. Visibility

1.1 Check signals and points are visible from the ground frame.

The operator shall have an unobstructed view of signals and points or is provided with indications.

2. Power Ground Frame

2.1 Maintain the trackside apparatus case/housing in accordance with NR/SMS/PartC/EL21 (Trackside Apparatus Case).

2.2 Maintain the switch panel in accordance with NR/SMS/PartC/SB11 (Signallers Control & Indication Panels or Displays).

3. Mechanical Lever Frame

3.1 Maintain in accordance with NR/SMS/PartC/LV11 (Lever Frames - Non Specific) or NR/SMS/PartC/LV12 (Lever Frame - Direct Locking), as relevant to the frame type.

4. Structure

4.1 Check structure, landing boards, staging, handrails, and stanchions (etc) for signs of serious rotting, corrosion, cracks, deterioration or damage. Report significant deterioration as corrective maintenance

4.2 Check that all covers and boards are properly fitted.

5. Cables and Wires

5.1 Check tail cables are correctly routed, secure and free from damage.

5.2 Check cable terminations. Protect as necessary.

5.3 Examine wires and cable cores for signs of damage and degradation.

5.4 Check that wiring is secure, properly routed and clear of moving parts.

6. Diagram

6.1 Check diagram is clean, legible, undamaged and secure.

6.2 Clean using damp cloth, dampened with dilute detergent.

7. Electric Locks and Circuit Controllers

7.1 Maintain in accordance with NR/SMS/LV21 – LV41.

8. Key Release Instrument

8.1 Maintain in accordance with NR/SMS/PartC/LV51 (Key Release and Token Instruments).

9. Plunger/Switch

9.1 Dust and examine plunger/switch mechanism, linkage, terminations, wires and fixings.

10. Needle Indicator (Spagnoletti)

10.1 Dust and examine exterior.

10.2 Check clarity of label/artwork.

10.3 Examine interior mechanism, particularly for:

a) Any damage or misalignment to needles/banners. Do not attempt to clean or oil.

b) Degraded terminations or wires.

10.4 Clean the glass.

10.5 With no current applied, gently operate the needle by hand. Observe it returns smoothly and rapidly when released.

10.6 Apply current for each position and check that the needle does not overdrive.

10.7 Check wires cannot be trapped or damaged; carefully replace and secure cover.

10.8 Request the Signaller to operate and observe correct operation.

11. Lamp Indicators

11.1 Dust and examine exterior.

NOTE: *Carefully remove the cover.*

11.2 Examine the interior, pay particular attention to:

a) Terminations and wires.

b) Lenses and lens engravings.

11.3 Check the lamps.

11.4 Clean the glass.

11.5 Examine fixings.

11.6 Carefully replace and secure cover.

11.7 Request the Signaller to operate and observe correct operation.

12. Telephone

12.1 Maintain in accordance with NR/L3/TEL/30181/011 - Maintenance of Operational Telephones.

SERVICE B

13. Function Test (Mechanical Lever Frames)

Simple ground frames only (e.g. 1 releases 2, 2 reverse locks 1). Layouts that are more complex might require a certified tester. If in doubt, ask your SM(S).

13.1 Check that the release lever is locked until a release is given by the controlling signal box or release mechanism/key.

13.2 Obtain a release and test (pull through) the operation of the ground frame.

13.3 Check that the controlling signal box cannot take the release back or the release mechanism/key remains locked until the release lever is replaced normal in the frame.

When replaced normal, check that the controlling signal box can take the release back or the release mechanism/key is unlocked and the release lever is locked.

14. Function Test (Power Ground Frames)

14.1 Check that the panel is inactive until a release is given by the controlling signal box.

14.2 Test the operation of the switch panel.

14.3 Check that the controlling signal box cannot take the release back until the panel is normalised.

When normalised, check that the controlling signal box can take the release back and the panel is inactive.

END

Mobile telephones that are switched on shall not be brought in close proximity of operational VDU based equipment.

SECTION INDEX

1. IECC - CLASSIC

Integrated Electronic Control Centre (IECC) - Classic.

Commonly Used Abbreviations.

Abbreviation	Meaning
ARS	Automatic Route Setting Subsystem
DIS	Flexible Display Subsystem
ECS	External Communications Subsystem
FBS	Fringe Box Subsystem
GWS	Gateway Subsystem
ISM	IECC System Monitor Subsystem
RII	Remote Interlocking Interface Subsystem
SDS	Signalling Display Subsystem
SPAD	Signal Passed at Danger
SSI	Solid State Interlocking
TTP	Timetable Processor Subsystem
IPL	Data Logging Facility
VDU	Video Display Unit (Monitor)

Table 1 - Commonly Used Abbreviations

ARS The ARS determines the optimum routing of trains in the area based on the timetable, their current position, their importance and their destination. It automatically requests the required route when they are available.

DIS DIS is a PC based operating interface between the IECC and the Signaller.

ECS The ECS provides an interface between the information networks and systems that cannot use the IECC's communications protocols or data notations.

FBS The FBS provides a train describer map, interpose and cancel facilities for the fringe Signaller via a monitor and keyboard.

GWS The GWS provides a link between the signalling network and the information network. It transfers information between the two when the source and destination are not on the same network. It also provides a buffer storage facility between the two networks.

ISM The ISM monitors the operation of all the subsystems in the IECC system and of the two networks and reports the system status to the Technicians. It also provides aids for fault finding and for reconfiguration of the IECC.

RII The RII enables a relay interlocking to be interfaced into an IECC in place of using a SSI interlocking.

TTP The TTP processes the timetable information for the IECC and the surrounding areas. This information is used by the ARS.

IPL The IPL provides the data logging facility in place of the PSM where the IECC is equipped with a DIS vice an SDS.

Master/Standby Changeover Testing

You shall liaise with the Signaller before initiating a changeover from master to standby. The changeover shall be initiated by command from the ISM (except when testing the status control panel).

Use the manual reset to restore from the failed to the available state and observe that further transition to standby takes place.

Following an ARS changeover, the Signaller needs to re-enable the ARS sub-areas as required.

Subsystem status shall be confirmed by using the ISM.

DIS Hot Standby

The DIS hot standby is confirmed by observing that the VDU information remains the same before and after a manual operation of the video switch.

Circuit Boards

To avoid damaging the circuit boards refer to the instructions in the IECC Technical Handbook, section IECC 6000 before attempting to extract, insert or move boards.

ISM Printout

Alarms/reports on the printout shall be noted and action taken as necessary.

ISM Printer

Printer paper and cartridges/ribbons shall be changed as detailed in the printer manufacturer's instructions.

Recording Medium, Storage and Rotation

The recording mediums should be handled carefully and removed from service if found to be damaged.

They should not be stored in hot or damp places and should be kept away from any magnetic fields.

They should be used in rotation to store data for a given period (this is usually seven days). The medium containing the oldest data should be used as the next replacement.

Tape Head Cleaning

Tape heads shall be cleaned as detailed in the manufacturer's instructions. Head cleaning tapes SHALL NOT be used.

Keyboard Maintenance

Keyboards should be held upside down when dusted.

VDU Screen Cleaning

Screens should be cleaned using an anti-static VDU cleaner following the manufacturer's instructions.

Tracker Ball

If the action of the tracker ball is not smooth, it should be cleaned or replaced.

VDU

VDU monitors using cathode ray tubes as the display media do require the degaussing if the colour display has deteriorated. In severe cases the monitor should be changed.

This does not apply to LED monitors.

Records

Record all IECC associated activities along with the time, date and signature in the site log.

IECC (Upgrade U003) System Architecture

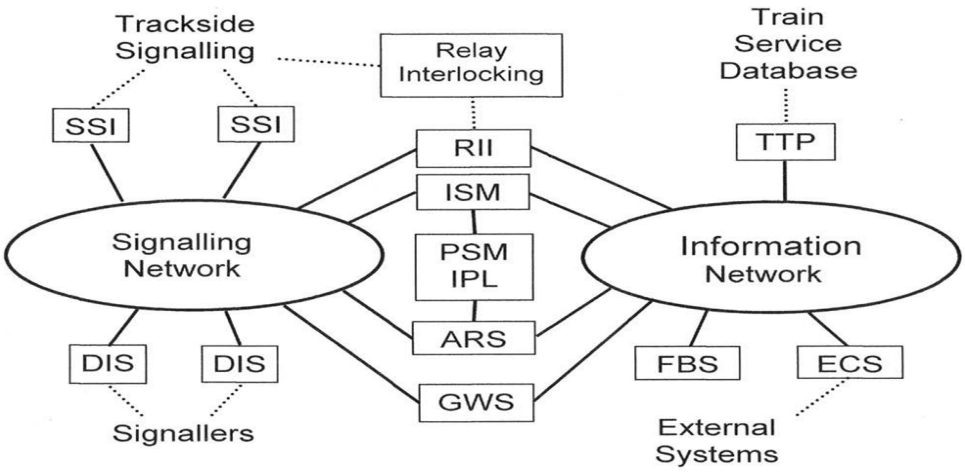


Figure 1 – IECC System Schematic

2. IECC - Scalable

Integrated Electronic Control Centre (IECC) – Scalable system description

IECC Scalable is a modern Signalling Control system designed to use up to date computer and network components commonly found in many high availability information technology applications.

The system provides the Signaller with the tools to monitor and control train movements and the state of the signalling infrastructure through a VDU based workstation.

IECC Scalable comprises sub-systems which replicate the functions of those found in IECC Classic. Ethernet network technology and a new sub-system, the Message Broker replaces the Nine-Tile network or Advanced Virtual Network of IECC classic.

Commonly Used Abbreviations

Abbreviation	Meaning
ARS	Automatic Route Setting Sub-system
CEG	Combined ECS and GWS
DIS	Flexible Display Sub-system
ECS	External Communications Sub-system
GWS	Gateway Sub-system
ISM	IECC System Monitor Sub-system
NAS	Network Attached Storage
RAID	Redundant Array of Inexpensive Devices
SII	SSI Interlocking Interface Sub-system
SSI	Solid State Interlocking
TD	Train Describer
TI	Technician's Interface
TTP	Timetable Processor Subsystem
VDU	Video Display Unit (Monitor)

Table 2 - Commonly Used Abbreviations

ARS The ARS determines the optimum routing of trains in the area based on the timetable, their current position, their importance and their destination. It automatically requests the required route when they are available.

CEG CEG provides the IECC Scalable with an interface to systems which provide data to and/or receive data from IECC Scalable, but do not use standard IECC Scalable protocols or data structures. E.g. TDs at adjacent signal boxes, SMART, etc.

DIS The DIS is a PC based operating interface between the IECC and the Signaller.

ISM The ISM monitors the operation of all the subsystems in the IECC system and of the two networks and reports the system status to the Technicians. It also provides aids for fault finding and for reconfiguration of the IECC. Interrogation of the ISM is via the TI.

SII Manages communications with SSI (and SSI derived interlockings) forwarding controls to the interlocking and receiving state of railway indications. SII also passes the interlocking diagnostic status to other Scalable sub-systems.

TTP The TTP processes the timetable information for the IECC and the surrounding areas. This information is used by the ARS.

NAS The NAS provides the data logging facility for ISM, ARS and TTP. This uses RAID technology and enables hot-swapping of the Hard Disk Drives.

Master/Standby Changeover Testing

You should liaise with the Signaller before initiating a changeover from master to standby. The changeover should be initiated by command from the ISM (except when testing the status control panel).

Use the manual reset to restore from the failed to the available state and observe that further transition to standby takes place.

Following an ARS changeover, the Signaller needs to re-enable the ARS sub-areas as required.

Subsystem status should be confirmed by using the TI.

DIS Hot Standby

DIS Hot Standby is confirmed by observing that the VDU information remains the same before and after a manual operation of the video switch.

Circuit Boards

These are susceptible to damage through electro-static discharge and through physical damage while handling. To avoid damaging the circuit boards refer to the instructions in the IECC Scalable maintenance manual before attempting to extract, insert or move boards.

Keyboard Maintenance

Keyboards should be held upside down when dusted.

VDU Screen Cleaning

Screens should be cleaned using anti-static VDU cleaner following the manufacturer’s instructions.

Tracker Ball

If the action of the tracker ball is not smooth, it should be cleaned or replaced.

Records

Record all IECC associated activities along with the time, date and signature in the site log.

3. Modular Control System (MCS)

The control system is generically called a Modular Control System (MCS). The structure of the system can vary depending upon the equipment it includes and the task it is performing.

Later systems are based around the Delphin 1024 platform or the Sapphire T48 platform; these can be configured as different sub-systems within the overall system.

The Signallers control equipment can be a VDU based control centre or a panel based control centre using a switch or NX panel.

As the system is 'modular' the SMSs for this equipment are separate. For the preventative maintenance of an MCS system some or all of the following SMSs are applicable:

SMS	Title
NR/SMS/PartC/CS06	Control System - Modular Control System
NR/SMS/PartC/IC51	Logging & Archive System (formerly GETS)
NR/SMS/PartC/IC61	Rugby Whole Route Display System
NR/SMS/PartC/TD42	GE Automatic Code Insertion (ACI) Terminal
NR/SMS/PartC/SB11	Signallers Control & Indication Panels or Displays

Table 3 - Maintenance Tasks

The tests applicable to the system (NR/SMS/PartB/Test/) are linked from the task SMS. Your work order advises you as to which tasks and tests are applicable to the system you are maintaining.

NOTE: *Earlier MCS systems not based around Delphin 1024 or Sapphire T48 platform are covered by other SMS's.*

System Architecture

The diagrams on the following pages give an outline of the system architecture for the permutations of GETS systems based on the Delphin 1024 and the Sapphire T48.

Please note that these are generic outlines and actual system configurations can vary, if you are in any doubt about the configuration of the system you are working on, ask your SM(S).

DELPHIN 1024 SYSTEM - RC / TDM & PIIU SYSTEMS

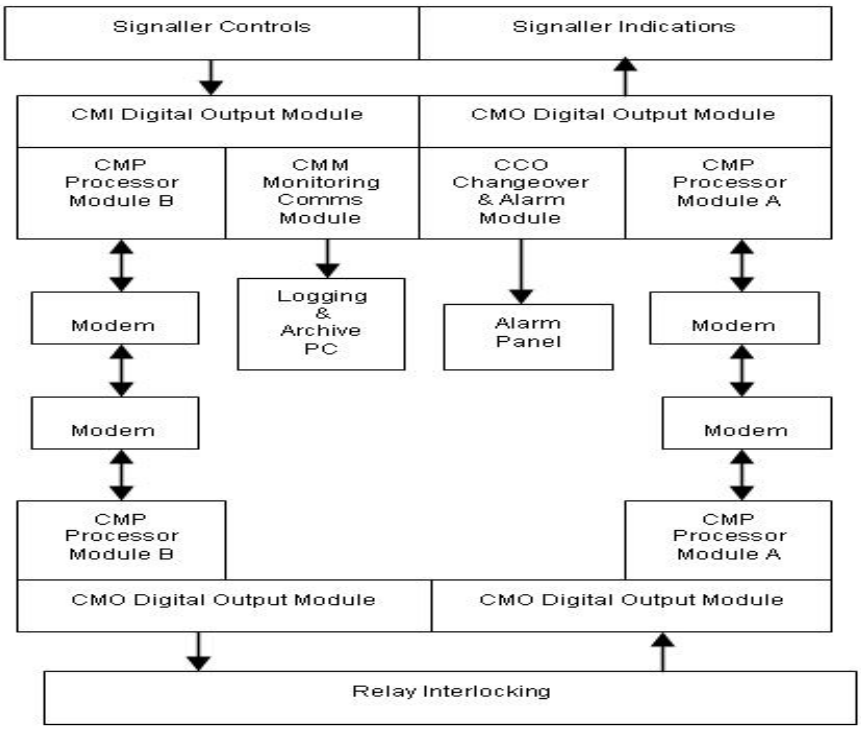


Figure 2 - Office End

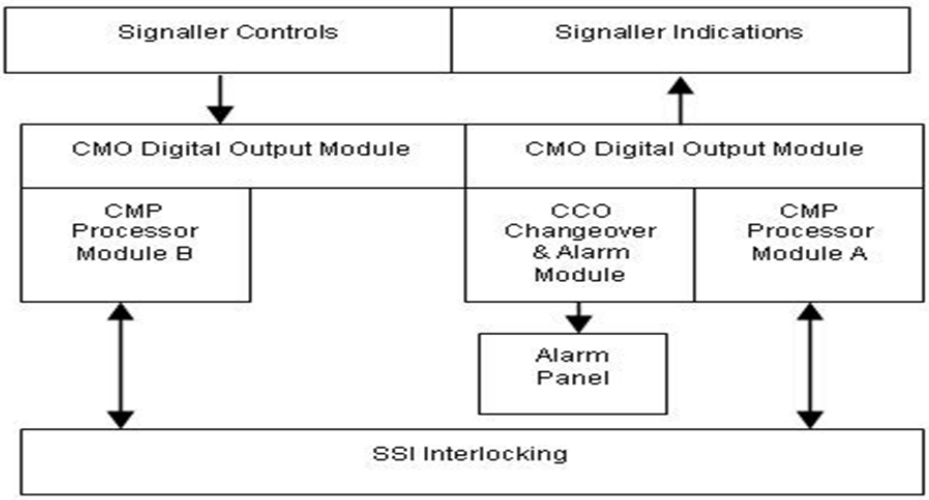


Figure 3 - Field End - PMUX

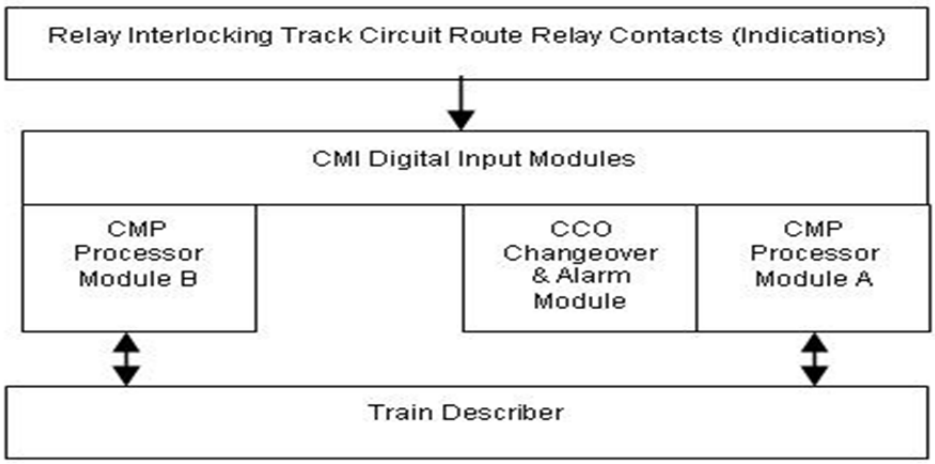


Figure 4 - Field End - TDMUX Systems

Interface with computer based interlocking

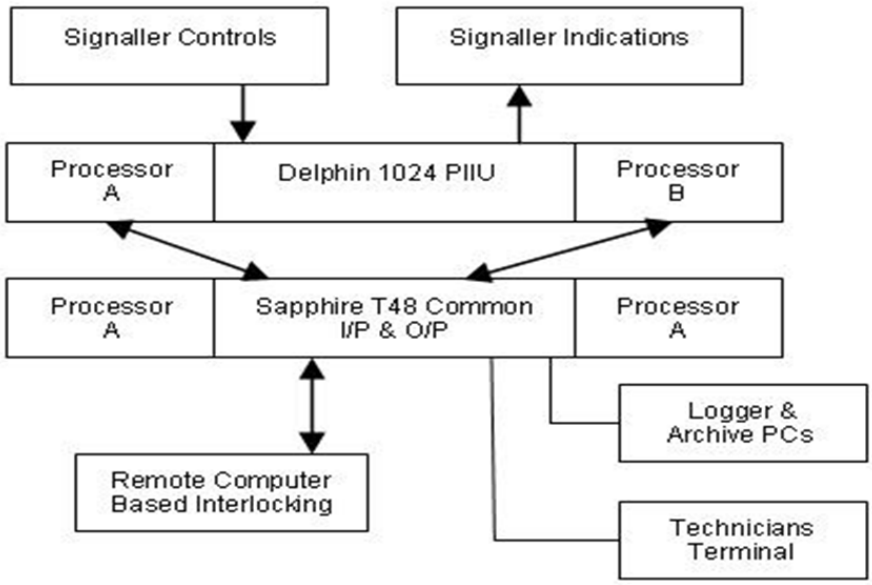


Figure 5 - Sapphire T48 Systems

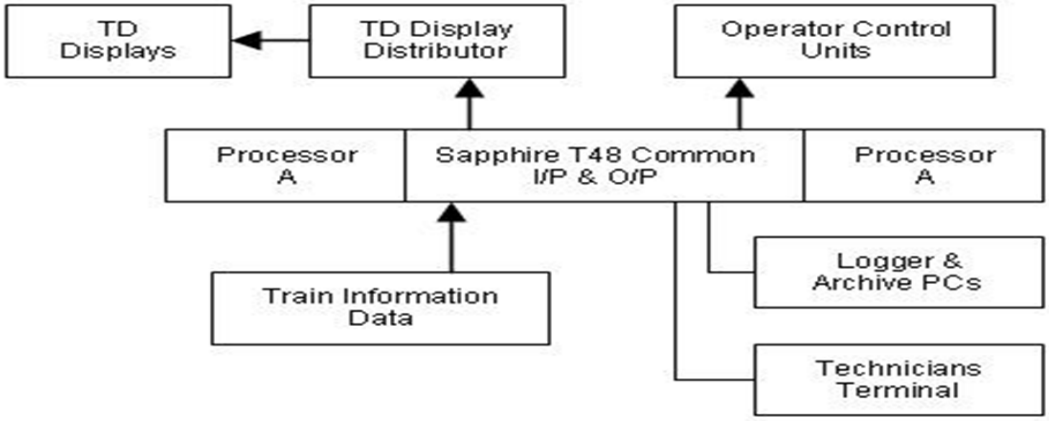


Figure 6 - Train Describer Interface

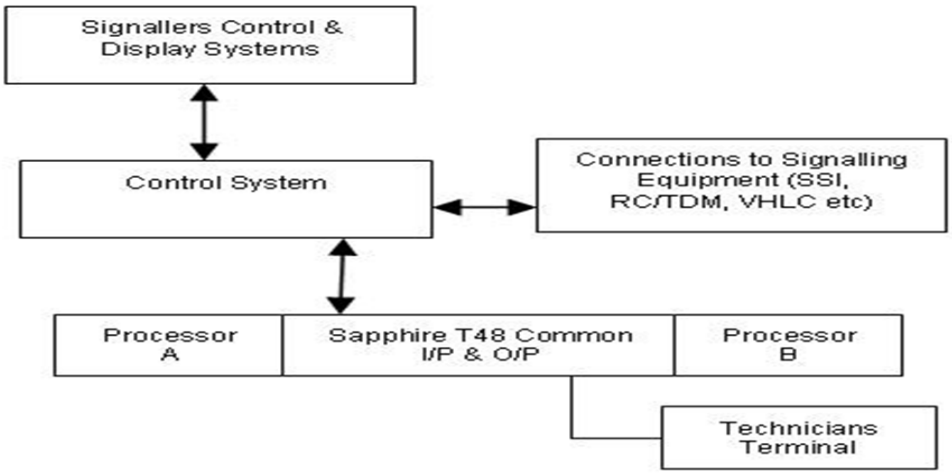


Figure 7 - SPAD Alert System

4. WESTCAD

Controlguide WESTCAD is an integrated Signalling Control System that provides a flexibly configurable platform for the control and indication of railway signalling.

This typically has a Signaller's user interface in the form of either a VDU based workstation or via a panel, and an interlocking control interface which can be to CBIs, SSIs, RRIs, or a combination of these.

WESTCAD can have an integral Train Describer (TD) or be interface to an external TD.

Automatic Routeing functions might be integrated or provided by interfacing to third party ARS products.

The WESTCAD system might be configured as a single hardware unit or as interconnected sub-systems performing specific functions.

The sub-system interconnection might be direct serial interfaces or by Ethernet networks.

There are two variants of the WESTCAD hardware platform: those based on legacy Compact-PCI modules and those using the later Modular Control Rack (MCR).

WESTCAD systems or sub-systems are assembled from standard modules comprising:

a) Power supplies and power filters.

b) CPUs and rear transition cards.

c) System Arbiter and rear transition cards.

d) Video output.

e) Serial Communications interfaces.

f) Video change-over.

g) Serial Communications change-over.

h) Modems.

Systems can have single or dual PSUs, Single or Dual CPUs. Modems can be integrated or external (depending on the Platform used).

A typical dual-redundant MCR system might have the following configuration:

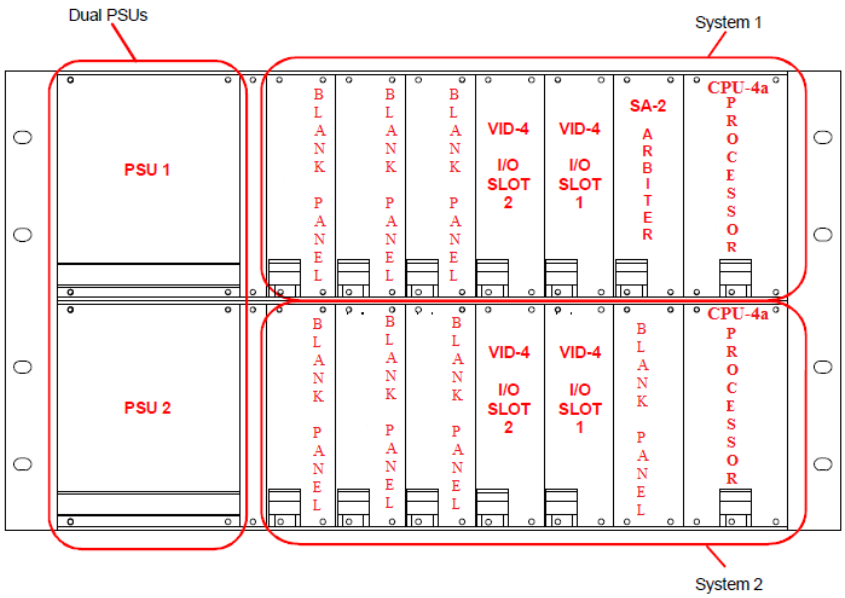


Figure 8 - Front Mounted Modules

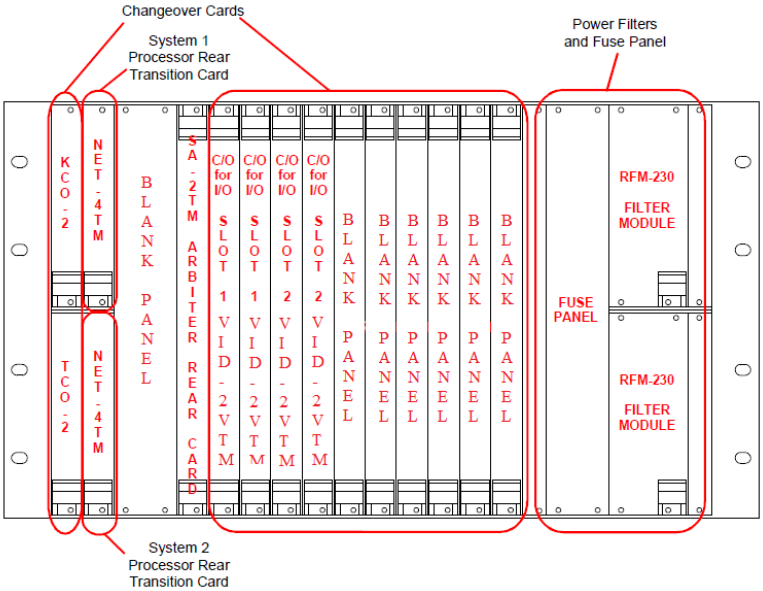


Figure 9 - Rear Mounted Modules

A PC based Technicians' terminal provides logging facilities and allows reconfiguration of the display system if necessary.

The terminal can be remote from the WESTCAD system and connect via a local area network (LAN) link.

Controlguide WESTCAD-E is a development of WESTCAD which provides additional interfaces and functionality to support the introduction of Traffic Management (TM) systems, ETCS signalling, and Automatic Train Operation.

This product uses the same MCR hardware platform as WESTCAD, but is configured into specific sub-systems:

a) Service Control Server (SCS).

b) Service Control Workstation (SCW).

c) Service Control Terminal (SCT).

d) ETCS Diagnostics Terminal (EDT)

e) Remote Interface (RIF) variants -

- Interlocking.
- RBC.
- Voice.
- CCTV.

Each system configuration only uses those sub-systems that are required for that instance, e.g. non-ETCS configurations do not need an SCT.

5. ElectroLogIXS

The ElectroLogIXS VLC is a generic logic processing platform, with the functionality being defined by the software i.e. the ElectroLogIXS System Software.

This means an ElectroLogIXS can be configured by the application designer to fulfil the functionality of different signalling system components that would normally use bespoke products.

For example, a single ElectroLogIXS unit can be used as the basis for an interlocking, or an object controller, or both simultaneously.

Some of the plug-in hardware (“modules”) are the same for both configurations, and some might be different, and the application data stored in the unit is different, but the general features, limitations and appearance are the same.

All application modules have front panel indicators that display module health status and indicate individual I/O status.

Parameter set-up and modifications can be performed via the VPM-3 web graphical user interface (web GUI) or via a local control/display unit at the ElectroLogIXS.

The Web GUI runs on a separate computer, or similar device, running a web browser.

There are 3 chassis types; 1, 4 and 9 slot, which correspond to the numbers of Vital I/O and/or Lamp Driver modules that can be accommodated.

It does not require air conditioning or forced air cooling, so when used at the trackside, it is normally installed in a location case.

There are two power feeds into the ElectroLogIXS one 12V supply to the chassis, then each VLD-R8AC also has a separate 110Vac supply onto the personality module.

END

Includes:	Automatic Route Setting Subsystem; External Communications Subsystem, Flexible Display Subsystem, Fringe Box Subsystem, Gateway Subsystem, IECC System Monitor Subsystem, Remote Interlocking Interface Subsystem, Signalling Display Subsystem, Timetable Processor Subsystem IECC PC Logger, PC SPAD Monitor
Excludes:	

DAILY SERVICES

1. IECC System Monitor Subsystem

1.1 Check that the ISM terminal is functioning correctly.

1.2 Check that the ISM displayed time is identical to Rugby clock time, and the Anthorn (formally Rugby) clock readouts are identical.

2. Printer

2.1 Check the paper supply and reload as required.

2.2 Check the quality of the printout and if necessary, replace the printer cartridge/ribbon

3. All Subsystems

3.1 Observe all equipment, panel and board indications are illuminated as for normal working.

3.2 Rectify any faults that are indicated on the ISM alarm panel and the RII field indication panel.

3.3 Check Node statistics on the ISM and record results in log book.

If a significant number of rejected packets or checksum errors are shown (i.e. greater than 1% of all 3.1 packets sent) then report it to your SM(S).

4. Recording Media Replacement

4.1 Remove the recording media(s) and re-load in the correct rotation order a recording media(s) in the Timetable Processor Subsystem.

5. PC SPAD Monitor or IECC PC Logger

5.1 Check using the PSM/IPL Technician facilities that the ARS and ISM are logging data correctly.

REGULAR SERVICES

6. IECC System Monitor Subsystem

6.1 Dust the keyboard and clean the VDU screen.

7. Flexible/Signalling Display Subsystem

7.1 Check that the crosshairs cursor is steady.

7.2 Check that all text is displayed on each monitor and that the cursor is visible when positioned in each corner of the display.

7.3 Check the operation of the tracker ball.

7.4 Check the monitor(s) for picture quality. Clean the monitor(s) screen(s). Replace with site spares and send defective monitors for servicing as necessary.

7.5 Dust the keyboard. Check its condition and change if necessary.

7.6 Check that the offline unit is at hot standby.

To check for hot standby, observe the signalling screens and perform a manual changeover of the video switch.

Check that the signalling screens are the same as previously observed, then reset the video switch to its original position.

This task shall only be performed with the Signaller’s permission.

SERVICE A

8. Standby Changeover (ARS, DIS, ECS, GWS, ISM, RII, SDS TTP and IPL).

8.1 Check that the non-operational computer unit is in a standby state and if SDS/DIS that it is at hot standby.

8.2 Change over the standby to master from the ISM terminal, check the changeover is successful.

8.3 Restore the previous master from failed to standby by pressing the reset button.

8.4 Initiate subsystem change, by using the status control panel change over pushbutton (not applicable on Vaughan IECC).

8.5 Check that the changeover was successful.

Observe that the IECC works correctly and the expected message is displayed in the system alarm window on the Signaller's workstation.

8.6 (Where fitted) observe that the serial line switches change from all green to all red indications (or vice versa) on a subsystem changeover.

8.7 Restore units from failed to standby by pressing the reset button(s).

8.8 Initiate a changeover to leave the original Standby in the Master state.

8.9 Check that the offline unit is in Standby mode.

8.10 Check that all the subsystems are fully operational from the ISM terminal.

SERVICE B

9. Recording Heads

9.1 If fitted, clean the recording media heads in the Timetable Processor Subsystem in accordance with the manufacturer's instructions.

This task is not applicable if the TTP-Server PC is installed.

10. All Subsystems

10.1 Check the following items:

a) The equipment is securely mounted.

b) The cables are undamaged.

c) The cable connectors are secure.

10.2 Clean the outside of the equipment cubicle and Dust the interior units.

10.3 Isolate the 110V feed to each node crossflow fan, remove the front grill, and extract the filter and check/clean the following:

a) The fan bearing for wear.

b) Clean or replace the filter, replace the front grill and reconnect the 110V supply.

c) Each fan operates correctly.

10.4 Dismantle the tracker ball assembly; Clean the tracker ball and its associated housing. Reassemble and verify correct operation.

10.5 (As necessary) degauss the CRT monitor(s).

11. SPAD Monitoring Facility

11.1 In liaison with the Signaller set up a number of SPAD scenario's using the SSI Technician's terminal to check the Monitoring Facility is functioning correctly.

The frequency shall not exceed 1 year.

This task is not necessary if SPAD has occurred on the workstation since the last maintenance visit.

PERIODIC TASKS

The tasks in sections 12 to 13 are not all at the same periodic frequency.

Unless the frequency is specifically stated below then ask your SM(S) for details of the manufacturers recommended frequencies, which are detailed in relevant sections of The IECC Technicians Manual NR/GN/SIG/19053.

Technical support staff and/or equipment specialists can manage these tasks separately. These tasks should be carried out in an electronic workshop environment.

12. Battery Replacement All Nodes

12.1 Replace the battery at 2 yearly intervals.

MVME 162, 172 and 215 Processor Boards.

12.2 Replace the board-mounted batteries in accordance with the IECC Technicians Manual NR/GN/SIG/19053 Section 5N.

All IECC PCs

12.3 Replace the internal batteries in accordance with the IECC Technicians Manual NR/GN/SIG/19053 Section 5N.

13. Fan Replacement

All IECC PCs (except TTP-Server PCs)

13.1 Replace the following equipment cooling fans on each PC with new units of the same type at 3 yearly intervals.

a) PC front air intake (x2).

b) Internal PC processor fan.

c) PC power supply.

Check after replacement that each fan works correctly.

END

Includes:	All IECC Scalable Sub-systems and components (including Scalable 2)
Excludes:	IECC Classic equipment

Record the results of all actions in the system logbook/Technicians Logsheet.

DAILY SERVICES

1. IECC Scalable Technician's Interface

1.1 Check that the Technicians Interface (s) are functioning correctly and that all subsystems / equipment it reported upon are healthy (see IECC Scalable & Middleware Technicians Interface User Manual).

1.2 Rectify any faults that are indicated by the Technicians Interface.

WEEKLY SERVICES

2. Data logging Health check

2.1 Check that the ARS and Status Monitor data is logging correctly using the IPL remote client or the IPL local Technicians interface.

2.2 Rectify any faults that are discovered.

3. IECC System Cabinets

3.1 Observe all equipment, panel and board indications are illuminated as expected, for normal working or carry out a "Remote System Status Check".

3.2 Rectify any faults that are indicated.

3.3 Observe the time on each TTP unit relative to the Network Clock. If the drift is greater than 1 minute, manually set the TTP time to match the Network Clock using the TCF client.

4. DIS System Cabinets

4.1 Observe all equipment, panel and board indications are illuminated as expected, for normal working both front and back panels or carry out a "Remote System Status Check".

4.2 Check the workstation Remote Level Convertor front and back panels for normal indications.

5. Middleware Cabinets

5.1 Observe all equipment, panel and board indications are illuminated as expected, for normal working or carry out a “Remote System Status Check.

5.2 Observe the Management PC and the Middleware Technician’s Interface are operating correctly.

MONTHLY SERVICE

6. Operator Interfaces

6.1 Check that the cursor or mouse pointer is steady.

6.2 Check that all text is displayed on each monitor and that the cursor or mouse pointer is visible when positioned in each corner of the display.

6.3 Check the monitor(s) for picture quality. Replace defective monitors with site spares and investigate the cause. Send defective monitors for servicing as necessary.

6.4 Clean and dust all monitors.

6.5 Dust the keyboard. Check its condition and change if necessary.

6.6 Check that the offline unit is at hot standby. To check for hot standby, observe the signalling screens and perform a manual changeover of the video switch. Check that the signalling screens are the same as previously observed, and then reset the video switch to its original position.

This task is applicable for DIS only and shall only be performed with the Signaller’s permission.

6.7 Dust and clean the Technician Interface keyboard and screen.

SERVICE A

7. Middleware and Upgraded Workstation

7.1 Check there is backup mouse and keyboard stored in a location convenient for the Signaller and replace if missing.

8. Standby Change-Over

This task shall only be performed where the DIS & blades operate in master/standby configuration.

Come to a clear understanding with Signaller, the implications of each subsystem changeover.

8.1 Check that the non-operational unit is in a standby state. For the DIS, check that it is at hot standby (see Technicians Interface User Manual).

8.2 Reboot the standby units and check they return to a standby state correctly.

8.3 Initiate subsystem change-over by using the Status Control Panel change-over pushbutton.

8.4 Check that the change-over was successful.

8.5 Observe that the IECC Scalable works correctly and the expected message is displayed in the system alarm window on the Signaller's workstation.

8.6 Restore units from failed to standby by pressing the reset buttons.

8.7 Check that all the subsystems are fully operational from the Technician's Interface terminal.

9. IECC Scalable Chassis Fan Filters

9.1 Replace the chassis Fan Filters (See IECC Scalable Hardware Maintenance & Fault Finding Manual).

9.2 Check the Technician's Interface to ascertain that it reports good health status for the Chassis, CMM, Fan Tray and Power Supply.

10. DIS Host , DIS PC and TI Fan Filters

10.1 Replace DIS Host, DIS PC and TI Fan Filters (See IECC Scalable Hardware Maintenance & Fault Finding Manual).

10.2 Check that DIS Host, DIS PC and TI are operating correctly.

11. Middleware Fan Filters

11.1 Replace Management PC and the Middleware Technician's Interface PC Fan Filters (see Middleware Maintenance & Fault Finding Manual).

SERVICE B

12. All IECC Scalable, DIS,TI Middleware cabinets and workstations.

12.1 Check the equipment is securely mounted.

12.2 Check the cables are undamaged.

12.3 Check the cable connectors are secure.

12.4 Dust and clean cabinets and workstations.

13. SPAD Alarm Test

13.1 In liaison with the Signaller set up a number of SPAD scenario's using the SSI Technician's terminal to check the Monitoring Facility is functioning correctly.

The frequency shall not exceed 1 year.

This task is not necessary if SPAD has occurred on the workstation since the last maintenance visit.

13.2 For SSI (also WESTLOCK or Smartlock) set up a SPAD scenario using the interlocking Technician's terminal for a sample of routes not less the three for each workstation.

13.3 For relay interlocking, perform a SPAD Alarm test as described in the IECC Scalable Technicians Interface User Manual.

13.4 Repeat 13.1 and 13.2 for each IECC Scalable Signaller's Workstation.

PERIODIC TASKS

14. All Blades, PCs and Radio Clocks

14.1 As per Table 1-Periodic tasks, replace the batteries in the listed components at the specific frequency.

Intervals	Description	Cycle
Periodic task 1	Blade Batteries	2 years
Periodic task 1	DC PC Battery	2 years
Periodic task 1	DIS Host PC Battery	2 years
Periodic task 1	TI Battery	2 years
Periodic task 1	Management PC Battery	2 years
Periodic task 1	MTI PC Battery	2 years
Periodic task 2	Workstation PC	4 years
Periodic task 2	NAS RAID	4 years
Periodic task 3	MSF Network Clock	9 years

Table 1 – Periodic Tasks

END

Includes:	Compact-PCI hardware-based versions of WESTCAD and Interface Systems (see appropriate NR/SMS for system type)
Excludes:	Siemens Controlguide WESTCAD and WESTCAD-E – MCR hardware-based versions (see NR/SMS/IC16)

GENERAL

Cable routes shall not be altered from their original position (if in doubt refer to the drawings manual). Never re-route cables during maintenance.

A usable copy of the Westcad maintenance manual should be available on site, if missing or damaged inform your SM(S).

The site software should be available although this might not be on site but held by the technical support group.

DAILY SERVICES

1. Technicians' Terminal

1.1 Check that the terminal remote access facility is working.

1.2 Any outstanding fault messages shall be investigated and cleared as corrective maintenance.

REGULAR SERVICES

2. Control Equipment Cubicle

2.1 Check that the LEDs on the CM2 module are showing as in Table 1.
If any LED is not showing as indicated, refer to the system maintenance manual.

LED	State
Sys 1 On Line	Illuminated if On Line, Extinguished if Off Line
Sys 2 On Line	
Sys 1 Available	Illuminated if Off Line, Extinguished if On Line
Sys 2 Available	
Sys 1 Watchdog	Flashing if Off Line, Extinguished if On Line
Sys 2 Watchdog	
Auto Latch	Flashing
PSU Fail	Extinguished

Table 1 – System LEDs

If any LED is not showing as indicated, refer to the system maintenance manual.

2.2 Check that the cubicle earth terminal is securely bonded to the equipment room earth point.

2.3 Visually check all cables and connectors are secure.

2.4 Check that the area in and around the cubicle is clean and tidy. Remove any rubbish and debris.

2.5 Check that all the cubicle doors are closed. The cubicle provides EMC protection, any signs of damage or deterioration shall be reported as corrective maintenance.

3. Surge Protection Units

3.1 Where Fitted: Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

SERVICE A

4. System Changeover

4.1 Check that the LED indications on the CM2 or system arbiter module are showing as per 2.1.

4.2 Set the rotary switch to manually select the off-line system and observe that the systems switch over.

4.3 Check the Technicians terminal fault reports to ascertain the system is working correctly.

4.4 Set the rotary switch back to the 'Auto' position.

4.5 Check that the 'Auto Latch' LED is flashing, if not press the 'Latch Reset' button.

4.6 Check that the Signaller's workstation(s) are operating correctly.

5. Equipment Cleaning

5.1 Clean all monitor screens and housings with a proprietary anti-static dry screen cleaner. Use cleaning products in accordance with the manufacturer's instructions.

5.2 Disconnect and clean the keyboard as necessary. Hold the keyboard upside down while cleaning.

5.3 Disconnect and clean the tracker ball / mouse. If necessary (if the operation has become intermittent or jerky), remove and clean the ball and rollers.

5.4 Check fans are working, and filters are clean. See appendix B.

6. Technicians' Terminal

6.1 Check that the time on the Technicians' terminal (bottom right of the monitor screen) is correct, re-set if necessary (Appendix A).

The internal clock on the Technicians' terminal is not controlled by the Anthorn (formally Rugby) clock therefore some drifting might occur. The change from GMT to BST and vice versa necessitates re-setting the time.

SERVICE B

7. System Reboot

This is only required on Systems running on the Windows NT operating system.

7.1 The two off line systems should be rebooted one at a time.

Remember to allow time for each system to collect all of the "state of the railway" information it requires. While this collection of information is taking place, the system appears to be in a failed state, hence the need to wait.

7.2 When both off line systems are operating normally the on-line system should be changed over to one of the now rebooted systems.

7.3 The system which was on line shall now be rebooted.

If this task is not completed for any reason the SM(S) shall be advised.

8. Cubicle Cleaning

8.1 With the front and rear doors closed, clean the outer surfaces using a dry lint free cloth.

8.2 Carefully dust the interior faceplates and blanking panels with a dry lint free cloth.

8.3 Check that all doors are securely closed on completion of cleaning. The cubicle provides EMC protection, any signs of damage or deterioration shall be reported as corrective maintenance.

PERIODIC TASKS

9. Computers

The routine replacement of the PC hard disk drive is only required on early versions of the system.

9.1 Replace the PC hard disk drive (HD) with a new HD of the same type.

APPENDIX A

Adjustment of Clock on Technicians' Terminal

1. On the windows task bar at the bottom right of the screen, double click on the time display with the left-hand mouse button. A date/time properties dialogue box is displayed.

2. Select 'Time Zone' by left clicking the tab. Check that the time zone shows '(GMT) Greenwich Mean Time: Dublin, Edinburgh, London, Lisbon', or select this zone from the selection in the drop-down menu.

3. Check that the tick box next to the dialog box 'Automatically adjust clock for daylight saving changes' is not ticked. If it is, un-tick it by a left hand click in the box.

4. Select 'Date & Time' by left clicking the tab. Check that the date is correct. If not select the correct month and year form the selection in the drop down menu and the date by left clicking the correct one displayed on the calendar.

5. Set up the time display for a short time in advance of the actual time. This is done by highlighting the hours figures located in the box under the clock by dragging the cursor across the figures whilst holding down the left hand button on the mouse. Adjust the hours by clicking the up or down arrows to the right of the box. Repeat for the minutes and seconds.

6. At the precise time left click the 'Apply' button and then left click 'OK'. The adjusted time is displayed in the windows task bar at the bottom right of the screen.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/IC15		
Siemens VICOS VDU Control System		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Siemens VICOS VDU Control System
Excludes:	All other Siemens VDU Control Systems

DAILY SERVICES

1. VICOS

1.1 Check the alarm list on all VICOS terminals for any outstanding faults. Rectify or report.

1.2 Check the archive PC is recording, there are no fault messages displayed, and that the display is pink. Rectify or report.

1.3 Archive daily logs to an external recording media.

This can range from a floppy disc to a memory stick depending on the system hardware. Data is automatically over written after 7 days if not archived.

1.4 Check that the IBS_PC and IBS_PC Mirror are operational there are no fault messages displayed and that the display is updating.

Check that all the nodes in the NUC view connections window are green. Rectify or report.

SERVICE A

2. VICOS Terminals.

2.1 Clean & dust the terminal screens, keyboards, & mouse. Use a dry lint free cloth for dusting and an approved cleaning product to remove marks & stains.

Keyboards should be held upside down when cleaning.

2.2 Check that all PC GPS & Anthorn (formally Rugby) clocks are correct. Rectify or report.

2.3 Check the filters in the back panel projection units. Replace if required.

SERVICE B

3. VICOS Terminal.

These tasks shall be undertaken in liaison with the Signaller

3.1 Shutdown and then reboot the main VICOS terminal.

3.2 Login to terminal then run the static test, dynamic test & all image tests. Rectify or report any problems. On completion, log off the terminal.

3.3 Check that all the connections to the terminals are correctly seated and fixing screws are tight where applicable.

Do not inadvertently disturb anything whilst undertaking this task.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/IC16		
WESTCAD - MCR		
Issue No: 04	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Siemens Controlguide WESTCAD and WESTCAD-E – MCR hardware-based versions
Excludes:	Compact-PCI hardware-based versions of WESTCAD and Interface Systems (see relative NR/SMS for system type)

GENERAL

Cable routes shall not be altered from their original position (if in doubt refer to the drawings manual). Never re-route cables during maintenance.

Observe ESD precautions before handling any electronic equipment.

A usable copy of the WESTCAD maintenance manual should be available on site, if missing or damaged inform your SM(S).

The site software should be available although this might not be on site but held by the technical support group.

DAILY SERVICE

1. Technician's Terminal

1.1 Check that the terminal remote access facility, where provided, is working.

1.2 Any outstanding fault messages shall be investigated and cleared as corrective maintenance.

2. ETCS Diagnostics Terminal

2.1 Check clock indication is displaying white text, investigate and rectify as corrective maintenance if displaying anything else.

2.2 Any outstanding fault messages (M_ERRORs) shall be investigated and cleared as corrective maintenance.

REGULAR SERVICE

3. Control Equipment Cubicle

3.1 Check that the indication LEDs on the SA-2 module, where fitted, are showing as in Table 1.

Any fault indication shall be investigated and cleared as corrective maintenance. Refer to the system maintenance manual as necessary.

Indication	Colour	State
Power	Green	When lit indicates the 12V dc power supply to the SA-2 module is present
WD	Yellow	Watchdog - flashes to indicate the associated system is operating correctly
OL	Green	When lit, indicates which System is on-line
FT	Red	When lit, indicates conditions for indicated System Watchdog are Not true
PSU 1/ PSU 2	Green	Indicates PSU functioning normally
	Red	Indicates PSU fault

Table 1 - LED indications

3.2 Visually check that the cubicle earth terminal is securely bonded to the equipment room earth point.

3.3 Visually check all cables and connectors are secure.

3.4 Check that the area in and around the cubicle is clean and tidy. Remove any rubbish and debris.

3.5 Check that all cubicle doors are closed.

4. Surge Protection Units

4.1 Where fitted, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

SERVICE A

5. Equipment Cleaning

5.1 Operator's monitor surfaces shall be cleaned using a lint-free non-abrasive cloth. Do not use any cleaning solution or glass cleaner.

5.2 Keyboards shall be cleaned using a soft cloth and mild detergent solution.

Moisture shall not be allowed to enter equipment apertures and shall be dried off surfaces as soon as possible. Do not use abrasive cleaners or pads.

5.3 The Operator's mouse (where provided) shall be cleaned using a soft cloth and mild detergent solution.

Moisture shall not be allowed to enter equipment apertures and shall be dried off surfaces as soon as possible. Do not use abrasive cleaners or pads.

5.4 Disconnect and clean the tracker-ball (where provided). If the operation has become intermittent or jerky, remove and clean the ball and rollers.

6. Operators mouse

6.1 Check for correct operation of mouse left and right buttons and cursor movement response. Replace any defective mice as corrective maintenance.

7. Technician's Terminal Clock

7.1 Check that the time on the WESTCAD Technician's Terminal (bottom right of the VDU) is correct. Adjust if necessary (Appendix A).

The internal clock is free running and is not controlled by the WESTCAD time reference, some drifting might occur.

8. Fan Tray (if fitted)

NOTE: *before carrying out this task liaise with the Signaller, as an alarm is generated.*

8.1 Disconnect and slide out the fan tray, clean using a soft cloth moistened with a detergent solution.

SERVICE B

9. System Changeover (dual processor systems only)

It is recommended that this task is carried out during periods of no train movements or only light traffic.

9.1 Check that the Indications on the SA-2 module are showing as follows:

- One On-Line LED is illuminated to indicate which system is on line.
- Both 'Watchdog' LEDs are flashing.
- Power LED is illuminated.
- FT LEDs are not illuminated.
- PSU LEDs are both illuminated green.

9.2 Set the rotary switch to manually select the off-line system and observe that the systems change-over.

9.3 Check the LED indications to verify the system is working correctly.

9.4 Check the Technician's terminal fault reports to ascertain the system is working correctly.

9.5 Verify correct operation of the system at the Signaller's workstation.

9.6 Set the rotary switch back to the 'Auto' position.

10. Cubicle Cleaning

10.1 With the front and rear doors closed, clean the outer surfaces using a dry lint-free cloth.

10.2 Carefully dust the interior faceplates and blanking panels with a dry lint-free cloth.

10.3 Check that all doors are securely closed on completion of cleaning.

11. Plugs and sockets

11.1 Check that all plugs and sockets are correctly fitted and that screw fasteners are tight.

11.2 Check that all wiring connections are correctly made.

12. CPU-3 and CPU-4a Modules Checks

Lithium Batteries

12.1 Check the date on the label fitted to the front of the module which details the date the module was installed or issued as a spare.

NOTE: *These Lithium batteries have a 5-year service life.*

If four years has elapsed since the date shown on the module you shall advise your SM(S), so that arrangements can be made to replace this module and replace its battery.

Hard Disk Drives (if fitted)

NOTE: *Earlier CPU-3 Modules were fitted with Hard Disk Drives (HDD). In the case of these modules, a label is fitted to the module detailing the date this module was installed. These Hard Disk Drives have a 5-year service life.*

12.2 Check the date on the label fitted to the front of the module which details the date the module was installed or issued as a spare.

If four years has elapsed since the date shown on the module you shall advise your SM(S), so that arrangements can be made to replace this module.

13. WESTCAD MCR 12V dc PSUs

13.1 Using a Digital Multi-Meter check the output voltage of each PSU. Adjust the trim control on the PSU front panel as necessary to achieve 12.0V DC.

Appendix A - Adjustment of Technician's Terminal Clock

This instruction should be carried out as soon as possible after changes between BST and GMT to realign the WESTCAD Technician's Terminal internal clock with the WESTCAD clock.

1. If not already powered up, switch on the Technician's Terminal. At the Windows task bar at the bottom of the screen double-click on the time display with the left-hand mouse button. A 'Date/Time Properties' dialogue box is displayed.

2. Select the 'Time Zone' by clicking on the tab. Time zone should show '(GMT) Greenwich Mean Time: Dublin, Edinburgh, London, Lisbon' immediately below the tab.

   If a different legend is shown, click on the down arrow to the right of the legend and select the required GMT from the drop-down menu displayed.

3. Near the bottom of the dialogue box, check the box adjacent to the legend 'Automatically adjust clock for daylight saving changes' is NOT ticked. If it is, click in the box to remove the tick.

4. Select 'Date & Time' by clicking on the tab.

5. To change month or year, click on the down arrow next to the month/year display, then click on the required month/year on the drop-down menu displayed.

6. To set the date, position the cursor over the required date and click the left-hand mouse button.

7. Set up the time display for a short time in advance of the actual time as displayed on the front panel of the radio clock/NTP server unit or other reliable time display.

8. To set Time, scroll the cursor over the 'hours' figure located under the clock face. The figure becomes highlighted. Now click on the up or down arrow to the right of the time digits to set as required.

9. Repeat Step 8 for 'minutes' and 'seconds'.

10. At the precise time, click on 'Apply'.

11. Click on 'OK' to clear the dialogue box from the screen.

12. On completion, the new time is shown at the bottom right of the monitor screen.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/IC17		
Signallers Assistant (TREsa)		
Issue No. 5	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Signallers Assistant (TREsa)
Excludes:	Any other Signallers Assistance Equipment

TREsa is an automatic route setting system designed to help signallers by reducing working by routing timetabled services automatically.

The TREsa consists of a number of subsystems:

- A Diagnostics subsystem. This subsystem acts as a central communications hub, maintains log files and is the TREsa configuration management system.
- A Timetable server (TREtts). This subsystem receives and processes timetables from Network Rail's integrated timetable planning system (ITPS). This subsystem distributes the timetables to the rest of the system.
- A number of SARS processors. Each pair of SARS processors (one acting as Master and the other as Standby) interfaces to the control equipment and issues panel requests to set routes for trains.
- A number of SACS PCs. These subsystems provide the signaller's interface to TREsa. They provide a means of controlling ARS functions and provide the signaller with information regarding the route setting status of each train.
- A number of smaller subsystems such as a change-over system (for each SARS pair), an internet router, network switches and printers.

The SARS can run standalone, but when connected to the Diagnostics system requires a user to set them both to standby. The change-over system should then select one as the Master SARS to provide the automatic routing functions, while the other SARS operates as the standby processor.

Please refer to the System Maintenance Manual for comprehensive maintenance and fault finding instructions.

DAILY SERVICE

1. Daily Tasks

1.1 Check the Diagnostics System Status display for subsystem status.

1.2 Check the Diagnostics alarm list for alarms raised in the last 24 hours:

- If there is an alarm regarding a failed timetable download, inform the Signalling Manager.
- Contact ITPS and request a new full timetable download.

WEEKLY SERVICE

2. TREtts

2.1 Login to the TREtts PC. Open Windows Explorer and navigate to C:\TRETTS\data\backup. Remove all but the last week's database backup files; these files will have a .gbk file extension.

2.2 Remove any error files in C:\TRETTS\import.

2.3 Navigate to C:\TRETTS\data and check the size of the TRETTS.GDB file. Using the TREsa TREtts database form, note the file size against the date and check that it is less than 5GB.

If the file is now larger than 5GB, perform the backup and restore procedure (see TREtts database maintenance below).

2.4 Empty the Recycle Bin.

2.5 Using Windows Explorer, navigate to My Computer, right click on the C:\ drive icon and select Properties. Check the disk space on the C: drive. It should be no more than 80% full. If the preceding activities have not freed up sufficient disk space, contact the design authority.

2.6 Logout of the TREtts PC.

MONTHLY SERVICE

3. SARS

3.1 Inform the signallers that this maintenance task can cause all sub areas to drop out of ARS control.

The sub areas for each workstation need to be manually put back into ARS control by the signaller when the new Master SARS processor is online.

3.2 Force a change-over of SARS processors using the change-over subsystem.

This can force the current Master SARS to reboot and the current Standby SARS to be promoted to Master.

On completion of the reboot, promote the SARS to Standby using the 'SARS Control' function on the Diagnostics subsystem.

4. TRETTS

4.1 Check that:

- The TREtts is not performing a timetable import (this normally happens between 7pm and midnight every day);
- No users have a TREtts Client running.

4.2 Reboot the TREtts Server PC.

4.3 Allow up to 10 minutes for the PC to reboot and initialise, then check that the subsystem is displayed as 'up' on the Diagnostics System Status display.

SERVICE A

5. Diagnostics

5.1 Inform the signallers that they can still be able to control the ARS functions (with the exception of Parameter Set activation/deactivation) via the workstation while the Diagnostics is being rebooted.

5.2 Reboot the Diagnostics PC.

6. SACS

6.1 Inform the signallers that they can still be able to control the ARS functions (with the exception of Parameter Set activation/deactivation) via the workstation while the SACS PC is being rebooted.

6.2 Reboot each of the SACS PCs.

SERVICE B

7. General

7.1 Remove, clean and replace the air filter at the front of the all PC's.

8. Diagnostics

8.1 Remove and exchange the removable hard drive for a new one. Archive the old removable hard drive.

9. TREtts database maintenance

9.1 On the TREtts Server, stop TREtts service:

- From the Windows start menu select
  Control Panel > Administrative Tools > Services > TTPService

- Highlight TTPService, right-click and select Stop.

9.2 Using Windows Explorer, navigate to the folder C:\TRETTS\data

9.3 Rename the database file TRETTS.GDB with the current date as the prefix in the format YYYYMMDD, for example: 20150402TRETTS.GDB

Note that this filename must be used where ever DATABASE.GDB is mentioned in the instructions below:

9.4 Start a command line session:

- From the Windows start menu select Run.
- Type cmd in the dialog box then press OK.

9.5 In the command line, enter the following commands:

Note: Only if the command is unsuccessful, an error can be returned by the program, otherwise the command is deemed to be a success.

a. cd C:\Program Files\Firebird\Firebird_2_5\bin Now <press enter>

b. gbak –b –G C:\tretts\data\DATABASE.GDB C:\tretts_backup.gbk –user sysdba –pass masterkey Now <press enter>

Command on a single line:

c. gbak –b –G C:\tretts\data\DATABASE.GDB C:\tretts_backup.gbk –user sysdba –pass masterkey Now <press enter>

d. gbak –r C:\tretts_backup.gbk C:\tretts\data\TRETTS.GDB –user sysdba –pass masterkey Now <press enter>

Command on a single line:

e. gbak –r C:\tretts_backup.gbk C:\tretts\data\TRETTS.GDB –user sysdba –pass masterkey Now <press enter>

Should command b. be returned as unsuccessful, re-enter the command before attempting command c.

Should it be unsuccessful a second time, then undo the process of file renaming as described at the start of this task by renaming the file back to its original name of TRETTS.GDB. Reschedule this maintenance for one week later.

9.6 Reboot the TREtts PC.

Allow up to 10 minutes for the PC to reboot and initialise, then check that the TREtts subsystem is displayed as ‘up’ on the Diagnostics System Status display.

End

Includes:	ElectroLogIXS Electronic Interlocking / Controller 1 Slot, 4 Slot & 9 Slot Chassis'
Excludes:	All other types of Electronic Interlocking and Chassis variants

No possession arrangements are required to perform the services described below; all the tasks are non-intrusive.

Equipment Identification

1 Slot Chassis

4 Slot Chassis

9 Slot Chassis

SERVICE B

1. Cleaning

1.1 Clean the outside of the chassis using a dry lint-free anti-static cloth.

2. Visual Checks

2.1 Check for foreign material inside the chassis. Remove if electrical isolation of equipment is not required to do so, or report these findings as corrective maintenance.

2.2 Check the chassis is securely mounted.

2.3 Check that all modules are fully seated within the chassis and the locking mechanisms are in the locked position.

2.4 Check for any visual damage. Report any damage so that a replacement can be arranged as necessary.

2.5 Visually confirm that all VPM-3 and CIO-PCA module network cables are latched in position.

2.6 Examine the equipment, terminals, cables and cable connectors. Particularly look for physical damage, overheating and arcing. Rectify as necessary.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/IC20		
WESTCAD Level Crossing Touch Screen Device		
Issue No. 01	Issue Date: 01/09/2018	Compliance Date: 01/12/2018

Includes:	Siemens WESTCAD-LC-TSD (Level Crossing Touch Screen Device)
Excludes:	WESTRONIC 1024 TDM System or WESTRONIC Eight Bit TDM

Cable routes shall not be altered from their original position (if in doubt refer to the drawings manual). Never re-route cables during maintenance.

Observe ESSD precautions before handling any electronic equipment.

A usable copy of the WESTCAD-LC-TSD maintenance manual should be available on site, if missing or damaged inform your SM(S).

The product data is stored on a CompactFlash card. The spare CompactFlash card should be available; this may not be on site but held by the technical support group.

Equipment Identification

There are two versions of the LC-TSD as follows:

- 12.1” LCD monitor with integral processor card, Siemens Part No. 615300129
- 12.1” LCD monitor with external processor installed in a 3U housing located in the workstation desk section, Siemens Part No. CAT00000000306

Cleaning Products

When cleaning the LC-TSD never use:

- Abrasive pads or paper towels.
- Window cleaner, soap or scouring powder.
- Solvents such as alcohol, benzene, ammonia or paint thinner.
- Cleaning fluids, wax, or chemicals.

Service A

1 General Cleaning

LCD screens are fragile and can be damaged if you press too hard during cleaning.

1.1 With the signaller’s agreement, activate the products cleaning mode.

1.2 Clean the frame and screen with a microfiber cleaning cloth.

If that does not work, spray water directly onto the microfiber cleaning cloth.

Never spray anything directly onto the LC-TSD screen.

1.3 Return the LC-TSD to its operational mode after cleaning.

Service B

2 Regular Maintenance

2.1 Check the LC-TSD panel brightness and contrast are suitable for the user, adjust the settings as necessary.

The contrast and brightness controls are accessible after removal of a rear mounted protective cover (refer to the technical manual for additional information if required).

2.2 Visually check all cables and connectors are secure.

2.3 The field end Time Division Multiplexer (TDM) System status is displayed on the LC-TSD screen (Top middle section). Investigate further any TDM faults displayed (refer to the technical manual for additional information if required).

2.4 Check on the technician's terminal for any LC-TSD related faults. Investigate further any LC-TSD faults displayed (refer to the technical manual for additional information if required).

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/IC51		
Logger & Archiving System (Formerly GETS)		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Logger and archive/analysis PCs
Excludes:	All other types of Logger or Archiving PC

Before working on the system ESD precautions shall be taken.

General

The Logger (or Archive Recorder) PC can be connected to a number of different systems (e.g. RC/TDMs and/or PIIUs). The logger records the information sent from these systems.

It operates in conjunction with an Archive/Analysis PC, which regularly extracts each day's information to be preserved as required on CD ROM, and which provides an analysis facility. These archived logs can then be analysed by creating reports, which can be printed.

An Archive & Analysis PC is designed to connect to the GE Logger either directly through a LAN or remotely through a modem. The messages to the Archive/Analysis hard disk are overwritten every eighth day.

The Logger transfers data to the Archive/Analysis PC every 24 hours or on request, where it is stored on a removable CDR, which is typically capable of holding one month's data.

It is recommended that six re-writeable disks are provided, labelled, and used in rotation, providing six months of stored data.

Records

All activities carried out on the Logger and Archive/Analysis PCs shall be recorded in the system log book.

REGULAR SERVICES

1. System Health

1.1 Request and print a train report for a late train from the previous day specifying date, time, and train description. This proves that the archive PC has received the previous day's data.

1.2 Check all power supply indications are correct.

2. Archive Data

2.1 Change the CDR disc in archive & analysis PC, and label and store the old disk.

2.2 Place a new CDR in the archive & analysis PC.

2.3 Check that the removed disc has accessible and readable data before storage.

SERVICE A

3. System Checks

Due to individual system configurations not all the tasks are performed on both the logger & archiving system, if you are unsure of the correct tasks, ask your SM(S).

3.1 Check that the power supply cooling fans and other cooling fans are running and that the air intakes are not obstructed on both the Logger and archive & analysis PCs.

3.2 Check that the link between the logger terminal and the train describer is reported as OK. Rectify any defect.

3.3 Check that the link (LAN or Modem) between the logger and archive & analysis PCs is reported as OK. Rectify any defect.

3.4 Check the time and date on the logger and archive & analysis PCs. If it is incorrect check the Radio Clock unit and connections.

3.5 Check the power supply indications are indicating correctly for all units.

3.6 Check that the PCs keyboards and mouse are functioning and that the display screens are working correctly. Confirm that there is a working spare keyboard and mouse on site.

SERVICE B

4. System Maintenance

4.1 Change out the Logger and Archive/Analysis PCs with the spare units. Check that the detail of each unit location and serial number is recorded in the site log-book.

4.2 Clean the display screens and housings using a proprietary anti-static screen cleaner, used in accordance with the manufacturer’s instructions. Disconnect and Clean the keyboard and mouse as required, then reconnect. Hold the keyboard upside down when cleaning.

PERIODIC TASKS

5. Equipment Servicing

5.1 Arrange for the PCs to be returned to the supplier for service and replacement of PSU and processor fans, batteries, and hard drives.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/IC52		
GE Standalone FTN unit		
Issue No. 01	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Standalone FTN unit
Exclude:	

ESD Precautions.

Before working on system use appropriate ESD precautions.

General

FTN Protocol Converter Unit interfaces the TDM products via the Network Rail Fixed Telecom Network fibre infrastructure. This product adds a wrapper layer to the serial (PS9) message structure of the TDM system.

Records.

All activities carried out on the unit shouldbe recorded in line with current maintenance standards.

A Discrepancy Report Form provides a method of logging equipment and system discrepancies/faults that have occurred on a commissioned system. The form is to be completed and should accompany any returned equipment In the event that it is not practical to return the faulty equipment due to its size or installation, the form should be returned to GE as a means of advice of a problem.
Any failures found should be reported to the supervisor/manager.

1 SERVICE A

1.1 Check that the power supply is functional and that its ventilation is not obstructed.

1.2 Check that the link between the TDM systems (field to office) is reported as OK, rectifying any defect.

1.3 Check the power supply indications are indicating correctly for all units.

1.4 Check that the DCD LEDs on any fitted modems are lit.

1.5 Check that there are no fault indications lit.

2 SERVICE B

2.1 Check that all power and serial cables are plugged in and retained to the unit. Do not over tighten the jackscrews / retainers.

2.2 Clean the unit housing using a proprietary anti – static cloth, used in accordance with the manufacturer's instructions.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/IC53		
GE Leicester Keyboard/Trackerball unit		
Issue No.01	IssueDate: 04/03/17	ComplianceDate: 31/05/17

Includes:	GE Leicester keyboard/trackerball unit
Exclude:	Any other Keyboard or Trackerball

ESD Precautions.

Before working on system use appropriate ESD precautions.

General

The GE Leicester Keyboard/Trackerball unit is a replacement solution that effectively emulates the original interface connections to the Vaughan Keyboard/Trackerball and is transparent to the signallers.

Records.

All activities carried out on the unit shall be recorded in line with current maintenance standards.

A Discrepancy Report Form provides a method of logging equipment and system discrepancies/faults that have occurred on a system. The form shall be completed and shall accompany any returned equipment In the event that it is not practical to return the faulty equipment due to its size or installation, the form shall be returned to GE as a means of advice of a problem.

Any failures found should be reported to the supervisor/manager.

SERVICE A

1.1 Check the link between the unit and the Train describer is OK by checking the cursor moves on the map display with the trackerball movement and that the keyboard characters echo back on the map display. Rectify any defect.

1.2 Check the power supply indications are indicating correctly on the Fanless PC and its power supply.

1.3 Check that the there is a working keyboard/trackerball spare on site

SERVICE B

1.4 Clean the keyboard, trackerball and PC housing using a dry lint-free cloth.

1.5 Check all signal and power connections to the PC are made and where applicable secure. Do not over tighten screw-locks.

PERIODIC TASK

1.6 Send the PC to the supplier for service of battery and hard drive.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/IC61		
Rugby Whole Route Display System		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Synelec LMR 1000-50 cube units & LMR 1200- 84 projector & lens
Excludes:	All other Route Display Systems

General

Before working on the system ESD precautions shall be taken.

The Rugby Whole Route Display System utilises the Synelec LMR1000-50 cube units, which comprise of the mechanical structure, the LMR1200-84 projector, and lens. A maintenance PC, installed with the Combase software, is provided that connects to all the cubes via an Ethernet LAN.

This can be used to control the projector functions. Projection lamps will be run until they fail therefore routine lamp changing will not be carried out.

More information on the system can be obtained from the manufacture's manual.

Records

All activities carried out on the system shall be recorded in the system log book.

SERVICE A

1. Screen Cleaning

1.1 As required, clean the front screen with a clean lens cloth.

SERVICE B

2. System Inspection

2.1 Check the condition and the display quality of the system. Ask the Signaller(s) if they have any problems.

This should include the physical condition of the hardware and the projector adjustment.

Any problems should be addressed if possible, prior to continuing with the servicing.

3. System Maintenance

3.1 Check the alignment between projectors. Adjust if necessary.

For very poor alignment use the grid pattern. More information on this can be found in the Mechanical Adjustment Lite Master 50" Series manufacturer's manual.

Check for correct colour balance and adjust if necessary, using the Combase software. More information on this can be found in the Mechanical Adjustment Lite Master 50'' Series manufacturer's manual.

3.2 Check that all cables are secure and undamaged and that they are all screwed into position.

Extreme care should be taken when performing this task as 380V is present on one of the cables.

3.3 Check the image processing electronics. Check that all the cooling fans are working, rectify as necessary. Check that filters are clean and change if necessary.

Check that all the connectors are in position.

4. Cube Cleaning

4.1 Dust the projector casings. Clean the projector lens with a clean lens cloth. Mirrors should not need cleaning, but when necessary clean only with a clean lens cloth.

The inside of screens should not require cleaning on each visit but should be monitored and cleaned when necessary. The same cleaning procedure for lenses and mirrors apply.

5. Final

5.1 Check that all projectors are closed and securely fastened. Check that the Signaller(s) are satisfied with the quality of the displayed images.

END

1. Cambrian Lines (ERTMS)

1.1 System Overview

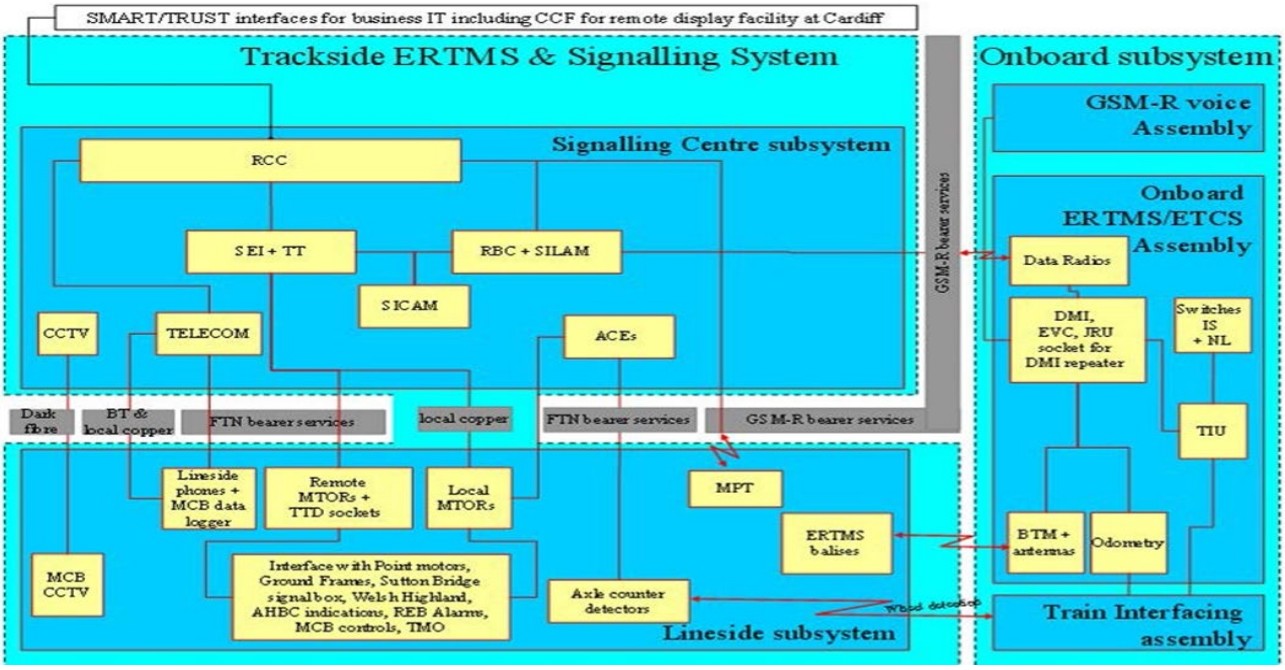


Figure 1 - Schematic Layout of the Cambrian System

1.2 ERTMS Abbreviations

Abbreviation	Meaning
ACE	Axle Counter Evaluator
AHBC	Auto Half Barrier Level Xing
BTM	Balise Transmission Module
CCTV	Closed Circuit Television
DMI	Driver Machine Interface
EVC	European Vital Computer
IS	Isolation
JRU	Juridical Recording Unit
MCB	Manual Crossing Barriers
MTOR	Object Controller
MPT	Mobile Protection Terminal
NL	Non-Leading
RCC	Route Control Centre
RBC	Radio Block Centre
REB	Relocatable Equipment Building
SEI	Interlocking
SICAM	Central Maintenance Aid Equip
SILAM	Local Maintenance Aid Equip
TMO	Trainman Operated Level Xing

Abbreviation	Meaning
TT	Technicians Terminal
TTD	Technicians Terminal Remote
TIU	Train Interface Unit

Table 1 - Abbreviations

1.3 General

The European Rail Traffic Management System (ERTMS) is a cab-based speed signalling system providing automatic train protection (ATP) and is designed to standardise the train control systems of Europe.

ERTMS is the collective term for the following:

a) European Train Control System (ETCS) – Automatic Train Protection (ATP).

b) GSM-R – Standardised mobile communications system for railways that can handle voice communication between the Signaller and train driver as well as data communication between the signalling system and the on-board train ETCS equipment.

The Cambrian lines operate in ETCS Level 2, the principle elements of Level 2 are:

a) Continuous voice communication between the train and Signalling Control Centre (SCC) via GSM-R.

b) Continuous data communication between the train and Signalling Control Centre (SCC) via GSM-R except for defined radio holes.

c) Intermittent communications via Eurobalise to trains.

d) Movement Authority is requested by trains and issued by the Radio Block Centre (RBC) when all necessary conditions are met.

e) Continuous train detection on running lines is by axle counter.

f) Local track circuits are provided to operate level crossings.

g) Fixed block principles are used to separate trains.

h) Line side signals have generally been removed.

i) Degraded mode signalling is provided, train separation achieved by fixed block markers and speed controlled by degraded mode speed signs.

The interlocking system is provided by a 2-out-of-3 Computer Based Interlocking (CBI), the Ansaldo CBI is known as the SEI.

The Radio Block Centre (RBC) enables communications to be made between the SEI and the on-board train ETCS equipment via the GSM-R data radio.

The RBC is a 2-out-of-3 safety processor using similar architecture to the SEI and is configured to confirm only valid messages are transmitted. It also receives position and other information from trains operating within the area of supervision.

All messages between the RBC and trains are encrypted and communications are established by comparing ERTMS Radio Keys loaded onto the RBC and those loaded onto on board units.

Security of these keys is critical therefore copies of the ERTMS Radio Keys shall be stored in a secure specified location.

The contents of any medium on which they are stored shall not be copied or provided to third party.

Separate procedures are in place for the security of ERTMS Radio Keys and only authorised persons shall amend, distribute, receive, store or upload ERTMS Radio Keys.

Lineside signals are only provided in the transition area between the ERTMS and conventional signalling at Sutton Bridge Jcn and in the train maintenance depot at Machynlleth. Lineside markers and speed signage is provided for use when operating in degraded mode.

Moveable items of the infrastructure are sent commands and return indications to the SEI via Object Controllers using the Fixed Telecommunication Network (FTN) or British Telecom (BT) fibre optic networks.

Train detection for train separation is by axle counter, these also use the FTN or BT fibre optic networks to communicate with their respective Axle Counter Evaluator (ACE). All detection points report into one of the four ACE located in the SCC at Machynlleth.

Balise are installed centrally between the rails at intervals along the line, they can be single units or form part of a group using up to four individual balise.

These are passive programmed devices that only transmit data to trains when activated by the train on board equipment.

The data received by the train can include its position in meters, awakening function, text messages, stop messages, etc. This information is used to enable various on-board functions.

e.g. Preventing trains from exceeding the permitted limits of shunt or degraded mode moves, display of text messages on the Driver Machine Interface (DMI) i.e. “AOCL AHEAD”, wheel diameter calibration etc.

1.4 GEST

Temporary and Emergency Speed Restrictions (TSR & ESR) are imposed by the Signaller who sets the requirement for a restriction on a screen called the GEST located in the SCC.

When a restriction is activated the GEST updates the RBC which in turn modifies the data sent in the Movement Authority for the area of the TSR or ESR.

No on-track equipment is required to notify drivers of the position of a TSR or ESR as details are displayed to the driver on the in-cab Driver Machine Interface (DMI) screen.

The on-board equipment calculates the braking for the restriction and displays this to the driver on the DMI.

1.5 Axle Counter Missed Packets and Constraints on the use of RAAA Serial Cards.

The axle counter system employed at Machynlleth is the THALES AZLM and its data transmission is via the FTN 1511 MUX.

This arrangement requires two conversions of message protocol to allow communication over the FTN, firstly from ISDN to V24 at the detection point end of the system and then V24 back to ISDN at the evaluator end.

Both conversions are performed by V24/ISDN dual channel converters located close to the FTN equipment, copper cable is used elsewhere in the system.

Using this arrangement for converting from ISDN to V24 and back again shortens the AZLM packets at each conversion.

THALES, the AZLM manufacturer, specifies a maximum of two conversions to confirm the packet remains long enough to be read by the ACE and give reliable operation.

However, the FTN 1511 MUX is not designed to efficiently handle the AZLM packet configuration. To overcome this problem its Rate Adaptor Cards (RAC) are configured to over sample the message packets, this over sampling effectively equates to a third conversion of protocol, one conversion over the maximum specified for the AZLM.

When the AZLM system was first installed and tested it worked satisfactorily with no corrupt messages or dropped packets and was duly issued with a Trial Product Acceptance Certificate.

During the first months of operation some pre-processor boards also known as the Serial Cards were changed in response to failures, it then became apparent that random single message packets were being dropped by the detection points where the replacements were installed.

The original Serial Cards were coded by THALES as QBAA and the replacements coded as RAAA, the RAAA had been given permanent Product Acceptance as a direct replacement for the OBAA.

The upgrade from QBAA to RAAA was necessary because the processor chip of the QBAA had become obsolete, the same chips are used in the ISDN to V24 converters and on the EAK digital card, and these boards were also been upgraded and continued to work reliably.

An investigation into packets were being dropped revealed the clock speed of the QBAA and RAAA were different, this change coupled with the over sampling of the FTN RACs caused the AZLM packet to be shortened very slightly more when the RAAA was used as a substitute for the original QBAA.

The shortened messages were now very occasionally incomplete when presented to the AZLM processor, so it correctly rejected them and recorded the event.

When the RAAA boards were replaced with the earlier QBAA variant the missed packets ceased and the system ran error free.

Consideration was given at the time to an upgrade of the FTN 1511 MUX to a 1511 MAX variant of the MUX, but trials on the Exeter Salisbury line found this did not rectify the problem.

Upgrading of the AZLM to an Ethernet version was not possible at the time because the only example of an Ethernet version was undergoing trials in Switzerland and was likely to remain on trial until 2014.

The four ACE at Machynlleth are configured to allow a maximum of four consecutive message packets to be rejected and for the system to continue operating normally. Should a fifth consecutive message be rejected the detection point enters a disturbed state.

This tolerance is higher than that specified for wholly copper cabled installations and is required to permit re-routing operations to take place within the FTN network without disturbing the axle counters.

The disturbed state is where the ACE processor fails the detection point causing one or two track sections to become occupied in the signalling system. During tests it was seen that the RAAA never missed more than a single message packet so retained safe and reliable operation with a large margin remaining before a service affecting failure occurred so can be used in the system.

It should however be noted that as the population of the RAAA Serial Cards increases the number of reports of missed message packets increases and can in time mask other reports where attention is required.

1.6 Electronic downloads for achieving

Where maintenance requires the downloading for achieving of data purposes the data shall be retained for 12 months.

1.7 Positioning of ETCS Equipment

On the Cambrian, the longitudinal position of all items of signalling infrastructure installed as part of the Cambrian ERTMS Project were set and recorded by reference to Kilometre and 0.5 Kilometre posts with the zero point at Sutton Bridge Jcn.

The Kilometre posts were taken out of use as a general location reference point and the heads removed in favour of retaining mileposts.

The posts that formally supported the Kilometre heads have been retained as reference points and a label attached indicating the location of each one in Kilometres.

These posts shall be used as a reference to position ETCS, axle counters, point ends and other signalling infrastructure for consistency.

2. Technician Controls

The Cambrian ERTMS password protected Technical Terminals have seven options for applying Technician's controls, they can be found in the TT and TTD Technical data under Technician Controls in the Command menu, they are:

Description of the Bar	Type of Control	Use
AXLE TS	Equipment	Disconnection of equipment using T1A
ENTRANCE EXIT OF A ROUTE	Equipment	Disconnection of equipment using T1A
GROUND FRAME	Equipment	Disconnection of equipment using T1A
POINT	Equipment	Disconnection of equipment using T1A
ROUTE	Route Bar	Protection of staff or work by ERTMS possession, line blockage or disconnection of signaling equipment
SIGNAL NODE	Equipment	Disconnection of equipment using T1A
WHR INTERFACE	Route Bar	Protection of staff or work by ERTMS possession, line blockage or disconnection of signalling equipment

Table 2 - Technician Controls

3. Route Bars

3.1 Entrance Exit of a Route

This control prevents a route node from being used as both an entrance and exit and can also be applied to an exit route node of a bay platform or siding.

This control applies to all routes irrespective of class to and from the node being set. An individual control can be applied at each route setting point.

3.2 Route

The Interlocking system provides a control for the maintainer to prevent a specific route being set.

An individual control is provided for each route.

A route bar cannot cancel a route that is already set at a route setting point.

3.3 Node

This control allows routes to be set from the disabled node but prevents the node from clearing and prevents a movement authority from being issued.

An individual control is provided for each Signal and Node.

This control does not prevent a route being set, and any route that has been set with the control in place clears when the control is removed.

4. Equipment Bars

4.1 General

It is not possible for the Signaller to override equipment bars put in place by use of the TT.

4.2 Axle TS

This control allows an axle counter track section to be set to occupied when clear within the SEI, the operation of the axle counter equipment is unaffected by this control.

Occupation of an axle counter track section does not prevent routes from being set, where permissive routes are provided, an MA can still be issued for these routes.

4.3 Ground Frame

This control allows a ground frame release to be locked in the normal position and for detection to be maintained.

4.4 Point

This control allows a set of points to be held in the normal and / or reverse position with detection maintained and prevents the Signaller moving them except as described below.

A point control can be put in place with the switches detected in the position for which the bar is to be enforced and for them to be moved away from that position by the Signaller.

If the padlock is not displayed on the Technical Terminal, the control is not effective.

4.5 Computer Virus Protection

The uploading or downloading of software using any medium is strictly prohibited without the specific authority of the Network Rail Duty Box Technician.

This requirement applies to all equipment, at all times.

5. Indications and Useful Voltage

Board	LED Name	Colour	Meaning	OK state	NOK State
CVO	W	Green	Watchdog	On	Off or Flashing
CVO	H	Red	Halt	Off	Flashing or on
CVO	M	Yellow	Master	Flashing	Off
CVO	E	Yellow	Slave	Off	Flashing or on
CVO	1	Green	Software active	Flashing	Off
CVO	2	Red	Showing the functioning of the 2 out of 3 processing	Off	Blinking (2 out of 2 processing) On (1 out of 1 processing)
PVF2	NORMAL	Green	Fans Okay	On	Off
CME	E	Red	Error	Off	On
CME	V/Rx	Yellow	Reception message valid	Flashing	Off or On
CME	A/Rx	Green	Reception link Active	On	Off or Flashing
CME	V/Tx	Yellow	Transmitting message	Flashing	Off or On
CME	A/Tx	Green	Transmitting link Active	On	Off or Flashing
CALS	5V VME	Green	Supply Present	On	Off
CALS	+12V VME	Green	Supply Present	On	Off
CALS	-12V VME	Green	Supply Present	On	Off
CALS	5V VL	Green	Supply Present	On	Off
CALS	24VREG	Green	Supply Present	On	Off
CAP	BFL	Yellow	Board Failure	Flashing	On or Off
CAP	CPU	Green	Processing Unit Correct	Flashing	On or Off
CALM2	+5V1	Green	Supply Present	On	Off
CALM2	+5V2	Green	Supply Present	On	Off
CALM2	5VLS	Green	Supply Present	On	Off
CALM2	24HES	Green	Supply Present	On	Off
CALM2	+24V1	Green	Supply Present	On	Off
CALM2	+24V2	Green	Supply Present	On	Off
CALM2	+24KD1	Green	Supply Present	On	Off
CALM2	+24VISO	Green	Supply Present	On	Off
MTOR2	CG	Green	Watchdog	On	Flashing or Off
MTOR2	ER	Red	Error	Off	On or Flashing
MTOR2	V1	Yellow	FTN Network A	On	Off or Flashing
MTOR2	V2	Yellow	FTN Network B	On	Off or Flashing
MTOR2	1	Green	Ongoing Task	Flashing	Off or On
MTOR2	2	Yellow	Ongoing Task	Flashing	Off or On
MTOR2	E	Green	Entrée (Input)	On or off	
MTOR2	S	Green	Sortie (Output)	On or off	

Board	LED Name	Colour	Meaning	OK state	NOK State
MTOR2	ES	Green	Entrée Securite (Safety	On or off	
MTOR2	SS1	Green	Controle Defaut D	On or off	
CALM2	+5V1	Green	Supply Present	On	Off
CALM2	+5V2	Green	Supply Present	On	Off
CALM2	5VLS	Green	Supply Present	On	Off
CALM2	24HES	Green	Supply Present	On	Off
CALM2	+24V1	Green	Supply Present	On	Off
CALM2	+24V2	Green	Supply Present	On	Off
CALM2	+24KD1	Green	Supply Present	On	Off
CALM2	+24VISO	Green	Supply Present	On	Off
CRCD	SNS1 - 20	Yellow	Lit the corresponding		

Table 3 - SEI Cabinet Indications

Board	Test Point	Nominal Voltage	Maximum Voltage	Minimum Voltage	Ripple
PVF2		24	28.8	21.5	1V pp
Switch		24			
Supply to PAP-CSD Rack		24	21.5	28.8	1V pp
Supply to PES2		24	21.5	28.8	1V pp

Table 4 - SEI Power Supplies

Board	Test Point	Nominal Voltage	Minimum Voltage	Maximum Voltage	Ripple
CALS	5V VME	+5	+4.7	+5.5	100mV pp
CALS	+12V VME	+12	+11.5	+12.5	100mV pp
CALS	-12V VME	-12	-11.5	-2.5	100mV pp
CALS	5V VL	+5	+4.7	+5.5	100mV pp
CALS	24VREG	+24	+23	+25	1V pp

Table 5 - SEI Power Supplies (2)

Board	LED Name	Colour	Function	OK state	NOK State
CLAP	R	Green		Flashing	Off
CLAP	H	Red		Off	On
CLAP	W	Green		On	Off
CLAP	D	Red		Off	On
CLAP	1	Green		Flashing slowly when used as CIC or CIRS and fast when used as a CGL or CVO)	Off
CLAP	2	Red		Off	Flashing Note CIRS Only: Flashes when port is faulty or when in mainten ance mode
CME1	TX	Yellow	Flashing when transmitting data	Flashing	Off
CME1	RX	Yellow	Flashing when receiving data	Flashing	Off
CME1	MA	Green	Link OK	On	Off
CME1	DEF	Red	Fault	Off	On
CME+	E	Red	Error	Off	On
CME+	V (RX)	Yellow	Flashing when receiving data	Flashing	Off
CME+	A (RX)	Green	Receiver Okay	On	Off
CME+	V (TX)	Yellow	Flashing when transmitting data	Flashing	Off
CME+	A (TX)	Green	Transmitter Okay	On	Off
CALS	5V VME	Green	Supply Present	On	Off
CALS	+12V VME	Green	Supply Present	On	Off
CALS	-12V VME	Green	Supply Present	On	Off
CALS	5V VL	Green	Supply Present	On	Off

Board	LED Name	Colour	Function	OK state	NOK State
CALS	24VREG	Green	Supply Present	On	Off
CAP	BFL	Yellow	Board Failure	Flashing	On
CAP	CPU	Green	Processing Unit Correct	Flashing	Off or On
Modem	POWER2	Green	Supply Present	On	Off
Modem	POWER1	Green	Supply Present	On	Off
Modem	POWER	Green	Supply Present	On	Off
Modem	TEST	Green			
Modem	CTS2	Red	On when the modem is	On	Off
Modem	DTR2	Red	On when the connected	On	Off
Modem	CTS1	Red	On when the modem is	On	Off
Modem	DTR1	Red	On to indicate Data	On	Off
Modem	MODE2	Red		Off	
Modem	CD2	Red	On when the B channel		
Modem	MODE1	Red	Off	Off	
Modem	CD1	Red	On when the B channel		
Modem	□	Red	Modem on	On	Off
Modem	Data	Red	Flashes when data is		
Multiplexer	□	Green	Indicates the	On	Off
Multiplexer	TRUNK1	Red	Indicates activation of	Off	On
Multiplexer	TRUNK2	Red	Indicates activation of	Off	On
Multiplexer	CTRL	Green	At least one B channel is active	On	Off
Multiplexer	TEST	Red	Auto-test or alarm	Off	On

Table 6 - Radio Block Centre Cabinet Indications

Board	Test Point	Nominal Voltage	Minimum Voltage	Maximum Voltage	Ripple
PVF		24	28.8	21.5	1V pp
CALS	5V VME	+5	+4.7	+5.5	100mV pp
CALS	+12V VME	+12	+11.5	+12.5	100mV pp
CALS	-12V VME	-12	-11.5	-2.5	100mV pp
CALS	5V VL	+5	+4.7	+5.5	100mV pp
CALS	24VREG	+24	+23	+25	1V pp

Table 7 - Radio Block Centre Cabinet Power Supplies

Board	LED Name	Colour	Meaning	OK state	NOK State
CME1	TX	Yellow	Flashing when transmitting data	Flashing	Off
CME1	RX	Yellow	Flashing when	Flashing	Off
CME1	MA	Green	Optical fibre connected	On	Off
CME1	DEF	Red	Fault	Off	On
CALS	5V VME	Green	Supply Present	On	Off
CALS	+12V VME	Green	Supply Present	On	Off
CALS	-12V VME	Green	Supply Present	On	Off
CALS	5V L	Green	Supply Present	On	Off
CALS	24VREG	Green	Supply Present	On	Off

Table 8 - SILAM Cabinet Indications

Board	Test Point	Nominal Voltage	Maximum Voltage	Minimum Voltage	Ripple
PVF		24	28.8	21.5	1V pp
CALS	5V VME	+5	+4.7	+5.5	100mV pp
CALS	+12V VME	+12	+11.5	+12.5	100mV pp
CALS	-12V VME	-12	-11.5	-12.5	100mV pp
CALS	5V VL	+5	+4.7	+5.5	100mV pp
CALS	24VREG	+24	+23	+25	1V pp

Table 9 - SILAM Cabinet Power Supplies

Board	LED Name	Colour	Meaning	OK state	NOK State
PVF2	NORMAL	Green	Fans Okay	On	Off
CALM2	24HES	Green	Supply Present	On	Off
CALM2	+24V1	Green	Supply Present	On	Off
CALM2	+24V2	Green	Supply Present	On	Off
CALM2	+24KD1	Green	Supply Present	On	Off
CALM2	+24VISO	Green	Supply Present	On	Off
MTOR2	E	Green	Entrée (Input)	On or off repeats	
MTOR2	S	Green	Sortie (Output)	On or off repeats	

MTOR2	ES	Green	Entrée Securite (Safety Input)	On or off repeats input	
MTOR2	SS1	Green	Controle Defaut D (KDI) Sortie Securite (Safety Output)	On or off repeats input condition	
MTOR2	CG	Green	Watchdog	On	Flashing or Off
MTOR2	ER	Red	Error	Off	On or Flashing
MTOR2	V1	Yellow	FTN Network A	On	Off or Flashing
MTOR2	V2	Yellow	FTN Network B	On	Off or Flashing
MTOR2	1	Yellow	Ongoing Task	Intermittently	Off or On
MTOR2	2	Yellow	Ongoing Task	Intermittently	Off or On

Table 10 - Remote Object Controller Cabinet Indications

Board	Test Point	Nominal Voltage	Maximum Voltage	Minimum Voltage	Ripple
PVF2		24	28.8	21.5	1V pp
Supply to PES2		24	21.5	28.8	1V pp

Table 11 - Remote Object Controller Cabinet Power Supplies

Broad	LED Name	Colour	Meaning		
V24	POWER	Green	Power supply present	On - Okay	Off – Fault
V24	B1 TX	Yellow	Logical state of the interface	On - High	Off - Low
V24	B1 RX	Green	Logical state of the interface	On - High	Off - Low
V24	B2 TX	Yellow	**Not used**		
V24	B2 RX	Green	**Not used**		
V24	+	Red	Remote power supply condition	Off - Okay	On -Fuse ruptured
V24	-	Red	Remote power supply condition	Off - Okay	On -Fuse ruptured

Table 12 - Converter ISDN/V24

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/IE21		
Cambrian ERTMS: Remote Object Controller Cabinet		
Issue No: 03	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Remote Object Controller Cabinets
Excludes:	All other types of Controller Cabinets

GENERAL

The Remote Object Controller cabinet consists of:

a) Cable terminations.

b) One PVF2 fan rack to cool the cabinet.

c) One PES2 rack housing 1 object controller.

d) Two Ethernet switches.

e) Fibre optic termination shelf.

DAILY SERVICES

1. SEI Cabinet

1.1 Check the SEI Cabinet component status as indicated on the Technical Terminal.

SERVICE A

2. Status & Ventilation

2.1 Observe the green LED is illuminated on the PVF2 rack and that no abnormal noise is evident from any of the fans as this might indicate a failing cooling fan.

2.2 Clean the filter of the ventilation system using a vacuum cleaner; it shall be replaced if in poor condition.

SERVICE B

3. Cabinet

3.1 Dust the external surfaces of the cabinet.

3.2 Check the condition of the cabinet, hinges and locks.

3.3 Examine the equipment, including terminals, cable and cable connectors. Look for signs of physical damage, overheating or arcing.

3.4 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

3.5 Check labels remain clearly legible.

4. System Indications

4.1 Observe the correct illumination of all system LEDs.

5. Earth Bonding

5.1 Measure the resistance between the signalling earth bus bar and each earth terminal, cable shield and surge arrester. The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/IE22		
Cambrian ERTMS: Radio Block Centre (RBC) Cabinet		
Issue No: 03	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Radio Block Centre (RBC) Cabinet
Excludes:	All other types of Radio Block Centre Cabinets

GENERAL

The RBC cabinet consists of:

a) Two modem racks.

b) Three PAPR racks.

c) Two multiplexers.

d) Three PVF fan racks.

Before handling any electronic equipment observe ESSD precautions.

DAILY SERVICES

1. Status

1.1 Check the RBC component status as indicated on the MAR1.RBC screen on SILAM and investigate any problems.

4 WEEKLY SERVICE

2. Spares

2.1 Check that spare equipment is available, ready for use, pcb mounted batteries are in date, and that replacements are available for equipment undergoing repair or investigation.

SERVICE A

3. Cabinet

3.1 Clean the filters of the ventilation system using a vacuum cleaner. Replace them ifin poor condition.

3.2 Check the operation of the cooling fans mounted in the PVF fan racks, this shall be carried out by isolating, unplugging and removing one rack at a time. With the fan rack removed, manually rotate each fan to check it rotates freely. Replace the PVF rack and reset the CBs wait for 30 seconds and check that no abnormal noise is evident from any

SERVICE B

4. Cabinet

4.1 Dust the internal and external surfaces of the cabinet.

4.2 Check the condition of the cabinet, hinges and locks.

4.3 Examine the equipment, terminals, cable and cable connectors. Look for signs of physical damage, overheating or arcing.

4.4 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

4.5 Check labels remain clearly legible.

5. System Indications

5.1 Observe the correct illumination of all system LEDs.

6. Power Supply Voltages

6.1 Measure the following power supply voltages on three CALS boards:

a) +5 VME

b) +12 VME

c) -12 VME

d) +5 VL

e) 24V REG

See NR/SMS/IE00 (Cambrian ERTMS – General) for details of tolerances.

7. Earth Bonding

7.1 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield. The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

7.2 Check all doors are securely closed on completion of maintenance.

The cubicle provides EMC protection, any signs of damage or deterioration shall be reported to your supervisor.

PERIODIC TASKS

8. Batteries

8.1 Observe ESSD precautions while carrying out this task.

8.2 Change the battery on the CIER and CCS3 boards in the PAP_CSD rack and on any spare boards or return the complete board to the manufacturer for the battery to be changed.

The date the battery was installed is on a label attached to each battery

END

Includes:	GEST and RCCS Workstations, RCCS, RCCS Printer, RCCS Servers and Computers
Excludes:	All other GEST or RCCS Equipment

DAILY SERVICES

1. Alarms

1.1 Check for alarms and events by interrogation of the RCCS Maintainer Workstation and investigate any problems.

REGULAR SERVICE 1

2. Weekly Service

2.1 Check the computer name on the LCD front panel of each RCCS, GEST, Automatic and Database server is indicated in blue, its normal state. If the computer name is indicated in orange a hardware fault is present which shall be investigated.

REGULAR SERVICE 2

3. Two Weekly Service

3.1 Execute an anti-virus update of the RCCS Maintainer Workstation.

The update is downloaded to a computer with internet access from http://www.avast.com/eng/updates.html .

The download button initiates the download “vpsupd.exe” from Avast which shall be placed onto a memory stick previously scanned and proved clear of any virus for upload to the RCCS Maintainer Workstation.

To upload onto the RCCS Maintainer Workstation insert the memory stick and double click on “vpsupd.exe”. When message “Database updated from x to y” appears, click OK.

REGULAR SERVICE 3

4. Four Weekly Service

<u>Operating System</u>

4.1 Check the contents of the application, security and system logs for any errors and excessive activity using the following path: -

Start > Settings > Control Panel >Administrative Tools > Event Viewer

Any errors found shall be investigated.

Network Time Protocol (NTP)

4.2 Check the NTP to confirm Local Time and Reference time are synchronised. This activity shall be carried out on all servers and workstations.

To carry out this task launch “ntpq.exe” as follows: - Windows Start menu > RCCS > Maintenance > NTP > ntpq:

a) If an error message “ntpq.exe: read: No such file or directory” is raised, this might be due to a large difference between local and reference time.

To correct this error a synchronisation shall be attempted by using the synchronisation tool as follows: - Windows Start menu > RCCS > Maintenance > NTP > Synchronize.

After synchronisation wait for 15 minutes and again launch “ntpq.exe”, if the fault persists further investigation shall be undertaken.

b) In the “ntpq” type “pe” and check there is “*” at the beginning of one line which indicates the current reference clock which can be a GPS-RECEIVER or one of the signalling server names.

If the “*” is not displayed it might be as a result of a computer having been rebooted during the last hour after a long period of being stopped, if this is found the NTP requires synchronising as described above.

ILOG Server “Logical Mapper” Service (Excl GEST Server)

4.3 Check the ILOG Server Logical Mapper service is running by observing the icon. If it is not running stop the RCCS applications and restart the ILOG Server Logical Mapper from Start > Settings > Control Panel >Administrative Tools > Services, then restart the RCCS applications.

RCCS Software - DigCom Equipment

4.4 Check the connection status of the DigCom equipment on all RCCS Servers and work stations (excl GEST Server and workstation) by double clicking on the LAN service blue icon or the serial service yellow icon (Automatic Server only)

Select “Open Spy” in the menu. In the spy window check the status reports for links; when in order they display “Correct” any displaying “Bad” shall be investigated.

RCCS Software - ILOG Connections

4.5 Check the status of the ILOG connections RCCS Servers excluding the GEST Server.

NOTE: *To carry out this task the "x" command shall be executed in the console window of all server applications except the "Watchdog" application.*

The results returned by use of the "x" command shall be compared with those in the Ansaldo STS RCCS Signalling Maintenance Manual; if they are not identical the application shall be restarted.

Network Card

4.6 Check in the Windows system tray that the following network connections are working correctly: -

Network Connections	Servers	Workstations
Local Area Connection	Automatic and Signaling	All
Local Area Connection 2	Disabled	All
Local Area Connection 3	All	NA
Local Area Connection 4	All	NA
Virtual Area Connection	All	All

Table 1 – Network Connections

Memory and Hard Disk Drive

4.7 Check on all RCCS servers and workstations that the available memory is not less than 20% for a 10-minute period.

Check this on the Physical Memory section of the Performance page of the Windows Task Manager by comparing the available Physical memory with the Total Physical memory.

If the available memory drops below 20%, reboot the computer, leave it operational for 4 hours and recheck memory use, if the condition persists, further investigation shall be carried out in accordance with the RCCS Maintenance manual.

4.8 In the computer management administrative tool (Start\Control Panel\Administrative Tools\Computer Management\Sisk Management):

a) Check the state of health of the hard disk drives,

b) Check that the free disk space percentage is not less than 20% for each hard drive,

c) Run the Microsoft Windows Disk Defragmenter tool and if required defragment each hard disk drive in a traffic down period.

d) If the free disk space percentage is less than 20% on one drive, follow procedure described in the RCCS Maintenance manual and check again used disk space; if the problem persists further investigation shall be carried out in accordance with the RCCS Maintenance manual.

RS485 Ports

4.9 Check the functioning of RX/TX LEDs on the RS485 Port. If they do not illuminate momentarily in a two-minute period check the status of the RCCS application.

The red TX and green RX LEDs associated with the “Hot” Automatic Server flashes momentarily and at the same time the green RX LEDs flash on the port associated with the standby Server.

CPU Card

4.10 Check for ten minutes using the task manager that each CPU does not experience a continuous load exceeding 50%.

If any CPU load exceeds 50% for more than 10 minutes, reboot the computer and check again after four hours, if the problem persists further investigation shall be carried out in accordance with the RCCS Maintenance manual.

USB Ports

4.11 Check all USB ports are disabled in software, password protected and fitted with a device to prevent connection of a USB configured device.

SERVICE A

5. Server Switchover

5.1 Manually switch over the GEST, signalling and automatic servers.

NOTE: *This operation stops trains from being signalled and should be carried out in a period when few operations are being carried out.*

6. Virus Check

6.1 Check using current antivirus software that the GEST, signalling and automatic standby servers are free from any virus.

If a virus is found advise your SM(S).

7. General

7.1 Check ventilation fans are running freely on processors and computers.

7.2 Clean all the RCCS and server workstations including the screen, keyboard and mouse.

7.3 Check all the RCCS and server workstations for visual quality of the screens and keyboards.

7.4 Check the RCCS printer for alarms and service following the manufacturer's instructions.

SERVICE B

8. Archive and Delete Files and Directories

8.1 Before deletion of any file, the information shall be burnt onto a DVD using the RCCS Maintenance Workstation, labelled and stored securely on site.

8.2 Delete the files older than 3 months from the "Backups" directory Backup files do not exist on GEST Server or Workstation. The Backup files are only found on: -

a) Signalling Server 1 & 2.

b) Automatic Server 1 & 2 Database Server.

c) Signallers Workstation 1 & 2 Maintenance Workstation.

Using Windows Explorer at each RCCS Server or Workstation, navigate to D:/Backups. The files in the directories are the RCCS application traces.

These are used to investigate faults in the RCCS applications.

8.3 Delete the Reports Directories older than 3 months on the RCCS Database Server.

This is accessed via Windows Explorer – My Computer \ Shared on 'RCCS-db-s'(S:). The files in this directory are the time stamped events/alarms in text format, classified per week directory and day directory.

8.4 Delete the *.ttea files in the TTEA Copy Directory that are older than 3 months on the RCCS Data Base Server.

This is accessed via Windows Explorer – My Computer \ Shared on 'RCCS-db-s'(S:) \ Reports \ Internal Data \ TTEA Copy Dir.

These files are the timetable engineering arrangements backup files and are used in case of cold re-start of the RCCS automatic servers.

PERODIC TASKS

9. General

9.1 Examine the equipment, including terminals, cable and cable connectors. Look for signs of physical damage, overheating or arcing.

9.2 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

9.3 Check labels remain clearly legible.

9.4 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield.

The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

9.5 Check by running the Dell diagnostic tool on each server for any hardware or system incidents that have occurred, record details of any incidents and report them to your supervisor.

9.6 Empty the trace buffer on each server.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/IE24		
Cambrian ERTMS: Maintenance Aid Equipment (SAM)		
Issue No: 03	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	SILAM, SICAM
Excludes:	Technical Terminal (TT), Consultation, Key Management Centre (KMC)

GENERAL

Before handling any electronic equipment observe ESSD precautions.

SAM comprises:

a) One SICAM: Central maintenance equipment.

b) One SILAM: Local maintenance equipment.

c) One Consultation Workstation.

DAILY SERVICES

1. SICAM

1.1 Check the following applications are open and running correctly:

a) Scheduler.

b) Connect silams.

c) Animation silams.

d) Loader.

e) Unloader DbCourant.

f) Unloader DbArchieve.

g) DbCourant dumplog.

h) LanEquipment.

i) Gest Gateway.

2. SILAM

2.1 Check for alarms and events by interrogation of the SILAM Workstation and investigate.

REGULAR SERVICES

3. Weekly Service - SICAM

3.1 Check the contents of the application, security and system logs for any errors and excessive activity, the files are accessed by the following path:-

Start up > Settings > Control Panel > Administration tools > Even viewer.

3.2 Empty the contents of the application, security and system logs following this check.

3.3 Check all tasks are running correctly by launching the “SQL Server Management Studio” using the following path:-

Start > Programs > Microsoft SQL Server 2005 > SQL Server Management Studio.

3.4 Expand the SQL Server tree diagram to access “\SICAM\SQL server Agent\Jobs”.

3.5 To check each task is running properly right click the task and choose “View History” For each task.

3.6 Delete the contents of each file following this check.

3.7 Check the status of the Database. This is accessed by the following path:-

Start > Programs > Microsoft SQL Server 2005 > SQL Server Management Studio

3.8 In the toolbar select “New Query”, in the query window type “Dbcc Checkdb (DbTempsReel)” and click “Execute” The status of the database is displayed to allow examination of the results.

3.9 In the toolbar select “New Query”, in the query window type “Dbcc Checkdb (DbCourant)” and click “Execute” The status of the database is displayed to allow examination of the results.

3.10 When complete, close the query window and the SQL Server Management Studio Window.

3.11 Check that no abnormal noise is evident from any of the cooling fans which might indicate a failing fan.

3.12 Check that spare equipment is available and ready for use in the event of a failure, and that replacements are available for equipment undergoing repair or investigation.

4. Two Weekly Service – Backup the Historic Database

4.1 Extract the incremental back up tape by selecting “SQL Management Studio” and in the list of jobs select “Eject Tape”.

4.2 Insert a “Cleaning Cartridge” tape in the tape drive, it is then drawn in by an automatic mechanism.

4.3 When the tape has been drawn in, two green lights flash on the front panel and the cleaning cycle commences. The process takes approximately 1 minute to complete and the tape is then ejected.

The cleaning cartridge can only be used for a limited number of operations so a record shall be kept of use to enable its replacement.

4.4 Insert a blank tape in the tape drive, it is then drawn in by an automatic mechanism.

4.5 To run the back up in the “SQL Server Management Studio” go to “Jobs” and right click “Backup-DbCourant” and choose “Start Job”. On the front panel of the tape drive the left-hand indicator displays continuously while the right hand indicator flashes.

4.6 While the tape is running right click the task at 30 second intervals and choose “refresh”. The “Status” column indicates if the archiving is progressing. When the archiving is complete the “Status” column displays “success”.

4.7 To confirm the archiving has been successful right click the task and select “View History” which reports either “The job succeeded” or “The job failed”.

If successful, note the information on the exit message (number of pages archived, tape name), write this information on the tape which has automatically eject and place it into storage.

If unsuccessful, repeat the operation.

NOTE: *The SICAM has a storage capacity of 30 days before it overwrites historic data.*

4.8 Reinsert the incremental back-up tape, it is then drawn in by an automatic mechanism.

4.9 On the front panel of the tape drive both indicators flash, wait until they become steady before proceeding.

4.10 Right click “Prepare the tape” and choose “Start job” which cause the right-hand indicator to start flashing whilst the left remains steady.

4.11 While the tape is running right click the task at 30 second intervals and choose "refresh". The "Status" column indicates if the task is progressing. When the task is complete the "Status" column displays "success.

4.12 To confirm the task has been successful right click the task and select "View History" which reports either "The job succeeded" or "The job failed".

If successful, this has completed the initialisation of the tape.

If unsuccessful, repeat the operation.

4.13 Close the "SQL Server Management Studio".

5. Four Weekly Service – Memory and Hard Disk Drive

5.1 Check on servers and workstations that the available memory is not less than 20% for a 10-minute period. Check this on the Physical Memory section of the Performance page of the Windows Task Manager by comparing the available Physical memory with the Total Physical memory.

If the available memory drops below 20%, reboot the computer, leave it operational for 4 hours and recheck memory use. If the condition persists, further investigation shall be carried out in accordance with the Maintenance manual.

In the computer management administrative tool (Start\Control Panel\Administrative Tools\Computer Management\Sisk Management):

a) Check the state of health of the hard disk drives,

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b) Check that the free disk space percentage is not less than 20% for each hard drive.

c) Run the Microsoft Windows Disk Defragmenter tool and if required defragment each hard disk drive in a traffic down period.

d) If the free disk space percentage is less than 20% on one drive, follow procedure described in the Maintenance manual and check again used disk space. If the problem persists, further investigation shall be carried out in accordance with the Maintenance manual.

SERVICE A

6. SILAM Cabinet and SICAM

6.1 Clean the filters of the ventilation system using a vacuum cleaner. They shall be replaced if in poor condition.

6.2 Check the operation of the cooling fans mounted in the PVF fan racks, this shall be carried out by isolating, unplugging and removing one rack at a time. With the fan rack removed manually rotate each fan to check it rotates freely. Replace the PVF rack and reset the CBs. Repeat the process for each rack in turn.

6.3 Check ventilation fans are running freely on workstation processors.

6.4 Clean the workstation screens, keyboards and mice.

6.5 Check the visual quality of the workstation screens and keyboards.

SERVICE B

7. SILAM Cabinet

7.1 Dust the external surfaces of the cabinet.

7.2 Check the condition of the cabinet and its hinges and locks.

7.3 Examine the equipment, terminals, cable and cable connectors. Look for physical damage, overheating, arcing.

7.4 Check the security of all fixings and connectors and remove accumulations of dust or other debris.

7.5 Check labels remain clearly legible.

8. Indications

8.1 Observe the correct illumination of all system LEDs.

9. Power Supplies

9.1 Measure the following power supply voltages on three CALS boards:

a) +5 VME.

b) +12 VME.

c) -12 VME.

d) +5 L.

e) 24V REG.

See NR/SMS/PartC/IE00 (Cambrian ERTMS – General) for details of tolerances.

9.2 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield. The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

9.3 Check all doors are securely closed on completion of maintenance.

9.4 The cubicle provides EMC protection, any signs of damage or deterioration shall be reported to your supervisor.

END

Includes:	SEI and Local Object Controllers (MTOR)
Excludes:	Remote Object Controllers (MTOR)

GENERAL

The SEI cabinet contains the following:

a) One PAP-CSD rack which is the Processing Unit of the SEI.

b) Four PES2 racks, each one housing 3 object controllers.

c) Three PVF2 fan racks to cool the cabinet.

d) Two Ethernet switches linking modules of the different racks to the two FTN links.

DAILY SERVICE

1. SEI Cabinet

1.1 Check the SEI Cabinet component status as indicated on the Technical Terminal.

REGULAR SERVICE

2. System

2.1 Observe the green LED is illuminated on each of the three PVF2 racks and that no abnormal noise is evident from any of the fans which might indicate a failing cooling fan.

2.2 Check that spare equipment is available and ready for use, and that replacements are available for equipment undergoing repair or investigation.

SERVICE A

3. Filters

3.1 Clean the filters of the ventilation system using a vacuum cleaner; they shall be replaced if in poor condition.

SERVICE B

4. Cabinet

4.1 Dust the internal and external surfaces of the cabinet.

4.2 Check the condition of the cabinet and its hinges and locks.

4.3 Examine the equipment, terminals, cable and cable connectors. Look for physical damage, overheating or arcing.

4.4 Check the security of all fixings and connectors and remove accumulations of dust or other debris.

4.5 Check labels remain clearly legible.

5. Power Supplies

5.1 Measure the following power supply voltages on three CALS boards:

a) +5 VME.

b) +12 VME.

c) -12 VME.

d) +5 L.

e) 24V REG.

See NR/SMS/PartC/IE00 (Cambrian ERTMS – General) for details of tolerances.

6. System Indications

6.1 Observe the correct illumination of all system LEDs.

7. Earth Bonding

7.1 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield. The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

7.2 Check all doors are securely closed on completion of maintenance.

The cubicle provides EMC protection, any signs of damage or deterioration shall be reported to your supervisor.

PERODIC TASK

8. Batteries

Observe ESSD precautions while carrying out this task

8.1 Change the battery on the CIER and CCS3 boards in the PAP_CSD rack and on any spare boards.

END

Includes:	Technical Terminal, Consultation Workstation
Excludes:	All other Technicians Terminal or Workstations

REGULAR SERVICE

1. Memory and Hard Disk Drives

1.1 Check on all servers and workstations that the available memory is not less than 20% for a 10-minute period.

Check this on the Physical Memory section of the performance page of the Windows Task Manager by comparing the available Physical memory with the Total Physical memory.

If the available memory drops below 20%, reboot the computer, leave it operational for 4 hours and recheck memory use, if the condition persists, further investigation shall be carried out in accordance with the Maintenance manual.

1.2 In the computer management administrative tool (Start\Control Panel\Administrative Tools\Computer Management\Sisk Management):

a) Check the state of health of the hard disk drives.

b) Check that the free disk space percentage is not less than 20% for each hard drive.

c) Run the Microsoft Windows Disk Defragmenter tool and if required defragment each hard disk drive in a traffic down period.

d) If the free disk space percentage is less than 20% on one drive, follow procedure described in the Maintenance manual and check again used disk space; if the problem persists further investigation shall be carried out in accordance with the Maintenance manual.

SERVICE A

2. Equipment

2.1 Check ventilation fans are running freely.

2.2 Clean the screen, keyboard and mouse.

2.3 Check the visual quality of the screen and keyboard.

2.4 Check all USB ports are disabled in software, password protected, and each USB is fitted with a device to prevent connection of a USB configured device.

SERVICE B

3. Equipment

3.1 Examine the equipment, terminals, cable and cable connectors, in particular look for signs of physical damage, overheating or arcing.

3.2 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

3.3 Check labels remain clearly legible.

END

Includes:	Terminal servers (Also known as a MOXA converter), Ethernet Switches, TRUST serial converter, TRUST modem and Remote Access Server (RAS)
Excludes:	All other Terminal Servers or related equipment

REGULAR SERVICE

1. Clock

1.1 Check the NTP clock has a GPS Lock indication displayed as a full stop in the bottom right of the display and the time is correct.

SERVICE A

2. Equipment

2.1 Examine the equipment, terminals, cable and cable connectors, in particular look for signs of physical damage, overheating or arcing.

2.2 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

2.3 Check labels remain clearly legible.

END

Includes:	CATS Signaller and supervisor workstations, CATS Printer, CATS servers and computers.
Excludes:	All other CAT based equipment

GENERAL

REGULAR SERVICE

1. Function Test

1.1 Carry out a functional test of the CATS system. This is to include a functional test of the GSMR and telephone concentrator.

SERVICE A

2. CAT Server

2.1 Check the computer name on the LCD front panel of each CATS server is indicated in blue, the normal state. If the computer name is indicated in orange a hardware fault is present which shall be investigated.

2.2 Check the CATS system time to confirm all parts of the CATS system are synchronised and the time is correct. This activity shall be carried out on all servers and workstations.

3. Operating System

3.1 In the Operating Systems check the contents of the application, security and system logs for any errors and excessive activity using the following path:-

Start > Settings > Control Panel >Administrative Tools > Event Viewer.

Any errors found shall be investigated.

4. Memory and Hard Disk Drives

4.1 Check on all CATS servers and workstations that the available memory is not less than 20% for a 10-minute period. Check this on the Physical Memory section of the Performance page of the Windows Task Manager by comparing the available Physical memory with the Total Physical memory.

If the available memory drops below 20%, reboot the computer, leave it operational for 4 hours and recheck memory use, if the condition persists, further investigation shall be carried out in accordance with the RCCS Maintenance manual.

In the computer management administrative tool (Start\Control Panel\Administrative Tools\Computer Management\Sisk Management):

a) Check the state of health of the hard disk drives.

b) Check that the free disk space percentage is not less than 20% for each hard drive.

c) Run the Microsoft Windows Disk Defragmenter tool and if required after this analysis defragment each hard disk drive.

d) If the free disk space percentage is less than 20% on one drive, follow procedure described in the RCCS Maintenance manual and re-check the used disk space. If the problem persists further investigation shall be carried out in accordance with the RCCS Maintenance manual.

5. CPU Card

5.1 Check for ten minutes using the task manager that each CPU does not experience a continuous load exceeding 50%. If any CPU load exceeds 50% for more than 10 minutes, reboot the computer and check again after four hours. If the problem persists further investigation shall be carried out in accordance with the RCCS Maintenance manual.

6. USB Ports

6.1 Check all USB ports are disabled in software, password protected and fitted with a device to prevent connection of a USB configured device.

7. Virus Check

7.1 Check using current antivirus software that the GEST, signalling and automatic standby servers are free from any virus. If a virus is found advise your SM(S).

8. Final

8.1 Check ventilation fans are running freely on processors and computers.

8.2 Clean all the CATS and server workstations including the screen, keyboard and mouse.

8.3 Check all the CATS and server workstations for visual quality of the screens and keyboards.

8.4 Check the CATS printer for alarms and service following the manufacturer’s instructions.

SERVICE B

9. Equipment

9.1 Examine the equipment, terminals, cable and cable connectors. Look for signs of physical damage overheating or arching.

9.2 Check that all fixings and connectors are secure and remove accumulations of dust or other debris.

9.3 Check labels remain clearly legible.

9.4 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield. The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

END

Includes:	SEI-CLSS (Ferriby to Gilberdyke)
Excludes:	All other Interlockings

DAILY SERVICE

1. Technicians Terminal

1.1 Check the Technicians Terminal for alarms/alerts for the previous 36 hours and action accordingly.

This can be carried out remotely at the TTD or the TTC.

1.2 Observe the visual quality of the Technicians Terminal.

SERVICE B

2. Power Supply and Earth Check (external)

2.1 Observe that the Green 'DC ok' LED is illuminated on the 24 V DC PULS supply unit, if not, replace unit.

2.2 Carry out NR/SMS/PartB/Test/053 (ELD Function Test) or NR/SMS/PartB/Test/051 (Busbar Earth Test).

3. PVF Racks (Internal)

3.1 Check that the PVF2's front panel indicator is illuminated Green.

4. Board Batteries

4.1 Check that the batteries on the CIER and CCS3 boards are in date and record.

PERIODIC TASK

5. Filters (Internal)

5.1 Replace the ventilation system filters (Figure 1) in the air guides of the cabinets.

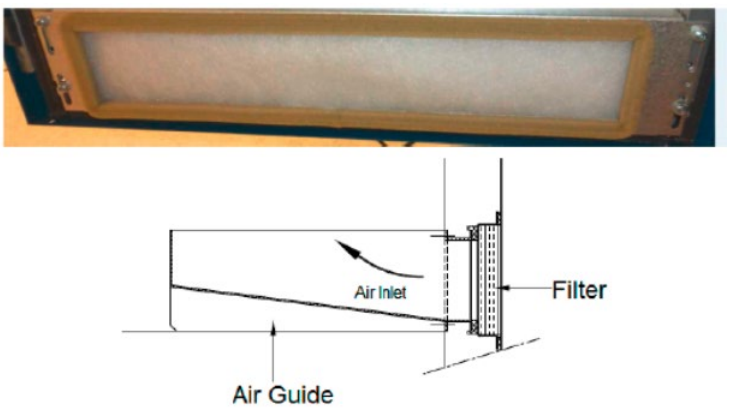


Figure 1 - Ventilation system filter

6. Batteries

Arrange for the replacement of batteries on the CIER and CCS3 boards, including spares, record the details.

These batteries can only be replaced by sending the CIER and CCS3 board to the supplier, this is not a task that the Technician can carry out.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/IF01		
Atlas 200 ETCS Radio Block Centre (RBC) and Maintenance Supervision System (MSS)		
Issue No: 03	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Atlas 200 Radio Block Centre (RBC) and Maintenance Supervision System (MSS)
Excludes:	All other RBC's, MSS's and Network Transmission Gateway

GENERAL

Do not connect unauthorised test equipment to a working 2oo3 platform system.

The use of an ESD wrist strap is mandatory for any maintenance of RBC equipment.

More information on this system can be found in the ALSTOM documents: System and Subsystem Description, Control Centre Maintenance Manual, Control Centre Operational Manual, and MSS HMI Operational Manual.

DAILY SERVICES

1. MSS Servers and Clients

1.1 For each MSS Client Gateway and Wyse Terminal, check that the menu bar is accessible, that the alarm viewer works, and that command icons respond to mouse clicks.

1.2 Using any MSS Wyse Terminal, check that the three coloured health indicator is correctly animated.

1.3 Check the status of every connection is healthy. Rectify any faults as necessary.

1.4 Check system status by examining the Alarms List for any outstanding faults. Investigate and rectify any faults as necessary.

1.5 Check the time is correctly displayed and that no faults are indicated in the MSS Server state windows.

1.6 Check that active Temporary Speed Restrictions and Unconditional Emergency Stops match those recorded in the operations log.

1.7 On completion of tasks, log off from the MSS HMI Console.

1.8 Clean and tidy the work area as required.

REGULAR SERVICE 1

2. MSS Client Gateways, MSS Servers, Wyse Terminals, KVM Switch, and NTP Server.

2.1 Check for correct operation of all MSS Wyse Terminals by logging on to the system. Rectify or escalate any defects as required as corrective maintenance. On completion, log off.

2.2 Check that the NTP Time Server is synchronised to the broadcast MSF clock. Investigate and rectify any defects as necessary as corrective maintenance.

2.3 Check that the clock of the Master MSS server is in line with the broadcast time and date displayed on the NTP time server by checking the time displayed in the top right-hand corner of the MSS HMI.

2.4 Check that all MSS Client Gateway clocks are within 15 seconds of the NTP time and date. If not, refer to Second Line Maintenance.

2.5 Check that the RBC is properly synchronised to the MSS Server time.

2.6 Check for correct operation of the KVM switch by selecting each connected channel.

2.7 Check for correct event recording and dormant balise failures by examining the Historian archives for the previous 7 days stored on the MSS Client Gateway. Investigate and rectify any faults as necessary.

3. RBC

3.1 Check for correct operation of the cooling fans. Investigate and rectify any faults as necessary as corrective maintenance.

REGULAR SERVICE 2

4. MSS Servers

4.1 Check the health of each MSS Server’s hardware.

4.2 Check the air-cooling vent filters are clean. If necessary, clean or replace the filter in accordance with manufacturer’s instructions.

4.3 Check that the cooling fans are rotating.

5. MSS Client Gateways and Wyse Terminals

5.1 Check the health of the hardware for the MSS Gateways and Wyse Terminals in accordance with manufacturer's instructions.

5.2 Dust and clean the Client Gateway / Wyse Terminal keyboards and VDU screens as required.

This should be done using a soft cloth moistened with a detergent solution. Wring out the cloth before use to remove excess detergent solution.

5.3 Check moisture does not enter equipment apertures and is dried off surfaces as soon as possible using a dry lint-free cloth. Do not use abrasive cleaners or pads.

SERVICE B

6. MSS Servers, Client Gateways, Wyse Terminals and RBC Cubicle

6.1 Examine the equipment, terminals, cables and cable connectors. Particularly look for security, physical damage, overheating and arcing. Rectify as necessary.

7. Equipment Cabinets

7.1 Dust the external surfaces of the cabinet.

7.2 Check the condition of the cabinet, hinges and locks.

7.3 Examine the equipment, including terminals, cable and cable connectors. In particular, look for signs of physical damage, overheating or arcing. Rectify as necessary.

7.4 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

7.5 Check labels remain clearly legible.

PERIODIC TASK 1

8. RBC Cubicle (site without air conditioning)

8.1 Replace each fan tray unit.

PERIODIC TASK 2

9. RBC Cubicle (site with air conditioning)

9.1 Replace each fan tray unit, site temperature range shall be between 18 - 27°C otherwise treat as unheated.

PERIODIC TASK 3

10. RBC Cubicle

10.1 Replace the three USB keys (flash drives) loaded with the specific application data and the interlocking software.

PERIODIC TASK 4

11. MSS Cubicle

11.1 The MSS Servers and Client Gateways shall be restarted.

This should be done in turn (e.g. one item at a time, waiting for it to recover before restarting the next).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/IF02		
Atlas 200 ETCS - Enclosure and Balise		
Issue No: 04	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Atlas 200 ETCS Enclosure (LEU) and Balise (Alstom)
Excludes:	All other LEU's and Balises

GENERAL

Any maintenance or operating difficulties shall be reported to your SM(S) as corrective maintenance.

An ETCS site may include:

a) Lineside Electronic Unit (LEU) enclosure containing Micro-coder encoding equipment, MIPS200 switched mode power supply, and interfaces.

b) A balise group of at least 2 Balises. If a LEU is provided, then one or more Balises will be switchable and connected to the LEU with a disconnection box and cables.

c) Mounting beam for each balise.

Dormant Balise Failures

Balise failures remain dormant until they are attempted to be read by a train.

Certain safety features used in degraded signalling system / ETCS system modes rely on messages transmitted from specific Balises therefore maintenance processes have to check that all of these specific Balises are regularly proven as read.

If traffic patterns mean that some of these Balises are not regularly read by a train, they have to be tested with a BEPT. Refer to the Area Specific Balise Maintenance Manual for details on affected Balises and the procedure and periodicity of these tests.

SERVICE B

1. LEU Enclosure (Switchable Balise Only)

1.1 Remove any fire risks (e.g. oily waste, paper etc).

1.2 Check for security and signs of damage.

1.3 Dust and examine interior.

1.4 Check micro-coder vents are clear.

1.5 Check the security of accessible terminals and cable glands and look for signs of water ingress.

1.6 Check the effectiveness of the door seal and latches and lock in keeping the door seal tight against the enclosure. Adjust as necessary.

1.7 Lubricate locks, latches, and hinges.

1.8 Examine earth connections. If in doubt, test continuity and resistance.

1.9 Check that each configuration key is securely chained to its Micro-coder.

2. Disconnection Box (Switchable Balises Only)

2.1 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the disconnection box and cables.

2.2 Check the Balise disconnection box is properly fixed to the mounting stake / pole and look for signs of water ingress.

2.3 Examine the terminals inside the disconnection box. Clean and protect as necessary.

2.4 Examine cables and glands for security and damage.

2.5 Lubricate locks.

3. Balise

3.1 Examine Balise and mounting beam. Check that there is no visible damage, signs of excessive wear or cracks visible.

3.2 Remove any fire risks (e.g. oily waste, paper etc.) from the vicinity of the Balise.

3.3 Check that the Balise and mounting beam are correctly aligned.

3.4 Check the tab washer system – the tab washers are securely seated on the plastic tab washer retention plate and the tabs interface correctly with the bolt head.

3.5 Where the mounting beam is held in place by rail clips, check these are correctly installed and secure.

3.6 Where the mounting beam is fixed to the surface of the sleeper, check bolts or screws remain secure. Report any damaged or rotten sleepers or those with defective fastenings to your SM(S).

3.7 Check that balise labels are securely fastened to the balise (and in the case of a full size Vortok mounting bracket, on the bracket).

3.8 Using the Balise, Encoder Programming and Test Tool (BEPT), test the Balise signal level – 4 or 5 bars indicates an acceptable signal level.

If the signal levels are about or lower the acceptable level inform your SM(S) to arrange its replacement.

3.9 “For switchable Balises” check the cable connections are secure, that the cable is secured to the track bed/sleeper and it is connected to the disconnection box.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/IF03		
Atlas 200 ETCS Network Transmission Gateway		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Atlas 200 ETCS Network Transmission Gateway (NTG)
Excludes:	Radio Block Centre & Fixed Telecoms Network

GENERAL

Do not use an Avometer (or any similar meter) on the Ohms x 100 range on the NTG system. The 15V DC output from the meter on this range can damage electronic circuits. Similarly, do not use any form of buzzer or lamp for continuity testing on the system.

The use of protective gloves is mandatory for any maintenance procedures which require manual access to NTG equipment.

DAILY SERVICE

1. Equipment Room

1.1 Check that the chassis LEDs (one for each slot available for board insertion) are GREEN for used slots, and UNLIT for unused slots. A RED indication suggests a faulty card in the relevant slot. Investigate and rectify as necessary.

1.2 Check that the Diagnostic Board ‘Diag’ LED is blinking green. Any other indication suggests a Diagnostic Board fault. Investigate and rectify as necessary.

1.3 Check that the Diagnostic Board ‘FAN’ LED is extinguished. Any other indication suggests a failure of one or more cooling fans. Investigate and rectify as necessary.

1.4 Check that the Diagnostic Board ‘PSU’ LED is extinguished. Any other indication suggests a power supply failure. Investigate and rectify as necessary.

1.5 Check that the Diagnostic Board ‘TEMP’ LED is extinguished. Any other indication suggests that the NTG is overheating. Investigate and rectify as necessary.

1.6 Check that each Power Supply Board ‘Power’ LED is GREEN. Any other indication suggests a power supply failure. Investigate and rectify as necessary.

1.7 Check that each Power Supply Board ‘Fault’ LED is extinguished. Any other indication suggests a power supply failure. Investigate and rectify as necessary.

1.8 Check system status by examining the Diagnostic LCD for any fault messages. The text under normal operating conditions should match the installed software version as recorded in the System Release Note.

1.9 Check that both Power Bank Interrupter lamps are illuminated on the rear of the NTG. Investigate and rectify any faults as necessary.

1.10 Clean and tidy the work area as required.

REGULAR SERVICE 1

2. Fans

2.1 Confirm that the cooling fans are rotating by checking that there is vertical air flow from each fan unit – air is brought in from beneath the chassis and expelled at the top. Confirm there are no obstructions above or below the chassis.

2.2 Check the air-cooling fan filters are clean. If necessary, clean the filter.

SERVICE B

3. Final Checks

3.1 Examine the equipment, cables and cable connectors. Particularly look for security, physical damage, overheating and arcing. Rectify as necessary.

3.2 Check the main power supply.

END

Includes:	Thameslink Radio Block Centre (RBC) System only
Exclude:	All other Radio Block Centre types and systems

DAILY SERVICES

1 Visual Status

1.1 Check the RBC component status as indicated on the RBC Technician's Facility screen for alarms and investigate any problems.

(Note: access to the RBC TF can be via the RBC TF-L in LBER, or via the RBC TF-R in Arch 886).

If a fault or problem is reported on the TF or is otherwise suspected, further analysis might be required by removing the front cover of the RBC, exposing the RBC's three lanes and their associated LED indications.

Each Lane (A, B and C) is arranged (left to right as viewed front on) with the following 'blade' card modules:

MPM, SIOM, DPM, TBSLAN.

(Note: there are only two TBSLAN cards per RBC processor; one associated with lane A and one associated with lane C).

MPM and SIOM card have 3 possible LED indications (shown green above) that provide indication of the status of each lane: Green, Orange and Red.

- Green LED: RBC lane is in correct operation mode
- Orange LED: RBC lane is operating with a non-critical fault
- Red LED: RBC lane has a critical failure

In the event of a card failure or lane fault, cards should be replaced with the issued spare cards as per the SMTH process.

ROUTINE TASK

2 Ventilation and Cooling fans

2.1 Clean the filters of the ventilation system using a vacuum cleaner; they shall be replaced if in poor condition.

2.2 Check the operation of the cooling fans mounted in the PVF fan racks, this shall be carried out by isolating, unplugging and removing one rack at a time.

2.3 With the fan rack removed manually rotate each fan to check that it rotates freely. Reconnect the rack and fan and wait for 30 seconds to check that no abnormal noise is evident from any of the fans as this may indicate an imminent failure. Repeat the process for each fan rack in turn.

3 Cabinet

3.1 Dust the internal and external surfaces of the cabinet.

3.2 Check the condition of the cabinet, hinges and locks.

3.3 Examine the equipment, terminals, cable and cable connectors; in particular look for signs of physical damage, overheating or arcing.

3.4 Check the security of all fixings and connectors, and remove any accumulations of dust or other debris.

3.5 Check all labels remain clearly legible.

3.6 Observe the correct illumination both in terms of colours and the brightness of all system LEDs.

4 Power Supply Voltages and Earth Bonding

4.1 Measure and check for the following power supply voltages:

a) RBC Processor – Dual Power Supply - 110V AC

b) Stratus TCC FTS – 110V AC

c) Network Switch and RBC RIF – Dual Power Supply 48V DC

d) RBC Technician's Facility – 110V AC

4.2 Measure the resistance between the main signalling centre earth bus bar and each earth terminal and cable shield.

The resistance between the bus bar and any earth terminal or cable shield shall be less than 1 ohm when measured with an earth ground tester.

4.3 Check all doors are securely closed on completion of maintenance.

Note: The cubicle provides EMC protection, any signs of damage or deterioration shall be reported to your supervisor.

End

Includes:	NCL Radio Block Centre (RBC) System only
Excludes:	All other Radio Block Centre types and systems

GENERAL

Before undertaking any work within an existing/operational RBC cubicle, the Signaller shall be informed before doing so.

The ESD wrist strap shall be worn while carrying out tasks within the RBC Cubicle.

DAILY SERVICES

1. Visual Status

1.1 Check the RBC component status as indicated on the RBC Technician's Facility screen for alarms and investigate any problems.

1.2 If a fault or problem is reported on the TF or is otherwise suspected, further analysis might be required by removing the front cover of the RBC, exposing the RBC's three lanes and their associated LED indications (Figure 1).

Figure 1

Each Lane (A, B and C) is arranged (left to right as viewed front on) with the following 'blade' card modules:

MPM, SIOM, DPM, TBSLAN.

NOTE: *there are only two TBSLAN cards per RBC processor; one associated with lane A and one associated with lane C).*

MPM and SIOM card have 3 possible LED indications (shown green above) that provide indication of the status of each lane: Green, Orange and Red.

a) Green LED: RBC lane is in correct operation mode.

b) Orange LED: RBC lane is operating with a non-critical fault.

c) Red LED: RBC lane has a critical failure.

In the event of a card failure or lane fault, cards should be replaced with the issued spare cards as per the SMTH process.

SERVICE A

2. Ventilation and Cooling fans:

All working shall be carried out in accordance with general instruction for staff working on S&T Equipment.

2.1 Clean the filters of the ventilation system using an anti-static vacuum cleaner, replaced if in poor condition.

2.2 Check the operation of the cooling fans mounted in the PVF fan trays, this shall be carried out by isolating, unplugging and removing one tray at a time.

2.3 With the fan tray removed manually rotate each fan to check that it rotates freely. (An aerosol duster may be used to rotate the fan).

Reconnect the tray and fan and wait for 30 seconds to check that no abnormal noise is evident from any of the fans as this might indicate an imminent failure.

Repeat the process for each fan tray in turn.

3. Cabinet

3.1 Dust the internal and external surfaces of the cabinet.

3.2 Check the condition of the cabinet, hinges, and locks.

3.3 Examine the equipment, terminals, cable, and cable connectors; in particular look for signs of physical damage, overheating or arcing.

3.4 Check the security of all fixings and connectors and remove any accumulations of dust or other debris.

3.5 Check all labels remain clearly legible.

3.6 Observe the correct illumination both in terms of colours and the brightness of all system LEDs.

3.7 Visually check Earth Bonding.

3.8 Check all doors are securely closed on completion of maintenance.

NOTE: *The cubicle provides EMC protection, any signs of damage or deterioration shall be reported to your supervisor.*

END

Includes:	ARAMIS Workstation and Cubicles
Excludes:	All other ARAMIS equipment and server-based equipment.

Software updates and data updates shall only be carried out by Thales staff only.

Cubicle earth terminal shall remain bonded to the equipment room earth point, as per the as built drawings. If disturbed during maintenance, verify that the connection and routing are restored before the equipment is returned to service.

Cable routes shall be preserved as originally specified in the as built drawing. Never re-route cables during maintenance.

It should be noted that the firewalls have LEDs that show the status of each of the individual PSU whereas Nagios is currently only able to determine the combined Power Supply Units (PSU) status.

For Additional information see NR/SMS/Appendix/19 (General Information on the ARAMIS System).

DAILY SERVICE

1. Nagios Checks

1.1 Using the Nagios application to check the headline pages (mainly the host groups screen) to determine if any monitored parameter has crossed its alert threshold.

All alerts shall be investigated by using the Nagios application to drill down into the system information.

Any alert which is not investigated / rectified should reported to the SM(S).

REGULAR TASK 1

2. Disk Space Check

2.1 Check the common storage VM where log files are stored to verify their is should sufficient disk space.

2.2 Log files which require archiving shall be extracted and placed in the appropriate archiving area.

SERVICE A

3. System Status Checks

3.1 The following equipment shall be inspected for damage and any dirt, debris, damage and unusual noises:

- Client PC - Dell Precision 7910 Rackmount – Hard Drive & Fans.
- Server - Dell PowerEdge R630 Rackmount - Hard Drive & Fans.
- Maintenance Blade Server – Hard Drive & Fans.
- Server Storage SAN - HP MSA 2040 – Hard Drive & Fans.
- Network Core Switch - Cisco Nexus 5672UP – Fans.
- Network Access Switch - Cisco Catalyst 2960XR-24TS-I – Fans.
- Network Management Switch - Cisco Catalyst 2960XR-48TS-I – Fans.
- Firewall - CISCO ASA 5545-X WITH FIRE POWER Services – Fans.

SERVICE B

4. Workstation Monitors

4.1 The workstation monitors should be cleaned with anti-static screen cleaner and a soft lint-free non-abrasive cloth.

Apply only light pressure when dusting the liquid crystal display (LCD) screen.

5. Workstation Keyboard & Mouse

5.1 Clean as required with a soft cloth dampened with detergent solution.

Do not use any glass cleaner or equivalent type. Squeeze out to remove excessive detergent from the cloth before use.

Do not allow moisture to enter equipment apertures and dry off surfaces as soon as possible using a dry lint-free cloth.

Do not use abrasive cleaners.

6. Client PC Cubicles

The maintainer should not possess mobile phones / radio equipment or metal objects whilst undertaking this task.

These tasks can be carried out without power isolation.

6.1 Using a dry lint-free soft cloth remove gently dust from the cubicle without disturbing any buttons or switches on the equipment, cabling or its terminations.

Do not use abrasive cloth or pads.

Where additional cleaning is required, use a soft cloth dampened with a detergent solution squeezing out excessive detergent before use.

6.2 On completion of this task, Check the front and rear doors are closed tight to prevent access of dust.

7. Visual inspection of equipment terminations

Workstation Equipment

7.1 Check cables from monitors, keyboard and mouse are secure to the amulet zero clients and there are no signs of cable stress or abrasions.

Client PC Cubicles

7.2 Front of cubicle - check all modules are correctly seated and secure.

7.3 Back of the cubicle - check all cables are correctly seated and plugs tight and secure.

END

Mobile telephones that are switched on shall not be brought in close proximity of operational electronic Interlocking's, it can interfere with the system processors

SSI /CBI INTERLOCKINGS

Commonly Used Abbreviations

Abbreviation	Meaning
CBI	Computer Based Interlocking
DMPM	Diagnostic Multiprocessor Module
DLI	Datalink Interrogator
DLM	Data Link Module
LDT	Long Distance Terminal
MPM	Multiprocessor Module
PC	Personal Computer
PPM	Panel Processor Module
SSI	Solid State Interlocking
TFM	Trackside Function Module
TP	Terminal Processor
TT	Technicians Terminal
VDU	Video Display Unit (Monitor)

General

Consideration should be given to the effects on SSI and CBI performance of any alterations or adjustments to the source power supply.

The correct operation of electronic interlocking's is reliant on having an efficient earthing system that is maintained within its designed parameters.

Equipment spares should be clearly labelled and stored in anti-static bags or boxes in a safe location.

Each system should have an onsite log book to record maintenance activities and system status information.

If controls are applied to or removed from electronic interlocking's, written records shall be made and retained.

Technicians' Terminals

The Mk1 terminals have now all been replaced with Mk2 terminals.

Event Logger

Tape loggers have now all been were replaced with the TTLR optical disc PC based recorders.

Optical Disc Handling, Storage and Rotation

Optical Discs can come in write only or a rewritable format.

The Optical Disc should be handled carefully and removed from service if found to be damaged.

They should be stored in an authorised location, away from any heat or damp and should be kept away from any magnetic fields.

Rewriteable Optical Discs are used in rotation to store data for a given period (this is usually seven days). The disc containing the oldest data should be used as the next replacement (Local instructions can vary this).

Where the technicians' terminal is at an unmanned site, the disc should be changed in accordance with local instructions.

Keyboard Maintenance

Keyboards should be held upside down when dusted.

VDU Screen Cleaning

Screens should be cleaned using an anti-static VDU cleaner following the manufacturer's instructions.

Printer

Printer paper and ribbons/toners should be changed as detailed in the printer manufactures instructions.

Printout Retention

A paper copy of the fault printout should be retained in a safe place for a given period (usually fourteen days).

Modems

The modem self-test procedure should be carried out according the manufacturer's instructions.

Correct Date and Time

The date and time can be corrected by using an option from the COMMAND MENU. Some SSI tech terms use the Althorn clock and therefore do not need adjusting.

Interlocking Cubicle

The interlocking cubicle contains the following equipment:

a) Interlocking Multiprocessor Modules.

b) Diagnostic Multiprocessor Modules.

c) Panel Processor Modules.

d) Data Link Modules.

e) Long Distance Terminal Modules.

f) Line Connection / Termination Units.

Trackside Equipment

Trackside locations can contain the following equipment:

a) Signal Modules.

b) Point Modules.

c) Data Link Modules.

d) Long Distance Terminal Modules.

e) Line Connection / Termination Units.

Point Modules

Open/loose links/terminations to the point drive can result in high DC voltages being present on them if the point's module is energized by commands from the interlocking. Newer installations incorporate a resistor across the links to avoid this.

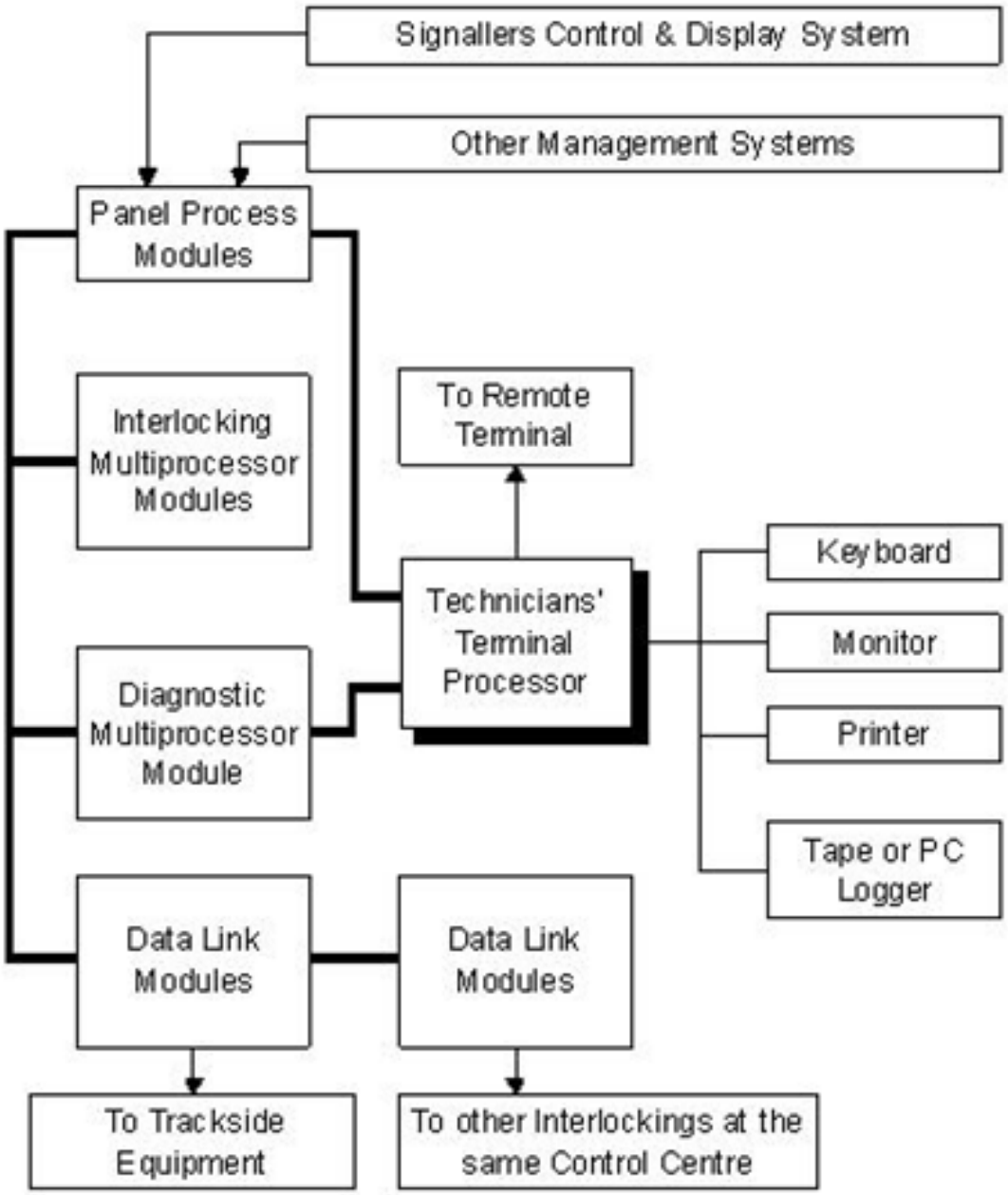


Figure 1 – Block Layout of SSI Interlocking

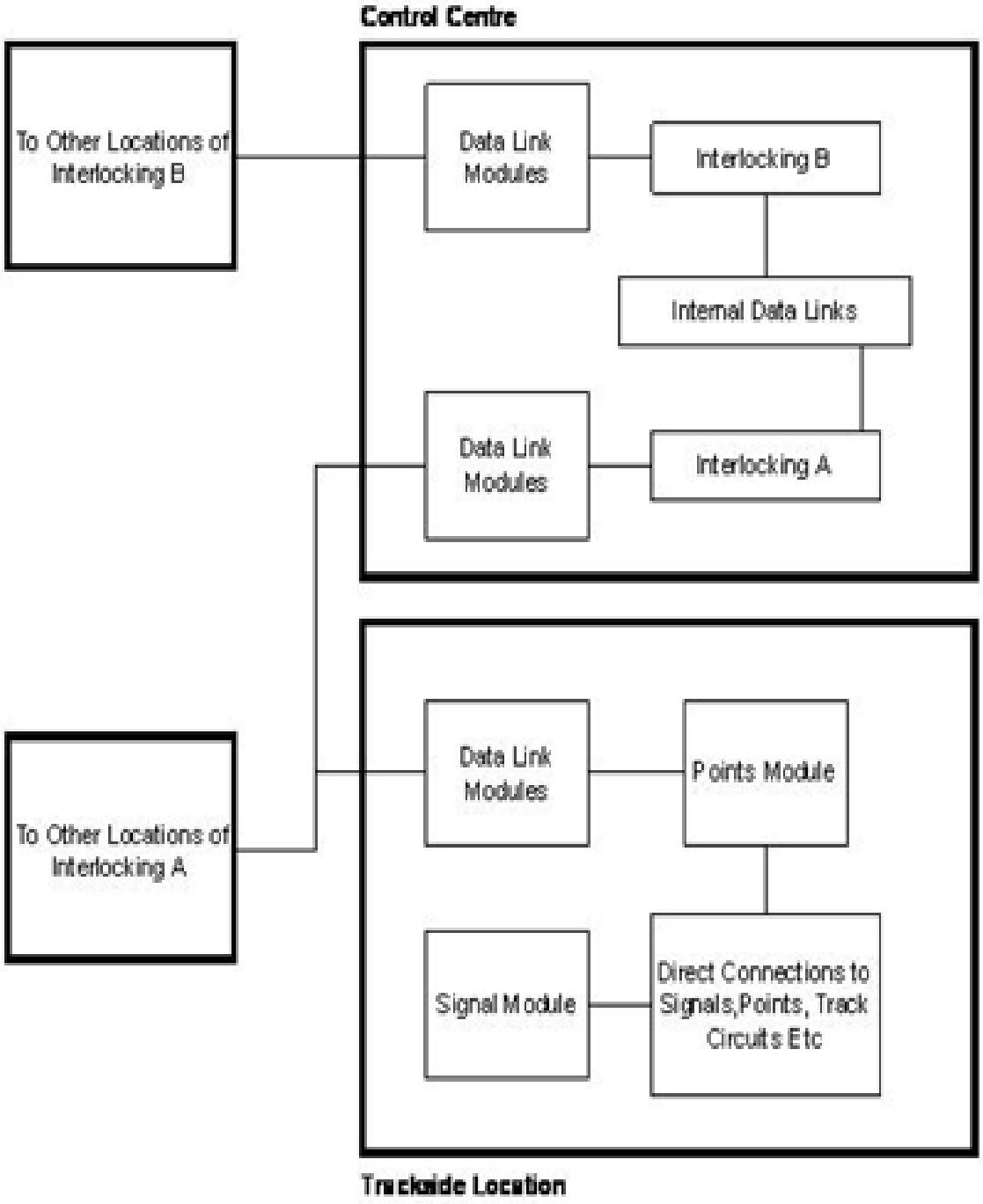


Figure 2 – Block Layout of SSI System

WESTRACE ELECTRONIC INTERLOCKINGS

General

Westrace is a modular computer based system for local interlockings. Each object controller within the system controls a signalling function. Extra modules can be added to increase the system's capacity. It can be connected to communicate to a control center, monitoring or to other Westrace systems over Ethernet TCP/IP networks (WAN).

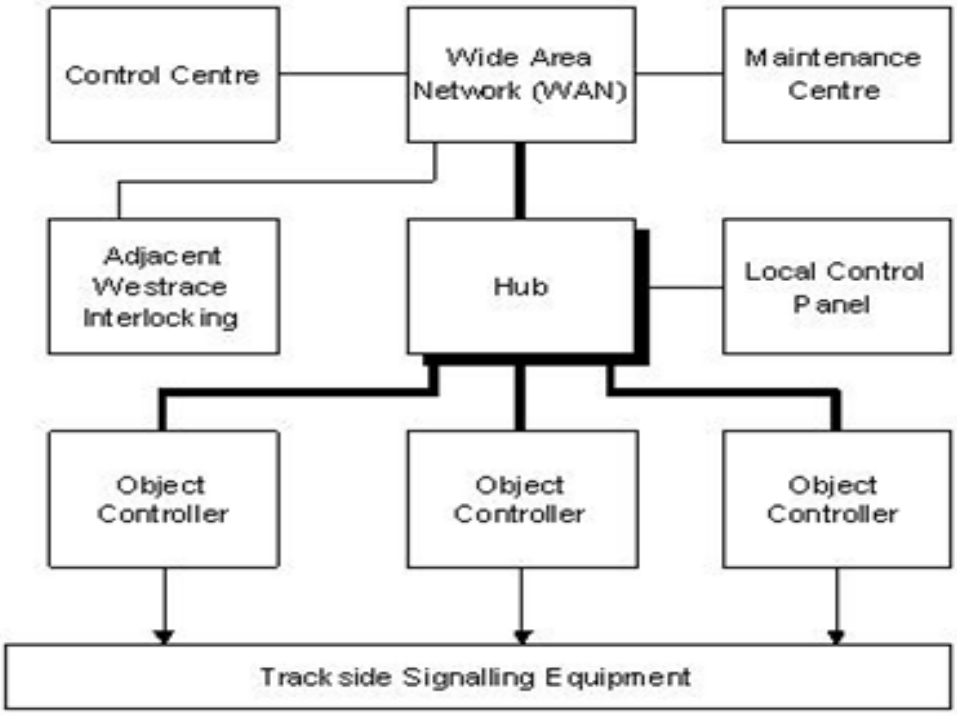


Figure 3 – Block Layout of a Westrace System

WESTLOCK ELECTRONIC INTERLOCKINGS

General

Westlock is a fourth-generation computer-based interlocking, based on SSI, with greatly enhanced hardware and new software tools to aid design, testing, and maintenance.

A Westlock interlocking can take the place of one or more existing SSIs, with no need to replace the trackside infrastructure.

Every Westlock Interlocking requires the following sub- systems:

a) a Central Interlocking Processor (CIP)

b) a local Technician's Workstation (TW(L)

c) one or more Trackside Interfaces (TIF)

d) Zero or one Control System Gateway (CSG) depending upon the Control System.

The CIP and TIF sub-systems are based on a range of modules that are configured to produce the functionality required for each sub-system.

The Technician's Workstation and Control System Gateway are Compact PCI based equipment.

Field equipment uses modules inherited from the SSI system, i.e. Data Link Modules (DLM), Long Distance Terminals (LDT), Signal Modules, and Points Modules. Communication between field equipment is via trackside data links.

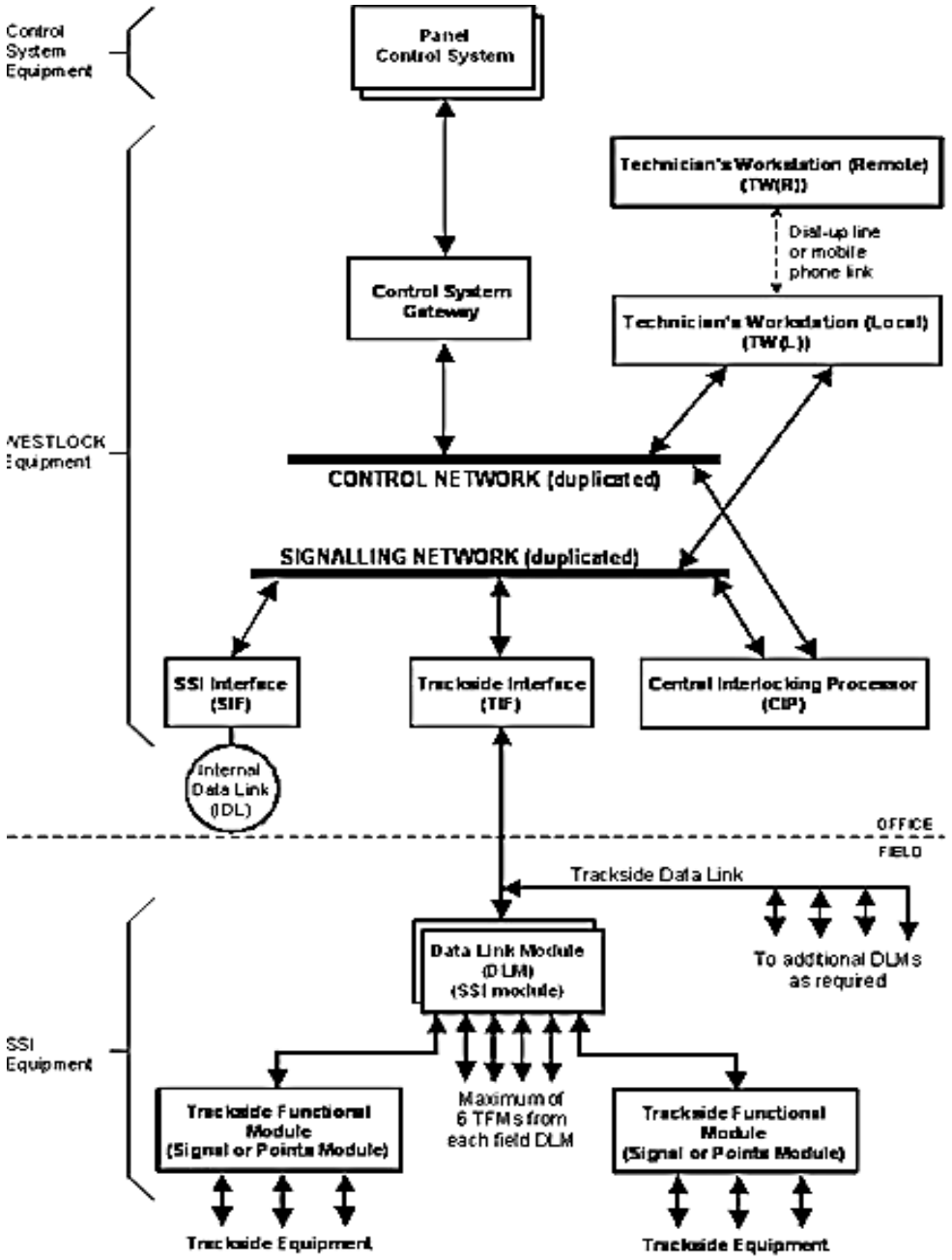


Figure 4 – Typical Westlock Interlocking

SMARTLOCK ELECTRONIC INTERLOCKINGS

General

Smartlock is a computer-based interlocking, designed specifically as a successor to SSI. The system offers updated facilities for the maintainer and improved application engineering tools for test and incident analysis.

The system retains the trackside communications architecture from SSI.

A Smartlock interlocking can take the place of one or more existing SSI, with no need to replace the trackside infrastructure.

Every Smartlock Interlocking requires the following sub-systems as a minimum:

a) a Central Interlocking (CIXL);

b) one or two Trackside Interface Communications Cubicles (TICC);

c) a Support System (SSys)

The CIXL provides a 2-out-of-3 safety computer configured to execute the interlocking logic rules. This also contains the I/O required to communicate with the signallers control system and with the TICC.

The TICC is responsible for managing the trackside communications and contains up to four pairs of gateways and their associated front ends. The TICC also accommodates pairs of SSI Datalink Modules (DLM) or Long Distance Terminals (LDT).

The SSys comprises a dual redundant server (SSer) and one or more client terminals, in addition to a time source and switches and routers for the networks in the system.

The Support system provides the diagnostic, logging and technician control facilities via local client terminals located in the SCC or connected by a LAN within the signalling
centre, a printer and where required remote client terminal facilities.

The trackside interface to the signalling objects is by use of SSI technology, i.e. DLM, LDT, Signal Modules and Points Modules.

Communication between field equipment is via trackside data links.

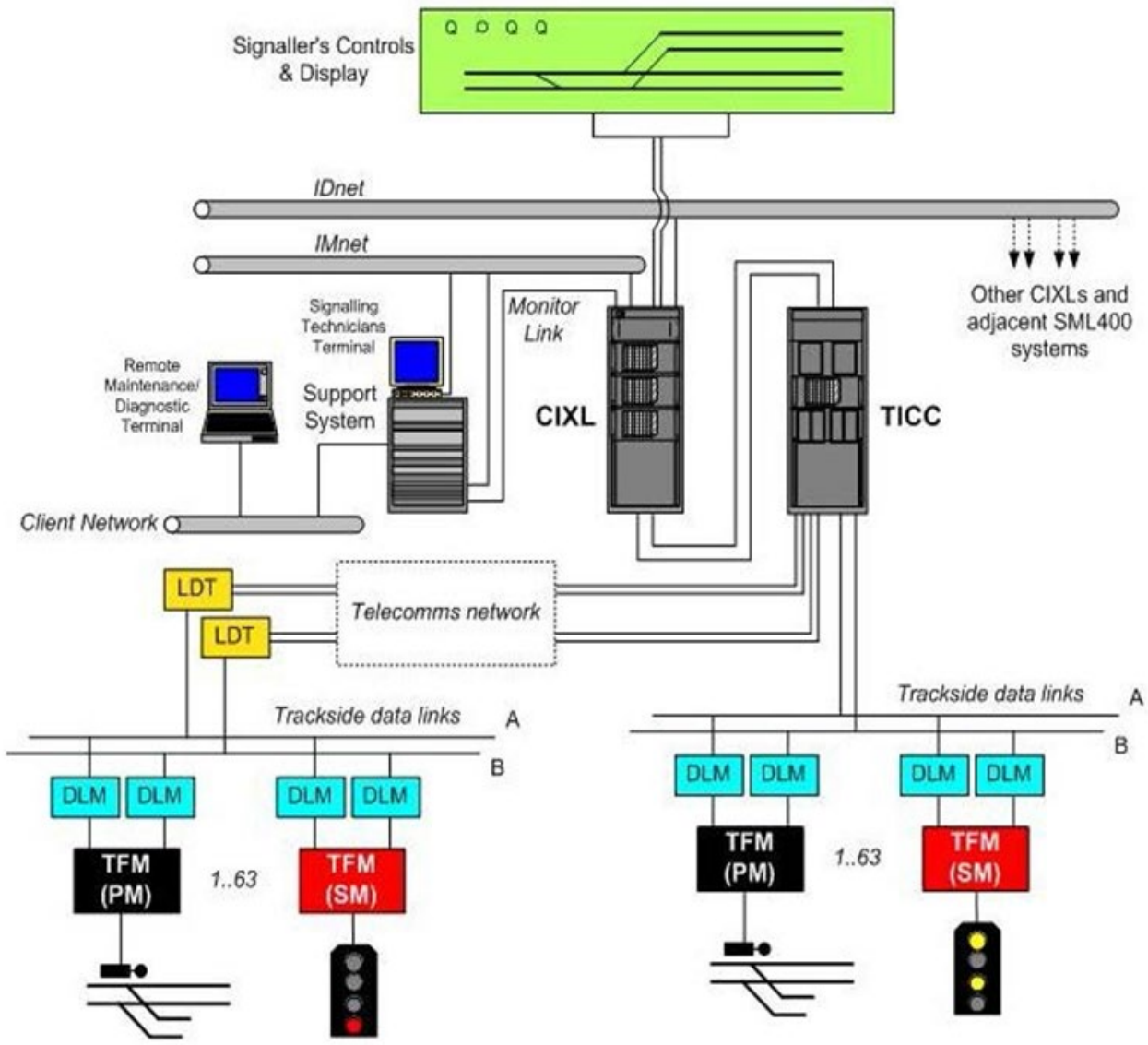


Figure 5 – Typical SMARTLOCK Interlocking

VITAL HARMON LOGIC CONTROLLER

The Vital Harmon Logic Controller (VHLC) is a Computer Based Interlocking (CBI) capable of driving signal aspects, controlling points and interfacing with other equipment such as track circuits.

It is a microprocessor based replacement for conventional relay-based interlocking systems intended to significantly reduce the number of vital relays needed to control a particular section of the railway.

As well as for signal interlocking control, VHLCs can be used at level crossings to undertake crossing control functions. VHLC systems are designed to operate in a distributed control configuration rather than a centralised control configuration.

As such, VHLC systems are located in trackside REBs close to the area of railway for which control is being provided. Non-vital communication links are provided between the VHLC and the associated controlling signal box.

The VHLC system architecture employs two microprocessors in a checked-redundant configuration to provide security against random component failures.

The VHLC consists of a cabinet, as shown in Figure 6 below, within which a series of modules, as described below, are contained. These modules shall be installed within slots in the cabinet and plug into corresponding connectors on the “back board”.

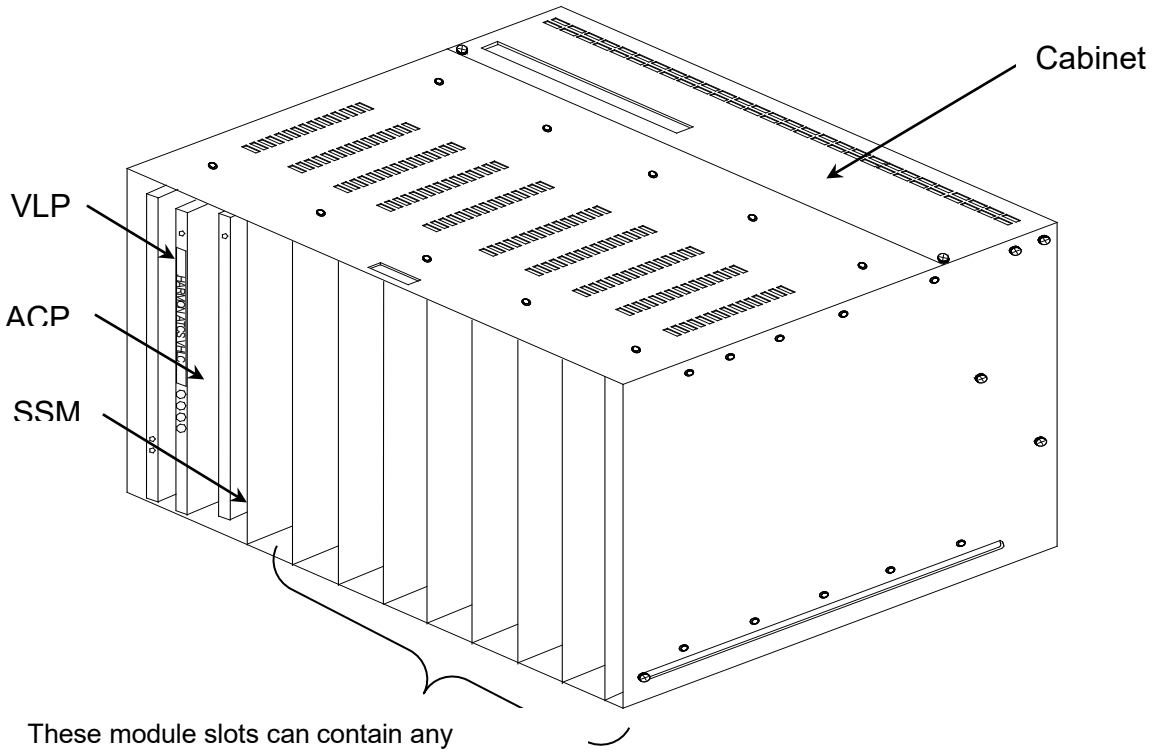


Figure 6 – VHLC Cabinet

Vital Logic Processor

The VLP shall always be inserted into the first module slot.

This is the central processor module for the VHLC and it holds the vital executive software for the system. The Vital Logic Processor (VLP) handles all of the processing necessary for the safe interpretation of inputs, the vital delivery of outputs, the evaluation of vital data and the testing of all vital input and output (I/O) and internal VHLC circuitry. The VLP has two processors, which constantly check and verify each other's safe operation.

Auxiliary Communications Processor

The ACP shall be installed in the second module slot.

The Auxiliary Communication Processor (ACP) handles all of the communication tasks for the VHLC. It contains a battery backed memory for logging diagnostic information or events at the interlocking. An important part of the ACP is the sixteen character, four button, Control/Display Unit (CDU) that can be used during system set-up and to access diagnostic information. There is also a port available for interfacing with a portable PC if necessary.

Site Specific Module

The SSM shall be installed in the third module slot and is set back from all other modules.

The Site Specific Module (SSM) contains the application logic, system configuration data and set-up data applying to a particular site. This information is stored on electronically programmable read only memory (EPROM).

Vital General Purpose Input Output Module

The Vital General Purpose Input Output Module (VGPIO) provides eight vital relay driver outputs and eight vital general purpose voltage sensing inputs. It is, therefore, two modules stacked together, the lower module processes the inputs whilst the upper module processes the outputs. Each VHLC unit can utilise up to nine VGPIO modules in slots 4 to 12. Connection to the backboard is made via a cable with a keyed connector, thereby, preventing any other module from being installed in a slot wired for a VGPIO.

Vital General Purpose Input Module

The Vital General Purpose Input Module (VGPI) has either eight (8VGPI) or sixteen (16VGPI) vital inputs and these are functionally identical to those found on the VGPIO. Each VHLC unit can utilise up to nine VGPI modules in slots 4 to 12. Connection to the backboard is made via a cable with a keyed connector, thereby preventing any other module being installed in a slot wired for a VGPI.

Non Vital Input Output Module

Each Non Vital Input Output Module (NVIO) contains sixteen non-vital, bi polar relay driver outputs and 16 non-vital, general purpose voltage sensing inputs. Each VHLC unit can utilise up to nine NVIO modules in slots 4 to 12. Connections to the NVIO are made using a cable with a keyed connector, thereby preventing other modules from being installed in a slot wired for a NVIO.

Vital Signal Driver Alternating Current (110V AC) Module

The Vital Signal Driver Alternating Current Module (VSDAC) provides 12 outputs for driving lamps or other types of equipment load. Each output is capable of supplying 0.8 Amps RMS continuous current, with the exception of outputs 4, 5 and 12 which are capable of supplying 1.5 Amps RMS continuous current.

The load of the entire module shall not exceed 9 Amps RMS. The VSDAC module does not generate the voltage required for the VSDAC outputs, instead it contains electronic switches to connect the output to the supply voltage. Each VHLC unit can utilise up to five VSDAC modules in slots 4 to 12. Connection to the backboard is made via a cable with a keyed connector, thereby preventing any other module being installed in a slot wired for a VSDAC.

Backboard

The backboard provides an interface between all plug-in modules, the power supply and Serial Interface Modules. However, the two sides of the backboard serve different purposes. The front of the backboard, which can be seen from the inside of the cabinet, houses a number of keyed connectors. These prevent a module from being inserted in the wrong module slot. It also houses a number if identification jumpers.

These are used to set the VHLC Chassis identification so that it is the same as that contained within the safety logic. This feature prevents modules from being installed in the wrong VHLC system. Alternatively, some modules use Dual Inline Package (DIP) switches to perform this task. The rear of the backboard, which is visible from the back of the cabinet, houses the power supply and Serial Interface Modules (SIM).

Power Supply Module

The +5VDC Power Supply Module converts the incoming +12VDC power supply to +5VDC for use by the internal electronics of the system. The switch for controlling power to the VHLC logic is located on this module. There can still be power supplied to the I/O modules when this is switched to off.

Serial Interface Module

Several types of Serial Interface Module (SIM) are available for the VHLC, such as the Current Loop Adaptor (CLA), which provides an interface between a local control panel and the VHLC, and the RS-232 Interface Module, which provides an isolated serial interface for communicating with the VHLC using RS-232 protocol.

Vital Signal Driver AC Standard Shunt

The Vital Signal Driver AC (VSDAC) Standard Shunt unit is used in conjunction with the VHLC at interlocking sites to reduce the voltage that is induced on the input lines to the VSDAC Module and to reduce the effects of capacitive coupling.

End

Includes:	Technicians' terminal and interlocking cubicle
Excludes:	TFM, DLM and Datalinks

DAILY SERVICES

NOTE: *The tasks in this section relate to the Technicians' terminal equipment.*

1. Printer

1.1 Check the printer paper supply and reload as required.

1.2 Request a fault summary printout and liaise with the signalling fault control if action is required. The printout shall be kept for a minimum of fourteen days.

2. Tape Logger (where fitted)

2.1 Check tape logger for the following:

a) The power switch is illuminated.

b) Both the red 'READY' indicators are illuminated.

c) The red 'BUSY' indicator is illuminated for the selected drive.

2.2 Where provided, remove the standby tape and load a replacement tape.

See NR/SMS/PartC/IS00 Electronic Interlockings – General).

3. PC Based Logger (where fitted)

3.1 Check the power is on to the PC.

3.2 Check that the rotating activity indicator is spinning and the active drive indicator light for activity.

If there is little SSI activity, log data can be generated by requesting a background scan from the Technician's control menu.

4. General

4.1 Check that on completion of the tasks, that the keyboard is locked.

4.2 Check that the work area is clean and tidy.

REGULAR SERVICES

NOTE: *The tasks in this section relate to the Technicians' terminal equipment.*

5. Printer

5.1 Check the quality of the printout and replace printer ribbon/cartridge if required.

6. Tape Logger (where fitted)

6.1 Check that the air-cooling vent is clean and clear of obstructions.

6.2 Clean the read/write heads.

6.3 Check that logger is recording correctly by reading back data from the tape.

7. PC Based Logger (where fitted)

7.1 Check the air-cooling vent filter is clean. If necessary clean or replace as per the manufacturer's instructions.

7.2 Observe that any fans are rotating (where possible).

7.3 Access the Command Menu of the Technician's terminal and select Option three (Eject Logging Tape/Disc & Set to Standby).

This facility allows the operator to remove the tape/disc that is currently in use.

NOTE: *Check the standby tape/disc is inserted in the recording device and that the corresponding READY Indication is illuminated prior to selecting this option.*

7.4 On selecting option three the following is displayed on the screen:

a) "Enter option * 3 Following selection correct? 3Y" Press the [Y] key to confirm that this is the correct option.

b) The current logging tape/disc shall be ejected and logging shall continue on the standby tape/disc.

c) Remove the ejected tape/disc and replace it with a new standby tape/disc. The ejected tape/disc can now be used on the analysis machine to confirm system is logging data correctly.

7.5 Check (where installed) the Graphical Replay feature is functioning properly by running any recorded data on the Graphical Replay terminal.

8. Technicians' Terminal

8.1 Observe that all the system 'healthy' indicators are illuminated.

8.2 Check that the keyboard is locked before dusting.

8.3 Observe with the VDU switched on that the integral indicator is illuminated and the quality of the display is satisfactory. Check the correct time and date is displayed (adjust if necessary).

SERVICE A

9. Interlocking Cubicle

9.1 Dust the equipment and clean the cubicle. Check that the area around the cubicle is clean and tidy.

9.2 Examine the equipment, terminals, cable, and cable connectors. Particularly look for physical damage, overheating and arcing.

9.3 On the MPM, PPM and DMPM check that the memory modules are securely fitted and sealed (not on Mk1 interlockings). Observe the following indications are illuminated and showing a steady light:

Front Panel

a) All System Indicators.

b) Rear Panel.

c) Power.

d) Fused supply (not on the PPM).

e) System.

All rear panel indicators are red.

9.4 On the DLM Observe that the red power indicators are illuminated and showing a steady light.

9.5 On the LDT Observe that the following red indicators are illuminated and showing a steady light.

Power.

System.

PCM Tx Clock.

PCM Rx Clock.

PCM Rx Line.

Data from SSI.

Data to SSI.

Data to PCM.

NOTE: *In the site logbook any LED indications that are not illuminated and report them to your supervisor.*

SERVICE B

Record all the following tasks in the logbook.

10. Technicians' Terminal

10.1 Dust the equipment and clean the inside of the Technicians' terminal pedestal.

10.2 Examine the equipment, terminals, cable, and cable connectors. Particularly look for physical damage, overheating and arcing.

10.3 Where a spare terminal is provided, check its function by substitution with the working unit.

11. PC Based Logger (where fitted)

11.1 Check the operation of the spare PC based logger by substitution with the working unit.

12. Modem

12.1 Observe that the power indicator is illuminated.

12.2 Perform the self-test procedure (if this is provided).

13. Function Tests

13.1 If relay controlled, apply the NR/SMS/PartB/Test/060 (Emergency Signals on Control (ESOC) Test), where provided. Confirm correct operation.

This task is not required where the emergency signals on control is hard wired in the power circuit. The 'All Signals On' button should be pressed for a minimum of 15 seconds.

PERIODIC TASKS

14. Technicians' Terminal

Anti-static precautions shall be taken for this task.

14.1 Replace the battery on the memory board. The suggested method is by substitution with a spare memory board where the battery has already been replaced.

During memory board change the logging & the control facility of the Technicians' terminal is lost. Immediately prior to the start of the work, note the current state of the faults on the printer and the applied Technician controls.

Remove the logging tape/disc according to local procedures and power down the Technicians' terminal. Substitute the spare memory board with the working memory board Re power the Technicians' terminal and examine the VDU screen.

The clock should be operational. Try operating the menu system. It should be possible to change from option to option.

Check that the time, configuration, and terminal name are set up properly. Change them if necessary, using the menu options.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/IS12		
Westrace Electronic Interlockings		
Issue No: 04	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Westrace Electronic Interlockings
Excludes:	All other type of Electronic Interlockings

General

Do not use an Avometer (or any similar meter) on the Ohms x100 range on the Westrace system. The 15V DC output from the meter on this range might damage the electronic circuits.

Similarly, do not use any form of buzzer or lamp for continuity testing on the system.

This NR/SMS covers all Westrace systems for first line maintenance only. All other equipment at the installation is covered by its own relevant NR/SMS.

More information on this system can be found in the Westrace Equipment Manual and the Westrace Diagnostic User Guide.

SERVICE A

1. Event Logging PC and Printer

1.1 Check the event logging PC is switched on and correctly connected to the printer and modem.

1.2 Check the printer is operational and has paper and ink/toner.

1.3 Request a printout and check for any outstanding faults. Investigate and clear as necessary.

1.4 Check that the area is clean and tidy. Remove any rubbish and debris.

2. Interlocking Equipment

2.1 Check all cubicles, housings, cases, boxes and cable troughs are secure and undamaged.

2.2 Check for any fault indications on the cards Investigate and rectify any faults as necessary.

2.3 Check all equipment doors are closed.

SERVICE B

3. Interlocking Equipment

3.1 Measure (where accessible) the power supply voltages. Compare these with previous readings; any variations or deficiencies are to be investigated as corrective maintenance.

3.2 Examine the EMC gaskets; any found damaged shall be replaced at the earliest opportunity.

3.3 Examine the EMC bond cables and connection points. Check they are clean, secure, undamaged and not in any way degraded. Any defects found shall be undertaken as corrective maintenance.

4. WESTLOCK Trackside Equipment (Zone Controller), if provided

4.1 Remove and test each Surge Suppression Cassette using the Surge Cassette Test Unit.

4.2 If the Surge Suppression Cassette fails, rectify as corrective maintenance.

PERIODIC TASKS

5. Interlocking Equipment

5.1 Replace the Lithium battery within the Diagnostic Module (DM). Technical support staff and/or equipment specialists may manage this task separately.

END

Includes:	CIP and TIF cubicles, Technicians' Workstation, Technicians' Facility and CSG
Excludes:	Lineside TFM, DLM and Datalinks

Do not use an Avometer (or any similar meter) on the Ohms x100 range on the Westlock system. The 15V DC output from the meter on this range can damage the electronic circuits. Similarly, do not use any form of buzzer or lamp for continuity testing on the system.

This NR/SMS covers all Westlock systems for first line maintenance only. All other equipment at the installation is covered by its own relevant NR/SMS.

More information on this system can be found in the Westlock Technician's Workstation manuals.

REGULAR SERVICES

1. Technicians' Workstation or Technicians' Facility

1.1 Check the TW or TF is functioning and ready for use.

Failure of a peripheral device such as the TW/TF monitor will not be apparent until the system is used to diagnose a fault.

1.2 Check the fault list for any unexpected reports.

Critical and Non-Critical faults are reported to the Signaller. Warnings or minor faults which do not affect the operation of the railway but may provide an early warning of a developing problem are shown in the TW/TF fault list.

1.3 Where fitted, check the paper supply and reload as required. Check the printer's output for legibility. If necessary, replace the printer cartridge following instructions in printer manufacturer's handbook.

1.4 Technicians' Workstation (TW): Check disks are fitted in both removable logging drive ports.

A disk may have been removed for incident investigation and not replaced. Rotation of disks through a pool of spares is not required.

1.5 Technicians' Facility (TF) – Local only: Unscrew the thumbscrew on the front of the PC and check disks are fitted in both removable logging drive ports.

The logging drives on a TF-Local are fitted to the front of the unit. The removable drive fitted to the rear contains the operating system and shall not be removed. No logging drives are fitted to TF-Servers or TF-Remotes.

1.6 As required, clean and tidy the work area.

2. Westlock interlocking (including CIP/TIF/FEP network switches and routers)

2.1 Check all ports and cabling for any unexpected changes or additions. Check that no additional equipment has been plugged into normally unused ports or that any cables have been re-routed via extra items of equipment. Any such items might pose a security risk and shall be escalated.

SERVICE A

3. Technicians' Workstation or Control System Gateway (where fitted) Compact PCI based equipment.

3.1 Check that the air-cooling vent filter is clean. If necessary clean or replace the filter in accordance with manufacturer's instructions.

3.2 Check that the cooling fans are rotating.

Technicians' Workstation Only

3.3 Check that the quality of the display is acceptable.

3.4 Check that the correct time is displayed at the bottom right corner of the display screen. Time is derived from a connected radio clock. If time is incorrect, investigate radio clock receiver fault.

4. Technicians' Facility or Control System Gateway (where fitted) BlueChip PC based equipment.

4.1 Check that the air-cooling vent filter is clean. If necessary clean or replace the filter in accordance with manufacturer's instructions.

4.2 Check that the cooling fans are operating.

4.3 Print and review Technician controls applied to the interlocking. Comparison should be made with site logbook for consistency. Any discrepancies shall be investigated and escalated. Retain a paper copy for reference until the next review.

5. FEP Module Changeover

5.1 Check the Standby OK LED on both PMs is Green.

5.2 Check the Ethernet A and Ethernet B Activity LEDs are both flashing Yellow.

5.3 If both steps 5.1 and 5.2 are true then press the Changeover button on the active PM.

5.4 After two seconds check the Active LED on the previously active PM is Off and Green on the new active PM.

If the changeover fails and the active PM does not swap then this shall be escalated.

6. WESTLOCK Trackside Equipment (Zone Controller), if provided

6.1 Check captive screws are tight on the PM, RSA and SOM110 modules.

6.2 Where 24V DC Power Module is fitted, observe that all the system 'healthy' indicators are illuminated, as follows:

Unit	Indication	Normal State
24V DC Power Supply	DC OK	Green steady
24V DC Buffer (if fitted)	Status	Green steady
24V DC Buffer (if fitted)	Diagnosis	Off
24V DC Buffer (if fitted)	Check Input Voltage	Off

Table 1 – Module Indications

SERVICE B

7. Technicians' Workstation or Technicians' Facility

7.1 Examine the equipment, terminals, cables, and cable connectors. Particularly look for physical damage, overheating, and arcing. Rectify as necessary as corrective maintenance.

7.2 Clean and dust keyboards and VDU screens as required, using a soft cloth moistened with a detergent solution. Wring out the cloth before use to remove excess detergent solution.

7.3 Carry out NR/SMS/PartB/Test/060 (Emergency Signals On Control (ESOC) Test) for the Westlock system.

More information on this can be found in the Technician's Workstation Technical Manual, Technician's Controls, ESOC Wizard section.

8. Control System Gateway

8.1 Examine the equipment, terminals, cables, and cable connectors. Particularly look for physical damage, overheating and arcing. Rectify as necessary as corrective maintenance.

8.2 Clean and dust the keyboard and VDU screen on the KVM unit as required, using a soft cloth moistened with a detergent solution. Wring out the cloth before use to remove excess detergent solution.

Do not allow any moisture to enter any equipment apertures. Dry off surfaces as soon as possible using a dry lint-free cloth. Do not use abrasive cleaners or pads.

9. WESTLOCK Cubicle

9.1 Examine the equipment, terminals, cables, and cable connectors. Particularly look for physical damage, overheating and arcing. Rectify as necessary as corrective maintenance.

PERIODIC TASK 1

10. Technicians' Facility or Control System Gateway (where fitted) BlueChip PC based equipment

10.1 Remove and replace the lithium battery.

Refer to NR/SMS/Appendix/11 (General Information on the Siemens Westlock Interlocking and Zone Controller).

PERIODIC TASK 2

11. Technicians' Workstation or Control System Gateway (where fitted) Compact PCI based equipment

11.1 Remove and replace the lithium battery.

Refer to NR/SMS/Appendix/11 (General Information on the Siemens Westlock Interlocking and Zone Controller).

PERIODIC TASK 3

12. WESTLOCK CIP and TIF Main Processors

12.1 After 14 years from the date of manufacture, Main Processor modules (MPs) used in the CIP and TIF shall be replaced with serviceable spares.

Refer to NR/SMS/Appendix/11 (General Information on the Siemens Westlock Interlocking and Zone Controller).

END

Includes:	CIXL, TICC, SSys and SmartIO
Excludes:	Lineside TFM, DLM and Datalinks

GENERAL

Do not use an Avometer (or any similar meter) on the Ohms x100 range on the Smartlock system.

The 15V DC output from the meter on this range damages the electronic circuits. Similarly, do not use any form of buzzer or lamp for continuity testing on the system.

This NR/SMS covers all Smartlock systems for first line maintenance only. All other equipment at the installation is covered by its own relevant NR/SMS.

More information on this system can be found in the ALSTOM Transport, Smartlock System and Subsystem Description, Smartlock Maintenance Manual, SMARTLOCK Operation Manual and Smartlock HMI Operation Manual.

DAILY SERVICES

1. Support System

1.1 Using any client terminal, check that the three coloured health indicator is correctly animated.

1.2 Check system status by examining the Alarms List for any outstanding faults.

Investigate and rectify any faults as necessary.

1.3 On completion of tasks, log off from the terminal.

1.4 Clean and tidy the work area as required.

REGULAR SERVICES

2. Support System

2.1 Check for correct event recording by examining current data from the support server.

2.2 Check that the NTP server was last synchronised with MSF within the last week.

Investigate and rectify any defects as necessary as corrective maintenance.

2.3 Check that clocks of both Support Servers are in line with the broadcast time and date displayed on the NTP time server. Rectify any defects as necessary.

2.4 Check for correct operation of the KVM switch by selecting each of the Support Servers and the local client and gateway PCs.

3. Remote Client

3.1 Check for correct operation of the remote client terminal by logging on to the system.

Rectify or escalate any defects as required as corrective maintenance.

On completion, log off.

4. Central Interlocking

4.1 Check for correct operation of the cooling fans. Investigate and rectify any faults as necessary as corrective maintenance.

SERVICE A

5. Support System

5.1 Check all printers' output for legibility. If necessary, replace printer consumables following instructions in printer manufacturer's handbook.

5.2 Check the air-cooling vent filters are clean. If necessary, clean or replace the filter in accordance with manufacturer's instructions.

5.3 Check for correct operation of the graphical event replay facilities by downloading a period of logged data and performing a replay.

5.4 Dust and clean the Client Terminal keyboards, VDU screens and Signaller's Alarm Screen as required using a soft cloth moistened with a detergent solution.

Wring out the cloth before use to remove excess detergent solution.

Check moisture does not enter equipment apertures and is dried off surfaces as soon as possible using a dry lint-free cloth. Do not use abrasive cleaners or pads.

6. Remote Client

Dust and clean keyboards, VDU screens and router as required.

SERVICE B

7. Equipment Cubicles

7.1 Examine the equipment, terminals, cables and cable connectors. Particularly look for security, physical damage, overheating and arcing. Rectify as necessary.

7.2 Clean the exterior surfaces and dust the interior of equipment cubicles using a dry lint free cloth.

7.3 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

7.4 As provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

7.5 As provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This will be necessary if the operation has become intermittent or jerky.

7.6 As provided, check the Althorn (formally Rugby) clock for correct operation.

7.7 Check that the cubicle doors are closed when cleaning the exterior and check leads, and connectors are not disturbed during cleaning.

8. Function Tests

8.1 NR/SMS/PartB/Test/060 (Emergency Signals on Control (ESOC) Test) - Smartlock.

END

SERVICE A

1. Cleaning

1.1 Clean the outside of the cabinet using a dry lint-free cloth.

1.2 Check that that the system ventilation holes are uncovered and unclogged. Clean if necessary.

1.3 Check for foreign material inside the VHLC cabinet. Remove if safe to do so, or report these findings as corrective maintenance.

1.4 Dust the inside of the cabinet.

2. Visual Checks – Front of Cabinet

2.1 Check that the VHLC is securely mounted.

2.2 Check that all modules are fully seated within the cabinet.

2.3 Check for any visual damage. Report any damage as corrective maintenance so that replacement can be arranged as necessary.

2.4 Check that the green “Health” LED is illuminated on all modules.

2.5 Check that the eight yellow “Status” LEDs on the VLP Module are visually active. These should be lit sequentially in rapid succession.

3. Visual Checks – Rear of Cabinet

3.1 Check that the Power Supply Module is securely fastened.

3.2 Interlockings only, check that the CLA Module is securely fastened.

3.3 Check that both the +5Vdc Pow,er Supply and Battery LEDs are illuminated on the +5V Power Supply Module.

3.4 Interlockings only, check that the data LED indicators are active on the CLA Module when the Local Control Panel is operated.

3.5 If fitted, check that all Serial Interface Modules (SIM) are securely mounted and that the data transmit/receive LEDs are active.

3.6 Check that all serial cables are securely fastened to the modules.

3.7 Check that all I/O connectors are securely fastened and that the cable restraining bars are effective.

SERVICE B

4. Component Checks

4.1 Interlocking only, Check that all modems and PSDs, associated with the VHLC are functioning correctly and that the modem transfer audio levels are correct.

5. Voltage Tests

5.1 Carry out the VHLC VOLTAGE TEST (152)

Appendix A

Remote Interrogation

The VHLC Data Logger has the capability to be remotely interrogated, such that system operation and fault data can be down loaded from the Logger and interpreted by an appropriately competent engineer.

A detailed description of how to carry out this process can be found in the appropriate manufacturer's proprietary manual.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/IS20		
Siemens SIMIS-W Interlocking		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Siemens SIMIS-W Interlocking
Excludes:	All other Siemens and other Interlocking Types

General

Mobile phones shall be switched off within 3 meters of electronic equipment or an equipment cubicle when any of the doors are open.

Cubicles provide electrostatic protection for the contained electronic equipment. Front and rear doors shall be kept closed at all times except when undertaking maintenance.

Retainers/jackscrews on the system cable retainers shall only be finger tight. Any corrective maintenance issues shall be undertaken as detailed in NR/SMS/PartA/A02 (Preventative & Corrective Maintenance).

DAILY SERVICE

1. Service & Diagnostic Terminal (S&D)

1.1 Check that the S&D terminal is correctly and securely connected to the Interlocking.

1.2 Request the fault list and check for any outstanding faults. Rectify or report.

1.3 Check that the work area is clean and tidy.

SERVICE A

2. Interlocking Cabinet(s)

2.1 Check that the cubicle doors are securely closed and as necessary locked. Inform your SM(S) if doors are found open.

2.2 Check that the cabinet earthing is securely mechanically connected.

2.3 Check that all the cable shields are securely mechanically connected to earth.

2.4 Check that there are no permanently illuminated RED LEDs on any of the SIMIS-W core components. Rectify or report.

2.5 Check that the “RF” LED is illuminated on all three VESUV3 boards in the IIC/OMC. Rectify or report.

3. Interlocking Cabinet Fans

Rectify or report any problems as corrective maintenance.

3.1 Check whether the operating voltage is present. The green LED at the front of the fan shall be illuminated.

3.2 Check the fan speed is O.K. The red LED at the front of the fan shall be extinguished.

3.3 Check that when the blue button is pressed, the red LED illuminates. Check that the fan fault has been registered on the S&D computer and then clear the fault from the log.

3.4 Check and if necessary clean or exchange the filter mats.

4. Service & Diagnostic Terminal (S&D) Data Base

Recording media can be a memory stick or a formatted floppy disk depending on the system hardware.

4.1 Back up the data on the S&D terminal to an external recording media using the following method:

a) Click the TRS button to start the backup (to abort while running, click the TRC button). Click the Execute button.

b) Connect the recording media to the S&D terminal and Click the CDI button to confirm that the media has been connected.

c) The data now copies to the recording media.

If there is a problem click the TRR button to repeat the last successful back up process e.g. when the recording media becomes defective or gets lost.

5. Final

5.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

5.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

6. Interlocking Cubicle(s)

6.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

6.2 Check that the cubicle doors are closed when cleaning the exterior. Do not disturb leads and connectors during cleaning.

7. Interlocking Equipment

7.1 Carefully dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

Retainers/jackscrews on the system cable retainers shall only be finger tight.

8. All Signals on Test

Bournemouth

8.1 Carry out an “All Signals on Test”, This test is carried out in liaison with the Signaller. There are 2 systems to be tested.

a) The first is on screen and these are divided into three areas (Bournemouth, Christchurch and Branksome).

b) The second is manual buttons, these are located at each end of the console, which has signals on.

The “All Signals On” button shall be pressed for a minimum of 5 seconds.

Havant

8.2 Carry out an “All Signals on Test”. This test is carried out in liaison with the Signaller. There are 2 systems to be tested

a) The first is on screen and these are divided into seven areas.

- Havant SGRC
- Ditcham SGRC
- Farlington Triangle SGRC
- Portchester SGRC

- Fratton SGRC
- Southsea SGRC
- Harbour SGRC

b) The second is two Manual All Signals on Buttons on the Emergency Consoles.

The “All Signals On” button shall be pressed for a minimum of 5 seconds.

NOTE: *Once the emergency Manual Button(s) have been operated the signals can only be replaced to normal working via the individual area VICOS SGRC.*

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

SERVICE A

No possession arrangements are required to perform Service A, as all the tasks performed during this service are non-intrusive.

1. Cleaning

1.1 Clean the outside of the cabinet using a dry lint free cloth.

1.2 Check that the system ventilation holes are uncovered and unclogged. Clean if necessary.

1.3 Check for foreign material inside the HXP-3 cabinet. Remove if safe to do so, or report these findings as corrective maintenance.

2. Visual Checks

2.1 Check that the HXP-3 is securely mounted.

2.2 Check that the equipment covers are properly installed.

2.3 Check that all modules are fully seated within the cabinet.

2.4 Check for visual damage to modules. Replace as necessary. Report any damage as corrective maintenance so that replacement can be arranged as necessary.

2.5 Check that there is no visual damage to external cables. Report any damage as corrective maintenance so that replacement can be arranged as necessary.

2.6 Check that there is a spare fuse on each TLM and RYD Module.

2.7 Check that the real time clock on the HXP-3 is consistent with the time stated on the associated VHLC unit. If this is not the case, contact your SM(S) for further instructions.

3. System Parameter Checks

Each of these tests is carried out via the Information Display Keypad (IDK) located on the front of the HXP-3 and recorded on the appropriate record card.

For system status codes refer to Appendix E.

3.1 Check that the STANDBY/AUTO/NORMAL switch on the TLM module is in the AUTO (centre) position.

3.2 Check that the NORMAL system is active. If the STANDBY system is active, arrange for the event logger to be interrogated to determine when the system changeover occurred and under what conditions.

Check that any corrective action is carried out and changeover to the NORMAL system before continuing.

3.3 Select Track #1 by pressing the TRACK SEL button; this toggles the display between Track #1 and Track#2.

3.4 Check and record the RX value.

a) Press the MONITOR SEL button.

b) Type the number 1 for RX.

c) Press the ENTER button.

d) The current RX value shall be displayed. This value shall be between 95 and 105. If this is not the case when the test is carried out, the RX value can be adjusted by referring to the procedure in Appendix A.

3.5 Check and record the Track Circuit Phase angle (PHASE) value.

a) Press the MONITOR SEL button.

b) Type the number 2 for the Track Circuit Phase angle value.

c) Press the ENTER button.

d) The current Track Circuit Phase angle value is displayed. This alternates with the compensated Phase angle if Phase Compensation (P-Comp) has been applied. The latter figure shall be preceded by the letter C.

e) The Track Circuit Phase angle shall be greater than 32. Values of less than 45 shall be reported to your SM(S).

f) Refer to Appendix B for instructions on how to adjust the Track Circuit Phase angle by using Phase Compensation.

3.6 Check and record the Ballast Compensation (BC) parameter.

a) Press the MONITOR SEL button.

b) Type the number 5, for Ballast Compensation parameter.

c) Press the ENTER button.

d) The current Ballast Compensation parameter is displayed.

e) Refer to the procedure in Appendix C of this document for instructions on how and why to adjust the Ballast Compensation parameter.

3.7 Check and record the Highest Stable RX (HS) and corresponding Track Circuit Phase angle values.

a) Press the MONITOR SEL button.

b) Type the number 6, for the Highest Stable RX value.

c) Press the ENTER button.

d) The Highest Stable RX and corresponding Track Circuit Phase angles are shown alternately.

3.8 Check and record the Lowest Stable Phase (LP) and corresponding RX values.

a) Press the MONITOR SEL button.

b) Type number 7, for the Lowest Stable Phase angle.

c) Press the ENTER button.

d) The Lowest Stable Phase angle and corresponding RX values are shown alternately.

3.9 Check and record the Transmitter Check TC value.

a) Press the MONITOR SEL button.

b) Type the number 9, for the Transmitter Check value.

c) Press the ENTER button.

d) The current Transmitter Check value is displayed. This shall normally be between “430” and “470”.

e) Values outside this range indicate a high impedance connection to the island track.

f) Refer to the procedure in Appendix D for instructions on how to make adjustments to the Transmitter Check value.

3.10 Check and record the current Phase Compensation (P-COMP) value.

a) Press the OPTION button.

b) Type the number 10 for Phase Compensation Adjustment.

c) The current Phase Compensation value is displayed.

d) Record the current Phase Compensation value.

e) When ballast conditions deteriorate to the extent that the HXP-3 goes into low phase condition, it is necessary to adjust the Phase Compensation value.

Refer to the procedure in Appendix B of this document for instructions on how to carry out such an adjustment.

3.11 Check and record the RX-Potentiometer (RX-POT) value.

a) Press the MONITOR SEL button.

b) Type the number 12, for the RX- Potentiometer value.

c) Press the ENTER button.

d) The current RX-Potentiometer value is displayed. This shall be within the range of “50” to “500”.

The RX-POT value should alternate with the compensated RX-POT value in instances where the Auto-RX function is in use.

3.12 Check and record the Approach Length value.

a) Press the MONITOR SEL button.

b) The value of Approach Length is displayed in the “ADJUST” window.

3.13 Check and record the Warning Time (WT) value.

a) Press the MONITOR SEL button.

b) The vale of Warning Time is displayed in the “ADJUST” Window.

3.14 Check and record the Track Enable (TK-ENA) value.

a) Press the OPTION button.

b) Type the number 1 for Track Enable.

c) Press the ENTER button.

d) The current value of Track Enable shall now be displayed in the “ADJUST” window.

e) Record the value on the ‘Crossing Location Record’.

3.15 Check and record the Frequency (TK-FD) value.

a) Press the OPTION button.

b) The current Frequency value shall now be displayed in the “ADJUST” window.

3.16 Check and record the Constant Warning/Motion Detect (CW-MD) value.

a) Press the OPTION button.

b) The current value shall now be displayed in the ‘ADJUST’ window.

3.17 Check and record the False Shunt RX (FS-RX) and False Shunt Timer (FS-TMR) values.

a) Press the OPTION SEL button.

b) Type in the number 20, for False Shunt Timer.

c) Press the ENTER button.

d) The current value of FS-RX shall now be displayed in the 'ADJUST' window.
e) While the FS-RX value is still on display, press the up arrow to display FS-TM.

3.18 Check and record the Approach Release RX (AR- RX) and Approach Release Timer (AR-TMR) values.

a) Press the OPTION SEL button.

b) Type in the number 22, for Approach Release Timer.

c) Press the ENTER button.

d) The current value of AR-RX shall now be displayed in the 'ADJUST' window.

e) While the AR-RX value is still on display, press the up arrow to display AR-TM.

3.19 Check that the values recorded in tasks 3.12 to 3.18 above match those on the "HXP Setup" sheet within the wiring diagrams.

3.20 Press the TRACK SEL button to display Track #2 and repeat steps 3.4 to 3.19 for Track #2 (if fitted).

SERVICE B

4. NORMAL/STANDBY Transfer Check

4.1 Set the Minute Timer switch on the TLM to 1 minute.

4.2 Toggle the STANDBY/AUTO/NORMAL switch on the TLM to the NORMAL (down) position.

4.3 Check that the MDR LED is on.

4.4 Toggle the STANDBY/AUTO/NORMAL switch to the AUTO position.

4.5 Temporarily install a mini shunt on both pins of the W14 jumper located on the front edge of the Normal System CPU module. It shall be noted that installing a mini shunt in this way can call the crossing.

4.6 Check that the MDR LED goes off as the MDR Drive ‘drops out’.

4.7 Check that power is transferred to the Standby System after a delay of 1 minute.

4.8 Temporarily install a mini shunt on both pins of the W14 jumper located on the front edge of the Standby System CPU module.

4.9 Check that the MDR drive is not energised and that the MDR LED is not illuminated.

4.10 Verify that power is transferred to the Normal System after a delay of 1 minute.

4.11 Move the mini shunt to the storage position on the W14 jumper for both the Normal and Standby System CPU modules. See Figure 1.

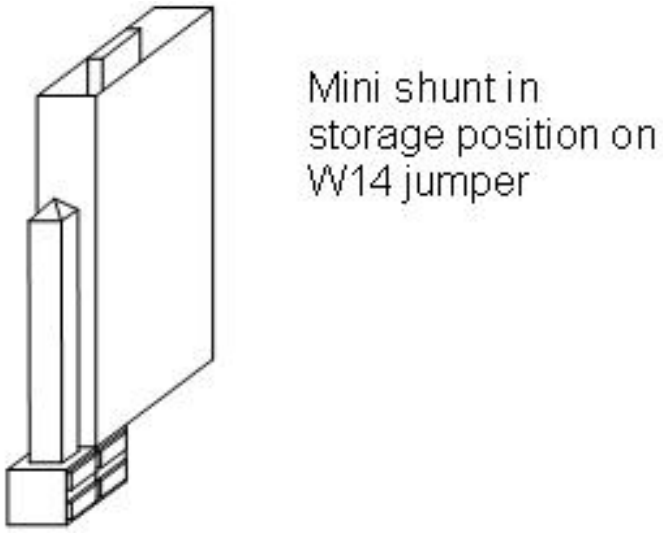


Figure 1 – Mini Shunt

4.12 Toggle the STANDBY/AUTO/NORMAL switch to the normal position to reselect the Normal System and allow the unit to clear (MDR on).

4.13 Reset the Minute Timer to the delay time specified on the setup sheet.

4.14 Press the MONITOR SELECT button on the IDK until the SD mode is selected and press the ENTER key, and then press SHIFT followed by CLEAR to delete all the diagnostic codes from the memory.

4.15 Toggle the STANDBY/AUTONORMAL switch to the AUTO position.

5. RSI Failure Transfer Check

5.1 Toggle the STANDBY/AUTO/NORMAL switch to the NORMAL position to select the Normal System and allow the unit to clear (MDR on).

5.2 Toggle the STNADBY/AUTO/NORMAL switch to the AUTO position.

5.3 Remove the Normal system RSI Module for Track 1.

5.4 Check that power is transferred to the Standby system after a delay of 30 seconds.

5.5 Re-install the Normal System RSI Module for Track 1.

5.6 Remove that Standby System RSI Module for Track 1.

5.7 Check that the power is transferred to the Normal System after a delay of 30 seconds.

5.8 Allow the unit to clear (MDR on).

5.9 Re-install the Standby System RSI module.

5.10 Temporarily connect the jumper wire between that ISL+ and ISL- terminals.

5.11 Check that the TLM transfers power to the Standby System after a delay of 45 seconds.

5.12 Check that the TLM transfers power back to the Normal System after a delay of 60 seconds.

5.13 Remove the jumper wire from ISL1+ and ISL- terminals.

5.14 Temporarily toggle the STANDBY/AUTO/NORMAL switch to the NORMAL position to re-select the Normal System.

5.15 Toggle the STANDBY/AUTO/NORMAL switch to the AUTO position.

5.16 Where necessary, repeat steps 5.3 to 5.15 removing the RSI modules for track 2.

6. Tests

6.1 NR/SMS/PartB/Test/151 (Harmon Crossing Processor (HXP-3 Tests)).

APPENDIX A

These tasks need only be carried out on an as-and-when required basis.

7. RX Adjustment

7.1 Press the TRACK SEL button to select the correct Track.

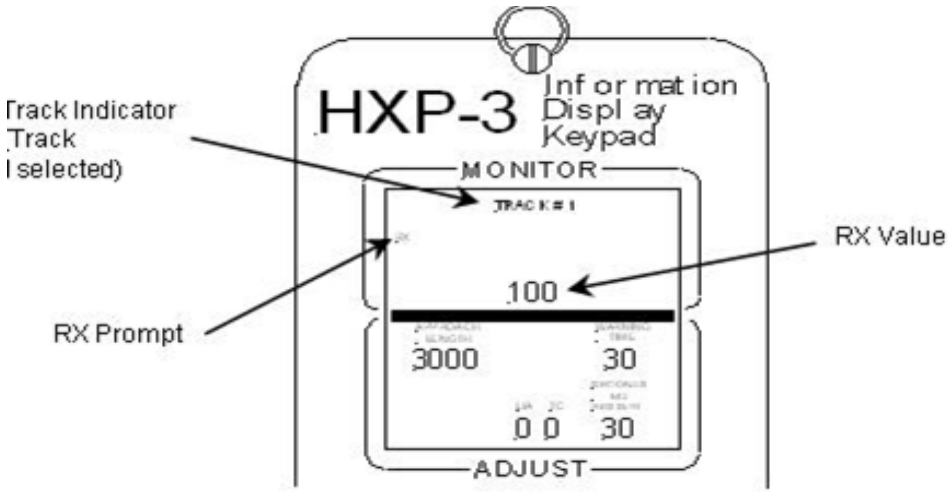


Figure 2 – HXP-3 Information Display – RX Prompt

7.2 Press the MONITOR SEL button until the RX prompt and value are displayed as shown in figure 2.

7.3 Toggle the ADJUST ENABLE switch on the TRM for Track selected. The value for RX can go blank while the ADJUST ENABLE switch is toggled.

If the password is not enabled, the display can prompt the operator for password entry.

7.4 When the approach is clear, rotate the RX POT knob to adjust the value of RX of 100.

7.5 Consult section 5.4.1 of IM Harmon Crossing Processor HXP-3 Instruction Manual for information on how to return RX to 100 in situations where this has not previously been possible. This may require an additional competence assessment to complete this task

7.6 After RX is set, press the MONITOR SEL button until the PHASE prompt is displayed, as shown in Figure 3.

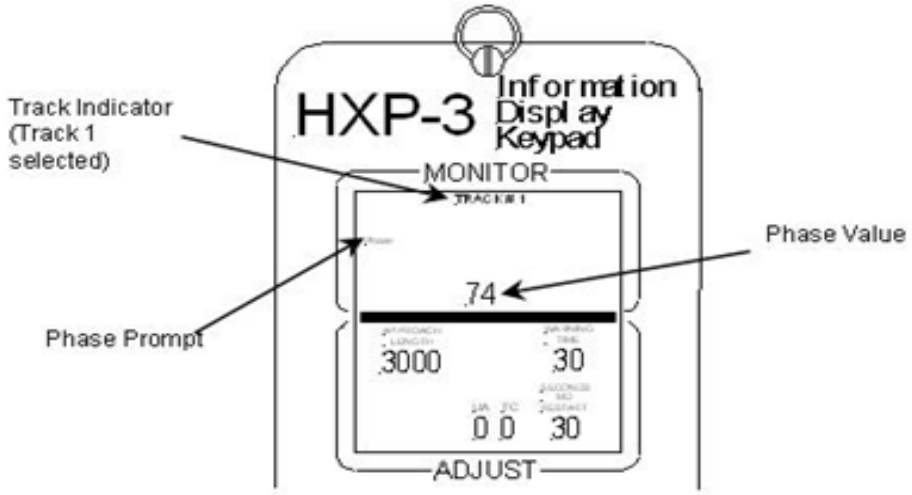


Figure 3 – HXP-3 Information Display - Phase Prompt

7.7 If the value displayed for Phase angle is below 45 degrees refer to Appendix C for corrective action.

7.8 If the current value for Phase Compensation is not 0 degrees, the display of the compensated Phase angle value (preceded by the letter “C”) can alternate with the current Phase value in the Monitor area.

7.9 Record the new RX-POT value on the record card.

APPENDIX B

These tasks need only be carried out on an as-and-when required basis.

8. Phase Compensation

8.1 Press the MONITOR SEL button until RX is selected, as shown in Figure 4.

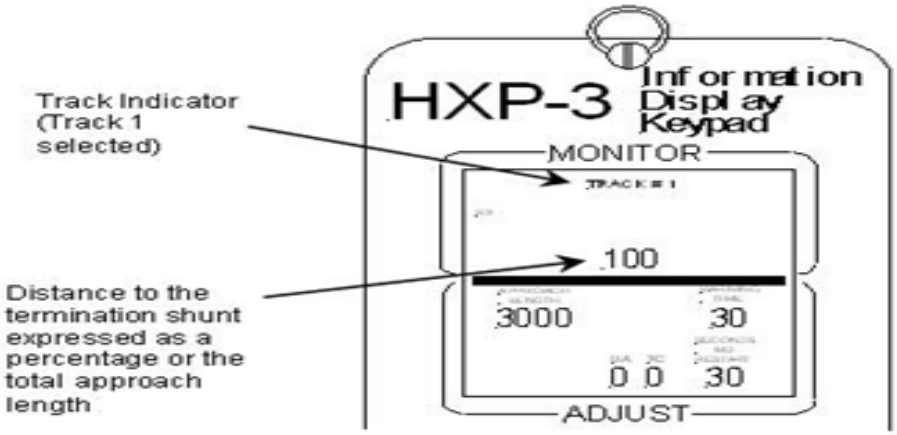


Figure 4 – HXP-3 Display Information RX

8.2 Place a hard wire test shunt at the termination and note the RX level.

8.3 Make sure the HXP-3 is not in High Signal or Low Phase because of a bad termination shunt before proceeding.

8.4 Move the hard wire test shunt to 90 percent out on the appropriate approach.

8.5 Verify that the RX drops by 5 or more when compared to the RX noted in 8.2 before proceeding.

8.6 Press the MONITOR SEL button until PHASE is selected as shown in Figure 4.

8.7 If the current value of Phase Compensation is not 0 degrees, the display of the compensated Phase angle value (preceded by letter “C”) can alternate with the current Phase value in the Monitor area.

8.8 If the Phase Angle is greater than 32 degrees, begin by adjusting the Ballast Compensation, as detailed in Appendix C of this report.

8.9 If the Phase Angle is less than or equal to 22 degrees, it is necessary to change the Track frequency or the application. This may require an additional competence assessment to complete this task

8.10 If the Phase angle is between 23 degrees and 32 degrees, press the OPTION button until option 10 is selected, the OPTION prompt flashes and “P- COMP” is displayed. This is shown in figure 5.

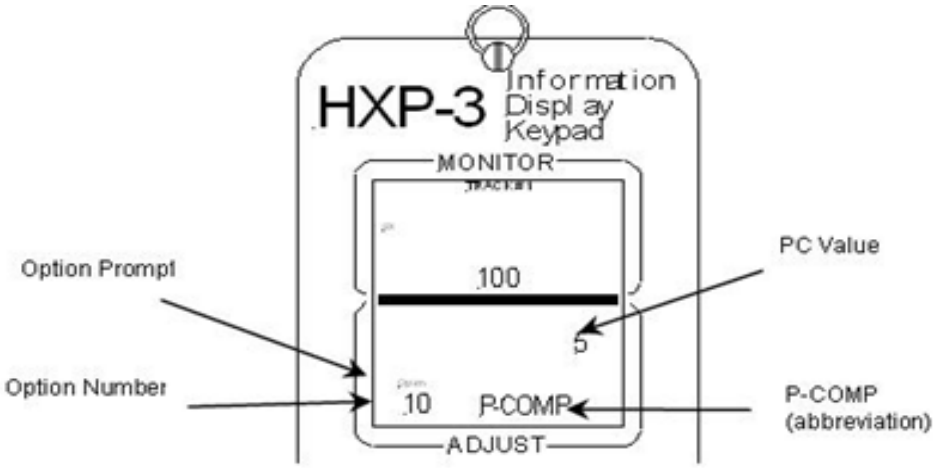


Figure 5 – HXP-3 Display Information P-COMP

8.11 Enter the password and Press the ENTER button until the abbreviation “P-COMP” and the TRACK indicator begin to flash and the OPTION prompt stops flashing. When the PC value is enabled for adjustment, the Monitor area of the IDK changes to display the PHASE prompt and the current Phase angle as shown in figure 6.

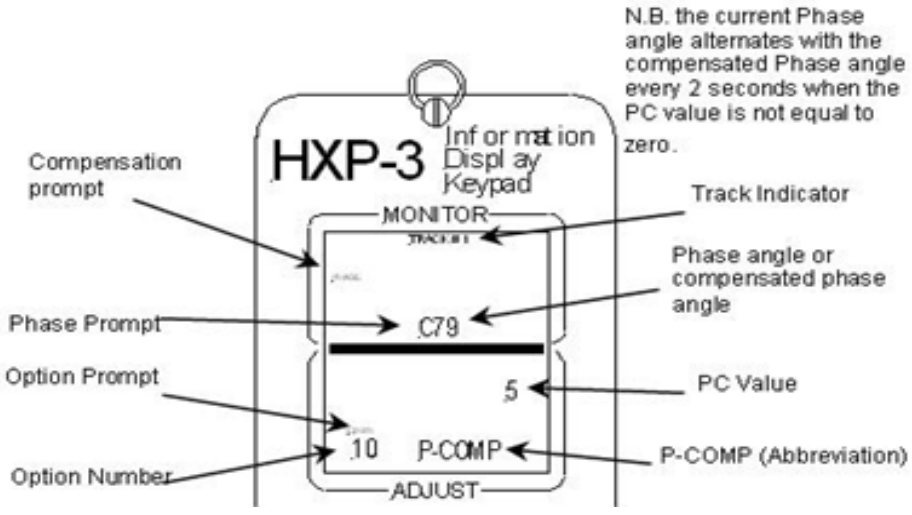


Figure 6 – HXP-3 Display Information

8.12 Type in the amount of compensation in degrees required to return the phase angle to 33 degrees.

8.13 Press and hold the ENTER button until the abbreviation “P-COMP” and the TRACK indicator stop flashing.

8.14 Press the MONITOR SEL button until RX is selected.

8.15 If the value for RX is not 100 following the Phase Compensation adjustment, use the Ballast Compensation adjustment, explained in Appendix C, to return RX to 100.

8.16 Record the new Phase Compensation value on the record card.

APPENDIX C

The Ballast Compensation Adjustment compensates for variations in RX due to widely changing ballast conditions. Ideally, the RX should stay as close to “100” as possible in all ballast conditions, to provide consistent warning times and accurate train speed data.

The Ballast Compensation shall be adjusted when the RX changes by a value of 5 or more, in either direction, from “100” due to changes in ballast conditions.

The highest stable RX and lowest stable phase value are displayed on the IDK to assist in determining the correct ballast compensation adjustment.

If the RX increases when the Phase angle decreases and the RX decreases when the Phase angle increases, decrease the BC value by a factor of 2 for every RX change of 1.

For example: If RX increases to “115” when the Phase angle decreases (deteriorating ballast” and the RX decreases to “100” when the Phase angle increases (improving ballast), decrease the BC value from “160” to “130.”
If the RX decreases when the Phase angle decreases and the RX increases when the Phase angle increases, increase the BC value by a factor of 2 for every RX change of 1.

For example: If RX decreases to “85” when the Phase angle decreases (deteriorating ballast) and the RX increases to “100” when the Phase angle increases (improving ballast), increase the BC value from “160” to “190”.

The following procedure explains how to carry out such an adjustment and need only be performed on an as-and- when required basis.

9. Ballast Compensation Adjustment

9.1 Press the OPTION button until Option 9 is selected, as shown in Figure 7, the OPTION Prompt flashes and “BC” is displayed.

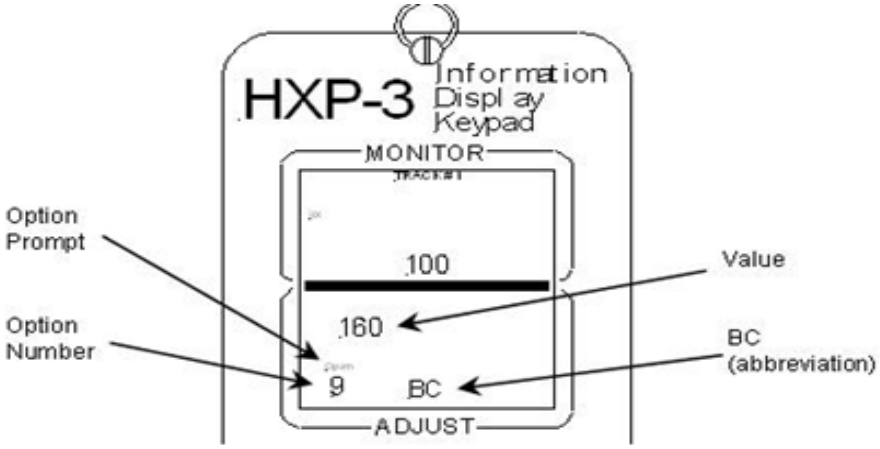


Figure 7 – HXP-3 Display Information Option 9

9.2 Press the ENTER button and type in this password.

9.3 Press the ENTER button until the abbreviated “BC” and the TRACK indicator begin to flash and the OPTION prompt stops flashing.

9.4 Type in the required value for ballast compensation.

9.5 Press the ENTER button until the abbreviation “BC” and the TRACK indicator stop flashing.

9.6 Follow the instructions in Appendix A to re-adjust RX to ‘100’.

9.7 Toggle the H/L RST switch on the CPU module to reset the HS and LP memory.

9.8 Record the new Ballast Compensation Value on the record card.

APPENDIX D

These tasks need only be carried out on an as-and-when required basis.

10. TC Adjustment

The Transmitter Check (TC) value shall never be adjusted without first verifying that there has been no degradation of any part of the Island e.g., track and associated cabling.

10.1 To view the TC value in the Monitor Area on the IDK display, press the MONITOR SEL button, followed by the number 9 and the enter button.

10.2 Press ADJUST SEL until the present value of TC begins to flash.

10.3 Press the ENTER button until the TC prompt begins to flash and the value stops flashing.

10.4 Press the 2 (up arrow) button to increase the TC number, and hence decrease the TC value, until the TC value falls below 470.

10.5 Press and hold the ENTER button until the TC prompt stops flashing to complete the adjustment.

APPENDIX E

11. Remote Interrogation

The HXP-3 Data Logger has the capability to be remotely interrogated, such that system operation and fault data can be down loaded from the Logger and interpreted by an appropriately competent engineer.

A detailed description of how to carry out this process can be found in the appropriate manufacturer's proprietary manual.

12. Fault Finding using The hPX-3 status codes

Select SD on the IDK in order to view any diagnostic codes have been stored by the HXP-3.

There are three types of diagnostic code that can be displayed. The diagnostic code number, description of the diagnostic code and suggested action is provided in the following tables.

When the suggested action is "check module", this means replace the module temporarily to determine if a fault in the original module caused the code to be displayed. If the code disappears, the original module shall be repaired. If the code is still present, reinstall the original module and check all alternative causes.

13. Status codes

These are identified by the presence of the letter "F" preceding the code number on the IDK. These all cause the HXP-3 to reset.

CODE	DESCRIPTION	SUGGESTED ACTION
F1	CPU memory malfunction.	Check CPU module.
F2	CPU memory malfunction.	Check CPU module.
F3	CPU memory malfunction.	Check CPU module.
F50	System failed to initialise properly.	Check CPU module.
F60	SIM RAM memory test malfunction.	Check SIM module.
F70	Track 1 TRM frequency was not detected.	Check Master/Slave switch. If OK then replace TRM.
F71	Track 2 TRM frequency was not detected.	Check Master/Slave switch. If OK then replace TRM.
F80	Track 1 TRM frequency phase out of range.	Make sure Track frequency is set equal to incoming frequency on Master/Slave terminals.

CODE	DESCRIPTION	SUGGESTED ACTION
F81	Track 2 TRM frequency phase out of range.	Make sure Track frequency is set equal to incoming frequency on Master/Slave terminals.
F100	CPU malfunction (Loop time failure).	Check CPU module.
F101	CPU memory malfunction.	Check CPU module.
F102	CPU memory malfunction.	Check CPU module.
F103	CPU memory malfunction.	Check CPU module.
F104	CPU strapped in program position.	Remove program strap on CPU module.
F105	CPU ROM sockets U8 and U9 are not empty.	Remove Memory ICs from CPU ROM sockets U8 and U9.
F120	Track 1 filters would not tune correctly.	Check Track 1 TRM.
F121	Track 2 filters would not tune correctly.	Check Track 2 TRM.
F150	Local parameters set to default by operator.	Program local parameters if required.
F200	CPU RAM memory test malfunction.	Check CPU module.
F201	CPU FLASH memory test malfunction.	Check CPU module.
F202	CPU EPROM memory test malfunction.	Check CPU module.
F203	CPU NVRAM memory test malfunction.	Check CPU module.
F204	RYD NVRAM memory test malfunction.	Check RYD module.
F205	RMM NVRAM memory test malfunction.	Check RMM module.
F206	Self test malfunction.	Check CPU module.
F207	Local parameter restore malfunction.	Check CPU module.
F208	Local parameter restore malfunction.	Check CPU module.
F209	CPU memory malfunction.	Check CPU module.
F210	Detected corrupt local parameters. The unit is forced to reset in an attempt to recover. If not possible, parameters will be set to defaults.	Reset local parameters.
F215	CPU non-volatile RAM data test malfunction.	Check CPU module.
F216	RYD non-volatile RAM data test malfunction.	Check RYD module.

CODE	DESCRIPTION	SUGGESTED ACTION
F217	RMM non-volatile RAM data test malfunction.	Check RMM.
F220	Cabinet number malfunction.	Check CPU module. If satisfactory, replace chassis.
F221	Cabinet type ID malfunction.	Check CPU module. If satisfactory, replace chassis.
F222	Track 1 Frequency Select switches (S3 and S4) malfunction.	Check Frequency Select switches (S3 and S4), Track 1 TRM and CPU module (actuators 1 to 5 shall be set to the same position on S3 and S4). If satisfactory, replace chassis.
F223	Track 2 Frequency Select switches (S7 and S8) malfunction.	Check Frequency Select switches (S7 and S8), Track 2 TRM and CPU module (actuators 1 to 5 shall be set to the same position on S7 and S8). If satisfactory, replace chassis.
F224	Vital Communications selection (Actuator 4) malfunction on System Configuration switches (S5 and S6).	Check System Configuration switches (S5 and S6), RYD module and CPU module (actuator 4 on S5 and S6 shall be in the off position). If satisfactory, replace chassis.
F225	CW/MD switch malfunction.	Check CW/MD switch and CPU module. If satisfactory, replace RYD module.
F226	Track 1 Normal Approach/Short Approach selection (Actuator 1) malfunction on System Configuration switch (S5).	Check Normal Approach/Short Approach selection, RYD module, and CPU module (Actuator 1 on S5 shall be in the correct position). If satisfactory, replace chassis.
F227	Track 2 Normal Approach/Short Approach selection (Actuator 1) malfunction on System Configuration switch (S6).	Check Normal Approach/Short Approach selection, RYD module, and CPU module (Actuator 1 on S6 shall be in the correct position). If satisfactory, replace chassis.
F228	Track 1 Short Approach/Very short Approach selection (Actuator 2) malfunction on System Configuration switch (S5).	Check Short Approach/ Very Short Approach selection, RYD module and CPU module (Actuator on S5 shall be in the correct position). If satisfactory, replace chassis.
F229	Track 2 Short Approach/Very short Approach selection (Actuator 2) malfunction on System Configuration switch (S6).	Check Short Approach/ Very Short Approach selection, RYD module and CPU module (Actuator on S6 shall be in the correct position). If satisfactory, replace chassis.
F230	+5 volt power supply malfunction.	Check RYD module.
F231	+15 volt power supply malfunction.	Check RYD module.
F232	-15 volt power supply malfunction.	Check RYD module.
F233	20 KHz malfunction.	Check RYD module.

CODE	DESCRIPTION	SUGGESTED ACTION
F240	HL/RST switch malfunction.	Check CPU module.
F241	AXD Module self test malfunction.	Check AXD module.
F242	AXD Module self test malfunction.	Check AXD module.
F243	Track 1 TRM self test malfunction.	Check Track 1 TRM.
F244	Track 2 TRM self test malfunction.	Check Track 2 TRM.
F245	Track 1 TRM Adjust Enable switch malfunction.	Check Track 1 TRM.
F246	Track 2 TRM Adjust Enable switch malfunction.	Check Track 2 TRM.
F247	RMM self test malfunction.	Check RMM.
F250	MDR, AAR Terminal.	Check RYD module.
F251	AX 1, AAR Terminal self test malfunction.	Check AXD module.
F252	AX 2, AAR Terminal self test malfunction.	Check AXD module.
F253	AXD 3 AAR Terminal self test malfunction.	Check AXD module.
F254	CPU memory malfunction.	Check CPU module.
F255	CPU memory malfunction.	Check CPU module.
F256	CPU memory malfunction.	Check CPU module.
F257	CWE 1 AAR Terminal self test malfunction.	Check RYD module.
F258	CWE 2 AAR Terminal self test malfunction.	Check RYD module.
F259	ISL 1, AAR Terminal self test malfunction.	Check RYD module.
F260	ISL 2, AAR Terminal self test malfunction.	Check RYD module.
F261	AUX AAR, Terminal self test function.	Check RYD module.
F262	Track 1 disable, AAR terminal indicates malfunction.	Check RYD module. If satisfactory, replace chassis.
F263	Track 2 disable, AAR terminal indicates malfunction.	Check RYD module. If satisfactory, replace chassis.
F270	Track 1 frequency has changed.	No action required.
F271	Track 2 frequency has changed.	No action required.
F275	Track 1 TRM was installed while unit was running.	No action required.
F276	Track 2 TRM was installed while unit was running.	No action required.
F280	Self test malfunction.	Check CPU and RYD modules.

CODE	DESCRIPTION	SUGGESTED ACTION
F285	MD only switch failure.	Check actuator 3 on S5 and S6 on HXP-3s; S6 standby and S7 on HXP-3Rs and S5 &S6 standby and S14 &S14 normal on HXP-3R2s.
F286	Switch settings are established for PMD-3D or PMD-3R2 operation and a SIM is installed.	Check actuator 3 on system configuration switch.
F287	Switch settings are NOT established for PMD-3D pr PMD-3R2 operation or a SIM is not installed.	Check SIM for proper installation.
F290	SIM fails to run.	Check SIM.
F291	SIM installed while unit running.	Check SIM.
F300	Self test malfunction.	Check CPU module.
F301	Self test malfunction.	Check CPU module.
F350	MD self test malfunction.	Check RYD and CPU module.
F351	AX 1 self test malfunction.	Check AXD module and CPU module.
F352	AX 2 self test malfunction.	Check AXD module and CPU module.
F353	AX 3 self test malfunction.	Check AXD module and CPU module.
F354	Self test malfunction.	Check CPU module.
F355	Self test malfunction.	Check CPU module.
F356	Self test malfunction.	Check CPU module.
F358	AXD module 1 self test malfunction.	Check AXD module and CPU module.
F359	Self test malfunction.	Check CPU module.

Table 1 – Status Codes

14. Condition codes

These are identified by the presence of the letter "C" preceding the code number on the IDK. These do not cause a reset, but can cause the MDR output to drop.

CODE	DESCRIPTION	SUGGESTED ACTION
C500	CPU module memory malfunction.	Check CPU module.
C510	Track 1 TRM Filter tuning malfunction.	Check Track 1 TRM.
C511	Track 1 TRM Frequency out of range.	Check frequency setting.
C515	Track 2 TRM Filter tuning malfunction.	Check Track 2 TRM.
C516	Track 2 TRM Frequency out of range.	Check frequency setting.
C520	Track 1 TRM MUX malfunction.	Check Track 1 TRM.

CODE	DESCRIPTION	SUGGESTED ACTION
C521	Track 1 TRM Frequency malfunction.	Check Track 1 TRM.
C522	Track 1 TRM Current malfunction.	Check Track1 TRM.
C523	Track 1 TRM Transmitter voltage saturation.	Check for open Track wires and check Track 1 TRM.
C524	Track 1 TRM Receiver saturation.	Check Track 1 TRM.
C525	Track 1 TRM Receiver amplitude malfunction.	Check Track 1 TRM.
C526	Track 1 TRM Transmitter amplitude malfunction.	Check Track 1 TRM.
C527	Track 1 TRM Transmitter current malfunction.	Check Track 1 TRM.
C528	Track 1 TRM Receiver phase malfunction.	Check Track 1 TRM.
C529	Track 1 TRM Transmitter phase malfunction.	Check Track 1 TRM.
C530	Track 1 TRM Transmitter current phase malfunction.	Check Track 1 TRM.
C531	Track 1 TRM Transmitter current saturation.	Check transmitter tail cables and check Track 1 TRM.
C540	Track 2 TRM MUX malfunction.	Check Track 2 TRM.
C541	Track 2 TRM MUX malfunction.	Check Track 2 TRM.
C542	Track 2 TRM current malfunction.	Check Track 2 TRM.
C543	Track 2 TRM Transmitter voltage saturation.	Check for open Track wires and check Track 2 TRM.
C544	Track 2 TRM Receiver saturation.	Check Track 2 TRM.
C545	Track 2 TRM Receiver amplitude malfunction.	Check Track 2 TRM.
C546	Track 2 TRM Transmitter amplitude malfunction.	Check Track 2 TRM.
C547	Track 2 TRM Transmitter current malfunction.	Check Track 2 TRM.
C548	Track 2 TRM Receiver phase malfunction.	Check Track 2 TRM.
C549	Track 2 TRM Transmitter phase malfunction.	Check Track 2 TRM.
C550	Track 2 TRM Transmitter current phase malfunction.	Check Track 2 TRM.
C551	Track 2 TRM Transmitter current situation.	Check transmitter tail cables and check Track 2 TRM.

CODE	DESCRIPTION	SUGGESTED ACTION
C560	Voltage difference between the transmitter and receiver was detected too large.	Transmitter tail cables can have high impedance (tail cables too longs).
C600	Track 1 High Signal detection.	A high signal occurs when RX is "110" or above. An open Track circuit (not a Track tail cable) will normally cause the HXP-3 to go into High Signal detection. An open that causes High Signal detection can be a bad termination shunt, open insulated joint coupler, bad bond or broken rail.
C601	Track 2 High Signal detection.	A high signal occurs when RX is "110" or above. An open Track circuit (not a Track tail cable) will normally cause the HXP-3 to go into High Signal detection. An open that causes High Signal detection can be a bad termination shunt, open insulated joint coupler, bad bond or broken rail.
C602	Track 1 Low Phase detection.	A low phase can be caused by; a bad termination shunt; a bad insulated joint coupler; a Track battery within the approach that does not have a reactor installed; a Track Relay less than 1 ohm without a reactor in service with one lead of the coil; bad gauge rods or switch rods or; improper application of frequency overlapping an existing motion detector or bad ballast conditions.
C603	Track 2 Low Phase detection.	A low phase can be caused by; a bad termination shunt; a bad insulated joint coupler; a Track battery within the approach that does not have a reactor installed; a Track Relay less than 1 ohm without a reactor in service with one lead of the coil; bad gauge rods or switch rods or; improper application of frequency overlapping an existing motion detector or bad ballast conditions.
C605	Reset switch on CPU module was pressed.	No action required.
C606	Track 1 Phase Compensation adjustment is preventing low phase condition.	No action required unless phase compensation cannot prevent low phase condition. Check phase.
C607	Track 2 Phase Compensation adjustment is preventing low phase condition.	No action required unless phase compensation cannot prevent low phase condition. Check phase.

CODE	DESCRIPTION	SUGGESTED ACTION
C610	Track 1, phase decreasing with approaching train.	Check for a high impedance rail connection within the HXP-3 approach.
C611	Track 2, phase decreasing with approaching train.	Check for a high impedance rail connection within the HXP-3 approach.
C612	Track 1 transmitter detected motion but receiver did not.	A high resistance can exist in the receiver Track wires. Check the R1 and R2 Track wires.
C613	Track 2 transmitter detected motion but receiver did not.	A high resistance can exist in the receiver Track wires. Check the R1 and R2 Track wires.
C620	Track 1, the voltage level difference between the receiver and the transmitter was detected too large.	Check for broken receiver tail cables and check Island circuit.
C621	Track 1, the voltage level at the receiver was detected to be greater than the transmitted voltage.	Check Track tail cables, Island circuit and TRM.
C622	Track 1 TC was detected in saturation.	Transmitter tail cables can have high impedance (tail cables too long), adjust TC as described in Appendix D of this document.
C630	Track 2, the voltage level difference between the receiver and the transmitter was detected too large.	Check for broken receiver tail cables and check Island circuit.
C631	Track 2, the voltage level at the receiver was detected to be greater than the transmitted voltage.	Check track tail cables, Island circuit and TRM.
C632	Track 2 TC was detected in saturation.	Transmitter tail cables can have high impedance (tail cables too long), adjust TC as described in Appendix D of this document.
C640	Track 1 TC phase out of range.	Check transmitter/receiver wire connections. If satisfactory, check TRM.
C641	Track 2 TC phase out of range.	Check transmitter/receiver wire connections. If satisfactory, check TRM.
C645	Track 1 erratic shunting was detected.	No action required.
C646	Track 2 erratic shunting was detected.	No action required.
C650	Track 1 was placed in MD made due to RX dropping below "74" for 10 minutes while phase was greater than 60.	Check for shunt approach. Possible that no action is required as a train has stopped on the approach.

CODE	DESCRIPTION	SUGGESTED ACTION
C651	Track 2 was placed in MD made due to RX dropping below "74" for 10 minutes while phase was greater than 60.	Check for shunt approach. Possible that no action is required as a train has stopped on the approach.
C655	Track 1 was placed into MD mode due to phase less than 60 and RX less than "74".	Check for resistive shunt in the approach.
C656	Track 21 was placed into MD mode due to phase less than 60 and RX less than "74".	Check for resistive shunt in the approach.
C660	Track 1 ringing due to shunt detection.	Check for shunt in the approach.
C661	Track 2 ringing due to shunt detection.	Check for shunt in the approach.
C665	Memory malfunction.	Check CPU module.
C666	Memory malfunction.	Check CPU module.
C667	Track 1 secondary detection occurred.	For information purposes only.
C668	Track 2 secondary detection occurred.	For information purposes only.
C670	Remote train data sequence number out of range.	Check RS-485 communications link.
C700	Track 1 enable, disable terminal and TRM installed don't agree.	If a Track is enabled or disabled, three adjustments shall be made: Track enable shall be set through the IDK; AAR disable terminals shall not be strapped to enable a Track or strapped to disable a Track.
C701	Track 2 enable, disable terminal and TRM installed don't agree.	If a Track is enabled or disabled, three adjustments shall be made: Track enable shall be set through the IDK; AAR disable terminals shall not be strapped to enable a Track or strapped to disable a Track.
C702	No active or functioning TRM unit.	Check TRM module(s).
C710	CPU module memory malfunction.	Check CPU module.
C711	CPU module non-volatile memory malfunction.	Check CPU module.
C712	RYD module non-volatile memory malfunction.	Check RYD module.
C713	RMM non-volatile memory malfunction.	Check RMM.
C715	Memory malfunction.	RMM, RYD and CPU module. Check RYD module.

CODE	DESCRIPTION	SUGGESTED ACTION
C716	Memory malfunction.	RMM, RYD and CPU modules.
C720	Track 1 TRM ID malfunction.	Check Track 1 TRM.
C721	Track 2 TRM ID malfunction.	Check Track 2 TRM.
C722	AXD ID malfunction.	Check AXD module.
C723	AXD ID malfunction.	Check AXD module.
C731	AX 1, zero offset is set for either Track 1 or Track 2 but not both.	If setting offset to zero, the offset for both Tracks shall be set at zero.
C732	AX 2, zero offset is set for either Track 1 or Track 2 but not both.	If setting offset to zero, the offset for both Tracks shall be set at zero.
C733	AX 3, zero offset is set for either Track 1 or Track 2 but not both.	If setting offset to zero, the offset for both Tracks shall be set at zero.
C734	CPU memory malfunction.	Check CPU module.
C735	CPU memory malfunction.	Check CPU module.
C736	CPU memory malfunction.	Check CPU module.
C740	Track 1, set to AX mode, offset distance equals zero (AX will be the same as MDR).	No action required unless offset distance should not be zero.
C741	Track 1, set to AX mode, offset distance equals zero (AX will be the same as MDR).	No action required unless offset distance should not be zero.
C742	Track 1 RX POT has been set to 49 due to corrupted local parameters. The HXP-3 will ring continuously.	Adjust to RX for Track 1 and check approaches.
C750	Normal system TRM Adjust Enable switch held down too long.	Check Normal System TRM
C751	Standby System TRM Adjust Enable switch held down too long.	Check Standby System TRM
C760	Occurs with track 2 disabled in software version 2.00, but does not ring the box. Corrected in software version 2.10.	No action required.
C761	AC rail to rail noise level is too high.	Check for AC interference.

Table 2 – Condition Codes

15. Non-vital codes

These are identified by the presence of the letter "n" preceding the code number on the IDK. These do not cause any action of the relay drives.

CODE	DESCRIPTION	SUGGESTED ACTION
n800	CPU clock error.	Check CPU module.
n801	RMM clock error.	Check RMM.

CODE	DESCRIPTION	SUGGESTED ACTION
n802	CPU clock has been updated by RMM clock.	Can occur with new module installation. If condition persists, check RMM and CPU module.
n810	RMM RAM data test malfunction.	Check RMM.
n820	SIM processor was reset.	No action required.
n821	HCA-3 installed with Port 3 configured.	Free port 3 for HCA-3.

Table 3 – NON Vital Codes

END

Includes:	WRSL Level Crossing Predictor (GCP3000)
Excludes:	All other types of Level Crossing Predictor

Remote Interrogation

The SEARII Event Recorder has the capability to be remotely interrogated, such that system operation and fault data can be downloaded from the recorder and interpreted by a competent person.

A detailed description of how to carry out this process can be found in the manufacturer's proprietary manual.

SERVICE A

No equipment possession arrangements are required to perform Service A, as all the tasks performed during this service are non-intrusive.

1. Cleaning

1.1 Clean the outside of the cabinet using a dry lint free cloth.

1.2 Check that the system ventilation holes are uncovered and unclogged. Clean if necessary, using a dry lint free cloth.

1.3 Check for foreign material inside the GCP3000 cabinet. Rectify if safe to do so or report.

2. Visual Checks

2.1 Check that the GCP3000 is securely mounted and the equipment covers are correctly installed.

2.2 Check that all modules are fully seated within the cabinet.

2.3 Visually check for damage to modules and external cables. Report any damage as a corrective maintenance requirement.

2.4 Check that the real time clock on the SEAR II Event Logger unit by examining the associated display. If this is not the case, contact your SM(S) for further instructions.

2.5 Check that all teeth are present on each Surge Arrestor. If any teeth are missing, report as a corrective maintenance requirement.

3. System Parameter Checks

Each of these tests is carried out via the Level Crossing Predictor Keypad (LCPK) located on the front of the GCP3000 and should be recorded on the record card.

During all of the following tests, the values shown will alternate between TRACK 1 and TRACK 2 when the button is pressed. The relevant Track will be indicated on the Level Crossing Predictor Display (LCPD).

3.1 Press the SYSTEM STATUS key.

3.2 Check and record the EZ value.

3.3 Check and record the EX value. Values of less than 45 should be reported immediately as a corrective maintenance issue.

3.4 Press the DOWN ARROW key.

3.5 Check and record the value of EX when EZ was highest.

3.6 Press the DOWN ARROW key.

3.7 Check and record the value of EZ when EX was lowest. The lowest EX value is indicated in the display as “LX”.

3.8 Press the DOWN ARROW key.

3.9 Check and record the value of the Transmit Current (this value is updated every ½ second).

3.10 Press the DOWN ARROW key.

3.11 Check and record the value of the Transmit Voltage (this value is updated every ½ second).

3.12 Press the DOWN ARROW key.

3.13 Check and record the value of the +/- 5 Volt Power Supply (this value is updated every ½ second).

3.14 Press the DOWN ARROW key

3.15 Check and record the value of the +/- 8 Volt Power Supply (this value is updated every ½ second).

3.16 Press the DOWN ARROW key.

3.17 Check and record the value of the +/- 15 Volt Power Supply (this value is updated every ½ second).

3.18 Press the ERROR key. If errors have occurred, note the error numbers.

A full list of all errors is shown in Appendix A. Any error that occurs more than three times shall be investigated. Note especially 'Frequency', 'Low EX', 'High EZ', 'EX Processing' and 'Self-Check' errors which occur frequently as these might be indicative of poor shunting.

3.19 Press the DOWN ARROW key until all errors have been displayed and note each error.

3.20 Clear the Error Memory by undertaking the following:

a) Press the SYSTEM RESET key. 'SYSTEM RESET' is displayed in the LCPD.

b) Press and hold the SYSTEM RESET key for approximately 3 seconds until 'PRESS ENTER TO CLEAR ERRORS' is displayed in the LCPD.

c) Press the ENTER key.

d) If 'ERROR <0>' is displayed, there are no active errors. Proceed to Step 3.21.

e) If one or more errors are still active, these should be corrected before proceeding.

3.21 Press the HISTORY key.

When the HISTORY key is pressed, 'HISTORY T1

<01> WARNING TIME: **' is displayed in the LCPD. The value shown in the angled brackets indicates the train number. On a single track LCP, the previous 20 train moves are recorded.

On a 2 track LCP, the previous 10 train moves are recorded. Note: '**' represents an unknown value.

3.22 Note the WARNING TIME.

Any warning times shorter than the minimum warning time for the crossing under test should be immediately reported as a corrective maintenance issue.

3.23 Press the NEXT key and note the DETECTED SPEED.

3.24 Press the NEXT key. Note the AVERAGE SPEED.

3.25 Press the NEXT key and note the DETECTED SPEED.

3.26 Press the NEXT key. Note the ISLAND SPEED.

NOTE: *Any very low or excessively high recorded speeds found in 3.22 to 3.26 shall be investigated as this might be indicative of poor shunting or faulty rail connections or shunts.*

3.27 If necessary, press the TRACK 2 key and repeat steps 3.1 to 3.26 for TRACK 2.

3.28 Observe the status lights on each module and confirm that each module is working correctly by reference to the table in Appendix B.

SERVICE B

4. Tests

4.1 NR/SMS/PartB/Test/155 (WRSL Level Crossing Predictor (GCP3000) Tests.

APPENDIX A - Error Codes

This table lists all the error codes displayed by the LCP with possible causes.

Error Code	Text Displayed	Description	Possible Cause
8007	-15 Volt Supply	-15 Volt Power Supply Out of Range	80013 Relay Drive Module
8008	+15 Volt Supply	+15 Volt Power Supply Out of Range	80013 Relay Drive Module
8111	T1 XMIT Voltage	Track 1 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8112	T1 XMIT Voltage	Track 1 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8113	T1 XMIT Current	Track 1 Transmit Current Low	80012 Transceiver Module, Transmit Track Wires
8114	T1 XMIT Current	Track 1 Transmit Current High	80012 Transceiver Module, Transmit Track Wires
8115	T2 XMIT Voltage	Track 2 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track

Error Code	Text Displayed	Description	Possible Cause
8116	T2 XMIT Voltage	Track 2 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8117	T2 XMIT Current	Track 2 Transmit Current Low	80012 Transceiver Module, Transmit Track Wires
8118	T2 XMIT Current	Track 2 Transmit Current High	80012 Transceiver Module, Transmit Track Wires
8200	Frequency	Processor Frequency Out of Range	80214 Processor Module
8201	T1 Frequency	Track 1 Frequency Out of Range	80012 Transceiver Module
8202	T2 Frequency	Track 2 Frequency Out of Range	80012 Transceiver Module
8203	T1 XMT Frequency	Track 1 Transmitter Frequency Out of Tolerance	80214 Processor Module
8204	T2 XMT Frequency	Track 2 Transmitter Frequency Out of Tolerance	80214 Processor Module
8300	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (Slot M3)
8301	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (Slot M4)
8411	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8412	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8413	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8414	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8421	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8422	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8431	T1 Self-Check	Track 1 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8432	T2 Self-Check	Track 2 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8007	-15 Volt Supply	-15 Volt Power Supply Out of Range	80013 Relay Drive Module
8008	+15 Volt Supply	+15 Volt Power Supply Out of Range	80013 Relay Drive Module
8111	T1 XMIT Voltage	Track 1 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8112	T1 XMIT Voltage	Track 1 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8113	T1 XMIT Current	Track 1 Transmit Current Low	80012 Transceiver Module (Slot M3), Transmit Track Wires

Error Code	Text Displayed	Description	Possible Cause
8114	T1 XMIT Current	Track 1 Transmit Current High	80012 Transceiver Module (Slot M3), Transmit Track Wires
8115	T2 XMIT Voltage	Track 2 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8116	T2 XMIT Voltage	Track 2 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8117	T2 XMIT Current	Track 2 Transmit Current Low	80012 Transceiver Module (Slot M4), Transmit Track Wires
8118	T2 XMIT Current	Track 2 Transmit Current High	80012 Transceiver Module (Slot M4), Transmit Track Wires
8200	Frequency	Processor Frequency Out of Range	80214 Processor Module
8201	T1 Frequency	Track 1 Frequency Out of Range	80012 Transceiver Module (Slot M3)
8202	T2 Frequency	Track 2 Frequency Out of Range	80012 Transceiver Module (Slot M4)
8203	T1 XMT Frequency	Track 1 Transmitter Frequency Out of Tolerance	80214 Processor Module
8204	T2 XMT Frequency	Track 2 Transmitter Frequency Out of Tolerance	80214 Processor Module
8300	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (Slot M3)
8301	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (Slot M4)
8411	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8412	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8413	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8414	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8421	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8422	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8431	T1 Self-Check	Track 1 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8432	T2 Self-Check	Track 2 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8007	-15 Volt Supply	-15 Volt Power Supply Out of Range	80013 Relay Drive Module
8008	+15 Volt Supply	+15 Volt Power Supply Out of Range	80013 Relay Drive Module
8111	T1 XMIT Voltage	Track 1 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track

Error Code	Text Displayed	Description	Possible Cause
8112	T1 XMIT Voltage	Track 1 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8113	T1 XMIT Current	Track 1 Transmit Current Low	80012 Transceiver Module (Slot M3), Transmit Track Wires
8114	T1 XMIT Current	Track 1 Transmit current high	80012 Transceiver Module (Slot M3), Transmit Track Wires
8115	T2 XMIT Voltage	Track 2Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8116	T2 XMIT Voltage	Track 2Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8117	T2 XMIT Current	Track 2 Transmit Current Low	80012 Transceiver Module (Slot M4), Transmit Track Wires
8118	T2 XMIT Current	Track 2 Transmit Current High	80012 Transceiver Module (Slot M4), Transmit Track Wires
8200	Frequency	Processor Frequency Out of Range	80214 Processor Module
8201	T1 Frequency	Track 1 Frequency Out of Range	80012 Transceiver Module (Slot M3)
8202	T2 Frequency	Track 2 Frequency Out of Range	80012 Transceiver Module (Slot M4)
8203	T1 XMT Frequency	Track 1 Transmitter Frequency Out of Tolerance	80214 Processor Module
8204	T2 XMT Frequency	Track 2 Transmitter Frequency Out of Tolerance	80214 Processor Module
8300	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (Slot M3)
8301	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (Slot M4)
8411	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8412	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8413	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8414	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8421	T1 Self-Check	Track 1 Self-check Not Successful	80012 Transceiver Module (for T1) or 80214 Processor Module
8422	T2 Self-Check	Track 2 Self-check Not Successful	80012 Transceiver Module (for T2) or 80214 Processor Module
8431	T1 Self-Check	Track 1 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8432	T2 Self-Check	Track 2 Self-check Not Successful	80013 Relay Drive Module or 80214 Processor Module
8007	-15 Volt Supply	-15 Volt Power Supply Out of Range	80013 Relay Drive Module

Error Code	Text Displayed	Description	Possible Cause
8008	+15 Volt Supply	+15 Volt Power Supply Out of Range	80013 Relay Drive Module
8111	T1 XMIT Voltage	Track 1 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8112	T1 XMIT Voltage	Track 1 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8113	T1 XMIT Current	Track 1 Transmit Current Low	80012 Transceiver Module (Slot M3), Transmit Track Wires
8114	T1 XMIT Current	Track 1 Transmit Current High	80012 Transceiver Module (Slot M3), Transmit Track Wires
8115	T2 XMIT Voltage	Track 2 Transmitter Voltage Too Low	80012 Transceiver Module or High Voltage on Track
8116	T2 XMIT Voltage	Track 2 Transmitter Voltage Too High	80012 Transceiver Module or High Voltage on Track
8117	T2 XMIT Current	Track 2 Transmit Current Low	80012 Transceiver Module (Slot M4), Transmit Track Wires
8118	T2 XMIT Current	Track 2 Transmit Current High	80012 Transceiver Module (Slot M4), Transmit Track Wires
8200	Frequency	Processor Frequency Out of Range	80214 Processor Module
8201	T1 Frequency	Track 1 Frequency Out of Range	80012 Transceiver Module (Slot M3)
8202	T2 Frequency	Track 2 Frequency Out of Range	80012 Transceiver Module (Slot M4)
8203	T1 XMT Frequency	Track 1 Transmitter Frequency Out of Tolerance	80214 Processor Module
8204	T2 XMT Frequency	Track 2 Transmitter Frequency Out of Tolerance	80214 Processor Module

APPENDIX B - Status Lights

This table shows the meaning of the status lights on the front of each module. The top row of LEDs on all cards should be illuminated and steady at all times.

Module	Ind.	Meaning
80012 Transceiver	STA	Light steady = module operational. Flashing = problem on module or track.
	PRD	Motion Indicator. Normally lit – extinguished when inbound motion is detected (meaningless when train on the Island Track).
80013 Relay Drive	STA	Light steady = module operational. Flashing = problem on module.
80016 DAX	STATUS	Light steady = module operational. Flashing = problem on module or track.

Module	Ind.	Meaning
80020 Control Interface	n/a	Status LED above keyboard: Light steady = interface operational Flashing = problem on keyboard interface PCB
80115 Data Recorder	STATUS	Light steady = module operational. Flashing = problem on module or track.
	LO BATT	Light steady = on-board lithium battery voltage is normal. Flashing = battery is low.
80211 Intelligent Processor Island	STATUS	Light steady = module operational. Flashing = problem on module.
	ACT	Activity indicator. Flashes when processor is operational, and programming is running. If the indicator is either lit steadily or is extinguished, the processor has failed.
	DISPLAY	Four-character alphanumeric display. See Intelligent Processor Island Display Messages in Appendix C for further details.
80214 Processor 80214 Processor	STA	Light steady = module operational. Flashing = problem on module.
	ACT	Activity indicator. Flashes when processor is operational, and programming is running. If the indicator is either lit steadily or is extinguished, the processor has failed.
	NETWORK ACTIVITY	Lit during Echelon LAN communication.
	SERVICE	Flashes when the SERVICE REQUEST push button on the module is pressed and when the network is accessed.
80265 SEAR Interface	STATUS	Light steady = module operational. Flashing = problem on module.
	NETWORK ACTIVITY	Lit during Echelon LAN communication.
	SERVICE	Flashes when the SERVICE REQUEST push button on the module is pressed and when the network is accessed.

APPENDIX C - Intelligent Processor Island Display Messages

Message Displayed	Time Message Displayed	Comments
BOOT	9 seconds	System Start: · After power up After calibration · After errors corrected
Software version display	5 seconds	Appears when the BOOT process is complete.
REL (release)	2 seconds	After the push button is held for 2 seconds. Release and press button to initiate automatic calibration.
ARMD (armed)	2 seconds	Ready to calibrate. Follows REL on the display. Press button immediately to commence automatic calibration.

Message Displayed	Time Message Displayed	Comments
CAL*	4 seconds	Appears when automated calibration is in progress. NOTE: (*) in the CAL* message is a rotating bar indicating that calibration is in progress.
DONE	Momentary	Appears momentarily at the end of the calibration process before the BOOT process.
Operating frequency e.g. 10.0 Pickup Delay Time Setting e.g. PU+4 (pickup delay 4 secs)	Operating frequency alternates with Pickup Delay Time. Frequency displayed for 8 seconds, then Pickup Delay Time for 2 seconds.	Displayed during normal operation.
FAIL	Remains until calibration select push button is pressed and calibration tried again.	Appears when the automated calibration process does not run to completion. Repeat calibration or replace the card.
CALR	Flashes intermittently	Appears if the frequency selection is changed but the IPI has not been recalibrated for the new frequency.
FRQ?	Flashes intermittently	Indicates that the frequency selection jumper has been removed or that there is more than one frequency selected on the 19-position header.
SIG (signature)	Momentary	On-frequency interference. Check for interference from other track circuits etc.
LOS	Approximately 10 seconds	Appears whenever the IPI detects a loss of train shunting in the island area.

APPENDIX D - Intelligent Processor Island Internal Failure Error Codes

Error Code	Error Description	Action Indicated
BATT	Battery voltage out of range.	Check battery condition.
CALC	Calibration parameters are corrupted.	Try recalibration. Replace the IPI module if the problem persists.
CRIT	Critical check failure.	Replace the IPI module if the problem persists.
GB	Guard Band failure.	Replace the IPI module if the problem persists.
HWSW	Hardware/software incompatibility.	Replace the IPI module if the problem persists.
IRO	Island Relay Output failure.	Replace the IPI module if the problem persists.
ISRX	Interrupt Service Routine failure.	Replace the IPI module if the problem persists.
PHLT	Programmed Halt.	Replace the IPI module if the problem persists.
PIRO	Primary Island Relay Output waveform failure.	Replace the IPI module if the problem persists.
PS_I	Intermediate power supply output incorrect.	Replace the IPI module if the problem persists.
PS5A	5-Volt analogue supply output incorrect.	Replace the IPI module if the problem persists.
PS5D	5-Volt digital supply output incorrect.	Replace the IPI module if the problem persists.
PS25	Internal reference supply voltage incorrect.	Replace the IPI module if the problem persists.
RAM	RAM failure.	Replace the IPI module if the problem persists.
ROM	ROM failure.	Replace the IPI module if the problem persists.
SIRO	Secondary Island Relay Output waveform failure.	Replace the IPI module if the problem persists.

APPENDIX E - Typical Problems

NOTE: *Over 75% of problems that are likely to be encountered are related to the track infrastructure or rail connections. Always expect a problem with the track before assuming that there is a problem with the LCP.*

Cannot Calibrate

The most likely cause is incorrect track lead connection. Check for the following:

- XMT1 and RCV1 must be connected to the same rail.
- The transmit leads should be the shortest run from the equipment housing.
- All required links (specially to check terminals) are correctly fitted.
- All track connections are secure.

Poor Linearisation

An installation that requires high a linearisation value may be caused by the following:

- A tuneable by-pass coupler too close to the crossing.
- An adjacent Frequency shunt too close to the crossing.
- Another track circuit connection loading an approach.

Low EX (9011 and 9013 Errors)

The LCP cannot operate with EX < 39 except when specifically set up with Low EX Adjustment. If Low EX is experienced, this might be caused by:

- Faulty bonds.
- Defective insulated joint couplers.
- Faulty or missing battery chokes in other track circuits on the approach.
- Defective point rodding insulation or sleeper pad insulation.
- An open circuit termination shunt.
- An adjacent Frequency narrow band shunt too close to the crossing.

High EZ (9015 and 9016 Errors)

The LCP initiates the crossing warning sequence if EZ exceeds 115. The most likely causes for this are as follows:

Open circuit termination shunts #1

Test by shunting with a hardwire shunt:

- EZ should not change by more than 2 for a wide band shunt.
- EZ should not change by more than 35 for a narrow band shunt.

#1 If the crossing is fitted with treadles to provide protection against railhead contamination, 9015/9016 errors can be consistent with operation of the treadle.

Repeated failures of this nature should still be investigated, however, as it is indicative of problems in the track infrastructure probably caused by rust or leaves.

Defective insulated joint couplers

Test by shunting each side of the joint(s) with a hardwire shunt:

- EZ should not vary by more than 2 for a wide band shunt
- EZ should not vary by more than 3 for a tuneable joint coupler.

Open or high resistance rail bonds

Test by shunting at the 50% point with a hard wired shunt:

- If EX increases, the bond is between the strike-in point and the shunt.
- If EX decreases, the bond is between the shunt and the level crossing.
- Repeat the test at intermediate locations until the faulty bond has been located.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/JA10		
Signalling Network Switches		
Issue No: 02	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Signalling Network Layer 2 and Layer 3 switches
Excludes:	All other types of Network Switch

GENERAL

Visible light is used for transmitting data through the fibre optic system. A small beam is emitted; however, the intensity can cause permanent eye damage.

Do not look into the open connectors of a fibre optic termination or use magnifying equipment to observe the light.

Test before touch! Prior to touching any network equipment, use a Volt Pen or Volt Meter to test that there is no Voltage Potential to the Cubicle itself or the housing of the network switch.

Signalling Network switches carry vital signalling data critical to the effective operation of the railway.

Disconnection or failure of any of these devices could impact the availability of live signalling equipment.

Liaison with the signaller is required to minimise risk to railway operation by carrying out tasks during periods of low train movements.

Anti-static precautions should be taken when handling network switches.

SERVICE A

1. General Maintenance

1.1 Check that the cubicle housing the equipment is accessible and that the doors are not obstructed.

1.2 Check that there is Earth continuity between the switch and the cubicle Earth point.

1.3 Check that all Earth connections are secure.

1.4 Clear away any debris that has built up around the switches within the cubicle.

1.5 Check the exteriors of the network switch for signs of corrosion and damage.

1.6 Check all handles and locks are secure and in good working order.

1.7 Check that all switch identity numbers, warning labels/signs are correctly displayed and legible as indicated in the design records.

1.8 Check cabling and patch cords are correctly routed, and free from insulation damage (e.g., kinking / chafing / wire ties / rodent damage).

1.9 Check that cable entry apertures and rodent protection is intact and cables are secured by their associated clamping supports.

The cable clamping should be fitted to check that short circuits cannot occur if the cable is pulled from outside.

1.10 Check that all cabling plug couplers are free from damage and secure.

1.11 Confirm that the SYS or SYST LED on the front of the switch is illuminated green, which indicates that the switch is operating normally.

An amber or red LED indicates a system fault and shall be reported for investigation.

2. Fan Maintenance (Cisco 3850 and 3750-X Only)

2.1 Perform a visual inspection of the switch to confirm that the fan module LED (indicated by the 1 marker in the figure 1) is an illuminated green LED.

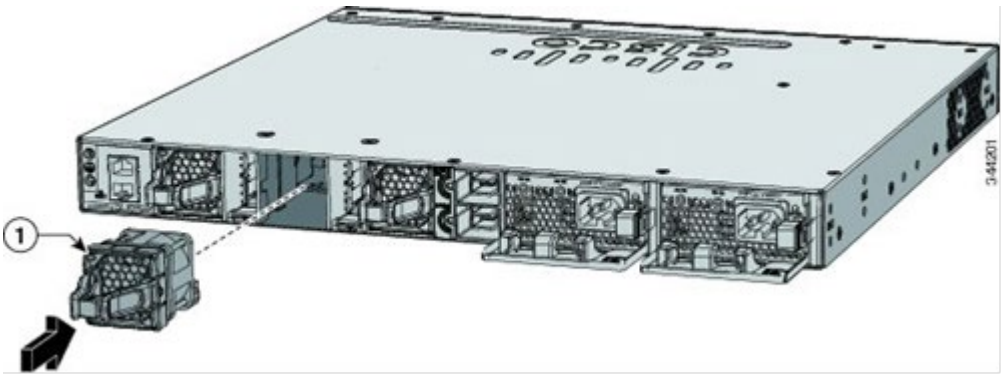


Figure 1 - Fan module

2.2 If a fan fails to show an illuminated green LED, it needs replacing.

This can be done on a live switch by pinching the retaining clips and pulling backwards. The replacement is pushed back into the vacant slot and the retaining clips should click to confirm it is correctly seated. The green LED will now be illuminated.

SERVICE B

3. General Maintenance

3.1 Remove any dust, dirt or infestations.

The accumulation of dust and debris on electronic equipment has the following adverse effects:

a) It increases the working temperature of the equipment, thus reducing the reliability and working life of the equipment in accordance to the Arrhenius effect.

b) The moisture and corrosive elements that are present in the dust can cause premature board failure due to the corrosion of the electronic or mechanical components.

3.2 Check that the relevant drawings are present, correctly stored and legible.

3.3 Check switches for signs of overheating, contamination, damage or failure.

END

When undertaking corrective or preventative maintenance at a level crossing, be aware of the effect of your activities on the operation of the level crossing and what is observed by the public (especially road traffic).

If the work you intend to carry out might result in an incorrect sequence of operation (e.g. one barrier raised, one lowered with red lights operating at an AHBC) then you shall obtain the Signallers permission and their assurance that no trains will approach the level crossing.

When setting up a safe system of work, always take into account the additional risk from road traffic.

Remember NO person is authorised to permit ANY vehicle over a level crossing when the red road lights (wig-wags) are operating.

It is good practice to minimise the amount of times a crossing is seen operating by the public, without the passage of a train.

The last function of maintenance is to test and observe that the equipment operates correctly and correct indications are received at the monitoring/controlling point or DCI.

1. Abbreviations

The following abbreviations are used in respect to level crossings:

Abbreviation	Meaning
AHBC	Automatic Half Barrier Crossing
ABCL	Automatic Barrier Crossing Locally Monitored
AFBCL	Automatic Full Barrier Crossing Locally Monitored
AOCL	Automatic Open Crossing Locally Monitored
AOCL+B	Automatic Open Crossing Locally Monitored plus Barriers
AOCR	Automatic Open Crossing Remotely Monitored
CCTV	Closed Circuit Television
MSL	Miniature Stop Light Crossing
MCB	Manually Controlled Barriers
MCB-OD	Manually Controlled Barriers with Obstacle Detector
MCB-CCTV	Manually Controlled Barriers With CCTV
MB	Manned Barriers
MG	Manned Gates
RB	Remote Barriers
TOB	Traincrew Operated Barriers
SOB	Staff Operated Barriers

Abbreviation	Meaning
OCB	On Call Barriers
UWC	User Worked Crossing
OC	Open Crossing
ATC	Another Train Coming
DCI	Drivers Crossing Indicator (DRL/DWL)
DRL/DWL	Drivers Red Light / Drivers White Light
N	Nearside (left when viewed from the direction of road traffic)
O	Offside (right when viewed from the direction of road traffic)
Y	The side of the Xing next to the up line #
Z	The side of the Xing next to the dn line #

#: On some BR Mk.1 crossings (Penguins) the Y&Z meanings are the other way around, check the diagrams

2. General

More information on level crossing equipment can be found in NR/SMS/Appendix/03.

The crossing section order will give details of the arrangements required at each individual location.

Manually or remotely (CCTV) controlled crossings are interlocked with protecting signals that can only be cleared when the crossing is proved down.

Gated crossings can be mechanically interlocked with protecting signals.

Automatic half barrier crossings are not protected by signals but may have signal controls. There are locations when a signal on the approach to an automatic crossing will be showing a proceed aspect with the barriers still raised. Check with the diagrams.

Automatic barrier or open crossings that are locally monitored do not have indications going to a monitoring signal box. A DWL gives indication to the driver that the crossing is operating and that they may proceed if the crossing is clear.

Crossing on footpaths or occupation roads are usually gated or open and have protection dependant on the usage and the sighting of trains (signs, telephones, MSL).

If there is any doubt over the type and/or operation of any level crossing, ask your SM(S).

3. Permission to Work at Automatic Level Crossings

Before you take an automatic level crossing that is monitored from a signal box on local control you shall reach an understanding with the Signaller at the monitoring signal box of what you are doing and have their permission.

At an automatic level crossing that is locally monitored you shall check that there are no trains approaching before you take local control. If telephones are provided at this type of crossing inform the Signaller what you are doing.

4. Permission to Work at CCTV Monitored Manned Barrier Level Crossing

Before you take a CCTV monitored manned barrier level crossing on local control, or do any work on the cameras that will disrupt the Signallers' view of the crossing, you shall reach an understanding with the Signaller at the monitoring signal box of what you are doing and obtain their permission.

5. Permission to Work at Manned Barrier Level Crossing with Obstacle Detector

Before you take an MCB-OD level crossing on local control, local crossing clear mode or undertake intrusive work on the RADAR or LIDAR systems, you shall reach an understanding with the Signaller at the monitoring signal box of what you are doing and have their permission.

6. Local Control Units

Local Control Units (LCU) are fitted at all modern manual and automatic crossings, although some older MCBs do not have them.

On newer installations that have door proving, a working/failed indication to the monitoring signal box will be given when the LCU door is unlocked.

On older installations that do not have door proving, it is when the 'raise' switch/button is operated. Check the diagrams if you are unsure before unlocking any LCU door.

On newer LCU installations there is a guide on the back of the door that states the door can only be closed when the switch is in the auto position. If this is missing report this as corrective maintenance.

On CCTV monitored manned barrier crossings check the manual/auto lower and/or raise switch on the Signallers control panel (if fitted) are in the manual position before local control is taken.

On automatic controlled level crossings, it is good practice when giving local control back to lower the barriers first then turn the switch to the auto position or press the auto button.

The barriers should then rise (providing all the controlling circuits have reset and there is no approaching train). If the LCU has door proving, 'barriers raised' indication is restored to the monitoring signal box when the door is closed and locked.

On older installations without door proving 'barriers raised' indication is restored when the auto button/switch is operated.

On BR Mk.1 AHBC LCUs, do not use the control arm to operate the auto button, as this will sometimes not fully engage the contacts. Always press the auto button first then operate the control arm.

On manned barriers (if fitted) and CCTV monitored manned barriers that have an LCU with door proving, lower the barriers then switch to the auto position and lock the control unit door. The Signaller will then raise the barriers from the signal box.

On LCUs without door proving, with the barriers raised operate the switch/button to the auto position. The light by the raise switch/button should then be extinguished and the Signaller will have their indications back.

7. BR Specification 843 Barrier Units

These types of units have a proving micro switch on the operators' door (rear of unit); if this door is unlocked indications to the monitoring signal box will be broken. There is no proving switch on the front door of these units. If these units are used on Rural Barriers there is no door proving switch provided on the back door.

On automatic barrier crossings locally monitored (ABCL), automatic open crossing locally monitored plus barriers (AOCL+B), automatic full barrier crossings locally monitored (AFBCL) and some manually controlled barriers (check the design details) the barriers packs fitted are coloured blue. These units are designed so that you have to energize the valve in order to lower the barrier.

Under no circumstances shall a blue coloured pack be fitted to any form of automatic half barrier crossing (AHBC).

8. Automatic Sequence Testing

On early types of BR Mk1&2 automatic level crossings the automatic sequence is controlled by the ATC and strike in treadles, the track circuit controls provide confirmation only.

Some of these designs require both of the treadles at the ATC and strike in to be proved reverse in order for the sequence to operate correctly. If you are unsure of the crossing mode of automatic operation check the diagrams before you attempt an automatic sequence test.

On crossings usually fitted with BR 843 spec barriers units, the automatic sequence is controlled by the track circuits. The strike in treadles provide a cut out for the track circuit feed only. Again, check the diagrams to establish the crossing mode of automatic operation.

Any automatic level crossing with bi-direction controls requires the exit track circuit to be shunted along with the operation of the exit treadle to correctly run the automatic sequence.

On most newer installations of automatic level crossings there is also directional proving in the controls. These designs can usually be identified by the exit treadles being mounted approximately 20 metres from the IRJ of the last controlling track circuit, if unsure check the diagrams.

With this circuitry on a sequence test the opposing exit treadle should be operated in the correct sequence whilst shunting the track circuits to ensure correct automatic operation of the crossing.

If the crossing has other features that will affect the automatic operation (e.g. signal controls, stopping/non stopping selection) check the diagram for how to simulate automatic operation for the maintenance test without these functions (e.g. shunting the controlling track circuit after the signal only, so the crossing operates immediately).

On early designs of crossing (which work from treadle operation) this may not be possible. In these cases, inform your SM(S) of the circumstances.

9. Level Crossing Annual Testing

It is advisable that the annual full test is conducted under a possession of the level crossing and a road closure.

10. Circuit Controller Band Settings

Band	Made Between
DN KR	0° and 4°
HJPR / RER	42° and 90° (#)
MR	0° and 83°
UP KR	81° and 90°

#: The HJPR band on some installations may be set to make sooner than 42°. Check the diagrams for the correct setting for the installation you are at.

The overlap between the UP KR band making and the MR band breaking is provided so that if the barrier moves from the vertical position, it can drive up again without the road lights operating.

On barrier units that use limit switches in place of circuit controllers, refer to the diagrams for the positions of the cams.

It is good practice after altering settings to verify them on manual operation before using power.

11. Typical Road Signs at Level Crossings

The diagrams shown in figures 1 - 6 are a general guide only to the more common level crossing layouts.

They are all shown with additional risk signs that may not be present at all installations.

Always refer to the section order and ground plan for the correct configuration and layout at each individual location.

12. Manually Controlled Barriers

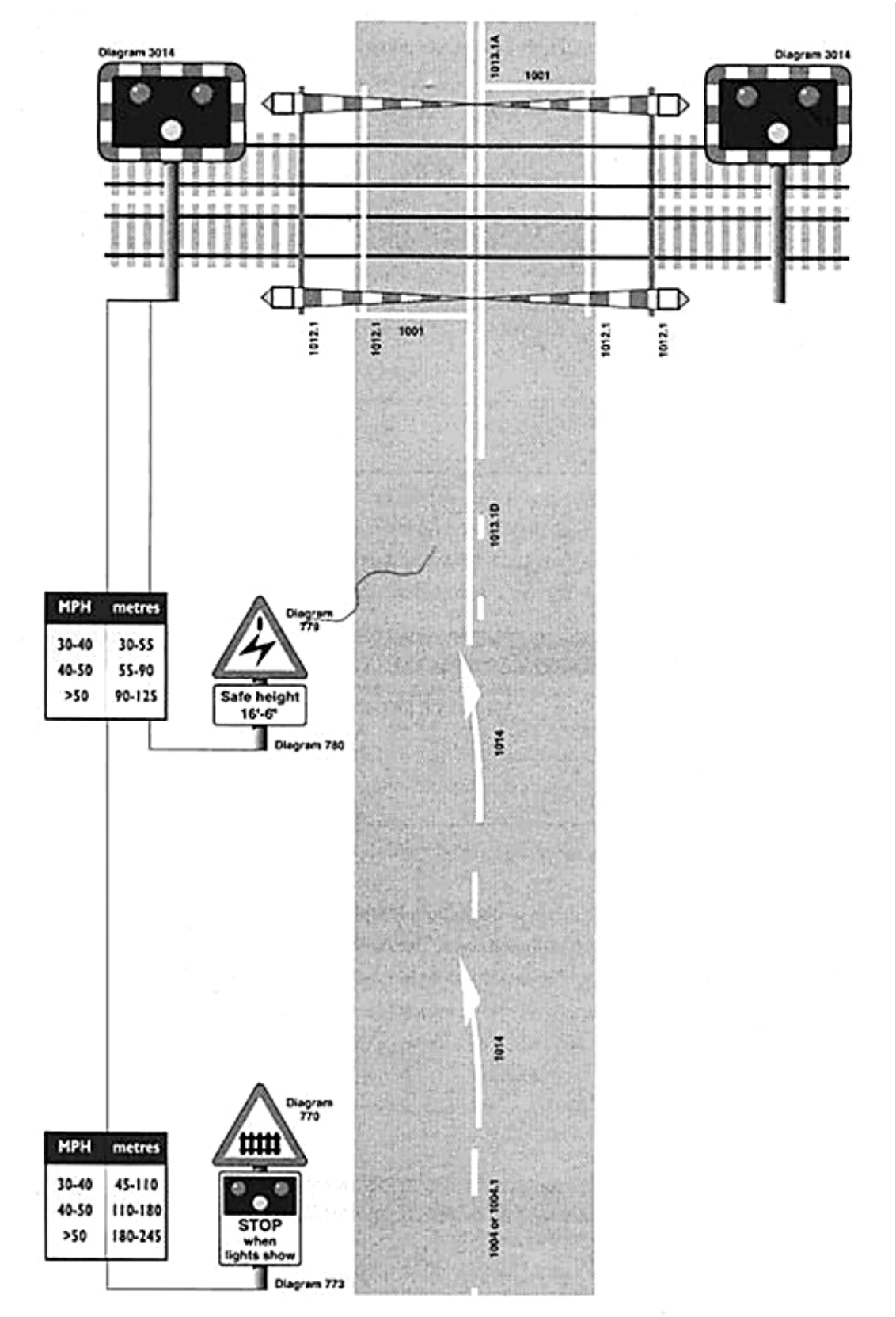


Figure 1 - Manually Controlled Barriers

13. Automatic Half Barrier Crossing and Automatic Half Barrier Crossing Locally Monitored

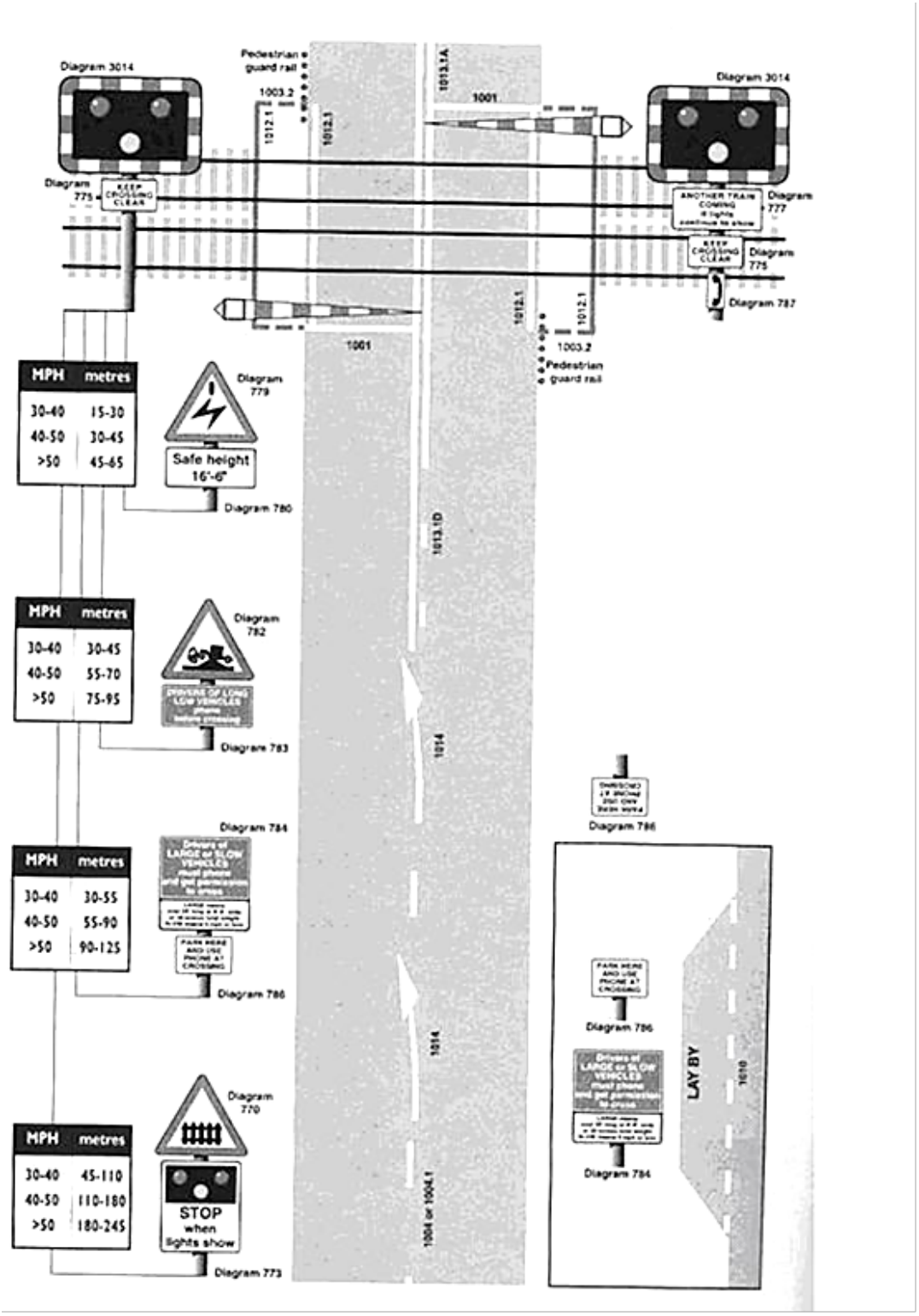


Figure 2 - Automatic Half Barrier Crossing and Automatic Half Barrier Crossing Locally Monitored

At older installations the signs may vary. Check the section order and plans or if in doubt ask your SM(S).

14. Automatic Open Crossing

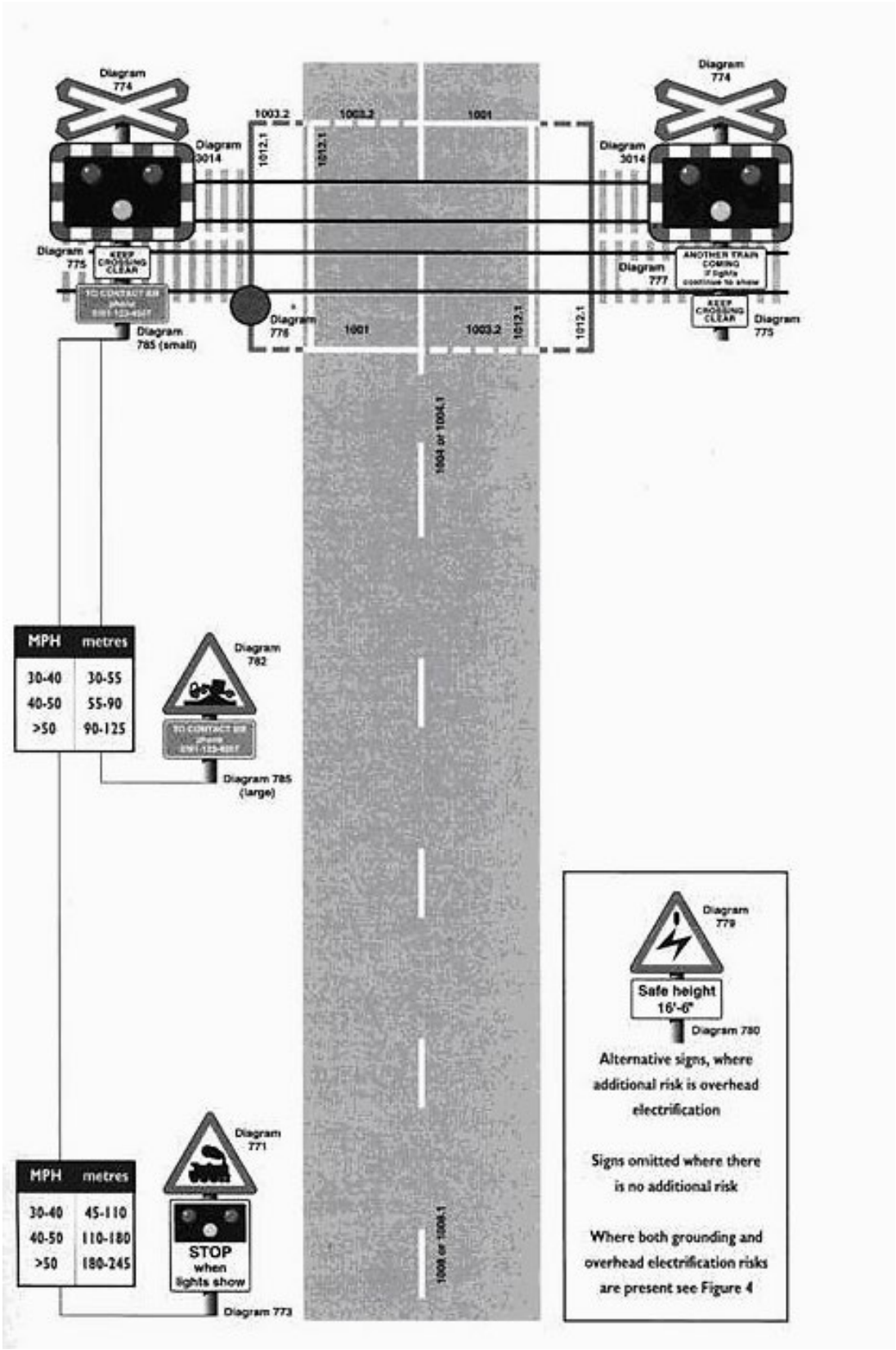


Figure 3 - Automatic Open Crossing

15. Open Crossing

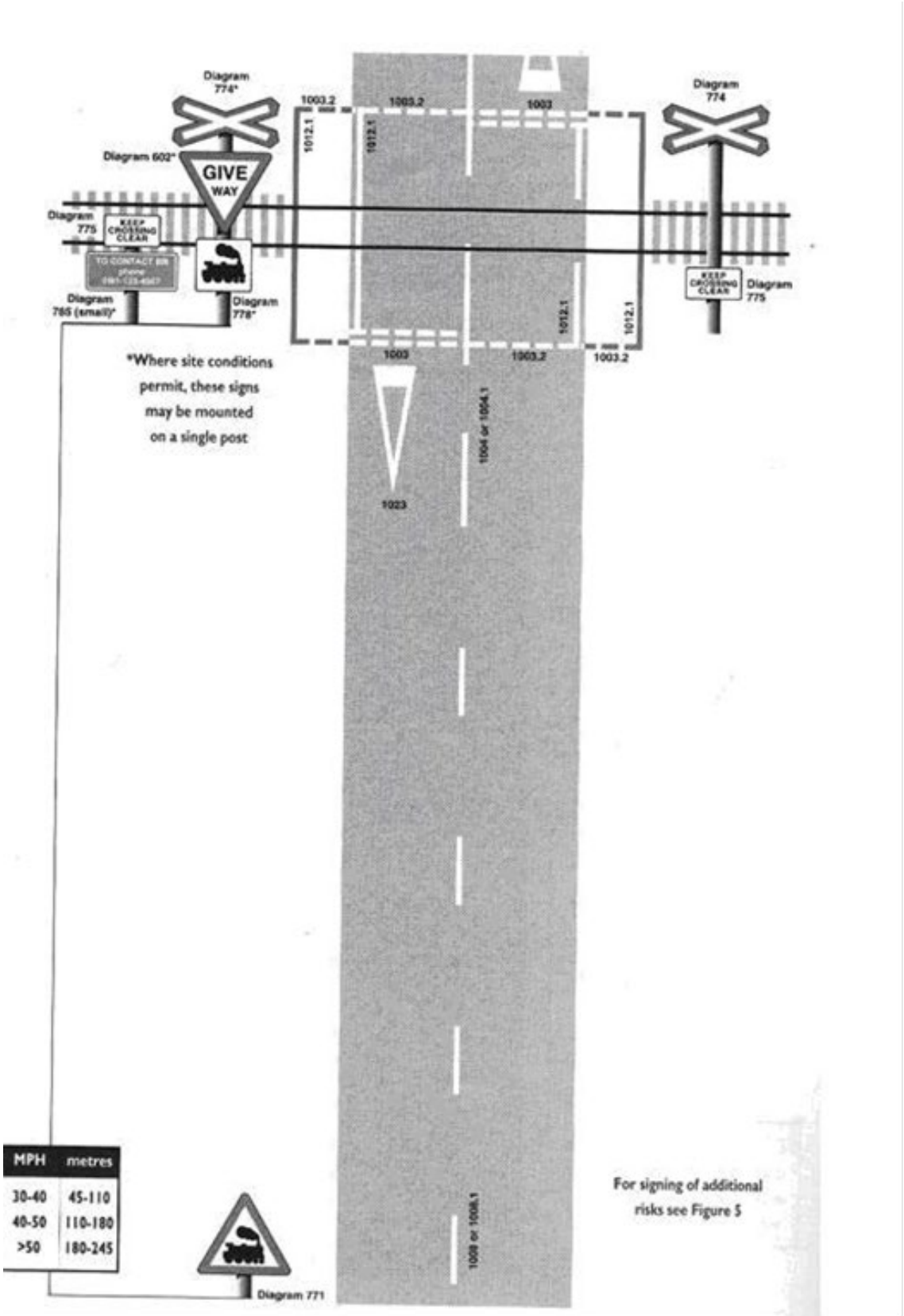


Figure 4 - Open Crossing

16. Miniature Stop Light Crossing with Gates

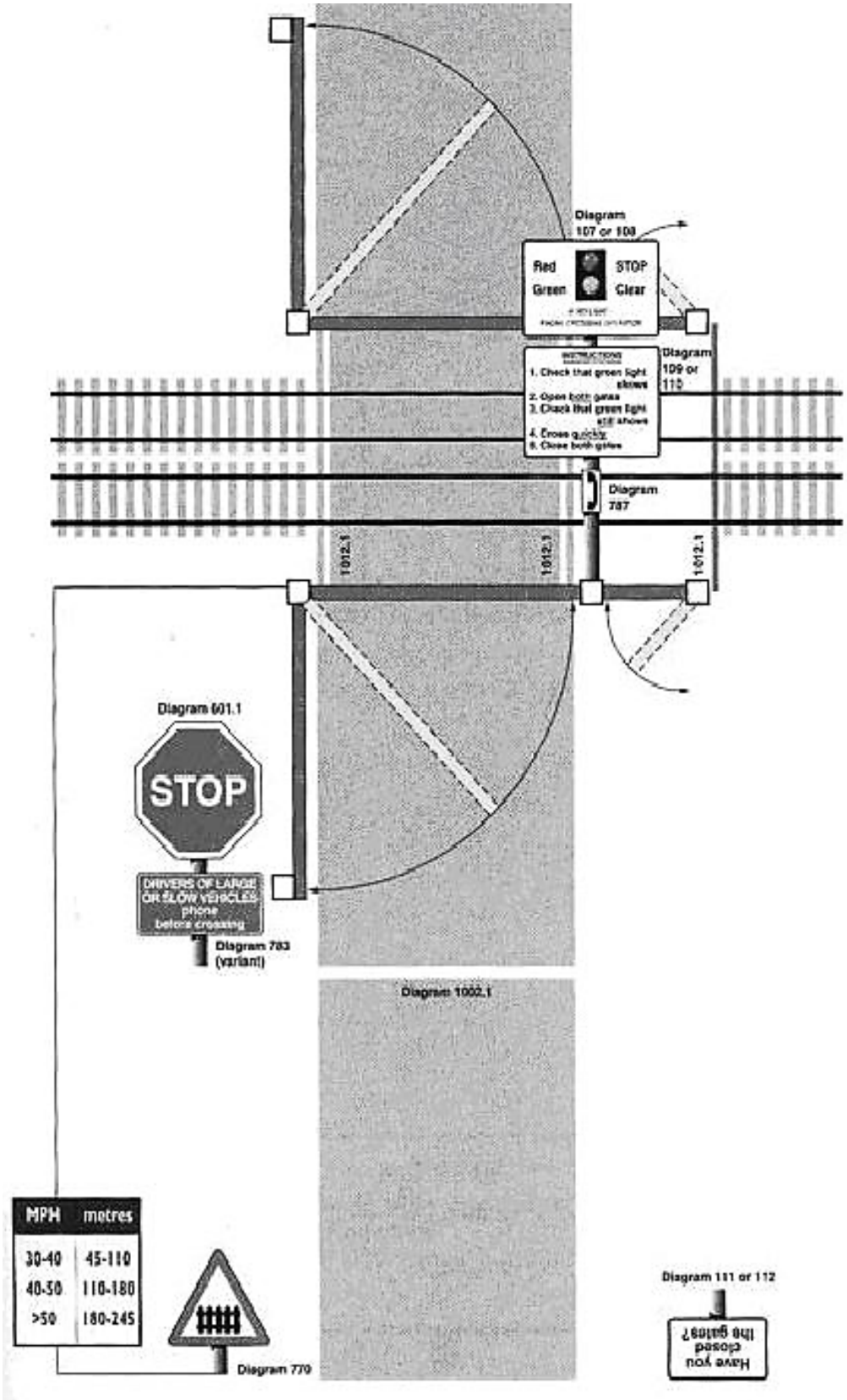


Figure 5 - Miniature Stop Light Crossing with Gates

17. Special Signs for use with MSL Crossings

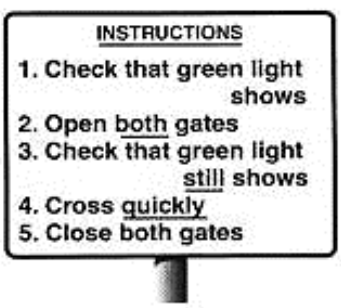


Diagram 109

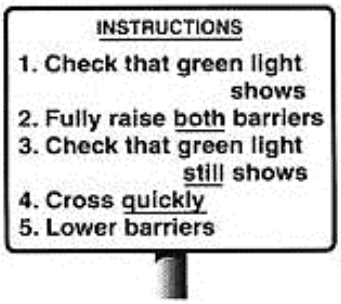


Diagram 110

Diagram 111

Diagram 112

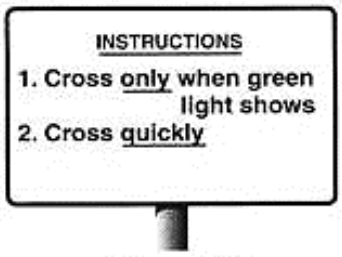


Diagram 114

Figure 6 - Special Signs for use with MSL Crossings

END

Includes:	Level crossings with obstacle detection equipment
Excludes:	All other level crossings

The beam height of LIDARs and RADARs is referenced to the level crossing deck surface.

The number of LIDAR and RADAR provided at a level crossing using obstacle detection will depend on the type of level crossing and the type of obstacle detection equipment.

If the deck height has been changed by works such as tamping or installation of new sleepers, then the impact on the RADAR and LIDAR beam levels needs to be assessed and if necessary, the beam heights of the affected scanners shall be checked, and if beam heights are not within tolerance the beam height shall be setup again.

Some track or surface work will not affect the beam height setting points and so beam heights do not need to be measured after the track works.

Any changes made to the shape of the crossing deck can affect the surveillance Area or Detection Areas of the crossing, e.g. changes to fences or deck panel longitudinal positions.

If a change in shape to the crossing deck has occurred, RADAR and LIDAR surveillance area or detection areas, including the non-detection zones, shall be checked after the track works have been completed. This can be done by a walk test of the Surveillance/Detection Areas using RWMON software and Redscan Manager software.

Details are in the Installation and Set Up Manual.

If the beam height needs to be set up, or if the Surveillance/Detection Areas need to be amended, this shall only be carried by someone competent in the setup of LIDAR or RADAR.

If this cannot be achieved before the crossing is to be handed back to train running, the crossing shall not be operated using the OD equipment.

Where facilities are provided for on-site confirmation of crossing clear e.g. a Crossing Clear Unit (CCU) at an MCB-OD, the crossing can be operated using this. If the crossing has no such facilities, it shall be operated by the LCU.

The tasks in this SMS concern the equipment unique to level crossings provided with obstacle detection equipment.

REGULAR TASK

1. Obstruction clearance

Keeping the crossing clear removes the chance of the crossing detecting vegetation as an obstruction.

1.1 Clear any build-up of dust or soil from the top of the anti-trespass guards.

Either task 2 or 3 shall be undertaken depending on the season in which it is performed.

2. Vegetation growing season

2.1 Check the vegetation growth within the crossing Surveillance Area or Detection Areas.

a) Remove all growth.

b) Keep sight lines to each RADAR Reference Reflector clear of vegetation and other obstructions.

Vegetation should not be allowed to grow above 150mm high within the Detection Area, as this can cause reliability issues with the Low-Level LIDAR scanners.

3. Winter season

3.1 Check for laying snow within the crossing Surveillance Area or Detection Areas.

a) Remove all snow.

b) Keep sight lines to each RADAR Reference Reflector clear of snow and other obstructions.

In winter, snow that has fallen on to the crossing surface can be detected by the Low-Level LIDARs if it builds up to approximately 150mm high or greater.

Winter preparedness plans shall include the pro-active monitoring of snow fall and pro-active clearance of snow from the whole crossing surface before it becomes detected.

The snow piles formed as vehicles traverse the crossing can be detected even though snow fall has been light.

Snow cleared from the crossing shall not be placed in a position where it might obstruct the line of sight of a Reference Reflector or a LIDAR scanner.

The intention of snow clearance is to keep the Detection Area for LIDAR and Surveillance Area for RADAR clear, including the line of sight to each Reference Reflector.

SERVICE B

4. Crossing Inspection

4.1 Check the following:

a) The barrier boom integrity is not strapped out.

b) The barrier down detection is operating correctly.

The barrier down detection is only given when boom is below the minimum angle.

c) The gap between the barrier tips when down is not larger than 65mm.

d) The anti-trespass guards are fitted and complete.

e) The warning labels on barrier machines are present and legible.

These labels are fitted when counterbalance fencing is omitted due to it obscuring the line of sight of the OD system (not to all barrier machines).

These labels warn members of the public to stay away from the machine due to moving parts as there may be no fence provided around counterbalance weights or step protection.

f) Vegetation is clear around each OD scanner and within the crossing area bounded by the barriers and line of sight to each Reference Reflector.

Any actions required shall be undertaken as corrective maintenance.

END

Includes:	AHBC, ABCL, AFBCL, AOCL, AOCL+B, AOCR, MCB, MCB-RB, MCB-OD MSL, MCG, CCTV-MB, MCB-CCTV TMOB, SOB, EBI Gate 200, POGO and Vamos
Excludes:	All other types of level crossing's

Signalling Technical Support staff and/or equipment specialists could perform the level crossing annual test (Service B) separately from maintenance, your SM(S) will advise you.

Access to some or all of the following documents will be required for the annual test:

a) The crossing ground plan.

b) The level crossing order.

c) The crossing control tables.

d) The signalling plan.

If any are not available, inform the SM(S).

If you are in any doubt about any aspect of a level crossing operational sequence, ask your SM(S).

More information on level crossings can be found in NR/L2/SIG/19608 & NR/SMS/Appendix/03 (General Information on Level Crossing Equipment).

SERVICE A

1. Operational Sequences

1.1 If practicable, Observe the operational sequence of the level crossing with the passage of a train.

Check that all the timings are correct for the crossing type and the operation is as described in NR/SMS/PartB/Tests 070 – 084, 159 and 160 (Level Crossing Sequence tests)

If 1.1 is not practicable, perform one normal direction sequence test for as appropriate to the crossing type in NR/SMS/PartB/Tests 070 – 084, 159 and 160 (Level Crossing Sequence tests)

If provided, perform a local control sequence function as appropriate to the crossing type in NR/SMS/PartB/Tests 070 – 084, 159 and 160 (Level Crossing Sequence tests)

This task may be carried out in conjunction with the appropriate tasks/tests of the barrier machine.

2. Adjustment

2.1 Check that on completion of testing and maintenance that all controls are normalised and the correct signal box and/or driver indications are showing.

Check that all hand gates are correctly closed. If possible, on automatic crossings, Observe the passage of a train on an automatic sequence.

Report to your SM(S) any crossing with hand gates that are found open on arrival.

SERVICE B

3. Level Crossing Annual Tests

3.1 Perform the annual test of the level crossing.

3.2 Level crossing annual tests are detailed in NR/SMS/PartD/Index (Level Crossing Annual Tests).

END

Includes:	Flashing Road Light Assemblies (Wig-Wags), Yodalarms, Bells, Pedestrian Lights.
Excludes:	Reflective or externally lit signs Crossing headlight units at AOCL/AOCL+B/ABCL/AFBCL crossings. Permanently lit night-time floodlights at MCB-CCTV

Road light structures do not have a permanent ladder fitted. When using a separate ladder, always follow the ladder drill, if you are unsure ask your SM(S).

The crossing section order and ground plan gives details of the correct alignment of these items. Appendix B gives details of the generic alignment of road light assemblies.

SERVICE A

1. Structures

1.1 Examine posts, fittings, and fixings. Check they are secure and stable.

2. LED Road Lights Assemblies

2.1 Check each road light assembly. The assembly shall be not damaged, properly secured and hoods securely fitted.

2.2 Check the backboard of each assembly, including the chequered border. If the black colour of the backboard is faded, report it as corrective maintenance (See details in Appendix A).

2.3 Check the alignment of the road light LED modules. (See details in Appendix B).

2.4 Report as corrective maintenance any sunlight issues with the sighting of the road lights. (See details in Appendix C).

This can be a problem with low winter sun if the crossing is on an east-west alignment.

Alignment of LED’s is not as critical as with filament types as they have a wider spread of light and a restricted amount of adjustment is available on the mounting.

The backboards shall be angled as shown on the ground plan and then the LED modules shall be aligned as near as practical to Appendix B values as the limited adjustment allows.

2.5 Check and wipe the LED module lenses. Cleaning shall be carried out using an approved cleaner. Lenses shall be clean, and free from cracks.

2.6 Examine weather seals and gaskets.

2.7 Check visible tail cables, conduits, cable entries, and glands.

3. LED and Filament Pedestrian Light Assemblies

3.1 Check each road light assembly. The assembly shall be not damaged and properly secured.

3.2 Check each unit is securely fitted and undamaged. Check they are correctly aligned as per the crossing ground plan.

3.3 Check that the hood is securely fitted, and the LED module lens or lamp unit lens is clean and undamaged. Wipe as necessary.

Cleaning shall be carried out using an approved cleaner. Lenses shall be correctly orientated, clean, and free from cracks.

3.4 Where Provided:

Check that the sunscreen is undamaged and securely fitted.

4. Filament Road Light Assemblies

4.1 Check each road light assembly. The assembly shall be not damaged and properly secured.

Where the road lights are attached to Mk1 concrete pedestals, check the brackets are properly secured. These lights tend to lean forward.

4.2 Check the backboard of each assemble. If the black colour of the backboard is faded, report it as corrective maintenance (See details in Appendix A).

4.3 Check the alignment of the road light lamp units. (See details in Appendix B).

4.4 Report as corrective maintenance any sunlight issues with the sighting of the road lights. (See details in Appendix C).

This can be a problem with low winter sun if the crossing is on an east-west alignment.

4.5 Check chequered borders and clips, where provided.

4.6 Check and wipe red and amber lenses. Cleaning shall be carried out using an approved cleaner. Lenses shall be correctly orientated, clean, and free from cracks.

4.7 Examine weather seals and gaskets.

4.8 Check visible tail cables, conduits, cable entries, and glands.

5. Audible Warnings

5.1 Check that the audible warning devices and associated fixtures are secure, undamaged, and correctly aligned with no obstructions in front of the device that might reduce the sound output.

5.2 Check visible cables and glands are undamaged. Yodalarm units can be prone to failure due to water ingress; all seals/glands shall be effective with the cable entry gland being lowermost. Renew as necessary as corrective maintenance.

5.3 Check that the sound output of the audible warning is adequate for the crossing circumstances and (if applicable) is reduced for the night time. Some crossings have had the sound output of yodalarms reduced because of local conditions, check the diagrams.

6. Mechanical Sangamo/Schlumberger Audible Warning Control Unit (AWCU)

Check the time indication displayed and the day/night settings are correct.

If incorrect by more than 30 minutes (taking into account, the bi-annual GMT/BST time alterations) assume that the internal battery or mechanism is defective, and the unit will require replacement as corrective maintenance.

Some time clocks have a day omit dial, the arrows on this shall all be pointing to the centre of the dial.

7. Electronic Audible Warning Control Unit (AWCU)

7.1 Check that the time displayed is correct. If an incorrect time is displayed the unit shall be regarded as defective and shall be replaced as corrective maintenance. If the display is blank press the ‘set’ button to restore the display.

The GMT/BST time alterations are automatic; however, it might take up to 24hrs for the change to occur on the units, this shall be taken into account.

A blank display can occur after a power failure.

NR/SMS/PartB/Test/069 (SELC Digital Timers Set up Procedure), Details how to setup SELC Timer

8. Final Check

8.1 Observe correct operation of all the road lights and audible warnings.

Some Yodalarms have a reduced sound output because of local conditions, Check the section order. This can be undertaken as part of sequence testing in NR/SMS/PartC/LC10 (Level Crossings Operational Sequences).

SERVICE B

9. All Road and Pedestrian Lights

9.1 Examine cable terminations and wiring.

9.2 Examine water seals and gaskets.

9.3 Filament Light Units Only:

a) Check reflectors and inside faces of lenses. Clean as necessary with a lint free cloth.

b) Check lamp holders and alignment of lamps.

c) Lubricate lens assembly retaining screws and hinges to prevent seizing.

d) Carefully re-assemble each unit and check the light units are correctly aligned along the road. (Appendix B).

10. Final Check

10.1 Observe correct operation of the road lights and audible warnings.

10.2 Check that all lights correctly illuminate and flash. This may be undertaken as part of sequence testing in NR/SMS/PartC/LC10 (Level Crossings Operational Sequences).

APPENDIX A - Road Light Assemble Back Boards

Figure 1 – Failed
Example of filament light unit with badly faded with variable grey shading on the back board, requires repainting/replacing urgently. Report immediately as corrective maintenance

Figure 2 – Failing
Example of filament light unit with fading back board (going grey). Acceptable but should be programmed for repainting/replacing. Report as corrective maintenance

Figure 3 - New
Example of a new LED light unit with solid black back board and extended visors. No actions required

APPENDIX B - Flashing Road Light Assemblies Alignment

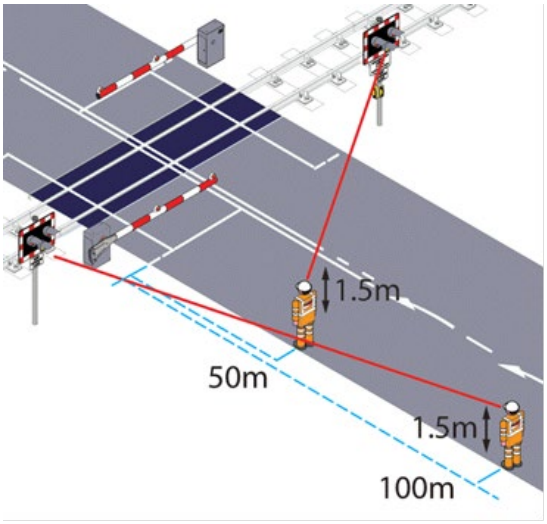


Figure 4 – Road user sighting

The primary Road Traffic Light Signal (wig wag) assembly (near side) should normally be aligned to a point 1.5 metres above the near side edge of the road way or footpath / pavement at 100 metres on the approach side of the stop line.

The duplicate primary Road Traffic Light Signal (wig wag) assembly (off side) should normally be aligned to a point 1.5 metres above the near side edge of the road way or footpath / pavement at 50 metres on the approach side of the stop line or as specified on the Ground Plan or schematic diagram.

If a different alignment is specified on the Ground Plan, then arrange for alignment in accordance with the Ground Plan.

Where alignment to 100m (50m) is not possible (e.g. due to road approach curvature within 50m or the local layout) then the alignment should be to a point 1.5m above ground level on the edge of the footpath at the point where a vehicle driver can first sight the road traffic light (wig wag), to give the motorist the earliest possible view of the flashing lights.

It should be noted that the alignment of the light units on a back-board assembly should all point to the alignment point and that the practice of aligning the red light units, on the same back board, in differing direction (chameleon eye effect) is not allowed.

The reason is that should a red lamp fail then the other might not be seen at the point of alignment. Should a wig wag have its red lights misaligned due to the need for an indication towards another approach this should be reported to the relevant Operational Risk Control Coordinators so that an assessment can be made whether an additional wig wag is required.

APPENDIX C - Sunlight Issues

Technicians and LCIM's shall notify their SM(S) if they become aware of any crossing where sunlight is likely to be an issue.

This 'issue' is deemed to be when visibility of the correct aspect of the RTL's to the road vehicle driver could be affected either by sunlight on the low horizon ahead (Figure 5), or by swamping of the lens from sunlight behind the vehicle (Figure 6).

Figure 5 – Sun flair

Figure 6 - Swamping

If a potential problem is discovered, then your SM(S) should make the necessary arrangements to fit the crossing with extended visors and consider changing the wig-wag units to LED.

END

Includes:	Drivers Plunger Unit, Trainman Operated Barrier Control Pedestal, Local Control Units, Crossing Clear Units, Drivers Release Units, Drivers Pull-Cord Mechanism
Excludes:	All other types of Crossing Plungers, Control Units, and Pull Cords

Contact the Signaller before you open any control unit door that is fitted with a micro-switch.

Before you operate any of the level crossing control buttons make arrangements with the Signaller to protect the line.

SERVICE A

1. Post and Fittings

1.1 Check the following structure items:

a) Posts and foundations.

b) Cable ducts and conduits.

c) Back-boards and lights.

d) Brackets, fittings and fixings.

2. Control Unit

2.1 Check the unit is securely mounted.

2.2 Check the following items:

a) The housing, doors, access plates and seals.

b) Hinges.

c) Latches and locking devices.

Lubricate the hinges, locks, and latches and tighten any loose fixings.

2.3 Check the tail cables. They shall be correctly routed, secure, sealed into the unit, and not damaged.

2.4 Check internal wiring is secure and correctly terminated. Protect terminals as necessary.

2.5 Examine insulation for damage and degradation.

2.6 Open the unit. If the door is fitted with a micro-switch, you shall first contact the Signaller and make arrangements.

2.7 Check and clean the faceplate, engraving and labelling. Check that all the wording is legible.

2.8 Examine plungers, buttons and indications. Check that the correct indications show where they are provided (e.g. train-man operated barriers).

2.9 Examine the door micro-switch, operating mechanism and wiring, where fitted.

2.10 Check the sealed key release is intact and make sure the keys are available (train-man operated barriers).

2.11 Check any door interlock and captive key feature and then close and lock the door.

3. Pull Cord Assembly

3.1 Examine the following on the pull cord assembly:

a) Wire and thimbles.

b) Eyelets.

c) Connection to rotary switch.

Replace the wire if it is damaged or corroded. Examine the following on the rotary switch assembly:

d) Operating arm.

e) Spindle.

f) Switch unit fixings.

g) Connecting lug and pin.

h) Mounting bracket.

i) Cable gland.

3.2 Check that the adjustable stop is tight (two lock nuts).

3.3 Lubricate the micro-switch spindle and lug connection.

SERVICE B

4. Control Unit

4.1 Check Crossing Clear Units (CCU) for correct operation and that the buttons are not stuck in.

4.2 Where a push button type, Local Control Unit (LCU), is provided check the buttons are not stuck in.

END

Includes:	Red/Green Light units at Miniature Stop Light (MSL) & Warning Light (MWL) Units
Excludes:	All Other Crossing Lights

Contact the Signaller before you open any control unit door that is fitted with a micro- switch.

Before you operate any of the level crossing control buttons. Make arrangements with the Signaller to protect the line.

SERVICE A

1. External Inspection

Two Filament Lamp Units:

1.1 Clean and examine light unit lenses. Rectify if missing, damaged or discoloured.

Four Filament Lamp Units:

1.2 Clean and examine front screen and internal glass filter. Rectify if missing, damaged or discoloured.

LED Modules:

1.3 Clean and examine the module fronts. Rectify if damaged do not use abrasive pads or abrasive cleaning agents.

1.4 Check that the post is stable and securely fixed in the ground.

1.5 Check that the lamp unit hoods are correctly aligned, secure, and undamaged.

1.6 Check that the tail cable is correctly routed, the sheath is undamaged and cable entry seal effective.

1.7 Check that the signs and notice boards are legible, correctly worded, and secure. Wipe as necessary to clean.

SERVICE B

2. Internal Inspection

This service is applicable to filament light units only.

2.1 Check the seals around the lenses and access doors.

2.2 Clean and dust the interior.

2.3 Check the wiring and terminations; Protect as necessary. Check that the wiring is routed clear of the lamps and cannot be trapped by the door hinge.

2.4 Check and lubricate doors, hinges and fastenings.

2.5 Examine the lamp holders and fixings.

2.6 Renew the red and green lamps. Check that the replacements are seated correctly and the main filaments illuminate.

Use a clean paper tissue or clean cloth to handle the replacement lamp to avoid contaminating the glass envelope.

Two Lamp Units:

2.7 Check (if provided) that the filament changeover operates correctly.

Four Lamp Units:

2.8 Check that the lamp changeover operates correctly.

2.9 Carry out NR/SMS/PartB/Test/021 – (Signal Filament Lamp Test).

2.10 Lubricate and secure padlock.

SERVICE R1

Includes:	Dorman LED Red / Green light Modules
Excludes:	Non LED Light Modules and MSL/MWL level crossings controlled by Predictors

3. Maintenance

3.1 Check that the tail cable is correctly routed, the sheath is undamaged and cable entry seal effective.

3.2 Clean the module fronts - do not use abrasive pads or abrasive cleaning agents.

3.3 Examine the module fronts. Rectify if damaged.

3.4 Lubricate module hinges and padlock.

3.5 Check door fits securely and has a padlock.

END

Includes:	DCI Signals and Crossing Headlight Units
Excludes:	All other types of crossing signal or light unit

Do not climb up any signal if you are in any doubt of the security of the structure.

Report any serious defects as corrective maintenance.

Some structures do not have a permanent ladder fitted. Always follow the ladder drill. If you are unsure ask your SM(S).

Do not obstruct the sighting of the signal to the driver of an approaching train during any maintenance activity.

General

Drivers Crossing Indicators (DCI) signals with Drivers Red Light/Drivers White Light (DRL/DWL) indications are found at ABCL, AFBCL and newer AOCL crossings.

DCI signals with Drivers White Light (DWL) indications only are found at older AOCL crossings.

Crossing Headlight Units are found at all types and ages of ABCL, AFBCL and AOCL crossings.

At some installations the crossing headlight and DWL are fitted on the same structure.

The crossing section order, ground plan, and signalling plan give details of correct alignments for these items.

SERVICE A

1. Structures (all units)

1.1 Examine posts, fittings and fixings. Check they are secure and stable.

1.2 If a ladder and hoop are fitted, check they are in good condition, secure and stable.

1.3 If anti-vandal measures are fitted, check they are in good condition and effective.

Ladder guards, lens meshes etc.

2. Crossing Headlight Units

2.1 Check that the headlights units are undamaged, have their hoods fitted and are correctly aligned.

2.2 Check that the lens is clean. Wipe as necessary. Carry out cleaning with an appropriate cleaner.

2.3 Check that both headlights illuminate when the flashing red road lights illuminate.

These units usually consist of a sealed beam assemble, if faulty the whole unit will require to be replaced

3. Drivers White Light Units (DWL)

3.1 Check that the DWL units are undamaged, have their hoods fitted, and are correctly aligned.

3.2 Check that the lens is clean, wipe as necessary. Carry out cleaning with an approved cleaner.

3.3 Check that the correct DWL illuminates for the direction of an applied train simulation, check DWLs for other directions do not illuminate.

This task can be carried out as part of a sequence test for the appropriate crossing.

4. Drivers Red/White Light Units (DRL/DWL)

4.1 Check that the DRL is flashing.

4.2 Check that the DRL/DWL units are undamaged, have their hoods fitted, and are correctly aligned.

4.3 Check that the lenses are clean, Wipe as necessary. Cleaning shall be carried out using an appropriate cleaner.

4.4 Open the unit and check the following items:

a) Door seal. Replace if necessary.

b) Cables and wires.

c) Check that the glands are effective.

d) Terminations. Protect as necessary.

4.5 Check there has been no moisture ingress inside the head. Any moisture found should be cleaned away and the source found and sealed.

4.6 Examine the printed circuit board on the DRL for any signs of moisture contamination or damage.

4.7 Check all the LEDs on the DRL unit are flashing. If any are not flashing, replace the whole DRL unit.

As the unit only pivots back a small degree a mirror is required to see the LEDs.

4.8 On completion, check that the door is correctly closed and locked. Lubricate the hinges and padlock.

4.9 Check from the speed restriction board the sighting of the DRL/DWL signal. Check the flashing red light is bright and clearly visible.

4.10 Clear away any obstructing vegetation. If this is not possible arrange via your supervisor for it to be done.

4.11 Check that the correct DWL illuminates for the direction of an applied train simulation.

4.12 Check DWLs for other directions do not illuminate.

This task can be carried out as part of a sequence test for the appropriate crossing.

5. Final

5.1 Check that on completion of maintenance all controls are normalised, and the correct driver indications are showing.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LC17		
Barrow Crossing Light Units		
Issue No: 03	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Single white light units
Excludes:	All other types of Barrow Crossing Light Units.

SERVICE A

1. Light Unit

1.1 Check that the post is stable and securely fixed in the ground.

1.2 Check that the light unit is undamaged, the hood (if provided) is secure, and the unit is correctly aligned.

1.3 Check that the signs and notice boards are legible, correctly worded and secure. Wipe as necessary to clean.

1.4 Examine the tail cable and cable entry gland.

1.5 Examine the internal wiring and terminations. Protect as necessary.

1.6 Check that with no trains approaching the lamp(s) are lit. Replace any defective lamps as corrective maintenance.

1.7 Clean the interior and exterior of the light unit.

1.8 If possible, observe correct operation for the passage of a train.

SERVICE B

2. Voltage Checks

2.1 Carry out NRSMS/PartB/Test/021 (Filament Signal Lamp Tests).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LC20		
Level Crossing – Automatic Half Barrier (Reliability – Centered Maintenance)		
Issue No: 05	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	AHB fitted with BR 843 barrier machines which have met the prerequisites shown in NR/L3/SIG10665
Excludes:	AHB fitted with other types of barrier machines

SERVICE R1

1. Analysis

1.1 Download all data from the level crossing logger for 4 periods over the last 4 weeks.

1.2 For each of the period downloaded check the following data:

a) The time between the start of yellow lamps to train arriving at crossing.

b) The time the barriers took to lower (UP KR down to DN KR up).

c) The time the barriers took to rise (DN KR down to UP KR up).

d) The time taken for the MROT to operate.

e) Look for any irregular operation of any of the RECR relays.

f) Look for any instances of the (DOOR) CR down with LCU(DOOR) CR Up.

SERVICE R2

2. Circuit Controllers (Contact finger type only)

2.1 Examine the case, fixing bolts/screw linkages & pins for signs of seizing or wear, lubricate where required (wipe off any excess).

2.2 Examine the cable & wiring for damage or degradation.

2.3 Examine the termination for risk of short circuit, coming loose or contamination, apply protection where required.

2.4 Examine the contact bands, segments & contact fingers for wear/ damage.

2.5 Clean contact surfaces with lint free cloth moistened with switch cleaner.

2.6 Check the lid for effective gasket.

2.7 Check and lubricate the bearing Bearings (OILITE or nylon should NOT be oiled).

2.8 Lubricate padlock (where fitted).

3. Operational Sequence Test

With the Passage of a Train

3.1 Carry out NR/SMS/PartB/Test070 (AHBC Operational Sequence Test) - Service A.

4. Level Crossing Phones

4.1 Check that each phone can contact the controlling signal box.

4.2 Check that each phone can be called back from the controlling signal box.

SERVICE R3

5. Filament Style - Flashing Road Light Assemblies (Wig-Wags)

5.1 Examine each post and its fittings.

5.2 Check each post for stability.

5.3 Check for damage or fading.

5.4 Check lens orientation (See Appendix A for details).

5.5 Check road light alignment (See Appendix C for details).

5.6 Clean the Yellow and Red lens.

5.7 Clean the pedestrian lights (Where fitted).

5.8 Clean all crossing signs.

6. Barrier Machine

6.1 Check for obstructions and fire risks.

6.2 Check the barrier is secure on the base and there is clearance between counter balance and the ground/base when in raised position.

6.3 Check any gap between base and pedestal is sealed.

6.4 Check the external seals for barrier bearings.

6.5 Check the front and rear door locks.

6.6 Check the boom, boom lamps, reflective strips, brackets and fastenings boom wiring, terminations, plug & sockets for integrity.

6.7 Check motor brushes, replace if less than 7mm in length.

6.8 Tuscan motors: remove screw caps with care as brushes can spring out. Brushes should slide freely in their holders and seat fully on the commutator.

6.9 Check the motor commutator, they should be light coffee colour.

6.10 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

6.11 Lubricate the pedestal door hinges and locks.

6.12 Check Torque Barrier side arm retaining bolt (210Nm) Boom locating pin and 'Vargal' nut (16Nm) (Using torque wrench).

7. Audible Warning Devices

7.1 Check the unit for security of fixings, damage and correct alignment.

7.2 Check the weather seals, visible cables, conduits & glands.

Where Electronic AWCU clocks are fitted

7.3 Check that it is working correctly and displaying the correct time.

For setup details see NR/SMS/PartB/Test/069 (SELC Digital Timer - Set-up Procedure).

SERVICE R4

8. Filament Style - Flashing Road Light Assemblies (Wig-Wags)

8.1 Examine the road light water seals and gaskets.

8.2 Examine the lamp holder and the condition of the internal wiring and terminations.

8.3 Examine and clean internal reflectors.

8.4 Examine and clean the inside of the lens.

8.5 Check the visible cable and conduits.

8.6 Lubricate the lens retaining screws and hinges.

9. Barrier Pedestal Unit

9.1 Wipe each pedestal side arm and counter balance weights.

9.2 Check each pedestal is correctly aligned.

9.3 Check the Auto/Manual valve is set to “AUTO” and split pin and lead seals are fitted.

9.4 Check the Top & Bottom trunnion blocks, mounting & tabs washers are fitted correctly.

9.5 Check the bolts connecting the trunnion to the operating lever are the correct length.

9.6 Check the torque of the trunnion retaining bolts (70Nm).

9.7 Check that the spirol pins are correctly fitted, and that the correct length of bolt is fitted into the correct set of holes.

Bolt Size	Use
M12 x 45mm	Used to secure the Top trunnion to the bottom set of holes in the operating arm bracket for boom lengths up to 7.1M
M12 x 70mm	Used to secure the Top trunnion to the TOP set of holes in the operating arm bracket for boom lengths 7.1M and above
M12 x 35mm	Used to secure the Bottom trunnion to its mounting position for ALL boom lengths
The unused Top trunnion holes should be fitted with the RED bolts provided. Tab washers shall be used and turned.	

9.8 Check the hydraulic fluid level and top up as necessary.

The fluid should just be visible in the strainer. If top-up is required then this should be carried out with the barriers in the lowered position.

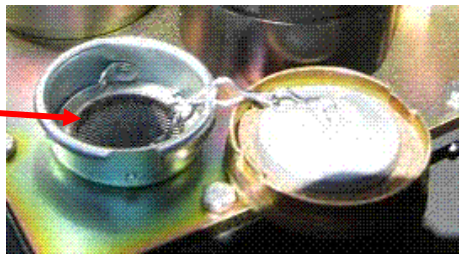


Figure 1 – Hydraulic Filler Cap

9.9 Check the Earth Bonding.

9.10 Check the effectiveness of door water seals, renew as necessary.

9.11 Check door hinges, locks & door stay.

9.12 Check the Main shaft bearings and its fastenings.

9.13 Check the up & down stops, shock absorbers, fixing brackets & fastenings and replace plastic stop striker pads as necessary.

The shock absorber plunger should not be able to be depressed by more than 3mm by finger pressure.

9.14 Check for excessive play in the keyway on the side arm to main shaft.

9.15 Check the cap head screw on circuit controller lever is secure (see Figure 2).

9.16 Check the position of the circuit controller roller is within the track of the cam.

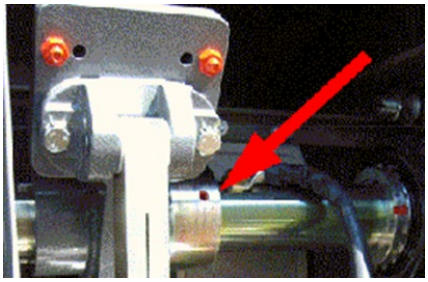


Figure 2 – Cap Head Screw Position

9.17 With the barrier in the lowered position, the roller should be visually flush with the right-hand side face of the operating cam ± 2mm.

9.18 Apply protection to the Pedestal fixing bolts, the main shaft bearing, side arm fixings, vargal nuts and the counter balance fixings.

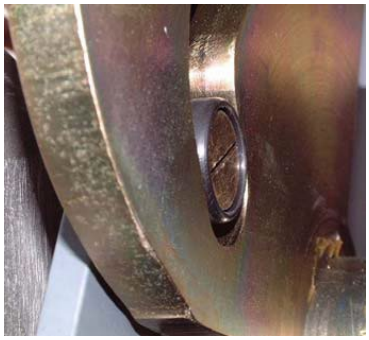


Figure 3 – Circuit Controller Roller

10. Booms

10.1 Check the height of the boom from the road surface.

Top of boom in the centre of the road should be no less than 0.9m. The maximum height from the underside of the boom to the road surface should not exceed 1m at any point.

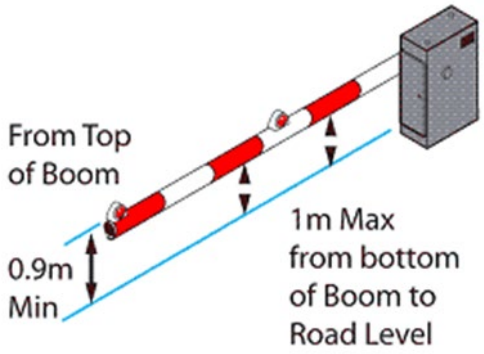


Figure 4 – Barrier Boom Height

10.2 Clean/wipe the Boom including the reflective strips and boom light lenses.

10.3 Check the boom is the correct length.

10.4 Check the booms are not “Hunting” when in the raised position.

Hunting is the term used to describe the action of powering a barrier back to the upright position repeatedly. This action is initiated when barrier falls below 83º due to a hydraulic pack fluid leakage. (And by the force of the wind in windy conditions).

10.5 Measure the gap between the pedestal cabinet and outer face of barrier side arm is 95mm-105mm (report if outside tolerance).

10.6 With boom fully lowered, Measure the distance between the left-hand side of the pedestal to the left-hand side face of the web of the operating lever arm. This distance should be 150mm +/- 2.0mm.

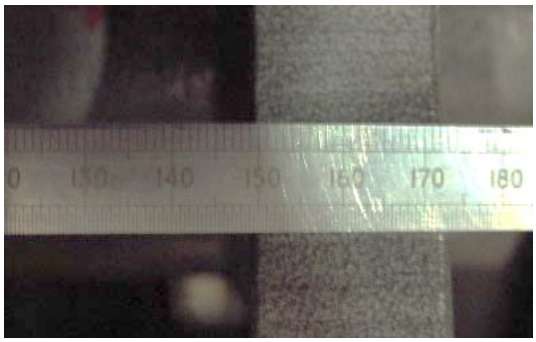


Figure 5 – Operating Lever Arm Measurement

10.7 Check the counter balance weights are secure.

10.8 Check the tip weight of each boom using the following method. Connect the weight measuring device to the tip end of the boom, lift the tip boom until it is approximately 4° to 5° from the horizontal.

Release the weight onto the measure device and record the weight before the lowering the boom to the ground.

11. Local Control Unit

11.1 Examine the Post, fixtures and fittings.

11.2 Check the post stability.

11.3 Check and lubricate door hinges and padlock.

11.4 Check the lock function correctly.

11.5 Check for signs of water ingress.

11.6 Check for signs of internal wire damage or degradation.

11.7 Protect terminations as required.

12. LED Style - Flashing Road Light Assemblies (Wig-Wags)

12.1 Examine each post and its fittings.

12.2 Check each post for stability.

12.3 Check for damage or fading.

12.4 Check lens orientation (See Appendix A for details).

12.5 Check road light alignment (See Appendix C for details).

12.6 Clean the Yellow and Red lens.

12.7 Clean the pedestrian lights (Where fitted).

12.8 Clean all crossing signs.

13. Level Crossing Annual Tests

13.1 Perform the annual test of the level crossing.

13.2 Level crossing annual tests are detailed in NR/SMS/PartD/Index (Level Crossing Annual Tests).

END

Includes:	Barrier Machine BR 843
Excludes:	All other Barrier Machines

When lowering a barrier, take care not to trap limbs between the boom assembly and open pedestal doors or fencing.

More information on these machines and the replacement of booms, A frames, micro-switch assembles etc. can be found in NR/SMS/Appendix/03 (General Information on Level Crossing Equipment).

If practical, take local control prior to starting work.

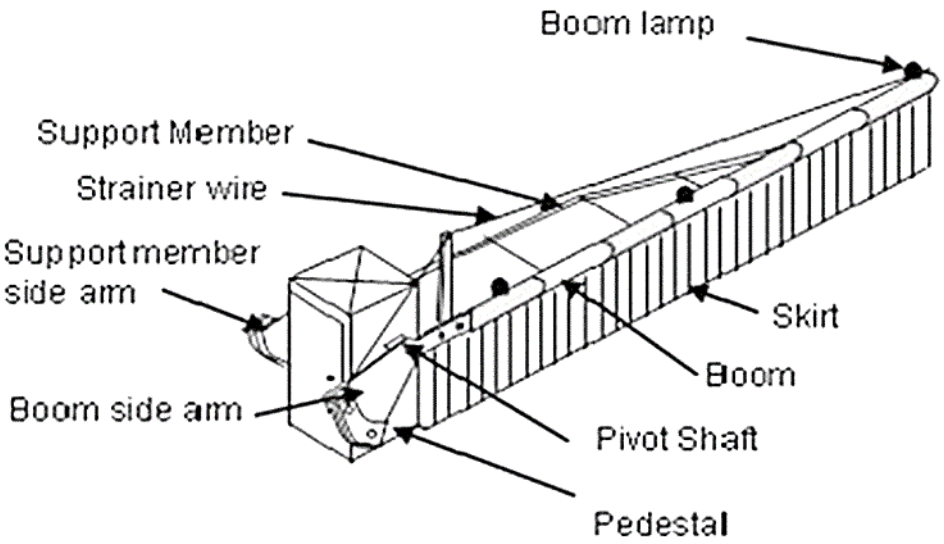


Figure 1 - Typical Boom Layout

SERVICE A

1. External Inspection

1.1 Remove potential obstructions and fire risks.

1.2 Check concrete base, pedestal exterior, side arm assembly, weights and adapter assembly.

1.3 Check that the barrier unit is secure on the base. The gap between the base and the pedestal shall be sealed to prevent rodent access.

1.4 Check external seals for barrier bearing.

NOTE: *Freezing water in bearings can cause barriers to jam.*

1.5 Observe barrier operation with the passage of a train or if this is not practical by local operation check the following:

a) Operation is smooth and not obstructed.

b) There is enough clearance between counter balance and ground / base when raised. The barrier side arm and weights shall not be obstructed by the base or surrounding debris, when raised.

c) The boom comes to rest at a raised angle of 80° – 85° and is damped during the final 10° to 15° when lowering.

d) The pedestal does not foul the operation of the barrier.

e) The boom is approximately horizontal when lowered.

Four Barrier Installations Only

1.6 Check when all 4 barriers are lowered that the distance between the YO-YN and the ZO-ZN barrier tips is no more than 65mm.

1.7 Check front and rear doors. Lubricate hinges and locks.

1.8 Check by means of a approved torque wrench set to 210Nm the security of the barrier side arm retaining bolt.

If side arm retaining bolt is found to be loose, or there is evidence of movement, then this needs to be replaced. Advise your SM(S)

1.9 Check barrier assembly components:

a) Boom, A Frame, welds and fastenings. The key-way shall hold the barrier rigid.

b) Reflective strips.

c) Boom lamps, brackets and fastenings. LED boom lamps shall be visible at 50m in daylight.

d) Skirt assembly link pivot, and fastenings, where fitted.

e) Pogo stick, where fitted.

f) Strainer wire and fastenings, where fitted.

The strainer wire shall hold the barrier in straight alignment. It shall be just taut with the barrier in the raised position, adjust as necessary.

g) Boom lamp wiring, terminations, plug & socket and fixings.

h) Boom proving circuit, terminations, microswitch and fixings, where fitted.

SERVICE B

2. External Inspection

2.1 Wipe all barrier components:

a) Pedestal & Clean the base.

b) Side arms & counter balance weights.

c) Main shaft and side arm.

d) Boom and reflective strips.

e) A frame and reflective strips, where fitted.

f) Boom light lenses and units.

g) Strainer wire, connections and fixings, where fitted.

h) Skirt, pogo stick, connections & fixings, where fitted.

3. External: Barrier Caging (if fitted)

Old BR style caging (pre-2018) Only

3.1 Check the cage is undamaged and securely mounted to the pedestal.

3.2 Verify that boom is unobstructed during its passage between the two sections of the gage and that the gap between the two sections of the cage is even from top to bottom.

3.3 Lubricate the hinges, sliding sections and securing bolts.

Newgate style caging Only

3.4 Check the following:

a) Guard is rigid, secure, true and square to the barrier pedestal.

b) Earth cable connected and un-damaged.

c) Security locks in place and undamaged.

d) Sliding doors operate freely.

e) Retaining plungers working freely

f) Machine guard to pedestal fixings are tight.

- M8 bolts torqued to 29Nm
- M20 bolts torqued to 50Nm

3.5 Check the following dimensions shown in figures 2 to 5 are within spec:

a) A & B 155mm +/- 5mm

b) C is 69mm +/- 5mm

c) D is 18mm +/- 5mm

d) E is no more than 5mm

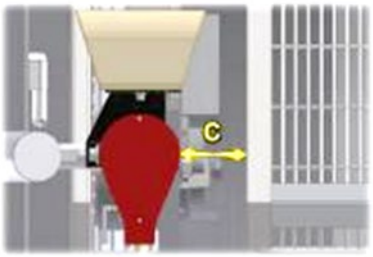


Figure 2

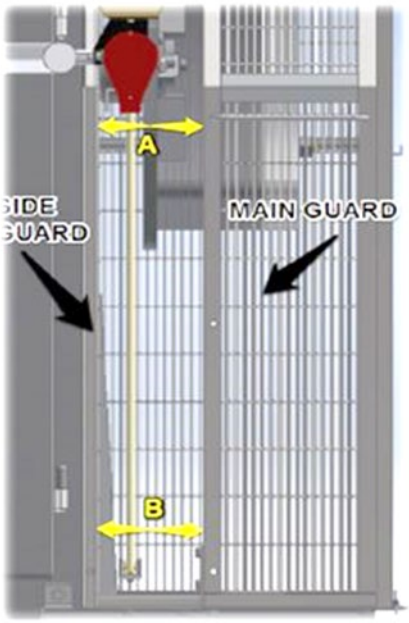


Figure 3

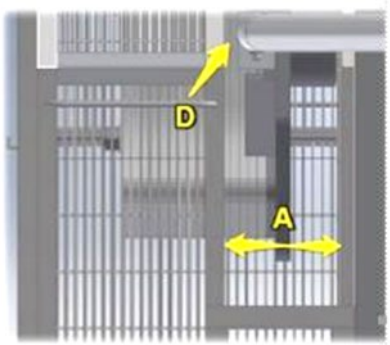


Figure 4

If the cage cannot be adjusted to meet the required specification, then the SM(S) shall be advised.

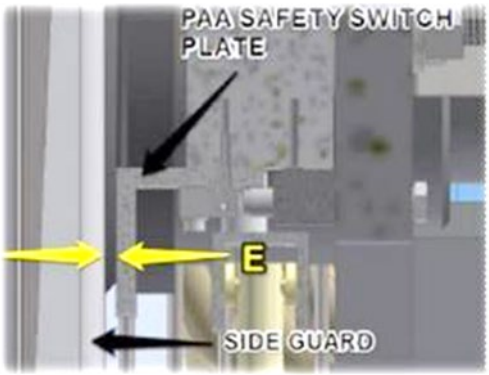


Figure 5

4. Boom Adapter

4.1 Check that the boom adaptor locating pin assembly is secure and undamaged. The E clip shall be complete, undistorted, and packed with adhesive grease.

If it is found to be broken the complete adaptor locating pin assembly shall be replaced.

5. Hydraulic Power Unit

5.1 Check the following:

a) Auto/Manual valve split pin and lead seal.

b) Power unit lid fastenings.

c) Top and bottom power unit trunnion block mountings and tab washers.

d) Check that the tabs are turned into the bolt head.

e) Bolts through the trunnion to the operating lever are the correct length.

f) The two Spirol pins are fitted.

g) The top and bottom power unit mounting pivots (2) and circlips (4) are not distorted (Bushes shall not be lubricated).

h) Power unit ram adjusting nut and lock washer (This shall not be adjusted).

Manually Controlled Barriers Only

5.2 On manually controlled barriers (MCB, RB, CCTV and TMOB) check that the Auto/Manual valve is in the ‘Manual’ position and the ‘lock down’ feature is effective.

Resistance should be felt when the boom is lifted.

Automatic & On Call Barriers Only

5.3 On automatic & on call barriers (AHBC, ABCL, AFBCL and OCB) check that the Auto/Manual valve is in the ‘Auto’ position and the ‘lock down’ feature is not effective the boom can be fully raised by hand.

5.4 Check the level of the hydraulic fluid and top up as necessary. The fluid shall be just visible in the strainer. If a top up is required, this shall be done with the barrier in the lowered position.

6. Motor

6.1 Check the following (where access is possible):

a) Motor commutator. It should be a light brown coffee colour.

b) Motor brushes replace as necessary.

c) Both motor brushes shall be replaced when any one reaches a minimum length of 7mm.

Tuscan motors: remove screw caps with care as brushes can spring out. Brushes shall slide freely in their holders and seat fully on the commutator.

7. Interior- General Assembly

7.1 Check the following:

a) Earth bonding assembly, where fitted.

b) Check the security of fixing and continuity between the item and the earth rod or rail.

c) Pedestal, doors and water seals, renew seals as necessary. Dust the unit.

d) Door hinges and locks.

e) Main shaft bearings (2) and fastenings (8).

f) Up & Down stops, shock absorber, fixing brackets & fastenings.

Replace plastic stop striker pads as necessary.

The shock absorber plunger shall not be able to be depressed by more than 3mm by finger pressure.

g) Cable terminations; Clean & protect as necessary.

h) Check that all ‘Klippon’ terminations are tight.

i) Cables and wiring and wire run / fixings.

j) Valve / Motor terminal blocks, connectors and wiring. Check that the blocks and terminations are secure. Loose connections are a common cause of failure.

k) Heaters (if fitted), are working.

7.2 Operate the barrier under power and check:

a) The barrier does not oscillate excessively.

b) When raised, the shock absorber plunger has depressed.

c) This maintains pressure in the hydraulic seal and prevents leakage.

8. Pivot Shaft Alignment

Any discrepancies found with these tasks in this section shall be reported as corrective maintenance immediately.

8.1 Visually Check for the following:

a) Displacement of the pivot shaft sealing washer on the outside face of the pedestal casing.

b) If displaced check for scrape marks on the pivot shaft.

c) Rubbing marks on the inclinometer. This is attached to the outside of the pedestal.

d) Bush particles on top of the hydraulic power pack, directly below the detector cam plate.

e) Wear marks on the detector cam plate.

8.2 Check that the cap head screw on the circuit controlling/operating lever is secure and the arm shows no signs of lateral movement on the pivot shaft keyway.

8.3 Check the dimension between pedestal cabinet and outer face of barrier side arm is 95mm -105mm. Any side wear shall be reported immediately.

8.4 With the boom fully lowered, Measure the distance from the left-hand side of the inside of the pedestal to the left-hand side face of the web of the operating lever arm (see Appendix A).

- 150mm ± 2mm.

If this measurement is not within the tolerance stated refer the matter to your SM(S) immediately.

8.5 Visually check the position of the circuit controller roller within the track of the cam.

With the barrier in the lowered position, the roller shall be visually flush with the right-hand side face of the operating cam ± 2mm.

9. Circuit Controller

9.1 Refer to NR/SMS/PartC/LV31 (Circuit Controller - Rotary Actuated).

a) For all TY199 circuit controllers, check the length of top studs as described in NR/SMS/Appendix/03 (General Information on level Crossing Equipment).

b) Where pedestal is fitted with F&G type TY 199 group 5 circuit controllers, see NR/SMS/Appendix/03 (General Information on level Crossing Equipment) for any adjustments.

9.2 Check cam, fixing and plastic bush / key-way.

10. Lubrication

10.1 Lubricate with lithium grease the spindle bearings (2 grease points).

10.2 Where fitted lubricate with mineral oil the skirt link pivot and pogo-stick.

10.3 Protect, with adhesive grease.

a) Pedestal fixing bolts (4).

b) Main shaft, side arm fixings and Vargal nuts.

c) Counter balance fixings.

d) Strainer wire adjuster thread, where fitted.

11. Hand Pump Sequence

11.1 Switch the LCU to the lower / hand position and check that all barriers fully lower.

11.2 Open the operator's (rear) door of the cabinet and extend the pump handle.

11.3 Check that the audible alarms are extinguished and the red road lights (wig- wags) are flashing. Pump the barrier to the fully raised position. Check that the barrier does not lower between each pump.

11.4 Repeat 11.2 for the other barrier(s). When the final barrier reaches the fully raised position, check that the red road lights extinguish.

11.5 Check that the operator's door of the cabinets cannot be closed with the pump handle extended.

11.6 Check the operator's door micro switch, wires, and fixings.

11.7 Lift and push in the pump handle on one of the barriers enough to release the valve and check that the barrier starts to lower, and the red road lights start to flash.

a) Extend the handle and check that the barrier movement is arrested.

b) Check that the audible warnings are still extinguished.

c) Push the handle fully home and check that the barrier fully lowers.

11.8 Repeat 11.6 for the other barrier(s).

11.9 Close and lock the operator's door on all cabinets.

11.10 Check that the audible warnings sound only when the final operator's door is closed and locked.

11.11 The door proving micro switch cannot operate until the Yale key is turned fully clockwise, then turn back to normal.

11.12 Switch the LCU to either 'Raise' or Auto' and check that both barriers raise together, and the audible warning and red road lights extinguish when both barriers are fully raised.

12. Final

12.1 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

APPENDIX A - Pivot Shaft Alignment (not to scale)

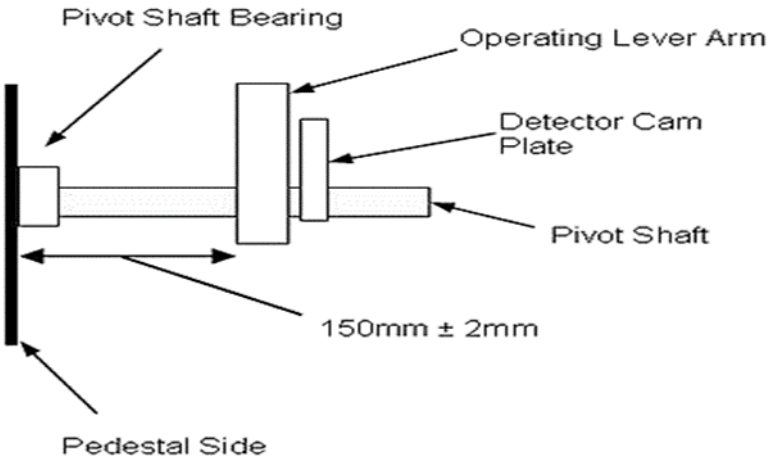


Figure 6 - Pivot Shaft Alignment

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/LC22		
EBI Gate 630 Barrier Machine		
Issue No. 1	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	EBI Gate 630 Barrier Machine
Exclude:	All other types of Barrier Machine

Appropriate protection / Possession arrangement shall be taken before commencing work on the Level Crossing System.

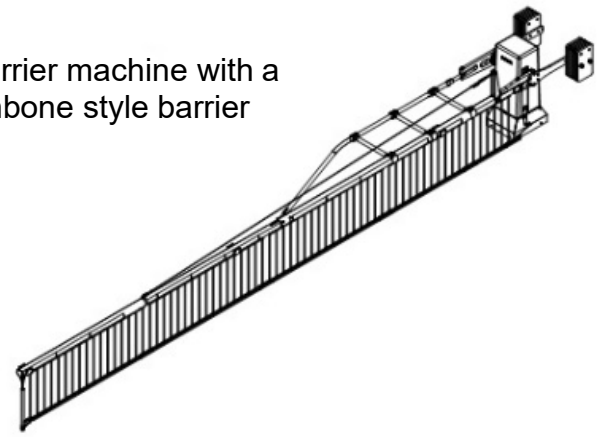
Opening the crank hole flap will release the electromagnetic brake which will cause the barrier boom to fall.

It is essential that the barrier boom is in the horizontal position (lowered) before any work activity is carried out.

When manually operating the barrier machine, if the counter-weights have been removed or the boom has been damaged, the unbalanced boom can cause the crank handle to turn.

For further detail see SMS Appendix 20 – General Information on the EBI Gate 630 / 2000 Level Crossing System.

Figure 1 - EBI Gate 630 Barrier machine with a left handed, ESD-8/01 wishbone style barrier boom.



SERVICE B

1. External Inspection

1.1 Remove potential obstructions and fire risks from around the barrier machine and boom.

1.2 Check concrete base and pedestal exterior for signs of damage.

1.3 Check that the barrier machine is secure on its base and fixing bolts are free from corrosion.

1.4 Check the barrier machine external cover is not damaged.

1.5 Check the counter weights are correct and securely fitted (Torque = 200Nm).

1.6 Check the barrier boom flanges are secure (Torque = 140Nm).

1.7 Check the boom flange plug is present.

1.8 Lubricate the external barrier machine cover lock mechanism and the crank handle cover padlock.

2. Operation of Barrier Machine

2.1 Observe barrier operation with the passage of a train or if this is not practical by local operation, check the following and rectify if necessary

a) Operation is smooth and not obstructed.

b) Sufficient clearance between counter weights and ground / base when raised. The barrier side arm and weights shall not be obstructed by the base or surrounding debris, when raised.

c) The boom comes to rest at a raised angle of 80° – 85° and is damped during the final 10° to 15° when lowering.

d) The boom is horizontal to the road surface when in the lowered position.

e) The boom lights operate correctly.

2.2 Manually operate the barrier machine, check the following and rectify if necessary:

a) Crank handle and locking pin are present.

b) Check the power is cut off after opening the flap over the crank hole.

c) Check the gravitational pawl in the safety ‘break away’ device is working properly in the horizontal position.

d) Manually raise the barrier to the fully vertical position (turn the crank handle clockwise).

e) Operation is smooth and not obstructed.

2.3 Lock the boom in the vertical position with the blocking pin.

2.4 Check the gravitational pawl in the safety ‘break away’ device is working properly in the vertical position.

2.5 Check the self-falling operation of the barrier machine, check the following and rectify if necessary:

a) Remove blocking pin and then the crank handle from the crank hole.

b) The falling time should not exceed 20 seconds (10 seconds for EEG-310125/01).

c) Operation is smooth and not obstructed.

d) The boom is level with the road surface.

3. Inspection of Barrier Boom

3.1 Check the boom components and rectify if necessary:

a) Boom assembly and support frame if fitted.

b) Integrity of welds and fastenings.

c) Safety 'break-away' device is secure, greased and free from obstruction and excessive dirt.

d) Skirt assembly and fastenings, where fitted.

e) Pogo stick fastenings and that it touches the road surface but does not cause an upward pressure on the boom, where fitted.

f) Strainer wire, connections and fixings, where fitted.

g) Reflective strips and clean.

h) Lamps are operational and clean.

i) Barrier wiring loom, terminations, plug & socket and fixings.

j) Boom integrity circuit/ wire, terminations and fixings.

k) Boom earth cable is connected to barrier machine.

4. Internal Inspection of Barrier Machine

The internal inspection is to be carried out with the barrier boom in the horizontal (lowered) position.

The crank hole flap shall be opened, the crank handle inserted into the crank hole (this cuts the power to the barrier machine) and the locking pin inserted and locked into place.

4.1 Check the following and rectify if necessary:

a) Build-up of dirt, dust, vegetation or rodent ingress.

b) Evidence of condensation build up or water ingress.

c) Pedestal, cover, water seals and gland are secure and intact.

d) Earth bonds / cables are secure and fault free.

e) Heater is working, if fitted.

f) Signs of any component damage, excessive wear or corrosion.

g) Electrical components and terminations are secure and free from dirt.

h) Signs of any wiring degradation or snagging of wiring or harnesses.

i) Limit switches are free from dirt and are correctly and securely mounted.

5. Motor

5.1 Check the following:

a) Motor commutator. It should be a light brown coffee colour.

b) Both motor brushes shall be replaced when any one reaches a minimum length of 10mm.

c) Brushes shall slide freely in their holders and seat fully on the commutator.

Only brushes the correct type of brushes shall be used.

To access the brushes remove screw caps with care as brushes may spring out.

6. Cog Belt

6.1 Check the cog belt for damage and or wear and replace as required.

6.2 Check the tension on the cog belt

There should be between 5 and 10 mm deflection, adjust as required.

6.3 Grease the following components:

Only "Shell Aero Grease 14" shall be used to grease components of the barrier machine.

a) Guide bars;

- Remove old accumulated grease.
- Apply new grease and distribute evenly across the guide bars.

b) Ball screw;

- Remove old accumulated grease.
- Apply new grease through the grease nipples.

c) Safety 'break away' Device; (if the boom has been re-fitted)

- Surfaces are clean and free from dirt

- Apply grease to the surfaces

7. Final Checks

7.1 Measure the voltage on the 24v Busbar

Investigate and rectify if the voltage is 20v below or 32v above

7.2 DYNAMIC EARTH TEST (052)

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LC23		
Rural Barrier - Machine Operated		
Issue No: 03	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	GWE Rural Barrier machines and Smiths Industries Rural Barrier machines
Excludes:	All other types of Barrier machines

General

If the barriers are found raised, lower and inform your SM(S).

Smiths rural barrier machines were derived from the BR843 barrier but should not be confused with them. NR/SMS/PartC/LC21 (Barrier Machine BR Spec 843) covers the BR843 machine.

SERVICE A

1. Exterior

1.1 Remove all fire risks and potential obstructions from the pedestal base and the immediate surrounding area.

1.2 Brush the concrete base.

1.3 Check the following items:

a) With the barrier in the fully raised position, there is clearance between the ground and the barrier side arm and weights.

b) Concrete base and pedestal assembly.

c) Safety fencing.

d) Instruction boards.

e) Check they are not obstructed by undergrowth and the legends are correct and legible. Wipe as necessary to clean.

1.4 Examine the following items:

a) Boom side assembly and weights. Report any wear found on bearing shaft/side arm key-way assembly.

b) Seals on the barrier bearing cover. Freezing water in the bearings can cause the barriers to jam.

c) Slave bolts in pedestal lifting eye-holes. Arrange replacement if missing.

d) Boom, reflective bands and strips. Wipe as necessary to clean.

e) Skirt and end steady (pogo stick) if fitted. Wipe as necessary to clean.

f) Pump mechanism and barrier release handle.

2. Interior

2.1 Check the following items:

a) Hydraulic fluid level. Top up if necessary, with the barriers in the lowered position. Clean the filter if necessary. Report as corrective maintenance if an excessive quantity of fluid is required.

b) The barrier-locking pin is in-situ (if applicable).

2.2 Examine the following items:

a) Pedestal, dust as required.

b) Door seals. Replace as necessary.

c) Main bearings.

d) Split pins.

e) Hand pump bracket.

f) Rubber buffer.

g) Hydraulic ram.

h) All hydraulic pipes and connections.

i) Pedestal holding down bolts. Tighten if required.

3. Lubrication

3.1 Lubricate with mineral oil.

a) Door hinges, locks.

b) Pump mechanism linkage and turn pins.

c) Ram upper turn pin.

3.2 Lubricate with lithium based grease.

a) Skirt steady and end steady (pogo stick).

b) Barrier release handle grease nipple.

4. Final Checks

4.1 Check that the barriers are left in the lowered position.

4.2 All doors are secure and locked.

SERVICE B

5. Hand Pump and Barrier Sequence Check

5.1 Observe that both barriers are fully lowered and horizontal.

5.2 Check that approximately 14 full strokes (40 full strokes for Smiths rural barrier units) are required to fully raise both barriers.

5.3 Check there is no air in the system ('spongy' operation).

5.4 Operate the release valve and observe it takes 6 seconds for the barriers to reach the fully lowered position (horizontal).

If the lower time is slow, check that the bleed valve jet on the hand pump is clear. The barrier of the machine on which the release valve has been operated tends to lead the other barrier.

5.5 Repeat items 5.1 to 5.3 for the other barrier unit.

6. Final checks

6.1 Check that the barriers are left in the lowered position.

6.2 All doors are secure and locked.

END

Includes:	Electro-Mechanical and Electro-Hydraulic types
Excludes:	All Other Barrier Machines

SERVICE A

1. Exterior All Machines

1.1 Remove all fire risks and potential obstructions from the pedestal base and the immediate surrounding area.

1.2 Check the following items:

a) With the barrier in the fully raised position there is clearance between the ground and the barrier side arm and weights.

b) Concrete base and pedestal assembly.

c) Safety fence.

d) Tension of straining wire (If applicable). Adjust if necessary.

e) Alignment of boom lamps.

f) LED Boom lamps (if fitted) are visible from 50m.

1.3 Examine the following items:

a) Pedestal fixing bolts.

b) Seals on the barrier bearing cover. Freezing water in the bearings can cause the barriers to jam.

c) Boom, reflective bands and strips. Wipe as necessary to clean.

d) Skirt assembly (if fitted).

e) Support member and reflective bands (if fitted). Wipe as necessary to clean.

f) Boom lamps, lenses, housings, hoods and brackets. Clean lenses and replace any failed or faulty lamps.

g) Boom lamp cables, plug couplers and clamps.

h) Straining wire, stay bracket, clamp and adjuster (if fitted).

i) Skirt fittings and bottom retaining clamp bolts.

j) Skirt support arm pins.

k) Sliding members of end steady units and support posts (if fitted). Check that the spring is intact (if fitted). Clean as necessary.

l) Pneumatic buffers, check that the rubber gaiter is intact (if fitted).

m) Main shaft fixing and balance arm bolts.

1.4 Lubricate with mineral oil:

a) Sliding members of end steady units (if fitted).

b) Sliding members of support posts (if fitted).

c) Skirt support arm pins. Plastic skirt supports should not be oiled.

1.5 Lubricate with lithium-based grease the pneumatic buffers (if fitted).

2. Interior All Machines

2.1 Isolate the motor by opening the manual control door.

2.2 Check the Heaters(s) and check correct operation (if fitted). Check the thermostat is set to 16°C (60°F).

2.3 Examine the heater wire insulation.

2.4 Wipe the limit switches.

2.5 Lubricate with lithium-based grease the limit switches operating plunger.

2.6 Lubricate with mineral oil the limit switches plunger roller pivot.

2.7 Check security, fixings and cabling on all door contacts fitted.

3. Interior Electro-Mechanical Machines

3.1 Examine the motor/gears, base plate, and mounting nuts.

4. Multi-tooth Clutch and Disengaging Mechanism Type

4.1 Examine clutch swivel pin.

5. Electro-magnetic Clutch Mechanism Type

5.1 Examine the following items:

a) The Electro-magnetic clutch teeth. Check that the teeth mesh correctly when the barriers are in the raised position.

b) Wires on rubbing contact and on the gear wheels mountings.

c) Clutch securing bolts and Allen screws on motor operating shaft.
d) Allen screws on clutch disengaging socket and clutch micro-switch screws.

5.2 Lubricate with lithium-based grease the micro-switch cam.

6. Interior Electro-Hydraulic Machine

6.1 Check the following items:

a) Buffers prevent barrier rising above 85°. Adjust if necessary.

b) Hydraulic fluid level. Top up if necessary, with the barriers in the lowered position. Report as corrective maintenance if an excessive quantity of fluid is required.

6.2 Examine the following items:

a) Main bearing bolts and main shaft locating collars.

b) Top and bottom hydraulic pack mounting bolts and lock washers.

c) Top and bottom hydraulic pack mounting ram pins and circlips. **Do not lubricate**.

d) Ram adjusting nut and lock washer.

e) Rubber buffers, brackets and fixing bolts.

f) Hydraulic unit.

6.3 Reconnect the motor by closing the manual control door

7. Final Checks

7.1 Observe the operation of the machine. Check that the damping action is effective.

SERVICE B

8. Exterior All Machines

8.1 Brush the concrete base.

8.2 Examine the following items:

a) Pedestal. Wipe as necessary to clean.

b) Slave bolts in pedestal lifting eye holes. Arrange replacements if missing.

c) Balance weights. Paint marks can be used to check position.

d) Boom clamp bolts and bolt locknuts.

e) Support member clamp bolts and bolt locknuts (if applicable).

f) Straining wire, support bracket, eye bolt and adjuster (if fitted). Wipe as necessary to clean.

g) Skirt assembly (if fitted). Wipe as necessary to clean.

8.3 Lubricate with mineral oil the door hinges and door lock.

8.4 Lubricate with adhesive type grease:

a) Side arm/counter balance weights nut and bolts.

b) Straining wire adjuster thread (if fitted).

9. Boom Adapter

9.1 Run back the lock nut of the boom retaining clamp bolt; unscrew the bolt and Lubricate the exposed thread with lithium-based grease. Tighten the bolt and locknut.

9.2 Repeat 9.1 for all other boom clamp bolts and clamp bolts for retaining support member (if fitted).

10. Interior All Machines

10.1 Check cables and wires are supported clear of moving parts.

10.2 Examine the following items:

a) Pedestal Dust as necessary.

b) Door seals Replace as necessary.

c) Cam retaining Allen screws.

d) Limit switches, retaining screws and mounting plate.

e) Interior of limit switch. Arrange remedial action if water/contamination is found.

f) Terminations.

g) Cables, wires, and clamps.

10.3 On the limit switches make up a 3.5mm gauge from a 2mm and a 1.5mm gauge.

Check that the 3.5mm gauge inserted in gap B figure 1 of Appendix A causes the switch to operate, Contacts D close in figure 1 of Appendix A.

Now remove the 2mm gauge only which should cause the switch to return, Contacts D open and contacts C close in figure 1 of appendix A.

If not carry out Appendix A the re-set the gap and repeat this test.

10.4 Clean the surfaces of the limit switch cams and terminations. Protect terminations as necessary.

10.5 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test)

11. Interior Electro Mechanical Machines

11.1 Check the oil level in the motor gearbox. Top up if necessary, with SAE90 grade oil.

11.2 Check motor brushes replace if less than 7mm in length.

11.3 Examine the following items:

a) Contactors. Dust as necessary.

b) Contacts. Located behind top cover and Bakelite contact cover.

c) Barrier centralising collar and Allen screws.

d) Main bearing.

e) Gear teeth for correct alignment.

11.4 Wipe the spur reduction gear and Lubricate with lithium-based grease.

11.5 Lubricate with mineral oil the cover Allen screws (if applicable).

12. Multi-tooth Clutch and Disengaging Mechanism Type

12.1 Check the clutch disengages/operates correctly. Lubricate the gear rings with lithium-based grease and re-engage clutch.

12.2 Examine the clutch access flap micro switches, fixing brackets and the clutch spring.

12.3 Lubricate with mineral oil the hinge flap, door lock, and operating cam.

12.4 Lubricate with lithium-based grease the clutch swivel pin and main bearing.

12.5 Observe the operation of the machine.

13. Electro-magnetic Clutch Mechanism Type

13.1 Check the following items:

a) Adjuster lock nut at the top of the damper unit.

b) When the barrier lowers with the power off, the damping is effective. Adjust as necessary.

13.2 Examine the following items:

a) The connecting rod turn and split pin.

b) Situated between the damper unit and main operating shaft.

c) Damper Allen screws.

d) Bottom turn and split pin.

13.3 Top up pneumatic damper cylinder if necessary, with ‘Shell Tellus23’ oil. To top up: remove the small screw in the upper portion of the damper cylinder and use pump type oilcan to add the oil.

13.4 Lubricate with mineral oil the connecting rod and bottom turn pin.

13.5 Observe the operation of the machine.

14. Interior Electro-Hydraulic Machine

14.1 Check the Auto/Manual valve is in the correct position for the crossing type.

The AUTO position is only used for AHB crossings.

The MANUAL position enables the lock down feature for MCB crossings.

14.2 Examine the following items:

a) Split pin and wire seal on the Auto/Manual valve.

b) Hand lower valve.

c) This is operated by fully retracting the handle.

d) Operators door micro-switch.

15. Hand Operation Electro-Hydraulic machine

15.1 Open the operators' door and fully extend the manual pump handle.

15.2 Disconnect the solenoid valve, check the barrier remains raised. Push the manual pump handle fully home to operate the lower valve and allow the barrier to lower.

15.3 Fully extend the pump handle and manually pump the barrier to the fully raised position. Check the barrier does not lower between strokes.

15.4 Reconnect the solenoid valve and push the manual pump handle fully home. Check the barrier remains raised.

15.5 Repeat 15.1 to 15.4 for the other barrier(s).

16. Lock Down Feature Electro-Hydraulic machine

16.1 Check at MANUALLY controlled crossings when lowered the barriers cannot be raised by hand more than approximately 5° from the horizontal.

16.2 Check at AUTOMATIC controlled crossings when lowered the barriers can be fully raised by hand.

APPENDIX A - Limit Switch Identification

Crabtree Microswitch (Adjustable) Honeywell Microswitch (Fixed)

Figure 1 – Types of Microswitch

Limit Switch Adjusting Procedure

1. Check that the roller is not in direct contact with the cam.
2. Remove the cover, insulating shield and gasket.
3. Slacken the screws marked ‘A’.
4. Adjust the internal assembly as necessary to achieve the settings in step 1.28(usually where gap ‘B’ is approximately 1.5mm (1/16’’)
5. Tighten the screws marked ‘A’ and repeat step 1.28
6. Replace the insulating shield, gasket and cover.
7. The operation of the limit switch by the Cam shall be tested after adjustment of the limit switch.

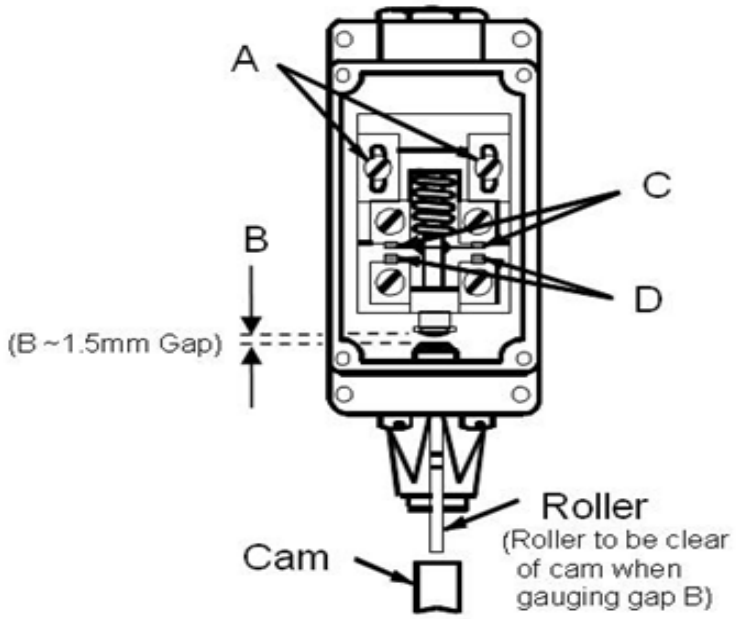


Figure 2 - Limit switch (snap-over switch)

A = Adjustment screw to move switch unit.

B = Gap between switch plunger and roller plunger.

C = Contacts ‘normally closed,

D = Contacts closed when plunger depressed,

END

SERVICE A

1 Exterior All Machines

1.1 Remove all fire risks and potential obstructions from the pedestal base and the immediate surrounding area.

1.2 Check the following items:

a) With the barrier in the fully raised position there is clearance between the ground and the barrier side arm and weights.

b) Concrete base and pedestal assembly.

c) Safety fence.

d) Tension of straining wire (If applicable). Adjust if necessary.

e) Alignment of boom lamps.

f) LED Boom lamps (if fitted) are visible from 50m.

1.3 Examine the following items:

a) Pedestal fixing bolts.

b) Boom, reflective bands and strips. Wipe as necessary to clean.

c) Skirt assembly

d) Boom lamps, lenses, housings, hoods and brackets. Clean lenses and replace any failed or faulty lamps.

e) Boom lamp cable, plug couplers and clamps. Pay particular attention to the cable between the pedestal and boom.

f) Boom retaining bolts, washers and fracture segments (if fitted).

2 Interior

2.1 Examine the following items:

a) Circuit controller, dust as necessary.

b) Motor and gearbox mounting bolts and base plate.

c) Motor adjustment set screws.

d) Emergency hand operation controls.

2.2 Lubricate with mineral oil:

a) The micro-switch push arm.

b) The manual lock toggle.

c) The manual selector shaft.

d) Limit switches plunger roller pivot.

2.3 Lubricate with lithium based grease the limit switches operating plunger.

SERVICE B

3 Exterior

3.1 Brush the concrete base.

3.2 Examine the following items:

a) Pedestal, Wipe as necessary to clean.

b) Slave bolts in pedestal lifting eye holes. Arrange replacements if missing.

c) Balance weights.

d) Boom fixings.

3.3 Lubricate with mineral oil the following items:

a) Door lock and hinges.

b) LCU door lock.

c) Main bearing.

4 Interior

4.1 Check motor brushes, replace if less than 7mm in length.

4.2 Examine the following items:

a) Micro-switches.

b) Power release lock micro-switches.

c) Manual lock release plunger mechanism.

d) Power release lock.

e) Cams and micro-switches.

f) Gear teeth. Report any evidence of incorrect meshing, excessive play between gears or excessive gear wear (e.g. metallic dust or swarf).

g) Terminations, Clean and Protect as necessary.

h) Clutch, Adjust if necessary.

i) Contactor (if fitted). Dust as required.

j) Oil level in the motor gearbox.Top up if necessary with SAE90 gear oil.

k) Remove (if necessary) contact strip.

l) Bands and contacts. Clean as necessary.

4.3 Lubricate with mineral oil the following items:

a) Actuating arms.

b) Manual lock release plunger mechanism.

4.4 Wipe and Lubricate with lithium based grease the motor gear wheel and drive segment. Wipe away surplus grease.

4.5 Dynamic earth test (052).

5 Boom Fixings

5.1 Remove boom main retaining bolts and washers, and Examine key and key way. Arrange for remedial action if worn or damaged.

5.2 Refit and secure boom main retaining bolts and washers.

6 Hand Operation

6.1 Operate the emergency hand control. Check this isolates power to the machine.

6.2 Lower and raise the barrier on emergency hand control. Check the road traffic lights operate when the machine lock is released.

6.3 Return the crossing to normal operation.

7 Final Checks

7.1 Observe the operation of the machine.

End

SERVICE A

1 Exterior All Machines

1.1 Remove all fire risks and potential obstructions from the pedestal base and the immediate surrounding area.

1.2 Check the following items:

a) With the barrier in the fully raised position there is clearance between the ground and the barrier side arm and weights.

b) Concrete base and pedestal assembly.

c) Cage.

d) Alignment of boom lamps.

e) LED Boom lamps (if fitted) are visible from 50m.

f) The barrier engages centrally on the post.

1.3 Examine the following items:

a) Boom, reflective bands, and strips. Wipe as necessary to clean.

b) Skirt assembly.

c) Boom lamps, lenses, housings, hoods and brackets. Clean lenses and replace any failed or faulty lamps. Wipe as necessary to clean.

d) Boom lamp cable, plug couplers and clamps. Pay particular attention to the cable between the pedestal and boom.

e) Clapping post.

f) Balance weights and retaining bolts. Wipe as necessary to clean.

g) Split pins retaining the trimming weight arms and roller.

h) The Allen screws in the barrier fulcrum spacing collars. If any movement is detected check that the fulcrum and barrier are central in relation to the pedestal. Arrange remedial action if necessary.

i) Allen screws securing the barrier.

j) Operating cranks, guides and rollers Clean as required.

1.4 Wipe to clean and then Lubricate with mineral oil:

a) Trimming weight rollers, tracks and pivots Check on replacement that the rollers are engaged on the tracks.

b) Barrier fulcrum bearings.

c) Side cover wing-nuts.

1.5 Wipe and Lubricate with lithium based grease the roller guides and roller grease nipples. Surplus grease shall be wiped away.

2 Interior

2.1 Examine the following items:

a) Operating Cranks and split pins. Check for a tight fit on the operating shaft. If movement is apparent tap the key further into the keyway so as to minimise movement.

b) Rack and pinion adjustable connecting rod and bolts. Wipe as necessary to clean.

c) Micro-switch fixing bolts and terminations.

d) Emergency hand operation controls.

e) Terminations.

f) Guard panel.

2.2 Clean and Protect the micro-switch terminations and other terminations.

2.3 Lubricate with mineral oil the guard panel lock.

2.4 Lubricate with lithium based grease the grease nipples on the following items:

a) The vertical crank shaft and turn pins.

b) The rack guide.

c) The rack guide bottom pin.

3 Barrier Operation and Sequence Check

3.1 Check that the trimming weight rollers are engaged on the tracks.

3.2 Request the signaller to lower the barriers and Observe the following:

a) The boom lights illuminate when the barrier is approximately 80° from the horizontal.

b) The barrier lowers smoothly.

c) The barrier is horizontal and locked when fully lowered.

3.3 Request the signaller to raise the barriers and Observe the following:

a) The barrier rises smoothly.

b) The skirt folds correctly whilst the barrier is rising.

c) The boom lights extinguish when the barrier is fully raised.

d) The barrier is locked when it is in the fully raised position.

End

The barriers shall be prevented from lowering before working within the cage. Utilise the hook and, if necessary, remove the motor fuses.

The machine shall not be operated electrically until any adjustments have been verified by manual operation, to check that the machine is operating without undue strain.

SERVICE A

1. External Inspection: Pedestal

1.1 Remove fire risks and potential obstructions from the barrier base and the immediate surrounding area.

1.2 Examine the concrete base, post and cage for security and signs of corrosion or damage.

1.3 Examine all fitting clamps and foundation bolts, where fitted, for security.
In particular, Examine the bottom clamp, which carries the lower ram pin, as this is prone to movement.

1.4 Examine the rear barrier strut for signs of damage or developing fractures. If any are found a replacement should be fitted as soon as possible.

The strut connects the ram to the barrier; its failure can result in the barrier lowering uncontrolled.

1.5 Check that the rear cage access panel can be removed and correctly replaced by one unaided person.

2. Barrier Boom

2.1 Check that the movement of the boom is free from potential obstruction.

2.2 Examine the boom for security and signs of damage. Look for signs of wear or movement around the barrier fulcrum bearings and brackets.

2.3 Check that all boom securing fixings are tight.

2.4 Examine and Wipe boom, reflective bands and strips.

2.5 Examine skirt assembly, fastenings and end stop. Replace any missing skirt rods as corrective maintenance.

3. Boom Lamps

3.1 Examine housings, hoods & brackets.

3.2 Clean and Examine lamps and lenses for discolouring or damage. Renew any faulty filament lamps as corrective maintenance.

3.3 Check the lamp alignment. Lamps shall be aligned along the road approach. LED boom lamps shall be visible at 50m on a straight approach.

4. Boom Wiring

4.1 Examine boom lamp supply cable, connectors and cable clamps.

4.2 Examine barrier fracture circuit (CCTV crossings only). Report any disconnected circuits as a corrective maintenance requirement.

4.3 On electrified line areas: Check the earth bonding is intact and not fouling moving parts.

5. Internal Inspection

5.1 Check security of the counter-balance weights.

5.2 Examine the following items:

a) Up stops.

b) Barrier retaining hook.

c) Rams, hoses, bearings and fittings, including weatherproof ‘boot’ A maximum of 5mm free play is permitted on either bearing.

5.3 Check the security of the circuit controller driving pin and link rod, including split pin.

Vertical free play in the link rod shall not exceed 2mm in either bearing.

Horizontal free play shall not exceed 5mm. This can be reduced by the insertion of correctly sized, non-ferrous washers.

6. Hydraulic Fittings

6.1 Check hydraulic power unit fluid level and top up as necessary.

The fluid should be at least 15mm above the strainer when the barrier is fully lowered.

If more than 500ml is required, Check all hydraulic components for leakage. If there are no obvious leaks, arrange for the barriers to be operated under power several times and re-check.

Leaks are particularly found at joints and where hoses are in contact with metalwork.

If fitted:

6.2 Test the pump unit door cut out switch for correct operation.

6.3 Check hydraulic power unit lid fits correctly and can be secured.

7. Circuit Controller

7.1 Maintain the circuit controller as per NR/SMS/PartC/LV31 (Circuit Controllers).

8. Lubrication

8.1 Lubricate with lithium grease the following:

- The main barrier bearings (2x grease nipples).
- Ram pivots (grease nipples).

8.2 Lubricate using mineral oil the following:

- Skirt components, including end stop.
- Bearings within the circuit controller linkage.

9. Power Operation

9.1 Check the barrier comes to rest at an angle of between 80° and 85° when raised.

9.2 Check the following when barrier is fully lowered

a) The barrier comes to rest in a horizontal position (0°- 4°).

b) The distance between the road surface and underside of the boom does not exceed 1000mm at any point.

c) The extended ram is 1.02m between centres of top and bottom ram pins.

d) The barrier end stop is not damaging the road surface.

e) The lowered barrier closes the road and is not horizontally misaligned.

9.3 Check the barrier damping is effective during the last 10cm(approx.) of movement when lowering.

9.4 Check the barrier does not bounce excessively at the top of the stroke, when being raised.

9.5 Check the barrier skirts are located in the correct position when barriers are raised.

10. Function Test

10.1 Check all covers and fixings are secure.

10.2 Test the level crossing barrier apparatus functions correctly when operated from the control point.

10.3 Restore to service.

SERVICE B

11. Boom

11.1 As necessary**:** Wipe and clean the barrier skirt and end-stop.

12. External: Barrier Caging (if fitted)

12.1 Check the cage is undamaged and securely mounted to the pedestal.

12.2 Verify that boom is unobstructed during its passage between the two sections of the gage and that the gap between the two sections of the cage is even from top to bottom.

12.3 Lubricate the hinges, sliding sections and securing bolts.

13. Power Unit

13.1 Isolate and clean the power unit interior.

13.2 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

13.3 Examine terminations, Clean and Protect as necessary.

13.4 Examine door micro-switch, wires, brackets and fastenings.

13.5 Remove and Examine the top and bottom ram pins. Renew the pins as corrective maintenance if surface degradation or fatigue cracks are found.

14. Motor

14.1 Examine the commutator. The commutator should be a light brown coffee colour.

14.2 Examine the motor brushes; renew as necessary. They should slide freely in their holders and seat fully on the commutator.

15. Hand Operation Test: Lowering

The barriers are driven up and down and are designed to be counter balanced. If the steps in 14 and 15 show that the barriers are out of balance, the details in Appendix B shall be followed to correct this.

These tasks shall be undertaken for all the barriers in the installation.

15.1 With both hand valves closed, Check the barrier cannot be moved by hand.

15.2 Open the valves and Check the following:

a) The barrier does not fall unaided.

b) One person can pull down the barrier unaided.

15.3 Close the valves and Check the barrier cannot be raised more than 15° by hand.

16. Hand Operation Test: Raising

16.1 With both hand valves open, Check the barrier can be fully raised by one person unaided.

16.2 When raised, check barrier holding hook maintains the barrier in a raised position so as to extinguish the road and boom lights.

16.3 Close the valves, unhook the barrier and lock the power unit door.

17. Final Tests

17.1 Carry out a Dynamic Earth Test - NR/SMS/PartB/Test/052.

17.2 Check all covers and fixings are secure.

17.3 Check that the boom retaining hook is left in the down position.

17.4 Test the level crossing barrier apparatus functions correctly when operated from the control point.

17.5 Restore to service.

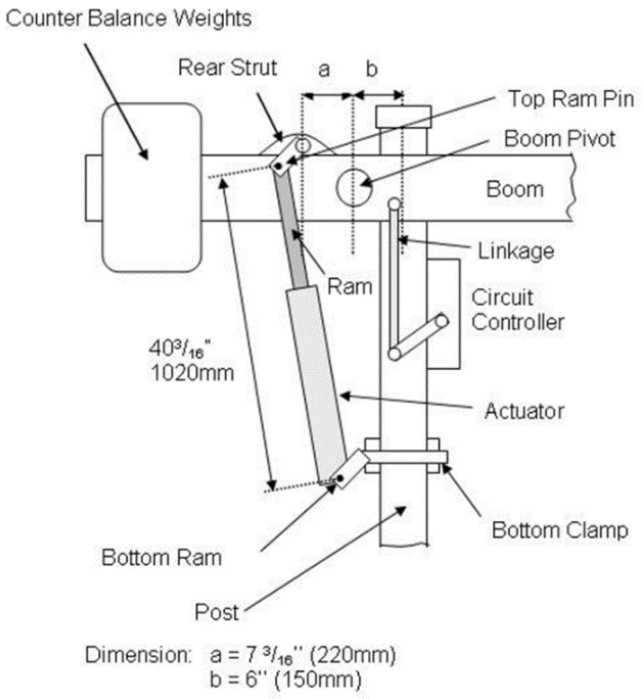


Figure 1 - Barrier Rams and Linkages
(Not to Scale)

APPENDIX A - Boom Re-fitting Instructions

This shall be read in conjunction with appropriate NR/SMTH test plan.

Counter balance weights should be fixed in the raised position before the boom is removed.

It is assumed that all broken or faulty equipment is removed as this procedure is carried out and that replacement parts are to hand.

Boom Replacement

1. Lower the old boom.
2. Disconnect the wiring to boom lights, and earth bonding, where fitted.
3. Support the rear of the operating mechanism near the weights.
4. Undo the bolts holding the boom and rear holding bar onto the skirt.
5. Fit the new boom and refit the rear holding bar onto the skirt, verifying the length is correct.
6. Reconnect the wiring to the boom lights, and earth bonding, where fitted.
7. Test for correct operation, including parts 9,14,15 & 16.

APPENDIX B - Boom Counter Balance Weight Adjustments

These barriers are designed to be counter balanced, failure to correctly set the counter balance weights can result in excessive component wear and failure of the hydraulic rams and power packs.

Weights shall be equal on both sides of the boom.

Due to the components being designed to imperial measurements, these are the only ones quoted.

1. Disconnect the ram from the rear strut and open both valves on the hydraulic pack.
2. Untighten the bolts holding the balance weights and remove the existing weights. Move the back plates until the centre bolt is halfway along the slot.
3. Add one-inch thick weights equally to both sides, then by using decreasing thickness of weights obtain an approximate balance of the barrier over its whole travel.

4. Reconnect the ram to the rear strut and operate the barrier by hand. If required adjust the weights along the channel slots to give a smooth operation throughout the whole barrier travel.

5. If the final position of the weights is at the extremity of the slots then reposition the weights at the centre of the slot and add or remove a quarter inch weight (on both sides) as necessary to enable further site adjustment in the future.

6. Where tie rods and bolts have been historically cut to size to prevent new weights from being added, replace them with one inch diameter threaded bar to enable the correct weight adjustment to be obtained.

Available Counter Balance Weights Sizes

Thickness (inches)	Weight (Pounds)
1	56
1/2	28
1/4	14

Tie Rod Length Required

Barrier Length	Tie Rod Length
15ft to 25ft	32 inches
25ft to 30ft	44 inches

Weights and threaded bar should be obtained through your SM(S).

END

Includes:	Barrier Machine, Boom; Skirt
Excludes:	All other types of barrier machine

When lowering a barrier, do not become trapped between the boom assembly and fencing.

Always obtain the Signallers' permission before operating the barriers on local control or hand operation permission when barriers need to be operated by local control or hand.

If practical, take local control prior to starting work.

Check the site logbook or record card for any entries since your last visit.

Where alterations are being carried out, your SM(S) should have briefed you on the work and the effect on planned maintenance.

If you find evidence of project work that you have not been told about, contact your SM(S).

Before leaving site, check that access points are secured to prevent unauthorised access.

SERVICE A

1. External Inspection

1.1 Report any sign of structural deterioration or forced entry as corrective maintenance.

1.2 Check for potential obstructions and fire risks. Remove or report any possible risks as corrective maintenance.

1.3 Check that security locks and ventilation are in order.

1.4 Check that door safety / warning label is correctly displayed and legible.

1.5 Brush / Wipe any dirt and / or infestation around the unit.

1.6 Check cable entries are sealed to deter rodents.

1.7 Check that the shear bolts intact and secure, replacing as corrective maintenance if there is any visible sign of damage or wear. Shear bolts shall be set to 20Nm by means of a calibrated torque wrench.

1.8 Observe barrier operation with the passage of a train or if this is not practical by local operation. Check the following:

a) Operation is smooth and not obstructed.

b) Lower and raise times are within specification.

c) That there is enough clearance between counter balance and ground / base when raised.

d) The barrier side arm and weights shall not be obstructed by the base or surrounding debris when raised.

e) The boom comes to rest at a raised angle of 85° – 90°.

f) The boom is approximately horizontal when lowered.

4 barrier installations only:

1.9 Check when all 4 barriers are lowered that the distance between the YO-YN and ZO-ZN barrier tips is no more than 65mm.

1.10 Check the following barrier assembly components:

a) Machine mounting bolts and clamps.

b) Boom fastenings.

c) Reflective Strips.

d) Boom lamps, brackets and fastenings. LED boom lamps shall be visible at 50m in daylight.

e) Skirt assembly, retaining bracket and linkage, and fixings where fitted.

f) Strainer wire and fastenings, where fitted. The strainer wire shall hold the barrier in straight alignment. It shall be just taught with the barrier in the raised position, adjust as necessary.

g) Boom lamp wiring, terminations, plug and socket and fixings.

h) Boom proving circuit, terminations, microswitch and fixings where fitted.

2. Internal Inspection

2.1 Check for obvious signs of excessive wear or movement of cams and contacts.

It is normal to see a small amount of dust from the cams collected inside the door.

Brush this out if present.

2.2 Check for presence of internal maintenance covers, labels and drawings inside the door.

2.3 Examine a sample of cables and wires for damage. Report any damage as corrective maintenance. Take immediate action on any exposed conductors.

Rodent damage can occur to wiring in ducting which is not immediately visible.

2.4 Isolate the machine, remove the gearbox cover; lock the barrier in its current position using the lock bar. Lubricate gearbox with lithium grease.

2.5 Remove lock bar, replace the gearbox cover, reconnect the machine, and check barrier operates freely.

SERVICE B

3. General Inspection

3.1 Wipe / Brush the following barrier components:

a) Base and support post.

b) Side arms and counter balance weights.

c) Conversion bracket.

d) Boom and reflective strips.

e) Boom light lenses and units.

f) Strainer wire, connections and fixings where fitted.

g) Skirt, connections and fixings where fitted.

3.2 Remove shear pins by means of torque wrench, check the boom rotates freely and lubricate the king pin with lithium grease.

3.3 Check for free operation of boom detector microswitch and lubricate with spray lubricant.

3.4 Check that the shear bolts intact and secure, replacing as corrective maintenance if there is any visible sign of damage or wear. Shear bolts shall be set to 20Nm by means of a calibrated torque wrench.

3.5 Check by means of a calibrated torque wrench set to 145Nm the security of the king pin.

3.6 Check by means of a torque wrench set to 145Nm the security of the support bracket nuts.

3.7 Check by means of a calibrated torque wrench set to 190Nm the security of the side arm central hub nuts.

3.8 Check by means of a torque wrench set to 75Nm the security of the conversion bracket bolts.

3.9 Check by means of a torque wrench set to 75Nm the security of the boom support bolts.

Manually Controlled Barriers:

3.10 On manually controlled barriers (MCB, RB, CCTV, OD, TMOB) check the 'lock down' feature is effective. Resistance should be felt when the boom is lifted.

4. Internal: General Assembly

4.1 Check the following:

a) Base, post, door and water seals, renew seals as necessary, dust the unit.

b) Door hinge and lock.

c) Measure Up and Down buffer clearance from segment gear. Note Auto and Manual barriers are different.

d) Cable terminations; clean and protect as necessary.

e) Cables and wiring and wire run / fixings.

f) Heater is working.

g) Presence of contact and gearbox maintenance covers.

h) Door microswitch, wires and fixings.

i) Isolation switch, wires and fixings.

4.2 Test the barrier under power and check the following:

a) The barrier does not oscillate excessively.

b) No excessive noise from motor, brake or gearbox.

c) The barrier raises and lowers freely.

5. Internal: Motor

5.1 Check the following;

a) Motor Commutator.

b) It should be a light brown coffee colour.

c) Motor brushes, replace as necessary.

d) Both motor brushes shall be replaced when any one reaches the marked minimum length.

e) Remove screw caps with care as brushes might spring out. Brushes shall slide freely in their holders and seat fully on the commutator. Only correct style brushes shall be used.

f) Brake air gap. Should be between 0.015” and 0.020” adjust as necessary.

6. Internal: Cams and Contacts

6.1 Check the following items:

a) Cam fixings and contacts.

b) The position of the contact on the cam (visually). Contacts should be approximately centre of the cam.

c) Cam and contact settings match circuits.

d) Contact gap and tension.

7. Internal: Lubrication

7.1 Isolate the machine, remove the gearbox cover; lock the barrier in its current position using the lock bar.

7.2 Lubricate the gearbox with lithium grease.

7.3 Lubricate the door lock and the door hinges with lithium grease.

7.4 Lubricate door detector with spray lubricant.

7.5 Remove the lock bar and check the barrier operates freely.

8. Hand Wind Sequence

8.1 Switch the LCU to the lower / hand position and observe that all the barriers fully lower.

8.2 Open the door of the machine, switch the isolation switch to the 'Hand' position, and check that the audible alarms are extinguished and the red road lights are working.

8.3 Insert the lock bar in the direction to keep barrier up and attach the winding handle. Wind the barrier up stopping intermittently to check the barrier does not lower.

8.4 Repeat 8.1 and 8.3 for other barrier(s). When the final barrier reaches the fully raised position, check that the red road lights extinguish.

8.5 Check that the door cannot be closed with the lock bar in place.

8.6 Switch the isolation switch to 'Road Lights Override' and check that the red road lights start to flash.

8.7 Remove the lock bar and check the barrier fully lowers.

8.8 Switch the isolation switch to 'Auto', close and lock the door.

8.9 Repeat 8.5 and 8.8 for the other barrier(s).

8.10 Check that the audible warning only sounds when the final door is closed and locked.

8.11 Repeat 8.1 to 8.10 for the other barrier(s).

8.12 Switch the LCU to either 'Raise' or 'Auto' and check that all barriers raise together and the audible warning and red road lights extinguish when all barriers are fully raised.

9. Final

9.1 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

NOTE: *that this could be 12v or 24v.*

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or NR/SMS record card.

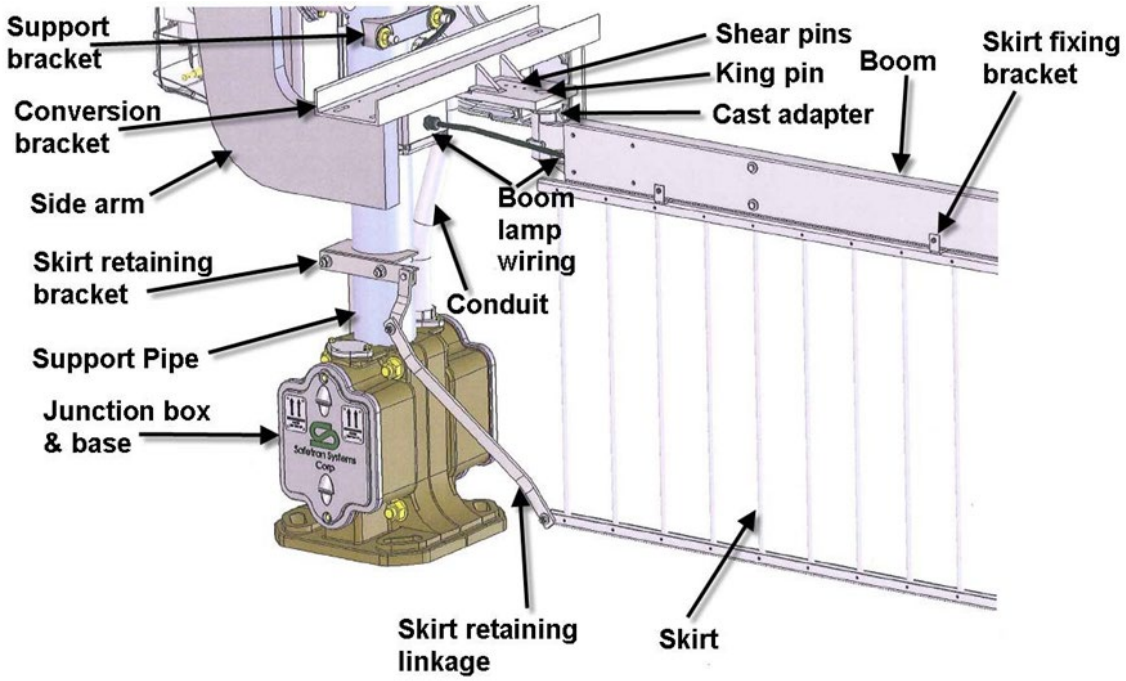


Figure 1 - S60 Barrier Unit Diagram (Not to scale)

END

Includes:	Automatic Half Barrier (AHB) Mk.1 (Penguin)
Excludes:	All other types of Barrier Machine

SERVICE A

1. Pedestal Exterior

1.1 Remove potential obstructions and fire risks.

1.2 Check the concrete base and pedestal. Look particularly for subsidence, movement, cracking, or damage.

A collision by a vehicle might have fractured the concrete, which may be supported by reinforcement rods.

1.3 Check the visible tail cables and route.

1.4 Check the pedestal top and bottom covers, anti-guillotine shields and fixings, and padlocks. Wipe as necessary.

Covers shall be properly fitted and shall not obstruct movement of the barrier. Report damaged covers as corrective maintenance.

The auto/manual valve access doors shall be secure. Pedestal phone covers shall be plated shut where not in use. Grease shall be smeared on anti-guillotine fixing bolts.

2. Pedestal Interior

2.1 Remove the top and bottom covers and examine the hydraulic unit assembly and connections. Wipe as necessary.

Operate the barrier under local control and look for hydraulic fluid leaks. Tighten joints as necessary.

2.2 Check the hydraulic fluid level, top up as necessary.

2.3 Check the Auto/Manual valve assembly. Wipe as necessary.

2.4 Check all cables, wiring and terminations. Pay particular attention to the security of terminations and condition of insulation. Wiring is prone to contamination by hydraulic fluid.

2.5 Clean and examine the following:

a) Motor commutator. It is normally a light brown coffee colour.

b) Motor brushes. Replace as necessary.

NOTE: *Tuscan motors: Remove the screw caps carefully as brushes might spring out.*

c) All brushes shall slide freely in their holders and seat fully on the commutator.

d) Spindle bearings.

e) Ram.

f) Top ram pin and bracket. The top ram pin (as modified) is fitted with a bracket, which shall be securely fixed with a bolt and locknut.

g) Bottom ram pin. The bottom ram pin shall be free to rotate and is fitted with a split pin.

h) Up and down stops and mounts.

2.6 Check and clean the local control push buttons and wiring.

2.7 Check that the door interlocking lever is in place and the local control unit door cannot be closed and locked unless the crossing is on automatic control.

Do not use the interlocking lever to switch the crossing to automatic operation. Using the lever only, does not always fully engage the auto switching. Press the auto button first then operate the interlocking lever.

3. Circuit Controller

3.1 Maintain the circuit controller as per NR/SMS/PartC/LV31 (Circuit Controllers).

4. Barrier Assembly

4.1 Check the barrier boom, cross members, brackets and fixings. Look particularly for rot, damage, and missing parts.

Confirm that the boom is rigid and horizontal when lowered.

4.2 Check the boom reflective strip. Clean as necessary.

4.3 Check boom lamps, lenses, wiring, terminations, plug and socket and fixings.

Confirm that the boom lamps are correctly aligned along the road.

4.4 Where fitted, check that LED boom lights are visible from 50m.

5. Lubrication

NOTE: *The hydraulic ram is self-lubricating.*

5.1 Lubricate with mineral oil the following:

a) Spindle bearings (2).

b) Linkages.

c) Bottom ram pin.

d) Door hinges, locks and fixings.

5.2 Protect the following with adhesive grease:

a) Pedestal fixing bolts.

b) Anti-guillotine shield fixings.

6. Final Checks

6.1 Operate barrier under local control and observe correct operation.

6.2 Replace and secure covers. Confirm that the covers do not foul barrier boom.

6.3 Return the crossing to ‘Auto’, hand back to the Signaller and check the correct indications are received.

SERVICE B

7. Hand Pump Sequence

7.1 In local control, lower the barrier under power.

7.2 Hand pump up the barrier. Check the barrier can reach the fully raised position and does not drop between each pump.

8. Tests and Final Checks

8.1 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

8.2 Operate barrier under local control and observe correct operation.

8.3 Return the crossing to 'Auto', hand back to the Signaller and check the correct indications are received.

9. General Arrangement (Not to Scale)

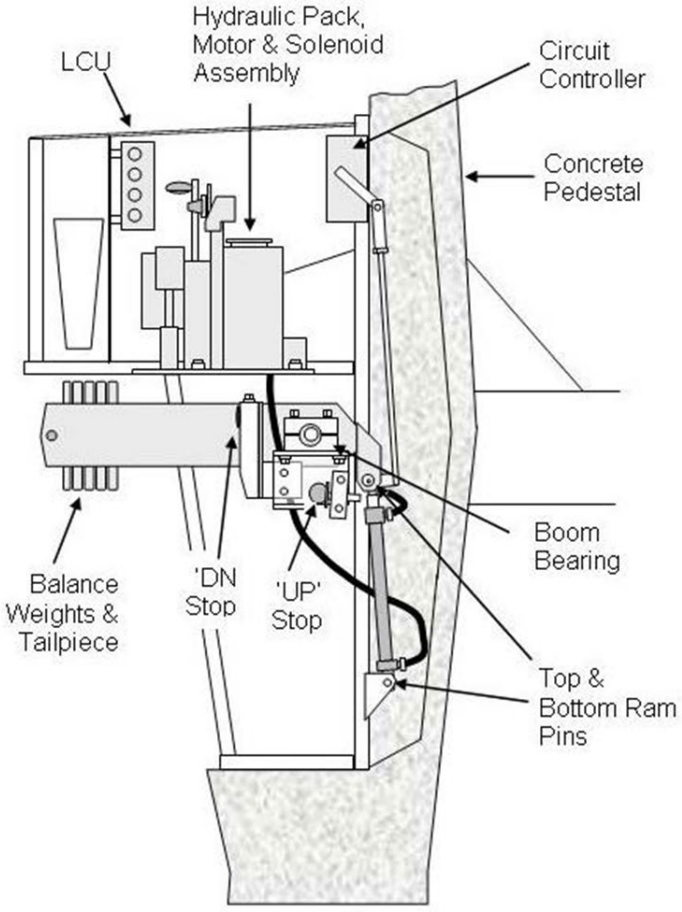


Figure 1 – General Arrangement

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LC32		
Barrier Machine: Newgate		
Issue No: 01	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Newgate Barrier NGR18000
Excludes:	All other types of barrier machine

When lowering a barrier, be aware that limbs can be trapped between the boom assembly and fencing.

Liaise with the signaller before operating the barriers on local control or hand operation permission when barriers need to be operated by local control or hand.

If you find evidence of project work that you have not been told about, contact your SM(S).

Equipment Identification Image

Figure 1 - Newgate Barrier Machine - NGR18000

SERVICE B

1. External: General Inspection

1.1 Report any sign of structural deterioration or forced entry.

1.2 Check the following and remove or report any possible risks.

a) Any potential obstructions and fire risks.

b) Sufficient clearance between counter balance and ground / base when raised.

c) That barrier side arm and weights shall not be obstructed by the base or surrounding debris when raised.

1.3 Brush/Wipe away any dirt and/or infestation around the unit.

2. External: Pedestal

2.1 Wipe and clean all components:

a) Pedestal & base.

b) Side arm(s) & counter balance weights.

2.2 Check the following:

a) Cable entries are sealed to deter rodents.

b) Base to under pedestal gap sealed (if required).

c) Barrier machine pedestal for paint damage (ref appendix).

d) Barrier machine pedestal for corrosion (ref appendix).

e) Earth Bonding straps present and undamaged.

f) That door security locks are in order.

g) No rubbing marks on the inclinometer.

h) Side covers are undamaged.

i) External flex conduit from pedestal to boom, terminations, plug & socket, fixings are secured and undamaged.

Rodent damage can occur to wiring in ducting which is not immediately visible.

3. External: Boom & Curtain

3.1 Wipe all components:

a) A frame and reflective strips, where fitted.

b) Boom lamps.

c) Reflective strips.

d) Boom curtain assembly.

3.2 Check the following:

a) LED boom lamps shall be visible at 50m in daylight.

b) Strainer wire and fastenings, where fitted. The strainer wire shall hold the barrier in straight alignment. It shall be just taught with the barrier in the lowered position, adjust as necessary.

c) Skirt assembly, curtain pivot bracket, and fixings where fitted.

d) Boom for visible damage.

e) Boom fastenings.

f) Boom proving circuit, terminations, reed switch and fixings where fitted.

g) Boom lamp fasteners.

4. External: Barrier Caging

4.1 Check the following:

a) Guard is rigid, secure, true and square to the barrier pedestal.

b) Earth cable connected and un-damaged.

c) Security locks in place and undamaged.

d) Sliding doors operate freely.

e) Retaining plungers working freely

f) Machine guard to pedestal fixings are tight.
- M8 bolts torqued to 29Nm
- M20 bolts torqued to 50Nm

4.2 Check the following dimensions shown in figures 2 to 5 are within spec:

a) A & B 155mm +/- 5mm

b) C is 69mm +/- 5mm

c) D is 18mm +/- 5mm

d) E is no more than 5mm

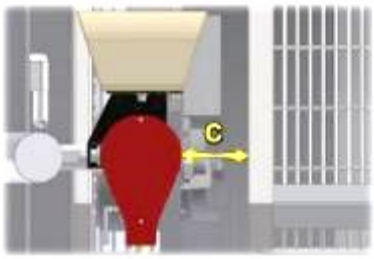


Figure 3

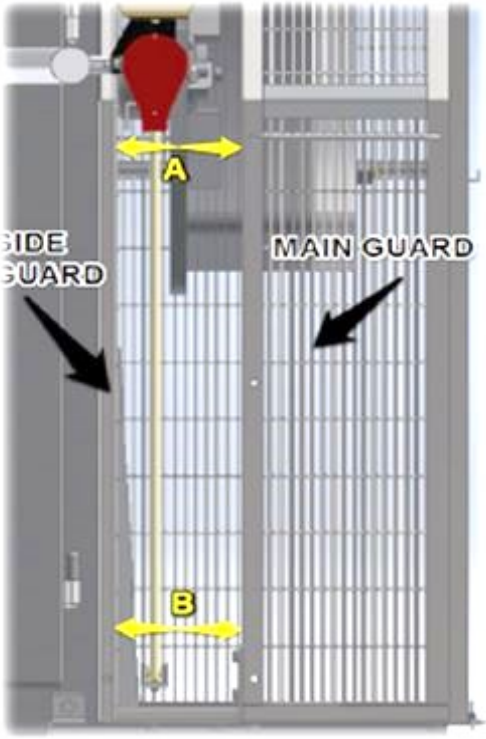


Figure 2

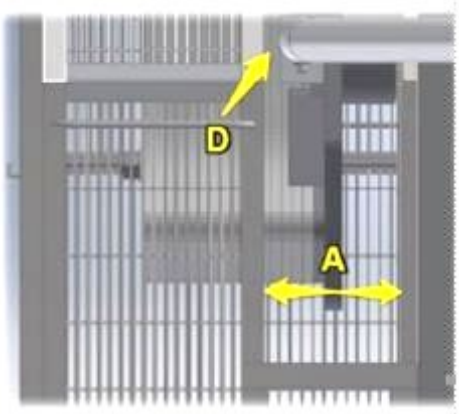


Figure 4

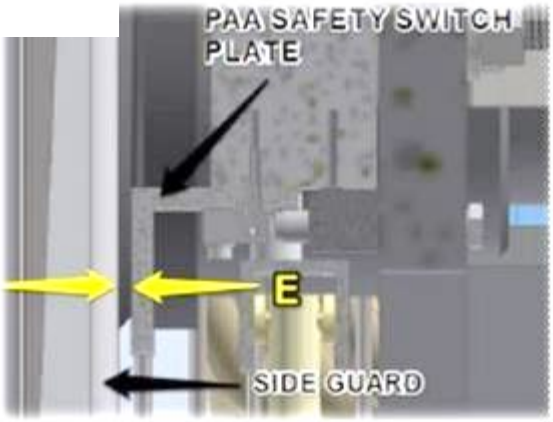


Figure 5

If the cannot be adjusted to meet the required specification, then the SM(S) shall be advised

5. Internal: General Assembly

5.1 Check the following:

a) Base mounting bolts are secure.

b) Door and water seals, renew seals as necessary.

c) Doors hinge and lock.

d) Cable plug couplers are locked and mounting plate secure.

e) Cable terminations are secure.

f) Cables and wires for damage.

g) Earth bonding straps for damage.

h) Heater is working.

i) Doors safety switches and keys are secure.

j) Motor break leaver safety switch & locking pin assembly switch.

k) Isolation switches operates.

l) Wires and fixings for damage & corrosion.

m) Excessive wear or movement.

n) Sealing cap for lock pin opening is in place.

6. Internal: Hydraulic Pump System

6.1 Check the following:

a) Pump handle is intact and stowed correctly.

b) Leaks from cylinder pipes and couplings.

c) Damage to flexible connection pipes.

d) Hydraulic reservoir oil level with the barrier in raised position.

7. Internal: Motor Gearbox

7.1 Check the following:

a) Gearbox oil level.

b) Seals and gaskets for oil leaks.

c) Bottom of the fan cowl clean and free of dirt & debris.

d) Break holding operation at 45 degrees (ref appendix).

8. Internal: Cams & Proximity Switches

8.1 Check the following:

a) Proximity switch mounting plate is secure.

b) Proximity switch should be visually in centre of cam.

c) Tamper proof paint for damage on all proximity switches and cam securing fasteners.

9. Internal: Down Limit Switches

9.1 Check the following items in the barrier down position:

a) Tamper proof paint on fasteners for damage.

9.2 Check the clearance between both limit switches and their cams by inserting a 1.5mm detection gauge, as shown in Figure 6.

Remove the 1.5mm gauge and offer up a 2mm detection gauge, this gauge should not be able to be inserted between the limit switch and its cam, as shown in Figure 7.

Figure 6 - 1.5 mm gauge (Inserted)

Figure 7 - 2 mm gauge (Unable to insert)

10. Lubrication

10.1 Lubricate the door lock and the door hinges.

11. Manual Operation Sequence Test

11.1 Switch the LCU to the hand position.

11.2 Open the door of the machine and release plunger on manual hand pump.

11.3 Release motor break leaver and secure in manual position.

11.4 Toggle direction leaver to the right to lower the boom.

11.5 Insert pump handle in to pump and manually pump to lower the barrier.

a) Check hand pump for ease of operation.

b) Check for leaks around pump pipes and couplings.

11.6 Check that the audible alarms are extinguished and the red road lights are working.

11.7 On manually controlled barriers (MCB, CCTV, OD) check the boom cannot be lifted.

Resistance should be felt when the boom is lifted.

11.8 Toggle direction leaver to the left to raise the boom.

11.9 Pump to raise the barrier.

11.10 When the barrier reaches the fully raised position, check that the red road lights extinguish.

11.11 Release and unlock motor break leaver and secure in normal operating position.

11.12 Push in and turn release plunger in a clockwise direction returning to normal running position.

11.13 Close all doors.

11.14 Repeat 11.2 & 11.13 for other barrier(s).

11.15 Switch the LCU to the 'Local' position and lower barriers. Observe barrier operation and check the following on all barriers:

a) Operation is smooth and not obstructed.

b) The boom comes to rest at a Lowered angle of 0°.

c) The barrier does not oscillate excessively.

d) No excessive noise from pedestal internal mechanism.

e) Lower time is within specification.

f) Audible alarms are extinguished and the red road lights are working.

4 barrier installations only

11.16 Check the distance between the YO-YN and ZO-ZN barrier tips is no more than 65mm.

11.17 With the LCU switch in 'Local Position' start raise sequence. Observe barrier operation and check the following on all barriers:

a) Operation is smooth and not obstructed.

b) The boom comes to rest at a raised angle of 85° – 90°.

c) The barrier does not oscillate excessively.

d) No excessive noise from pedestal internal mechanism.

e) Raise times are within specification.

f) Audible warning and red road lights extinguish when all barriers are fully raised.

11.18 With the LCU switch in 'Local Position' start barrier lower sequence.

11.19 Switch the LCU to the 'Normal' position and hand back to signaller.

12. Final

12.1 Carry out Dynamic Earth Test - NR/SMS/PartB/Test/052.

12.2 If possible, observe the passage of a train in both directions.

PERIODIC TASK

13. Hydraulic Oil

The periodise of the first oil change shall be calculated from the date of manufacture of the pedestal and not the date of installation.

13.1 Drain and replace the hydraulic oil.

END

Includes:	GateCare Power Operated Gate Opener. (POGO)
Excludes:	All other Power Operated Crossing Gates, Mechanically Operated Gates, Wicket Gates, Locked Gates, Hand Operated Gates

Protection arrangements shall be made for both road and rail traffic.

Do not enter the potential entrapment zone whilst the gate is in operation this includes the space between the gate when open and any obstruction such as fences, wall and landscaping.

Figure 1 - Power Operated Gate Opener (POGO)

SERVICE A

1. Gates and Posts

1.1 Remove all rubbish, surface debris, fire risks and vegetation from the vicinity of posts and gates.

1.2 Check the gates are horizontal using a spirit level and adjust as required.

1.3 Check all gates, posts and attachments, particularly for signs of damage or defects.

1.4 Check posts cannot be rotated.

1.5 Check that the rod eye hinge retaining pin and adjustment/securing nuts are in place and that the lock nuts are tight (Figure 1).

1.6 Clean and examine hinges and pivots, then lightly lubricate.

1.7 Check actuators are in line and not binding.

1.8 Check that when the Gate is locked in either the open or closed position, the solenoid sits squarely and in the centre of the jaws through which holds the latch pin.

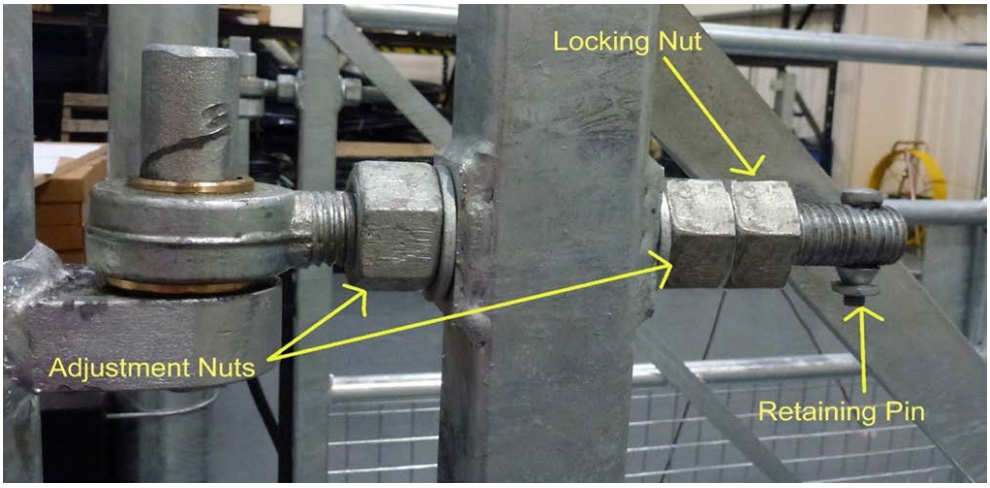


Figure 2 - Hinge and adjustment assembly

1.9 Check the control box and the disconnection boxes are mounted securely.

1.10 Check all operation push buttons are secure.

1.11 Clean and Examine all signage related to the crossing.

1.12 Check the Solar Panel is undamaged. If damaged advise your SM(S).

1.13 Check that there is no obscuration of the solar panel by vegetation etc. If there is or you have concerns this should be reported to your SM(S).

2. Normal Gate Operation Test

2.1 With the gates in the “Closed” position. Depress the green push button. Where linked to an MSL, check a green aspect is displayed on the MSL.

2.2 Check both closed gate solenoid’s release and the gates open smoothly.

2.3 Check both gates complete their travel to the fully open position and the latch pin engages.

2.4 Depress the green push button.

2.5 Check open gate solenoid’s release and the gates release smoothly.

2.6 Check both gates complete their travel to the fully closed position and the latch pin engages.

- If the green push button is depressed while the gates are in motion towards the “closed” position they will immediately stop.
- If the button is pressed again the gates will move back towards the “open”

position.

- If the green button is pressed a third time the gates will again stop.

- And if the button is pressed a fourth time the gate will restart and move to the “closed” position.

If the gate fails to meet any of the above requirements you should refer to NR/SMS/PartB/Test/084 (Power Operated Gate Opener Adjustment / Test).

3. POGO/MSL Link Test [Linked POGO / MSL Sites only]

3.1 With the gates in the “Closed” position, and the MSL displaying a Red aspect. Depress the green push button.

3.2 Check neither of the closed gate solenoids release.

4. Emergency Gate Operation Tests

Test One - Gates Closed

4.1 With the gates in the “Closed” position, depress the red push button on side of the crossing.

4.2 Check both gates immediately open fully and the latch in the open position.

4.3 Repeat 4.1 and 4.2 this time depress the red push button other side of the crossing.

Test Two - Gates Closing

4.4 With the gates in the “Open” position, depress the green button to start the closing sequence.

4.5 During the travel of the gate towards the closed position depress the red emergency button.

4.6 Check both gates immediately stop and reverse direction, opening fully and the latching in the open position.

4.7 Repeat 4.4 and 4.6 this time depress the red push button other gate post.

4.8 Return the gates to the “Closed” position.

5. Obstruction Tests

Test One - Gates moving from the “Closed” to “Open” position

5.1 With the gates in the “Closed” position place an obstruction or stand in the path of one of the gates.

5.2 Depress the green push button.

5.3 Check that when the gate meets the obstruction both gates reverse away and stop.

5.4 Remove the obstruction and depress the green button again.

5.5 Check the gates travels to the “Open” position and latch.

Test Two - Gates moving from the “Open” to “Closed” position

5.6 With the gates in the “Open” position place an obstruction or stand in the path of one of the gates.

5.7 Depress the green push button.

5.8 Check that when the gate meets the obstruction both gates stop and then immediately return to the fully open position and latch.

5.9 Remove the obstruction and depress the green button again.

5.10 Check the gates travel to the “Closed” position and latch.

SERVICE B

6. General

6.1 Check and Lubricate all locks and hinges.

6.2 Check the actuator, and its gate mounting and the manual release pins for signs of damage or wear.

6.3 Check the mounting bolts marked “A” in Figure 3 are secure and torqued to 65lbs/ 77Nm.

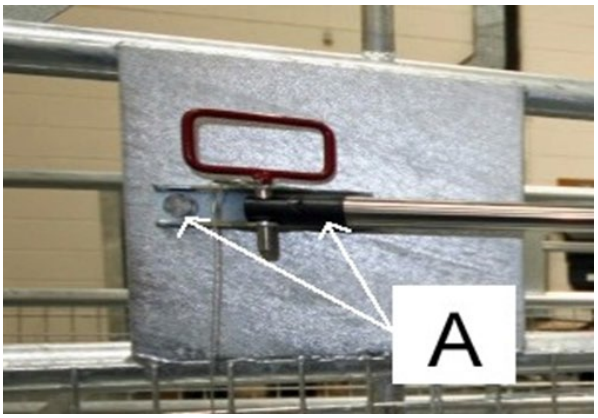


Figure 3 - Actuator pin Gate end

Figure 4 - Actuator pin Post end

6.4 Check the retaining wires on the release pins are serviceable and attached.

6.5 Check the actuator retaining pin at the post end is secured with a padlock. (Figure 4).

6.6 Check the actuator retaining pin for signs of damage or wear.

6.7 Check the following items are secure and adjusted to the correct torque settings:

- The actuator post mounting bracket bolts 48lbs / 66Nm (Figure 5 marked B).

- The actuator mounting extension arm bolt 48lbs / 66Nm (Figure 5 marked C).

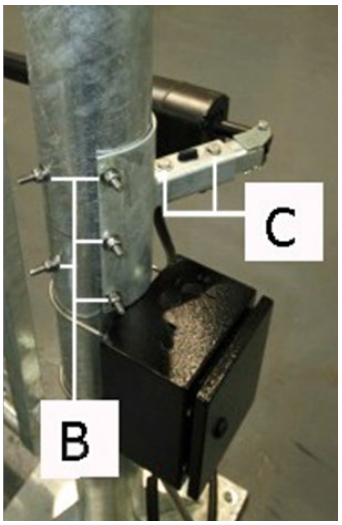


Figure 5 - Actuator mounting bracket

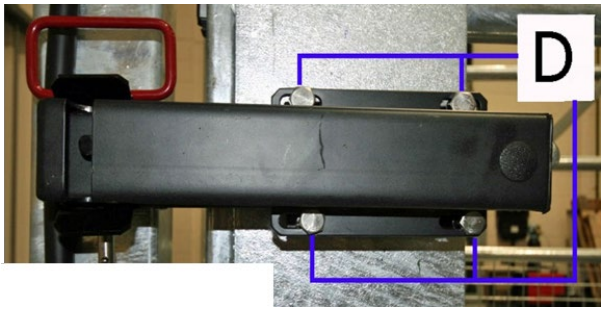


Figure 6 - Solenoid retaining bolts

- The Solenoid Lock bolts 48lbs / 66Nm marked D (Figure 6).

- The two retaining bolts on the reverse side of the gate mounting plate the solenoid is bolted to at 48lbs / 66Nm (Figure 6 marked E).

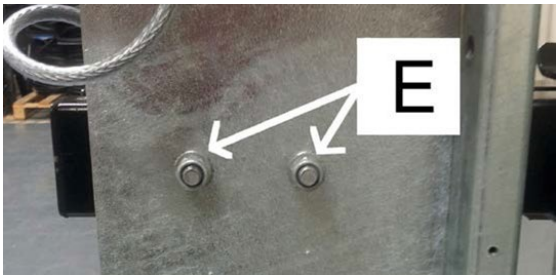


Figure 7 – Reverse side of mounting plate

6.8 Check the condition of all exposed cable.

6.9 Check all exposed cable fittings for tightness.

7. Solar Panel Check

Solar panel and or battery cables shall be insulated when disconnected as the short circuit caused by the cable cores touching will damage or destroy the power generation capabilities of the panel or battery.

7.1 In the cable termination box mounted next to the Crossing Control Box identify the two-core cable from the solar panel and slip the links (Figure 8).

Figure 8 - Solar Panel incoming terminations

7.2 Using a digital voltage meter set on DC check the output from the Solar panel by measuring the voltage across the incoming cable across the incoming terminals.

The expected voltages are related to weather condition and the table below gives the ranges.

Weather conditions	Input voltage range
Bright and sunny	17 to 22 volts
Grey and cloudy	12.7 to 17 volts
Stormy and dark	Less than 12.7

Measure and record the details on the record card. If the reading is lower than 12.7vDC and the weather is not stormy and or dark this should be reported to the SM(S) who should consider replacing the panel.

7.3 Do not reconnect the solar panel at this point.

8. Battery Check

Do not take any readings using the current setting of your meter on this type of battery.

8.1 Check the battery voltage with the solar panel disconnected is above 12.7vDC.

Battery condition	Voltage range
100%	12.7 (or greater)
75%	12.5
50%	12.2
25%	12.0

8.2 Measure and record the details on the record card. Replacement of the battery should be considered if the voltage is lower than 11.5vDC

8.3 Reconnect the solar panel.

END

Includes:	EBI Gate 200 Level Crossing System
Excludes:	All other Types of Level Crossings

Protection / Possession arrangement shall be taken before commencing work on the Level Crossing System.

A general description of the EBI Gate 200 Level Crossing system is given in NR/SMS/Appendix/09.

A record card is available NR/SMS/PartR/AX40-41/RC01, but completion of a card might not be required if the system being maintained has built data recording capabilities.

SERVICE B

1. Mechanical and visual check of wheel sensor RSR123

1.1 Examine the wheel sensor mounting plates and bolts for heavy soiling, security and external damage.

1.2 Check the area around the rail contacts (within 2m) are free of such items as:

a) Visible P/way defects.

b) Metallic debris.

c) New/scrap rails in the four/six foot or cess.

d) Traction bonds.

e) Excessive ballast.

Any problems that cannot be rectified shall be reported to your SM(S).

2. Trackside Connection Box (GAK)

2.1 Check the GAK is secure in the ground, undamaged, and the lid secure.

2.2 Remove the cover and examine the security of cable connections.

2.3 Check cable glands and ties. Unused cable entry points should be sealed.

2.4 Check the cable from the GAK to the wheel sensor is undamaged.

3. Master and Slave Units

3.1 Check the unit is secure in the ground, aligned correctly, undamaged and all doors are secure and padlocked.

3.2 Examine the crossing unit red and green LED's, clean if required. Rectify if damaged.

3.3 Examine the EBI Gate labelling is legible, clean if required. Rectify if damaged.

3.4 If the crossing is an "On-Demand" type, check the push buttons on each unit are not damaged. Rectify if damaged.

3.5 Check that the Axle Counter Boards (ACB) displays in the master unit are not showing any error messages.

3.6 Check that the Green "DC ok" LED is illuminated on the 24v DC PULS supply unit, If not, this unit shall be replaced (Figure 1).

Figure 1 - 24v DC PULS Unit

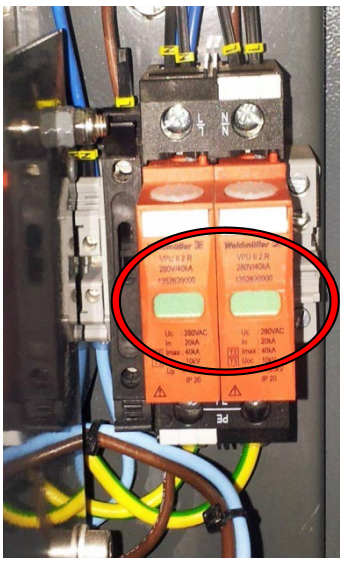


Figure 2 - Surge Arrestors

Figure 3 - UPS Controller

3.7 Check that both of the surge arrestors have green indications showing in the status windows as ringed in Figure 2.

3.8 Check that the status LEDs on the UPS Controller has a green indication showing, as ringed in Figure 3.

The EBI Gate 200 incoming supply fuse can be seen in Figure 2 to the left of the two orange surge arrestors.

4. Wheel Sensor Calibration Check (IMC Board)

4.1 Check the “PWR” LEDs on all IMC boards is lit.

4.2 For each IMC Board check the wheel sensor system currents as follows:

a) Plug the multimeter into the 2mm test sockets on the IMC and check if the life-signals for both wheel sensor systems are received.

NOTE: *The voltage should alternate from 0.5 V for 4 seconds to 0.51 V for 2 seconds. If the voltage is constant at 0.5 V no life-signal is present.*

b) Measure the voltage on the IMC for wheel sensor system 1.

c) Measure the voltage on the IMC for wheel sensor system 2.

d) Check that the readings are within the range:

- *System 1: 500mV ± 5% (475mV to 525mV).*
- *System 2: 500mV ± 5% (475mV to 525mV).*

NOTE: *The measured voltage complies with the wheel sensor system current via a 100 Ω shunt (100 mV therefore complies with 1 mA wheel sensor system current).*

e) If the values are not within the stated range check position of the wheel sensor RSR123 as described in NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3, Section 4.

f) If the position of the RSR123 is correct, adjust wheel sensor as described in one of the following:

- For EBIGate 200 NR/SMS/PartB/Test/082 (Frauscher: RSR123 Wheel sensor – associated with IMC & ACB Boards).

g) Recheck if the life-signal and voltages as per steps a) to d).
h) If the life signal is still missing and/or the voltages are out of range, replace the wheel sensor as described in NR/SMTH/Part04/AX40 (Replace a Frauscher wheel sensor RSR123).

5. User Instruction Signs

5.1 Check that user instruction signage is legible and secure. Wipe as necessary to clean.

6. Block Section Test

6.1 Check each ACB axle counting board (Block Section) is counting correctly. NR/SMS/PartB/Test/082 (Frauscher: RSR123 Wheel sensor – associated with IMC & ACB Boards) - Section 3.

7. Operational Sequence Test

7.1 Undertake NR/SMS/PartB/Test/082 (Frauscher: RSR123 Wheel sensor – associated with IMC & ACB Boards) - Section 6.

8. Double Lines Second Train Approaching Sequence Test

8.1 Undertake NR/SMS/PartB/Test/082 (Frauscher: RSR123 Wheel sensor – associated with IMC & ACB Boards) - Section 7.

END

Includes:	Vamos Crossing System
Excludes:	All other Types of Level Crossings

Protection/Possession arrangement shall be taken before commencing work on the Level Crossing System.

A record card is available NR/SMS/PartR/AX40-41/RC01, but completion of a card might not be required if the system being maintained has built data recording capabilities.

SERVICE B

1. Mechanical and visual check of wheel sensor RSR123

1.1 Examine the wheel sensor mounting plates and bolts for heavy soiling, security and external damage.

1.2 Check the area around the rail contacts (within 2m) are free of such items as:

a) Visible P/way defects.

b) Metallic debris.

c) New/scrap rails in the four/six foot or cess.

d) Traction bonds.

e) Excessive ballast.

Any problems that cannot be rectified shall be reported to your SM(S).

2. Trackside Connection Box (GAK)

2.1 Check the GAK is secure in the ground, undamaged, and the lid secure.

2.2 Remove the cover and examine the security of cable connections.

2.3 Check cable glands and ties. Unused cable entry points should be sealed.

2.4 Check the cable from the GAK to the wheel sensor is undamaged.

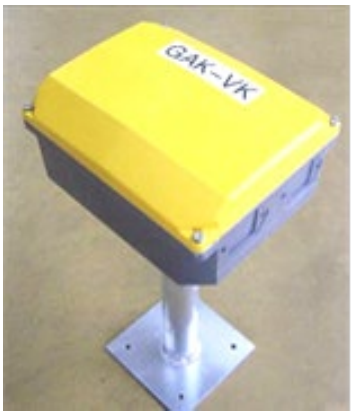


Figure 1 - GAK

3. Indication Posts

3.1 Check the posts are securely mounted, aligned correctly and undamaged.

3.2 Examine the crossing unit red and green LED's, clean if required. Rectify if damaged.

3.3 Examine the "On demand" unit labelling is legible, clean if required. Rectify if damaged.

4. User Instruction Signs

4.1 Check that user instruction signage is legible and secure. Wipe as necessary to clean.

5. Cabinet

5.1 Check the cabinet is securely mounted, undamaged and locked.

5.2 Check for water ingress and other contaminates.

5.3 Check cables and or plug couplers are undamaged and secure.

5.4 Scroll through the Telemetry Module screens to check there are no failure modes present, if one is noted investigate and correct the issue.

Figure 2 - Telemetry Module

5.5 Check that the Green "DC ok" LED is illuminated on the 24v DC PULS supply unit and the green "Status" light on the Buffer Module are both lit. If not, the failed unit needs to be replaced. Figure 3.

Figure 3 – PULS

5.6 Check that both of the surge arrestors have green indications showing in the status windows. Figure 4.

Figure 4 – Surge Arrestors

6. Wheel Sensor Calibration Check (IMC Board)

6.1 Check the "PWR" LEDs on all IMC boards are lit.

6.2 For each IMC Board check the wheel sensor system currents as follows:

a) Plug the multimeter into the 2mm test sockets on the IMC and check if the life-signals for both wheel sensor systems are received.

NOTE: *The voltage should alternate from 0.5 V for 4 seconds to 0.51 V for 2 seconds. If the voltage is constant at 0.5 V no life-signal is present.*

b) Record the lowest reading, measure the voltage on the IMC for wheel sensor system 1.

c) Record the highest reading, measure the voltage on the IMC for wheel sensor system 2.

d) Check that the readings are within the range:

- *System 1: 500mV ± 5% (475mV to 525mV).*
- *System 2: 500mV ± 5% (475mV to 525mV).*

NOTE: *The measured voltage complies with the wheel sensor system current via a 100 Ω shunt (100 mV therefore complies with 1 mA wheel sensor system current).*

e) If the values are not within the stated range check position of the wheel sensor RSR123 as described in NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3, Section 4

f) If the position of the RSR123 is correct, adjust wheel sensor as described in NR/SMS/PartB/Test/157 (Frauscher: RSR123 Wheel sensor – associated with IMC Boards).

g) Recheck if the life-signal and voltages as per steps a) to d).

h) If the life signal is still missing and/or the voltages are out of range, replace the wheel sensor as described in NR/SMTH/Part04/AX40 (Replace a Frauscher wheel sensor RSR123).

7. Rail Sensor Test (Detection Capability)

7.1 Undertake NR/SMS/PartB/Test157 (Frauscher: RSR123 Wheel sensor – associated with IMC Boards) - Section 3.

8. Operational Sequence Test

8.1 Undertake NR/SMS/PartB/Test159 (Vamos Sequence Test).

END

Includes:	EBI Gate 630 Barrier Machine
Exclude:	All other types of Barrier Machine

Appropriate Protection / Possession arrangement shall be taken before commencing work on the Level Crossing System.

Take necessary precautions when working on or near the vicinity of high voltages (230V AC), only use approved insulated tools.

Take necessary precautions when working on or near the vicinity of the batteries, only use approved insulated tools.

For further detail see SMS Appendix 20 – General Information on the EBI Gate 630 / 2000 Level Crossing System.

SERVICE B

1. External Inspection of Control Hut

1.1 Remove potential obstructions and fire risks from around the Control Hut.

1.2 Check the following and rectify if necessary:

a) The foundations for signs of damage.

b) The hut is secure on its base and fixing bolts are free from corrosion.

c) The hut exterior is not damaged.

d) The external signage is clear and legible.

e) The cable runs / troughing are sealed and undamaged.

f) The cable entry ducts are sealed.

g) The door is locked with both locks and is secure.

1.3 Check the earth connection is securely connected to the hut earthing point:

a) Check its continuity is less than 5 Ohms and that it is free from earth faults

2. Internal Inspection of Control Hut

2.1 Check the following and rectify if necessary:

a) Signs of water ingress.

b) Signs of rodent and insect ingress.

c) General cleanliness and remove any accumulated rubbish.

d) Visually check the condition of the equipment (components, wiring and terminal connections) installed on the racks for any signs of damage or over-heating.

e) Any plug couplers for damage and they are securely fitted.

f) The high voltage protection covers are fitted and secure.

g) The condition of the earthing connections / cables to each module.

h) The condition of overvoltage protection components are fitted and secure (the output terminals on the lower part of the racks).

i) Battery terminals for any corrosion.

j) The operation and thermostat settings of the heaters and fans:

- Fan temperature thermostat setting = 30°C
- Heater temperature thermostat setting = 5°C

3. Internal Equipment

3.1 Battery Condition Check:

a) Turn off fuses ZA, ZB and ZC

b) Check voltage on each battery set is at least 26V DC.

c) Turn on fuses ZA, ZB and ZC

3.2 Check the correct operation of the Local Control Unit (LCU):

a) Operate the LCU to raise the barriers

b) Operate the LCU to lower the barriers

3.3 Check the correct operation of the Remote Control Device (ERP-9):

a) Operate the ERP-9 to raise and lower the barriers

3.4 Check the correct operation of the RCD's:

a) Operate the RCD by pressing the units 'TEST' button

b) A mains power failure should be reported on the local diagnostic panel or ERP-9.

c) Reset the RCD

d) Check the fault has cleared on local diagnostic panel or ERP-9.

3.5 Check the operation of the earth leakage detector modules (Bender Units); MD-A, MD-B and MD-C on both control channels A and B:

a) Observe that the resistance value displayed on the front of each module is greater than 110K Ohms.

b) Connect a 90K Ohm resistor between +UA and PE

c) An acoustic indication (“Click”) should be heard from the module

d) A failure should be reported on the local diagnostic panel

e) Remove the resistor

f) Check that after 3 minutes, no failures are shown on the local diagnostic panel.

g) Connect a 90K Ohm resistor between +UB and PE:

h) An acoustic indication (“Click”) should be heard from the module

i) A failure should be reported on the local diagnostic panel

j) Remove the resistor

k) Check that after 3 minutes, no failures are shown on the local diagnostic panel.

4. Final Check

4.1 If possible observe the passage of a train.

4.2 After inspection the hut door shall be locked using both door locks.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LC73		
Flex Crossing System		
Issue No: 01	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Flex Crossing System
Excludes:	All other Types of Crossings

GENERAL

Protection/Possession arrangement shall be taken before commencing work on the Crossing System.

A record card is available NR/SMS/PartR/AX40-41/RC01, but completion of a card might not be required if the system being maintained has internal data recording capabilities.

SERVICE B

1. Mechanical and visual check of wheel sensor RSR123

1.1 Examine the wheel sensor mounting plates and bolts for heavy soiling, security and external damage.

1.2 Check the area around the rail contacts (within 2m) are free of such items as:

a) Visible P/way defects.

b) Metallic debris.

c) New/scrap rails in the four/six foot or cess.

d) Traction bonds.

e) Excessive ballast.

Any problems that cannot be rectified shall be reported to your SM(S).

2. Trackside Connection Box (GAK)

2.1 Check the GAK is secure in the ground, undamaged, and the lid secure, see Figure 1.

2.2 Remove the cover and examine the security of cable connections.

2.3 Check cable glands and ties. Unused cable entry points shall be sealed.

2.4 Check the cable from the GAK to the wheel sensor is undamaged and stil secured to sleepers etc.

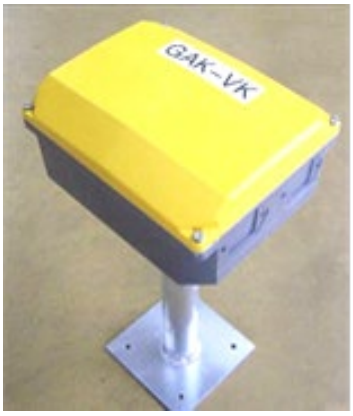


Figure 1 - GAK

3. Indication Posts

3.1 Check the posts are securely mounted, aligned correctly and undamaged.

3.2 Examine the crossing unit red and green LED's, clean if required. Rectify if damaged.

4. User Instruction Signs

4.1 Check that user instruction signage is legible and secure. Wipe as necessary to clean.

5. Cabinet

5.1 Check the cabinet is securely mounted, undamaged and locked.

5.2 Check for water ingress and other contaminates.

5.3 Check cables and or plug couplers are undamaged and secure.

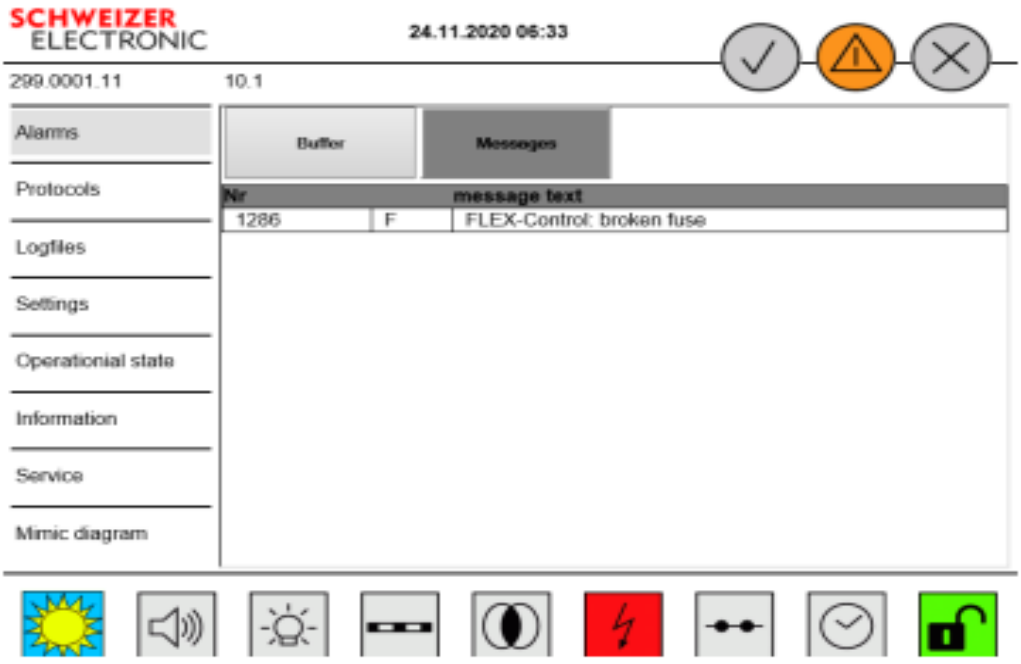


Figure 2 - Flex Life

5.4 Scroll through the Flex Life Log Files to check there are no failures present, if one is noted investigate and correct the issue, see Figure 2.

5.5 Check that the Green “operation” LED is illuminated on the 24v DC Akkutec Battery Charger and the Red “fault” LED isn’t illumiated. If the “fault” LED is illuminated investigate the failure, see Figure 3.

Figure 3 - Akkutec Battery Charger

Figure 4 - Surge Arrestors

5.6 Check that both of the surge arrestors have green indications showing in the status windows, see Figure 4.

6. Wheel Sensor Calibration Check (IMC Board)

6.1 Check the “PWR” LEDs on all IMC boards are lit.

6.2 For each IMC Board check the wheel sensor system currents as follows:

a) Plug the multimeter into the 2mm test sockets on the IMC and check if the life-signals for both wheel sensor systems are received.

NOTE: *The voltage should alternate from 0.5 V for 4 seconds to 0.51 V for 2 seconds. If the voltage is constant at 0.5 V no life-signal is present.*

b) Taking the lowest reading, measure the voltage on the IMC for wheel sensor system 1.

c) Again taking the highest reading, measure the voltage on the IMC for wheel sensor system 2.

d) Check that the readings are within the range:

- *System 1: 500mV ± 5% (475mV to 525mV).*
- *System 2: 500mV ± 5% (475mV to 525mV).*

NOTE: *The measured voltage complies with the wheel sensor system current via a 100 Ω shunt (100 mV therefore complies with 1 mA wheel sensor system current).*

e) If the values are not within the stated range, check position of the wheel sensor RSR123 as described in NR/SMS/PartC/AX40 (Frauscher Advanced Axle Counter) - Periodic Task 3, Section 3.

f) If the position of the RSR123 is correct, adjust wheel sensor as described in NR/SMS/PartB/Test/157 (Frauscher: RSR123 Wheel sensor Adjustment – associated with IMC Boards).

g) Recheck if the life-signal and voltages as per steps a) to d).
h) If the life signal is still missing and/or the voltages are out of range, replace the wheel sensor as described in NR/SMTH/Part04/AX40 (Replace a Frauscher wheel sensor RSR123).

7. Rail Sensor Test (Detection Capability)

7.1 Undertake NR/SMS/PartB/Test157 (Frauscher: RSR123 Wheel sensor Adjustment – associated with IMC Boards) - Section 3.

8. Operational Sequence Test

8.1 Undertake NR/SMS/PartB/Test161 (Flex – Operational Sequence Test).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LC81		
Level Crossing Gates		
Issue No: 04	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Mechanically Operated Gates, Wicket Gates, Locked Gates, Hand Operated Gates
Excludes:	All other types of gate or barrier

GENERAL

Take special care when working within the area of a level crossing. Protection arrangements shall be made for both road and rail traffic.

Some mechanical gate equipment is located sub-surface (gate stops and wicket gate mechanisms etc) and is only accessible by inspection covers in the road.

Tasks that require the locks, interlocking or protecting signals to be operated, shall be undertaken after liaising with the Signaller or Crossing Keeper.

Not all the tasks in each section will be applicable to all types of gate.

Many mechanical gate components were manufactured in pre-grouping days of the railways (pre 1923). Therefore, new or replacement parts are getting increasingly difficult to obtain/source.

In some cases, spare parts are no longer available at all, therefore great care shall be taken during any maintenance activity to avoid damage or breakage to any components.

SERVICE A

1. External

1.1 Remove all rubbish, surface debris and fire risks from the vicinity of posts, gates, gate locks, stops (road and rail) and rodding drive.

2. Posts and Gates (all types)

2.1 Check all gates, posts and attachments, particularly for signs of rot and damage.

2.2 Check vertical alignment.

2.3 Clean and examine hinges and pivots, then lightly lubricate.

Mechanical gates shall operate smoothly without the need for excessive force. Hand gates shall swing freely.

2.4 Check gate tie-bars and fixings.

2.5 Check the adjustment of each gate.

Adjust gate so that it does not foul the roadway or rails but operates correctly and engages with all the gate stops.

2.6 Check that the gates close the road/footway and cannot be inadvertently pushed open when locked.

2.7 Check any self-closing mechanism fitted to a gate is effective.

2.8 Lubricate the slide bar on locking wicket gates.

3. Gates (mechanically operated and manned)

3.1 Check that the gate is painted white and (if provided) any reflectors/reflective strips are secure and in good order.

Report any gates that require re-painting as corrective maintenance.

3.2 Check that red targets are fitted and are secure. Wash and wipe as necessary. Targets require to be retro-reflective.

3.3 Check that the gate lights are securely fitted, working correctly and correctly aligned for road and rail traffic. Rectify as necessary. Wipe all lenses/glasses.

3.4 On externally electrically powered gate lamps check that all cabling, fixings, junction boxes and glands are secure and effective.

4. Gate Stops

4.1 Before exposing road stops, the correct road protection shall be in place.

Road stops can be seriously affected when the road is salted or gritted.

Extra visits may be required, especially during winter months. The salt is very corrosive, and components must be protected by regular cleaning.

There will be heavy wear on the pins in particular. It is good practice to have a spare set of stops available as immediate replacement.

4.2 Check smooth operation of the stops when worked by the lever or wheel.

4.3 Check that the gates are correctly held in position and no over-riding can occur. The gates shall not be able to be pushed over the stops. Rectify as necessary.

Incorrectly adjusted gate stops can cause the gates to open in front of an approaching train. If not held securely by the stops and adjustment is not possible inform the Signaller immediately and report as corrective maintenance.

4.4 Where auto-raising stops are fitted, check the road stops operate satisfactorily and do not rise too soon.

4.5 Remove dirt and debris from the gate stop assembly. Check that the lid(s) fit securely.

4.6 Examine, clean and lubricate all component parts.

5. Gate Drive and Rodding to Locks

5.1 Examine the drive and rodding from the frame.

5.2 Check benches and foundations for stability, security damage, and deterioration.

Movement of the bench can lead to loss of stroke. Wooden benches can rot internally.

5.3 Scrape, wipe and clean all cranks as necessary. Check for security. Lubricate bearings and cotter pins.

NOTE: *Loose cranks can lead to loss of stroke.*

Items with grease nipples shall have new grease pumped into them to expel the existing grease in the bearing/pin.

Oil lubricated cranks shall have new oil added to flood the bearing/pin.

Check that any bearing covers (e.g. ‘Top Hats’) are replaced or renewed if missing. Wipe away excess grease and oil.

5.4 Examine ducting and boxing for signs of damage and subsidence.

5.5 Check rollers, pins and split pins. Do not lubricate.

6. Gate Wheels

Many variations exist. Generally, worm drives are of two or three start threads; these are not interchangeable.

The worm and nut should be treated as a unit and if changed, will require ‘working in’. Gears come as a pair.

The castings that support the drive are generally unavailable. Care is required with all gate wheel components.

6.1 Clean gate wheels. All old lubrication shall be removed.

6.2 Check security of floor fittings. Look particularly for signs of stress to the floor.

6.3 Check the castings.

6.4 Observe the operation of the wheel and gears or worm drive. Check that no teeth are missing, or the nut is not slipping on the worm.

6.5 Lightly lubricate and wipe away excess.

6.6 Observe smooth operation.

7. Gate Locks (hand operated manned interlocked gates)

Fortress key locks are covered in NR/SMS/PartC/LC86 (Fortress Key Locks).

There are different types of locks for these gates:

a) **Keylocks.** Post mounted lock, operated by a gate bolt and interlocked release key from the frame/panel.

b) **Black's Lock.** Post mounted lock, operated by a gate bolt and rodding from an interlocked lever.

c) **Bottle Lock.** Sub surface lock, operated by a gate bolt and rodding from an interlocked lever.

There are different designs and patterns. Parts are not interchangeable between designs and many are strategic spares.

Many components are right or left -handed and cannot be swapped.

In some cases, springs (e.g. in Keylocks and Black's Locks) are very small and might spring out when the cover is removed extreme care should be taken.

Keylocks (not Fortress style) and Black's Locks

7.1 Observe the operation of the gate lock.

7.2 Check mountings and fixings and then clean the exterior.

7.3 Remove the cover with care and clean the interior.

7.4 Examine the castings, springs, set screws and all interior fittings. Change weak springs.

7.5 Where possible, observe the operation with the cover removed. Take care not to disengage the springs.

7.6 Check the lock operates satisfactorily.

7.7 Replace and secure the lid and check the gate locks operate correctly.

Bottle Locks

7.8 Check the gate locking bolt for security, wear, and damage.

7.9 Remove any debris and scrape dirt from the road plates.

7.10 Remove covers and remove any debris from around the lock assembly. Examine the lock components. Check for cracks in the casting and excessive movement during the passage of road traffic.

7.11 Sparingly lubricate the lock assembly. Excessive lubrication can cause the bottle lock to move with traffic vibration.

7.12 Replace the covers and check the lock operates smoothly and correctly.

8. Gate Locks (hand operated user worked gates)

8.1 Check the gate lock works correctly and securely holds the gate in its closed position.

Gates on bridleways require to have latches that can be operated by mounted riders.

8.2 If provided, check the catches/stops, which hold the gate open, work correctly whilst in use.

SERVICE B

9. Keylocks (not Fortress style)

9.1 Check that the emergency keys are in good condition, painted red, and sealed in a container.

The seal will, in most cases, have to be broken to examine the keys.

9.2 Check it is correctly resealed after this task.

END

Equipment Identification

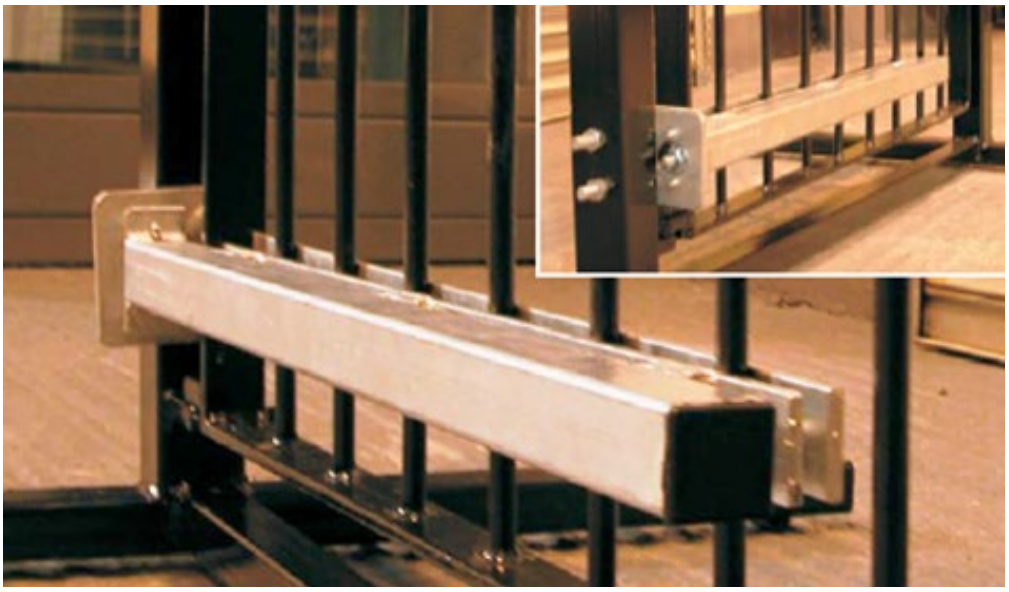


Figure 1 - Automatic Gate Closer

SERVICE A

1. Automatic Gate Closer

1.1 Check mountings and fixings related to the gate closer are secure and undamaged.

1.2 Clean the exteriors

1.3 Check the chassis and clamp plate for wear, damage and contamination (i.e. paint and grease).

1.4 If required, apply lithium grease to the end fixings & joints on both the gatepost & gate surfaces.

1.5 Open and close the gate checking the closer remains in a horizontal position at all times.

1.6 Lubricate the gate hinges.

End

To test the mechanical locking, (NR/SMS/LC81) will require the electromagnetic locks to be temporarily disabled.

Electromagnetic locks can be fitted to wicket gates as an addition to normal mechanical locking, or as the only form of locking the wicket gate.

The electromagnetic lock can be interlocked with signals.

SERVICE A

1 Electromagnetic Lock

1.1 Check mountings and fixings of the locks for security and damage

1.2 Clean the lock equipment.

1.3 Check the strike plate faces and lock bodies for wear, damage and contamination (i.e. paint and grease).

1.4 Clean the strike plate and lock bodies.

1.5 Examine the cables to the locks and cable entry glands.

1.6 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and padlocked and check terminals for security, corrosion, arcing and risk of short circuit/ disconnection.

1.7 Clean the indication panel in the signal box.

1.8 Carry out SMS Test 210 Electromagnetic Lock Test.

End

Includes:	Fortress key lock equipment
Excludes:	Any other type of key lock

General

Tasks that require the locks to be operated with the keys shall be undertaken with the permission of and in liaison with the Signaller or Crossing Keeper.

Any adjustments of the lock and its associated equipment shall be undertaken as corrective maintenance.

The Fortress key locking system is a range of large stainless steel locks and keys together with matching solenoid and switch contacts. These are used to interlock mechanical gates with local signalling. Various combinations of the Fortress range may be used at different sites.

SERVICE A

1. All Outside Equipment

1.1 Clean the exterior equipment and examine the equipment for mounting and security.

1.2 Check for any damage, bending or cracking of the Fortress mountings and brackets.

It should not normally be necessary to lubricate the Fortress fittings, but a light oil can be applied if necessary, cleaning up any surplus afterwards.

1.3 Check that the associated fittings on the post that locate and hold the gate (the Gate Roller and Post Ramp), are secure and holding the gate in the correct position for the lock to engage cleanly.

1.4 Lightly lubricate the roller if required and observe the roller for smooth operation.

1.5 Observe that the roller goes on to the ramp without undue force. Adjust ramp and gate as required to allow this.

1.6 Observe that the bolt is aligned with the lock aperture and travels smoothly into the lock. Adjust ramp and gate as required to allow this

1.7 Operate the bolt and lock to release the key and check for smooth operation.

Check that the key cannot be withdrawn until the bolt is in the unit.

2. Internal Equipment - Mechanical Locks

2.1 Clean the exterior of the fittings if necessary.

2.2 Check mountings and fixings.

2.3 Obtain the key/s. Operate the lock and check for smooth operation with no undue play in the mechanism. Light oil may be applied if necessary, cleaning up any surplus.

3. Internal Equipment - Solenoid Locked Key Unit

3.1 Clean the exterior of the fittings if necessary.

3.2 Obtain the key/s. Operate the lock and check for smooth operation. Light oil may be applied if necessary, cleaning up any surplus.

SERVICE B

4. Internal Equipment - Solenoid locked Key Unit

4.1 Remove the cover of the solenoid lock and examine the mechanism. Clean as necessary.

4.2 Operate the lock and check that the electric lock plunger travels freely and fully locks the lock slide.

4.3 Using a meter across each lock proving contacts. In turn test that they are only made when the electric lock plunger is fully or nearly fully home and break cleanly when the lock is withdrawn.

4.4 Replace the cover.

4.5 Check that the emergency keys are located in a sealed container. Open the container and confirm that they are in good condition.

4.6 Check they correctly operate the locks. Return the emergency keys to the container and re-seal.

END

General

You shall be competent and authorised in accordance with Network Rail standards to maintain, repair, adjust, or test mechanical locking, lever locks, and circuit controllers.

If you find a deficiency or failure that could affect the safe running of trains, or the integrity of the signalling system, you shall report it immediately to the Signaller and your SM(S).

Where signals have to be disconnected during any work on locking, the locking shall be fully tested prior to reconnection and return to service.

All work on locking and signalling equipment shall fully completed and tested before advising the Signaller that the equipment is in working order.

Adjustment, repair, or replacement of locking components shall only be carried out by competent staff who are authorised to work on the equipment.

An incorrect adjustment can result in an electric lock being out of correspondence with the lever position or key and therefore cause a wrong side failure.

If you are not deemed competent and adjustment or repair is necessary, never attempt to work on the equipment yourself. Contact your SM(S) for the necessary arrangements to be made.

The lids of any locking boxes shall not be removed unless you have been certified as competent to do so.

Many frames were manufactured in pre-grouping days of the railways (pre 1923) therefore new or replacement parts are getting increasingly difficult to obtain/source.

In some cases, spare parts are no longer available at all. Every effort shall be taken during any maintenance activity to avoid damage or breakage to frame components.

More information on lever frames can be obtained from NR/L3/SIG/19014.

NR/SMS/PartC/LV99 (Lever Frame Overhaul) describes the scope of work required for a lever frame overhaul.

Overhauls are to be managed in accordance with Network Rail national procedures and/or any local procedures.

1. Frame Types

Wherever possible the NR/SMS specific to the frame type should be used.

Where the frame you are maintaining is not included in this list, NR/SMS/PartC/LV11 (Lever Frames – Non-Specific) shall be used.

There have been many different manufactures of lever frames throughout the era of mechanical signalling.

Many lever frames have been re-used in different signal boxes from which they were originally designed and this process would have resulted in the frame being re-locked.

In some cases, the frames have been re-locked or modified a manufacturing company different from their original designer and this makes identification of a frame type, age and locking difficult.

It is important to correctly identify the frame, manufacturers plates cannot always be relied upon to correctly identify the frame or locking type, if in doubt ask your SM(S).

2. Levers

The colour of the lever denotes its function (a list of these colours can be found in Appendix A).

On most makes of frame, an associated name plate or the pull plate also describes the function.

A lever that operates an electrical item as opposed to a mechanical one has a reduced length handle (e.g. ground frame release or motor operated points).

3. Periodic Testing

Testing of lever frames shall only be carried out by persons who are certified for this task, competent and experienced in the type and complexity of the frame under test.

An up to date testing copy of the locking table is also to be available for recording the test.

The only exception to this, are simple ground frames (e.g. 1 release's 2, 2 reverse locks 1) that can be tested by a competent Technician using either a locking table or the layout diagram/plate legends.

4. Lubrication

Lubrication is to be carried out sparingly and with care. Whenever possible, any excess oil or grease should be wiped away. Oil spilt on insulation causes gradual degradation.

Oil collects dirt and therefore increases wear. An approved oil/lubricant should be used.

Before applying new lubricant, the old is to be removed.

5. Maintenance - General Guidance

Report any excessive dust, rubbish or soiling left by operating staff, to your SM(S).

Do not destroy any re-usable or repairable component.

NOTE: *All lever frame components are considered as strategic spares.*

Slack locking shall be remedied at the earliest opportunity.

6. Pins

Pins shall be examined for wear.

Oversize pins might be needed to take up slack in either the tappet or lever.

Before fitting oversize pins, check this does not compromise other components or affect the locking.

Keep a record of oversize pins fitted, identifying the following overleaf:

a) Original diameter and length.

b) New diameter and length.

c) Date fitted.

When reaming or drilling to fit new pins these shall be marked by lever number and identified by an X if oversize.

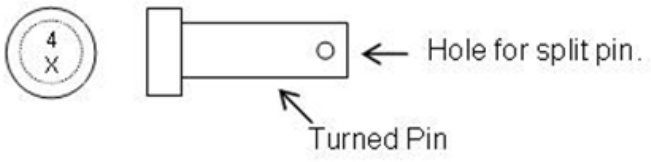


Figure 1 – Turned Pin

7. Split Pins

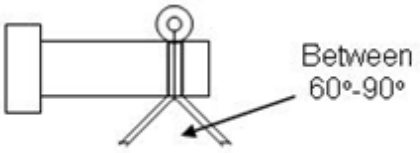


Figure 2 – Fitting of Split Pins

Split pins shall be of the correct type (i.e. not metric in imperial holes).

The length of the split pin should be approximately twice that of the turned pin diameter.

The split pin shall be a “good” fit but still free to move. Each leg shall be opened as shown in Figure 2.

8. Imperial/Metric

Imperial nuts/bolts, pins and split pins shall be used wherever possible, but due to them becoming more difficult to source, metric items might have to be used.

If metric items are used, they shall not be mixed with imperial (i.e. an imperial bolt with a metric nut) as this could result in damage and a failure of the fastening.

Record any metric fastenings used.

9. Records

To monitor the condition of a frame and to identify any signs of serious wear, it is good practice to maintain the following records:

a) Components found out of adjustment.

b) Components found to be slack.

c) Components renewed.

These records should also contain details of how the issue was identified:

a) As a result of above General maintenance.

Or

b) As result of a failure or reported issue

Each component should be recorded by lever number. The record card for each visit should be returned to your SM(S) so that the general condition can be monitored.

Renewal and overhaul can then be programmed.

LEVER LOCKS

General

More information on these items can be obtained from NR/L3/SIG/19025.

10. Force Down Feature

This feature is a mechanical device provided on many locks to force the lock to the locked position immediately before it engages with the locking face of the lock notch.

This operates whether the lock has merely failed to respond to gravity or where the operating coil remains energised as a result of a fault.

Where the force down feature is not provided, locks are restricted to horizontal mounting.

The principle of force down as applied to an SGE Type GF lock is illustrated in Figure 3.

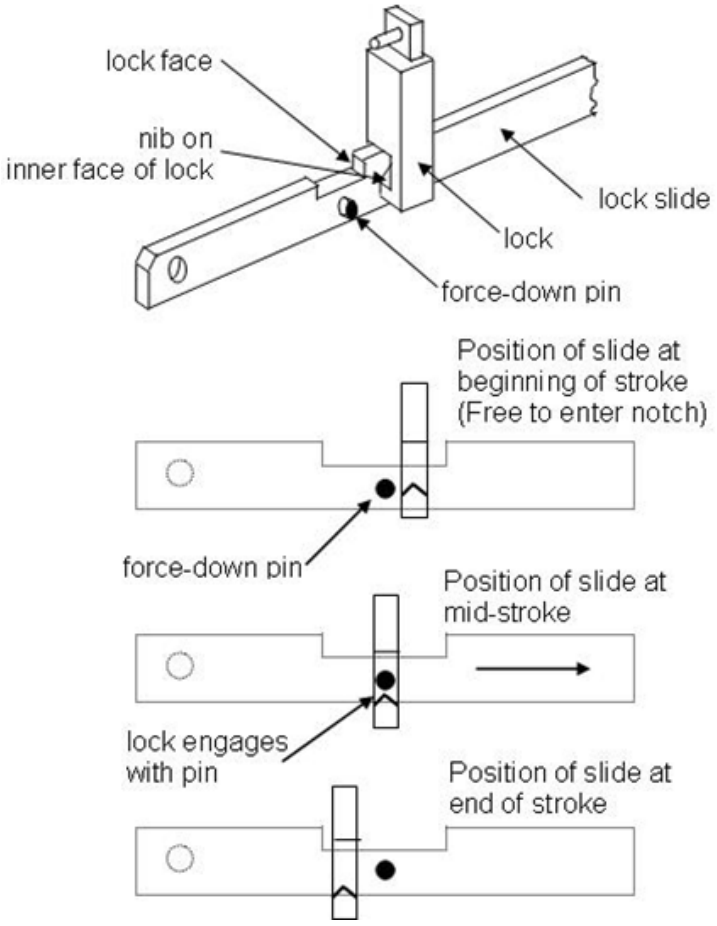


Figure 3 - Force Down Feature (Lock Body Omitted for Clarity)

11. Lock Slide

For locking to be effective, the lock has to fully engage in the correct lock notch.

If the face of the lock notch is worn, the lock might only partially engage and there is a possibility that the lock could 'creep' up the lock face and falsely release the lever (See Figure 4).

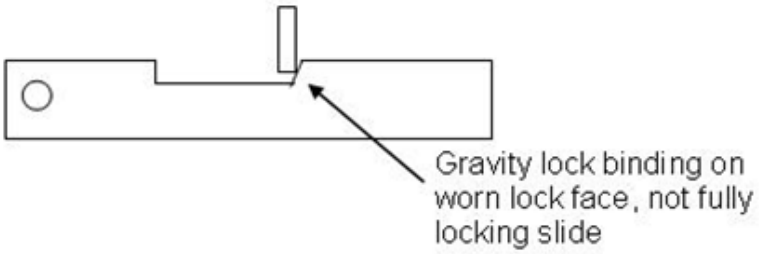


Figure 4 – Worn Lock Face

When cutting a lock, it is essential that the lock face is not chamfered and if anything, the lock face should be slightly undercut (See Figure 5).

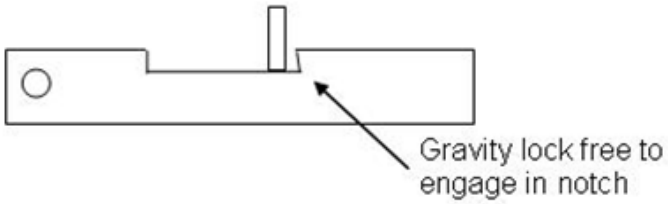


Figure 5 – Unworn Lock Face

12. Economiser Switch

An economiser switch allows the lever lock coil to energised only when operation of the lock is required.

This is a power saving function that reduces the drain on the batteries and prevents overheating of the coil.

It is essential that the switch operates correctly. Different types of lock have various arrangements of economiser switch. Alternatively, separate plungers or foot plungers might be provided.

13. SGE Type GF Lock

A roller on a pivoted lever engages in a small depression on the underside of the lock slide (Figure 6). When engaged, the coil is disconnected and so the depressions are positioned so that the contacts are only made during the stroke.

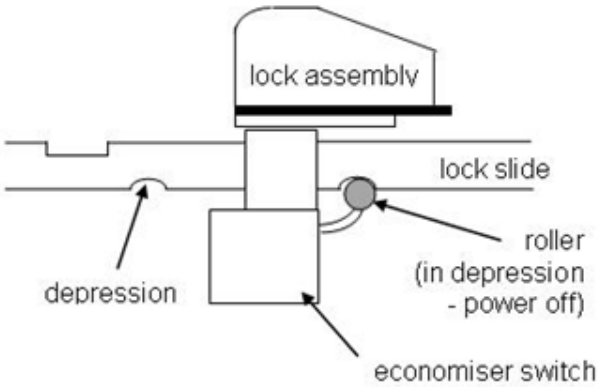


Figure 6 - Economiser

14. SGE Type GA Lock

A similar arrangement is provided on the GA lock, the depressions being located on the side of the lock slide.

Depressions vary in shape and form. To allow correct operation, it is essential that the depressions are kept free from dirt.

15. Western Region 42Ω Lever Locks

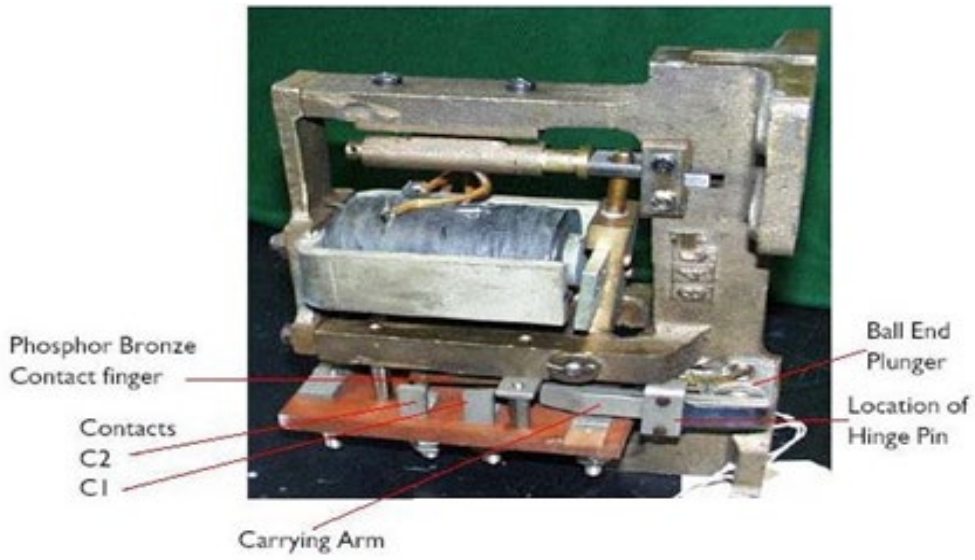


Figure 7 – WR 42Ω Lever Lock

Due to Ex-GWR lever frames having been installed in signal boxes other than the former BR-WR, these lever locks can be found in other areas.

Due to their design there is a possibility of a WSF occurring as wearing of mating surfaces occurs.

Care shall be taken in the gauging of contacts to prevent incorrect operation; any gauging that does not meet the criteria shall be reported to your SM(S) immediately.

Due to the intricate nature of the lock, any repair, adjustments or re-servicing work (other than those considered to be 1st line maintenance, ask your SM(S)) shall be carried out in a workshop environment by specialist staff.

COMBINED LOCK & CIRCUIT CONTROLLER

16. Ex WR Vertical Frames

On this type of frame, a combined lock and circuit controller is fitted directly beneath and is driven directly by the tappet.

There is a risk of oil draining from the locking above into the lever lock assembly.

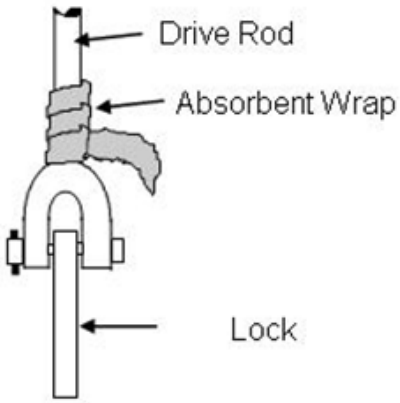


Figure 8 – Wrapping of drive rods

To prevent this, an absorbent wrap shall be tightly wrapped around the drive rod just above the lower fork connection to the lock slide and secured with a cable tie (Figure 8).

Absorbent wraps are made from jute scrim, a sack like material, cut into lengths of 450mm. The wraps should be renewed when they become saturated.

17. SGE Type GA - Slide Travel

If the travel of the lock slide is excessive or incorrectly adjusted, the semi-circular cam gear turns too far and become disengaged from the driving rack. This causes the RE band to remain made when the lever is returned to normal.

An indication of incorrect adjustment can be seen by relating the split pin (block or riveted stud) at each end of the lock slide to the lock body. If either pin is striking the lock body, is bent, or has sheared off, the lock slide is out of adjustment.

Before adjusting or testing the equipment, the Signaller shall be informed, and arrangements made to guarantee the signalling system is not compromised.

The equipment shall be tested before it is returned to service. To check the position of the cam, remove the cover and observe the position of the cam drive gear.

The edge of the cam should be approximately aligned with the edge of the lock slide. Operate the lever, the cam should be approximately aligned with the other side of the lock slide. Figure 9 shows the correct setting and Figure 10 the incorrect setting

Figure 9 – Correct Setting

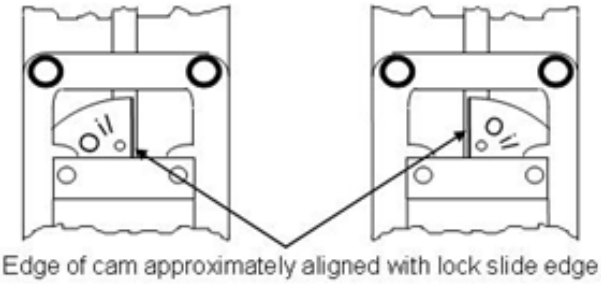
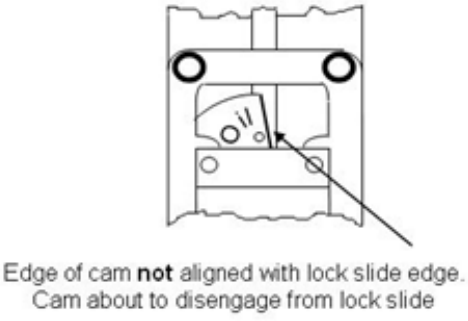


Figure 10 – Incorrect Setting



CIRCUIT CONTROLLERS

18. Field & Grant 4 or 6 way types

Early models use NYLATRON bearings to support the drive shaft of the operating arm. This material proved unsuitable as it tended to swell in damp conditions and shall be replaced.

New bearings with an OILITE sleeve and an improved gasket are identified by a 'P' stamped adjacent to the Tyers logo on the lid. A later modification uses an OILITE bearing with a modified hexagonal drive shaft.

The bearing is impregnated with oil during manufacture and is labelled 'DO NOT OIL'. This modification is identified by an 'R' stamped adjacent to the Tyers logo on the lid.

NOTE: *These bearings shall not be oiled as this degrades the bearing material.*

Only type P or R are permitted for use. Unmodified versions shall be reported to your SM(S) and a replacement obtained.

NOTE: *The drive shafts in some R type units have become seized due to drying out. In such cases the unit shall be replaced do not lubricate as this causes premature failure.*

19. Contacts Spring Pressure

The optimum spring pressure for contacts varies between types of contact assembly and is not published.

The spring pressure should be such that a contact is reliably made but does not cause excessive wear or grooving when the contact surfaces are moving.

Damaged, malformed, or wrongly adjusted springs causes wear and grooving and also produce metallic dust (a potential hazard of short circuit).

20. Metallic Dirt/Dust and Short Circuits

Electrical contacts are made by using iron to copper contacts. Copper is a relatively soft metal and wears more quickly than the iron it is in contact with resulting in copper filings.

Due to the design and positioning the filings can fall onto contacts and terminations, if allowed to accumulate they could cause a short circuit that could result in a wrong side failure.

NOTE: *The filings when mixed with oil and grease can look like any other dirt or dust but are still conductive.*

If you find metallic dirt or dust, it shall be immediately carefully removed with great care taken not to spread the contamination. Report the condition to your SM(S).

In cases of severe contamination, report the situation to your SM(S) immediately.

The safety of the line is the prime consideration at all times.

21. Contact Cleaning

Contacts shall be cleaned as necessary using an approved switch cleaner and using a lint free cloth (to prevent contamination by threads and dust).

The wearing action caused by dry, rubbing contacts can be reduced using an approved contact lubricant.

This shall be smeared on the contact surface; any excess being carefully wiped away.

22. Cables and Wires

Cables and wires shall be supported clear of moving parts or live components. Spiral wrapping or approved cable ties can be used. Ties shall not be over tightened and should allow rotation on the insulation.

When replacing lids and cover confirm that cables and wires are not trapped. Crimped connections shall be terminated so that they cannot come into contact with adjacent metallic components.

23. Lubrication

Mineral oil is applied to moving joints (pins, pivots, rollers, bearings etc) to allow smooth operation. Before applying lubrication, first check that all dirt and contamination is removed, and the component is clean.

Always apply lubrication with care, using the minimum necessary and wipe away any excess.

NOTE: *When applying lubrication in the vicinity of or above electrical wiring any oil spilt on insulation shall be wiped clean as it causes gradual insulation degradation, if not removed completely.*

Excessive lubrication might encourage the build-up of dirt and dust, which might find its way into the circuit controller or lever lock and affect the safe operation of the signalling equipment.

24. Oilite/Nylon Bearings

Certain bearings are constructed from nylon or 'OILITE'. These are self-lubricating.

NOTE: *These bearings shall not be oiled as this degrades the bearing material.*

25. Damp Environments.

Where lock slide surfaces are attacked by damp, a thin anti-rust film of oil should be applied with a lint free cloth.

26. Circuit Controllers

The top bearing of the SGE type GA circuit controller is lubricated by applying a drop of oil under the wing nut. A drop of oil should also be applied through either of the two holes in the cam gear wheel.

Other circuit controllers are lubricated via the oil holes provided at the ends of the circuit controller frame assembly. A single drop of oil at each end is enough.

APPENDIX A - Lever Colours

NOTE: *This list is for guidance only; it does not supersede the information in GK/RT0005 Safety Related Colours for Signalling Application*

Colour	Function(s)
Red	Stop Signals
	Ground Signals (inc yellow)
	Route Levers
	Lever Collars
Top Red White Band Bottom Red	Stop Signal that is released from another signal box
Top Red Bottom Yellow	Home and Distant Signals (Worked from the same lever)
Top Red White band, Bottom Yellow	Intermediate Block Signal
Top Red Bottom Brown	Acceptance Lever
Top Red Bottom Black and White Chevrons	Signals working with machine operated detonator placers
Yellow	Distant Signals
Black	Points
	Scotches
	De-railers
Blue	Facing Point Locks
	Clearance Bars
	Detector Levers

Top Blue Bottom Black	Power Operated Points Economical Points
Brown	Wicket Gates
	Gate Stops & Bolts
	Barrier Levers (Directly Worked)
	Bridge Bolts
Top Blue Bottom Brown	Release Lever Barrier Release Lever
	Switch Lever
	Annett's Key Lever
	Bolt Lock
Top Blue White Band Bottom Brown	Direction Lever
White	Spare lever
Green	Asking Levers
Green	Gongs
Black and White Chevrons	Detonators (Point up for up line) (Point down for down line) (Point in both directions for single lines)
Brown and White Stripes	King or Closing Lever

On two colour levers, the top colour indicates the function that operates first. Spare levers (white) have had all mechanical and electrical locking removed.

Levers that are fixed out of use (e.g. bolted in position and/or catch handles removed) but still retain some or all of their previous mechanical/electrical locking retain their former colour(s).

On some areas/routes, they are painted with the top half of the lever white with the bottom of the lever retaining the colour(s) of their former function.

END

Includes:	Any type of lever frame not covered by a frame specific RT/SMS (some sections will not apply to all types of frame)
Excludes:	All frames listed in the 'Includes' section in NR/SMS/LV12 to LV17

The removal of covers of locking box lids or straps may result in the disarrangement of locking. These lids etc. shall not be removed during maintenance unless you have been certified as competent to do so.

Changing of components listed in sections 2, 3, 4, 5 or 6 may affect locking or travel of the lever. Check carefully that neither are affected. Testing of the interlocking may be required.

General

The frame specific NR/SMS shall always be used in preference to this SMS.

The adjustment or renewal of components shall be classed as corrective maintenance.

SERVICE A

1. Frame Structure

1.1 Brush the lever frame, locking boxes and supporting structure.

1.2 Examine all nuts and bolts. Tighten as necessary.

Record slack fittings on the NR/SMS record card. Arrange for the renewal of persistent slack fittings.

1.3 Examine all visible bolt and pin holes. Look particularly for signs of cracking.

2. Catch Handles

2.1 Examine catch handles, turned pins and split pins. Renew worn components.

2.2 Lightly Lubricate using a light mineral oil and wipe away excess.

2.3 Observe smooth operation.

3. Knuckles and Catch Rods.

3.1 Examine components. Adjust and renew components, as necessary.

3.2 Lightly Lubricate using a light mineral oil and wipe away excess.

3.3 Observe smooth operation.

This is particularly important after changing or adjusting catch rods or knuckles.

4. Catch Blocks and Springs.

4.1 Examine blocks for chamfering and wear or breakage.

4.2 Examine springs for breakage and try for weakness. Renew as necessary.

Caution: Changing blocks or springs can affect the locking.

4.3 Lubricate wearing surfaces sparingly using mineral oil and wipe away excess.

4.4 Observe smooth operation.

5. Quadrants

5.1 Examine all bolts and set screws for security.

5.2 Examine visible bolt and pin holes for signs of cracking.

5.3 Check mid-stroke notches and ends of quadrants for signs of chamfering.

In some cases, it may be necessary to disarrange locking and signalling to renew quadrants.

5.4 Observe smooth operation.

6. Levers

6.1 Check each lever is painted correctly and the handle is the correct length.

6.2 Check for signs of breaking.

6.3 Check drives to electric locks, turned and split pins.

6.4 Observe correct operation of the lock in both normal and reverse positions.

6.5 Observe smooth operation without nip or force. External equipment may require adjustment.

7. Contact Boxes

7.1 Examine lever mounted contact boxes for security.

7.2 Check correct operation when the catch handle is operated.

7.3 Check wiring and report any obvious damage.

7.4 Examine “fingers” (operating rear mounted contact boxes) for security.

Check that the lifting catch rod engages box arm correctly.

8. Lever Name and Pull Plates

8.1 Check for damage, security and legibility. Re-order replacements as necessary.

8.2 Examine back-boards and fittings for security.

9. Locking Connections

9.1 Clean and examine drives to locking (to include cranks, cams, pins, threads, tumblers, radial arms, rockers and all connections).

9.2 Record any adjustment made.

9.3 Lightly Lubricate with suitable lubricants and wipe away excess (this could be mineral oil or grease, if outside).

9.4 Observe correct operation.

10. Locking Boxes

10.1 Brush lids.

10.2 Examine set-screws and bolts.

10.3 Examine lids / straps for security.

Do not remove lids or straps as they may hold down locking.

10.4 Examine locking boxes and adjacent fittings for cracks, chipping or other damage.

Particular attention is to be paid to bolt holes and tappet ways, where visible / accessible.

11. Tappets and Locking.

Care and judgement are needed at this stage to avoid interfering with working locking. Lifting tappets shall never be lifted by hand.

11.1 Examine tappet pins, jaws connections and split pins.

11.2 Clean, where accessible and without disturbing locking.

11.3 Renew worn components, where practicable.

Do not affect the integrity of the locking. If the integrity will be affected, then record the worn components for renewal at a later date.

11.4 Lubricate sparingly with a suitable lubricant (could be mineral oil or grease if outside) and wipe away excess.

11.5 Observe correct operation.

12. Electric Locks and Circuit Controllers

See NR/SMS/PartC/LV21 (Electric Locks), NR/SMS/PartC/LV31 (Circuit Controller), NR/SMS/PartC/LV41 (Combined Lock & Circuit Controller).

This also includes their connections to the frame.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LV12		
Lever Frame – Direct Locking		
Issue No: 04	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	BRB standard ground frame, GCR Tappet, CLC Tappet, Gloucester Wagon Co. (converted to lever locking), GNR tappet, McKenzie & Holland (direct tappet types or converted to direct tappet locking), Railway Signal Company frames (including: LNER standard, GN of I standard), L & Y Types, Saxby Rocker (converted to direct tappet locking), Stevens tappet, Tyers tappet, Westinghouse 17A
Excludes:	All other types of Lever Frame

GENERAL

The removal of covers of locking box lids or straps might result in the disarrangement of locking. These lids (etc.) shall not be removed during maintenance unless you have been certified as competent to do so.

Changing of components listed in sections 2, 3, 4, 5 or 6 might affect locking or travel of the lever. Check carefully that neither are affected. Testing of the interlocking may be required.

SERVICE A

1. Frame Structure

1.1 Brush the lever frame, locking boxes and supporting structure.

1.2 Examine all nuts and bolts. Tighten as necessary.

1.3 Record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.4 Examine all visible bolt and pin holes. Look particularly for signs of cracking.

2. Catch Handles

2.1 Examine catch handles, turned pins and split pins. Renew worn components.

2.2 Lightly lubricate using a light mineral oil and wipe away excess.

2.3 Observe smooth operation.

3. Knuckles and Catch Rods

3.1 Examine components.

Adjust and renew components, as necessary.

3.2 Lightly lubricate using a light mineral oil and wipe away excess.

3.3 Observe smooth operation.

This is particularly important after changing or adjusting catch rods or knuckles.

4. Catch Blocks and Springs

4.1 Examine blocks for chamfering and wear or breakage.

4.2 Examine springs for breakage and try for weakness. Renew as necessary.

Changing blocks or springs can affect the locking.

4.3 Lubricate wearing surfaces sparingly using mineral oil and wipe away excess.

4.4 Observe smooth operation.

5. Quadrants

5.1 Examine all bolts and set screws for security.

5.2 Examine visible bolt and pin holes for signs of cracking.

5.3 Check mid-stroke notches and ends of quadrants for signs of chamfering.

In some cases, it may be necessary to disarrange locking and signalling to renew quadrants.

5.4 Observe smooth operation.

6. Levers

6.1 Check each lever is painted correctly and the handle is the correct length.

6.2 Check for signs of breaking.

6.3 Check drives to electric locks, turned and split pins.

6.4 Observe correct operation of the lock in both normal and reverse positions.

6.5 Observe smooth operation without nip or force. External equipment might require adjustment.

7. Contact Boxes

7.1 Examine lever mounted contact boxes for security.

7.2 Check correct operation when the catch handle is operated.

7.3 Check wiring and report any obvious damage.

7.4 Examine “fingers” (operating rear mounted contact boxes) for security.

Check that the lifting catch rod engages box arm correctly.

8. Lever Name and Pull Plates

8.1 Check for damage, security and legibility. Re-order replacements as necessary.

8.2 Examine back-boards and fittings for security.

9. Locking Boxes.

9.1 Brush lids. Avoid sweeping debris into the locking box or electrical equipment.

9.2 Examine setscrews and bolts.

9.3 Examine lids or straps for security.

Do not remove lids or straps as they might hold down locking.

9.4 Examine lids and locking box for signs of fracture and chipping, or other damage.

Pay particular attention to bolt holes and tappet ways where visible/accessible.

10. Tappets and Locking.

10.1 Examine tappet pins, jaws connections and split pins.

10.2 Clean, where accessible and without disturbing locking.

10.3 Renew worn components. Do not affect the integrity of the locking. If the integrity might be affected, worn components shall be noted for renewal at a later date.

10.4 Remove old oil and grease, lubricate sparingly and wipe away excess (Use mineral oil or grease if outside).

10.5 Where double travelling tappets are used, check the security of the swivel pin.

10.6 Observe correct operation. Only use the operation of the lever to do this. Pay particular attention to swinging and lifting tappets.

Lifting tappets shall never by lifted by hand.

11. Electric Locks and Circuit Controllers

11.1 Electric Locks, Circuit Controllers and Combined Lock and Circuit Controllers shall be observed to confirm that they still operate correctly as they might have been affected by the work undertaken during this SMS.

END

Includes:	Security of contact boxes and electric locks fitted on the lever frame
Excludes:	Excludes all other type of Lever Frame

General

This frame was manufactured between 1870 and 1907. Spare parts ceased to be made in 1930. Special care shall be taken not to damage or break castings and components. There are no new replacement parts.

The cover plates can be removed but shall be stacked carefully and replaced, with care, after maintenance. There are no dust covers. These are catch handle locking frames.

SERVICE A

1. Frame Structure

1.1 Brush the covers of the lever frame quadrants and above floor supporting structure.

The foot-board shall be removed.

1.2 Remove covers and stack carefully.

1.3 Check frame set screws and through bolts both in front of and behind the frame.

1.4 Examine all nuts and bolts. Tighten as necessary. Record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.5 Examine all visible bolt and pin-holes for signs of cracking.

2. Catch Handles

2.1 Examine turned pins and split pins.

2.2 Renew worn components.

NOTE: *Changing a catch rod spring (old pattern) usually requires a disconnection of the locking.*

2.3 Lightly lubricate, using a light mineral oil and wipe away excess.

2.4 Observe smooth operation without nip or force. Outside equipment might require adjustment

Shorter catch handles on the relevant levers should be provided when trigger locking is fitted.

3. Catch Rods

3.1 Examine turned pins and split pins.

3.2 On the old patterned catch rods check security of the spring eye at the foot of the catch rod.

3.3 Check the catch rod has not gouged/become worn against the tumbler.

3.4 Check the catch rod lifts high enough to prevent wear on the rod bottom or quadrant.

3.5 Check the lever tumbler pin for security and observe the amount of wear.

Changing the catch rod or lever tumbler pin can seriously affect the locking on this type of frame and testing shall be required.

3.6 Lightly lubricate the spring box with a light mineral oil and wipe away excess.

3.7 Observe smooth operation.

4. Levers

4.1 Check each lever is painted correctly and the handle is the correct length.

4.2 Check for signs of fracture, especially around the spring box and tumbler pin holes.

4.3 Lightly lubricate the quadrant bearing pin.

4.4 Observe the smooth operation without nip or force. Outside equipment might require adjustment.

Changing of components in sections 3 & 4 affects locking and travel of the lever. Check carefully neither are affected. Testing shall be required.

5. Lever Name and Pull Plates

5.1 Check for damage, legibility and security. Arrange for replacement plates as necessary.

6. Tumblers

These are cast and prone to nib breakage if pins are moved or forced between the nibs. Great care shall be taken to avoid breakage. There are no replacements.

6.1 Check horizontal (backwards and forwards) and vertical movement.

6.2 Examine the tumbler through pin for security. Check rear nut and split pin.

6.3 Examine the tumbler for signs of recent damage. Look particularly for cracking of the casting.

6.4 Check that the lock or release tumblers cannot be operated by hand with the lever in either position.

7. Locking

This is held in position by pins and spacers. There is much more ‘slack’ in this frame than most others.

7.1 Dust in and around the nibs, packing pieces and bars.

7.2 Examine all “locking pins” and “holding down” pins.

Check that they are correctly in place and are cottered up. These pins shall not be able to move between nibs.

7.3 Check all split pins.

7.4 Examine all packing pieces for security and confirm they are supporting the locking bars. Non-standard pieces of packing should be noted on the maintenance fault list.

7.5 Check the locking is supported correctly and operates without binding or friction.

7.6 Examine lock bars at the swan necks for signs of stress or fracture. Particular care is required with bottom bars and trigger locking bars. A special check is needed from under the frame.

7.7 Examine block locking blocks for damage and check the set screw is secure.

Do not remove the holding setscrew on either top or bottom blocks.

7.8 Check drives to electric locks and circuit controller from the tumblers for security and signs of forcing. Report any damage immediately.

7.9 Very lightly lubricate with a light mineral oil between and around the bars.

A minimum of lubricant is needed. The locking of these frames operates best in a dry environment. The pins and split pins need no lubrication.

7.10 Observe operation of levers with covers removed for signs of stress (bowing of bars).

8. Electric Locks and Circuit Controllers

8.1 Electric Locks, Circuit Controllers and Combined Lock & Circuit Controllers shall be observed to confirm that they still operate correctly, as they might have been affected by the work undertaken during this SMS.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LV14		
Lever Frames – Tappet Locking		
Issue No: 03	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Midland Railway Tappet, Railway Executive Committee (R.E.C), British Standard (B.S), Pre 43, LMS Standard,1943 Tappet, Saxby & Farmer Rocker, McKenzie & Holland Cam & Tappet, GN Duplex. Security of Frame Fitted Catch Handle Contacts
Excludes:	LNWR Tappet, GWR 5 bar vertical tappet

General

Dust covers can be removed without interfering with locking, but care shall be taken with 1943 pattern dust covers to check that only the dust cover bolts are slackened.

The holding down strap bolts shall be checked.

The holding down pins shall be checked for security.

The cover plates can be removed but shall be stacked carefully and replaced, with care, after maintenance. There are no dust covers.

These are catch handle locking frames.

SERVICE A

1. Lever Frame Structure

1.1 Brush lever frame quadrants, locking boxes and above floor supporting structure.

The footboard shall be removed.

1.2 Examine all nuts and bolts and tighten as necessary, record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.3 Examine all visible bolt and pinholes for signs of cracking.

2. Catch Handle

2.1 Examine turned pins and split pins.

2.2 Check catch handle spring by operating handle. If the spring is weak, arrange for its replacement.

Caution: If changed, the rocker and consequently the locking could be affected.

2.3 Renew worn components.

2.4 Lightly lubricate with a light mineral oil and wipe away excess.

2.5 Observe smooth operation without nip or force.

3. Catch Rods

3.1 Examine turned pin and split pin.

3.2 Check for bowing.

3.3 Examine foot for wear.

3.4 Renew as necessary. Obtain the best fit possible.

3.5 Check security of spring box. If the spring requires changing or is changed, check the operation of the catch handle again.

3.6 Lightly lubricate with a light mineral oil and wipe away excess. Outside ground frames of this pattern might require grease.

3.7 Observe smooth operation.

4. Rockers

4.1 Check rocker bolt and nut. Confirm the nut is correctly tightened (over-tightening causes the locking to seize up).

NOTE: *Some frames have castle head nut and split pin.*

4.2 Renew the rockers if necessary.

NOTE: *Changing rockers might affect locking.*

4.3 On Duplex frames, check the rocker assemblies for correct fit with the spring box. It should not be possible to move the rocker or tappet out of the mid-stroke position with the lever in the half way position.

4.4 Lightly lubricate with mineral oil and wipe away excess.

4.5 Observe smooth operation.

Changing of components in sections 2, 3 & 4 might affect locking and travel of the lever. Confirm that neither are affected. Testing is required.

5. Levers

5.1 Check each lever is painted correctly and the handle is the correct length.

5.2 Check, especially around the spring box for signs of fracture.

5.3 Lightly lubricate the quadrant bearing pin.

5.4 Observe correct operation of the lever, spring and rocker as a unit.

5.5 Check there is no nip or force required to operate the lever. External equipment might require adjustment.

6. Lever Name and Pull Plates

6.1 Check for damage, legibility and security. Arrange for replacements as required.

7. Tappets and Locking

7.1 Examine tappet jaw for security, if riveted type.

7.2 Examine tappet pin and split pin.

7.3 Clean, where accessible, tappets in normal and reverse positions.

7.4 Observe bridges and bridge pieces (conditional sliders). Check rivets are tight.

7.5 Clean accessible locking (Only top bars can usually be cleaned).

7.6 Check, where visible, slack rivets.

7.7 Lightly lubricate with mineral oil, wipe away excess. Confirm no lubricant falls onto or enters any electrical apparatus or wiring.

7.8 Observe correct operation.

Lifting tappets for sequential/rotation locking are fitted on some frames. Under no circumstances shall these tappets be lifted.

8. Locking Boxes

8.1 Examine holding down straps or pins for security. Check that no locking can lift (other than lifting locks/tappets).

8.2 Clean locking boxes, where accessible, without disturbing the locking.

8.3 Check packing on top is operating and holding down correctly.

8.4 Examine locking box/castings for cracks, chipping or other damage. Particular attention is to be paid to bolt holes and tappet ways, where visible.

9. Catch Handle Contacts

9.1 Examine holding bolts and nuts.

9.2 Examine tappet pin and split pin.

9.3 Remove cover of contact box and observe correct operation by the lever.

9.4 Observe visible state of wiring and report any obvious damage/degradation.

9.5 An absolute minimum of lubricant may be required within the contact box. Wipe away any excess.

9.6 Replace lid. Check that all the holding bolts/setscrews are fitted. Do not over-tighten tappet/contact box pin.

10. Electric Locks and Circuit Controllers

10.1 Electric Locks, Circuit Controllers and Combined Lock & Circuit Controllers shall be observed to confirm that they still operate correctly, as they might have been affected by the work undertaken during this SMS.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LV15		
Lever Frames – LNWR Tumbler		
Issue No: 04	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	London and North Western Railway Tumbler Frame The mechanical fitting of contact boxes on the lever
Excludes:	Any other type of tumbler locking frame

General

The cast bows shall not be slackened off or over tightened. Manufacture of this frame commenced in 1873 and ceased about 1910. Special care shall be taken not to break castings as there are no new replacement parts.

Rockers, cam boxes, quadrants, and levers are changed as one complete unit and shall be kept together. The components are not interchangeable. A disconnection of the locking is required to carry out this work.

SERVICE A

1. Frame Structure

1.1 Brush the lever frame, locking boxes and supporting structure.

1.2 Examine all nuts and bolts. Tighten as necessary.

1.3 Record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.4 Examine all visible bolt and pin holes. Look particularly for signs of cracking.

2. Bow Handles

2.1 Examine the bow handles.

2.2 Check the pins and split pins, renew as necessary.

2.3 Lightly lubricate with a light mineral oil and wipe away excess.

2.4 Observe smooth operation.

3. Catch Rods and Blocks

3.1 Examine the catch rods and blocks.

3.2 Check the pins and split pins.

3.3 Examine block for wear and, in particular, chamfering at the front and back.

3.4 Renew as necessary. Check that the replacement operates correctly.

3.5 Lightly lubricate with a light mineral oil and wipe away excess.

3.6 Observe smooth operation.

4. Quadrants

4.1 Examine for security and signs of fracture.

4.2 Check ends of quadrants for signs of chamfering.

4.3 Observe smooth operation of the lever over the quadrant.

5. Cable Ties

5.1 Check for security.

5.2 Observe wiring is not chafed, damaged or in contact with mechanical equipment.

6. Levers

6.1 Check each lever is painted correctly and the handle is the correct length.

6.2 Check for signs of breaking.

6.3 Check lever mounted contact boxes and fixings.

6.4 Check the correct operation of the catch handle.

6.5 Examine the security of the “fingers” that operate the rear mounted contact boxes. Check that the lifting catch rod engages the box arm correctly.

6.6 Observe smooth operation without nip or force. Adjustment of external equipment might be required.

7. Lever Name and Pull Plates

7.1 Check for damage, legibility and security. Arrange for replacements as required.

7.2 Examine back-board and fittings for security.

8. Lever Shoes and Studs

8.1 Examine lever shoe bolt and hook rack stud. Record any loose bolts.

8.2 Clean and lightly lubricate with mineral oil, wipe away excess.

8.3 Examine stud drive to electric locks. Lightly lubricate with mineral oil, wipe away excess.

9. Rocker/Cam Box

9.1 Clean, where accessible.

9.2 Examine rocker/cam box.

9.3 Examine the hook rack. Attempt to lift hook rack using a small bar, checking for wear on the rocker/cam box.

The maximum allowable wear is one quarter inch (6mm) measured on the bottom rack, if more than this, record the numbers and report it as corrective maintenance.

9.4 On multiple rack locking frames, check for excessive wear in the rocker pins.

9.5 Lightly lubricate with mineral oil and wipe away excess.

9.6 Observe smooth and correct operation with the levers in both positions.

Warning: No attempt shall be made to change these components during maintenance.

10. Hook Rack Adjuster

10.1 Examine and wipe the hook rack adjuster.

10.2 Check for signs of the lever being forced or for signs of a run through (bent adjuster).

10.3 Check the barrel adjuster and lock nuts. This shall be centrally located between top and bottom links and contain enough thread to hold each link securely.

10.4 Tighten and record any slack nuts.

10.5 Lightly lubricate studs and threads with mineral oil. Check threads are clear and wipe away excess.

10.6 Observe smooth operation.

11. Guide Racks/Hook Racks

11.1 Clean, where accessible and examine alignment of the hook rack relative to the guide rack. Adjust, as necessary, to bring into line using the special hook rack adjuster spanner.

11.2 Observe operation of locking when and during adjustment and on completion (both normal and reverse positions).

Locking affected by any adjustment shall be thoroughly tested.

11.3 Lightly lubricate with mineral oil, wiping away excess.

11.4 Observe smooth operation of whole unit.

12. Bars, Locks, Bell Cranks, Weighted Bars, Studs and Fingers

Loose rivets shall not be tightened in the frame. At all times, particularly in cold weather, metal to metal contact (i.e. hammer) shall be kept to a minimum.

12.1 Clean all accessible locking and components.

12.2 Wipe all bar faces and, where possible, tops.

12.3 Examine all bell crank studs and weight studs for wear and security.

12.4 Examine all weights and returning bars for wear and security. Check that weights are correctly located and properly secured. Tighten and record any slack nuts and fingers.

12.5 Examine all rivets, locks and fingers for wear and security.

12.6 Record any slack locking and report to your SM(S).

12.7 Lightly lubricate with mineral oil and wipe away excess.

13. Electric Locks and Circuit Controllers

13.1 Electric Locks, Circuit Controllers and Combined Lock & Circuit Controllers shall be observed to confirm that they still operate correctly, as they might have been affected by the work undertaken during this SMS.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LV16		
Lever Frame – LNWR Tappet		
Issue No: 04	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	London and North Western Railway Tappet Frame Mechanical fitting of contact boxes
Excludes:	All other types of tappet locking frame

General

Manufacture of this frame, approximately 1907 to 1925, means spare parts are not generally available. Special care shall be taken not to damage fittings.

The removal of the locking box lids will result in the dis-arrangement of locking. These lids shall not be removed during maintenance.

This is a catch handle locking frame.

SERVICE A

1. Frame Structure

1.1 Brush the lever frame, locking boxes and supporting structure.

1.2 Examine all nuts and bolts. Tighten as necessary. Record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.3 Examine all visible bolt and pin holes. Look particularly for signs of cracking.

2. Bow Handles

2.1 Examine the bow handles.

2.2 Check pins and split pins. Renew as necessary.

2.3 Lightly lubricate with a light mineral oil and wipe away excess.

2.4 Observe smooth operation.

3. Catch Rods and Blocks

3.1 Examine the catch rods and blocks.

3.2 Check pins and split pins.

3.3 Examine block for wear and, in particular, chamfering at the front and back.

3.4 Renew as necessary. Check that the replacement operates correctly.

3.5 Lightly lubricate with a light mineral oil and wipe away excess.

3.6 Observe smooth operation, in particular, the catch handle returns to the normal position. The balance weights may require adjustment.

4. Quadrants

4.1 Examine for security and signs of fracture.

4.2 Check the ends of the quadrants for signs of chamfering.

4.3 Observe smooth operation of lever over the quadrant.

5. Levers

5.1 Check each lever is painted correctly and the handle is the correct length.

5.2 Check for signs of breaking.

5.3 Examine lever mounted contact boxes for security.

5.4 Check correct operation when the catch handle is operated.

5.5 Examine “fingers” operating rear mounted contact boxes for security. Check that the lifting catch rod engages the box arm correctly.

5.6 Observe smooth operation without nip or force. Adjustment of external equipment may be required.

6. Lever Name and Pull Plates

6.1 Check for damage, legibility and security. Arrange for replacements as necessary.

6.2 Examine back board and fittings for security.

7. Lever Shoes and Studs

7.1 Examine shoe bolts. Record the numbers of any loose bolts.

7.2 Clean and lightly lubricate with mineral oil, wipe away excess.

7.3 Examine stud drive to electric locks. Lightly lubricate with mineral oil and wipe away excess.

8. Rocker and Down Rods

The rocker is an integral part of the quadrant.

8.1 Clean, where accessible.

8.2 Examine the rocker and down rods.

8.3 Check rocker is in mid position when lever is halfway.

8.4 Check down rod pins and split pins.

8.5 Examine barrel adjuster for security. This must be centrally located between top and bottom links and contain sufficient thread to hold each link securely. Tighten and record any slack nuts.

Any adjustment of the barrel shall be carried out with great care because it will affect the positions of the connected tappets and hence the locking Adjustment shall only be carried out if the work can be tested afterwards.

8.6 Examine and lightly lubricate the rockers and down rods.

9. Tappets and Locking Boxes

9.1 Brush box lids Do not remove lids since these, hold down the locking within.

9.2 Check security of holding down bolts.

9.3 Clean tappet jaw and pins.

9.4 Examine tappet pin and split pin.

9.5 Lightly lubricate with a light mineral oil and wipe away excess.

9.6 Lightly lubricate, if necessary, the tappet each side of the locking box with the lever in both normal and reverse positions. Wipe away any excess lubricant.

10. Electric Locks and Circuit Controllers

10.1 Electric Locks, Circuit Controllers and Combined Lock & Circuit Controllers shall be observed to confirm that they still operate correctly, as they might have been affected by the work undertaken during this SMS.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LV17		
Lever Frame: GWR Five Bar Vertical Tappet		
Issue No: 03	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Great Western Railway Five Bar Vertical Tappet Frames and frames converted to five bar vertical tappet locking
Excludes:	All other types of vertical tappet frames

General

The removal or slackening of straps during maintenance might result in dis-arranging the locking and therefore shall not be done.

The cover plates on 3 bar horizontal frames shall not be lifted.

Excess oil shall not be allowed not fall onto or enter in any electrical equipment or wiring.

Examine the jute scrim on the blade to confirm it is not soaked in oil. Replace as necessary.

The Jute Scrim should be fitted at the lower end of the blade between the locking box and the electric lock.

These are lever locking frames.

The principles of this NR/SMS can also be used on other ex GWR type frames (except twistlock).

SERVICE A

1. Frame Structure

1.1 Brush the lever frame, locking boxes and supporting structure.

1.2 Examine all nuts and bolts. Tighten as necessary. Record slack fittings on the record card. Arrange for the renewal of persistent slack fittings.

1.3 Examine all visible bolt and pin holes. Look particularly for signs of cracking.

2. Catch Handles

2.1 Examine turned and split pins.

2.2 Examine the catch handle.

2.3 Renew any worn components.

2.4 Lightly lubricate with a light mineral oil and wipe away excess.

2.5 Observe smooth operation.

3. Back Strap and Spring Box

3.1 Examine the back strap and spring box.

3.2 Examine turned and split pins.

3.3 Check security of spring box. Change springs, when worn.

3.4 Examine foot of back strap for signs of chamfering and wear. Renew as necessary.

3.5 Lightly lubricate with a light mineral oil and wipe away excess.

3.6 Observe smooth operation.

4. Sweeps

4.1 Examine for security and signs of fracture.

4.2 Check mid stroke and end notches for signs of wear and chamfering.

4.3 Observe smooth operation of the lever across the sweep.

5. Levers

5.1 Check each lever is painted correctly and the handle is the correct length.

5.2 Check for signs of breaking.

5.3 Observe smooth operation without nip or force. Adjustment of external equipment might be required.

6. Lever Badges

6.1 Check for damage, legibility and security. Arrange replacements as necessary.

7. Cam Boxes and Drives

7.1 Clean and examine for security and wear. Tighten as necessary. Record slack or worn boxes on the record card. Arrange replacement if necessary.

7.2 Lightly lubricate with oil and wipe away excess.

7.3 Observe smooth operation.

8. Locking

The holding straps shall not be loosened.

8.1 Clean all accessible locking.

8.2 Check all straps and bar set screws for security.

8.3 Examine blade pins and split pins, joints and drive studs to electric locks/controllers.

8.4 Observe correct operation of nibs, interlocks, blocks and sequential springs, during operation of frame.

8.5 Check rivets on drives, where visible, for security. Lightly lubricate, as necessary.

9. Electric Locks and Circuit Controllers

9.1 Electric Locks, Circuit Controllers and Combined Lock & Circuit Controllers shall be observed to confirm that they still operate correctly, as they might have been affected by the work undertaken during this SMS.

END

Includes:	Great Western Railway Five Bar Vertical Tappet Frames and frames converted to five bar vertical tappet locking
Excludes:	All other types of electric lock

If a lever lock is found to be operating incorrectly or is incorrectly adjusted, it shall be treated as faulty and taken out of service immediately.

Adjustments shall only be made by a competent person, who is authorized to adjust and test lever locks.

SERVICE A

1. Exterior

1.1 Examine and dust exterior casing.

1.2 Examine fixing screws and bolts.

2. Internal

2.1 Remove the cover and examine interior of the lock and the interior of the cover.

Look particularly for contamination by metallic dust, dirt, or particles. If any is found, carefully clean and report the condition to your SM(S). More details on this can be found in NR/SMS/PartC/LV00 (Lever Frames, Lever Locks, & Circuit Controllers - General).

2.2 Examine drive, pivots, rollers, pins, split pins, locknuts, and studs.

2.3 Lightly lubricate (wipe away excess), drive, pivots, rollers and pins.

3. Wiring

3.1 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

3.2 Examine terminations. Clean and protect as necessary.

4. Contacts

4.1 Examine contacts. Clean with a lint free cloth moistened with an approved switch cleaner.

5. Final

5.1 Carefully replace cover and secure/lock.

5.2 Check absorbent wrap is effective (where required) and renew as necessary.

5.3 In liaison with the Signaller operate the equipment and observe correct operation of the lock.

SERVICE B

6. Lock and Lock Slide

6.1 Remove the covers and examine the interior as per 2.1.

6.2 Examine lock (where accessible).

6.3 Examine lock slide (blade) notches and force down pins (if fitted).

6.4 Examine notches and depressions in the lock slide, remove any dirt or oil.

6.5 Where necessary (damp conditions), rub a small amount of mineral oil onto the lock slide to provide an anti-rust film.

6.6 Check for correct operation throughout the full movement:

a) Lock dog operates freely.

b) Force down feature (if fitted).

c) Economiser switch (if fitted).

d) Lock proving/checking contacts.

Check that the lock properly engages in the notch. If slackness or mal-adjustment is found, correction and retesting shall be carried out by a person authorised to work on electric locks.

6.7 Check that spring driven contacts fully operate and do not stick when depressed.

7. WR 42-Ohm Lever Lock

If any of the following steps fails the criteria, you shall inform your SM(S). Contact pressure and contact gaps are inter-dependant; any adjustment on one might affect the other.

7.1 Check that the plunger ball and lock slide are not worn.

7.2 Check that the LCC contacts break evenly when the lock pawl has lifted 0.0625" (1.6mm). Check that they open evenly and remain broken until the lock re-engages in the lock slide.

Measure, using an approved gauge, the contact pressure at the point of contact. This should be a minimum of 2oz (60g).

7.3 Check that a gap of between 0.005" and 0.010" (0.13mm and 0.25mm) exists between the sides of the triangular operating plate and the spring rubbing pads when the lock is de-energised.

7.4 Measure, using an approved gauge the contact pressure on C1/C2 contacts; this should be 2oz (60g). Check once the lock slide has moved and the contacts are open there is a contact gap on the two fingers of between 0.060" and 0.075" (1.5mm and 1.9mm).

7.5 Check that the armature assembly operates freely without any trace of binding. Confirm this requirement is met, whatever the rotary position of the armature pivot pin is.

7.6 Check the following when the armature is parallel to the coil assembly when the coil is energised:

a) The residual pin is in contact.

b) The minimum air gap between the armature and the core pole piece is 0.030" (0.75mm).

8. Final

8.1 Carefully replace cover and secure/lock. Lubricate padlock where fitted.

8.2 Check absorbent wrap is effective (where required) and renew as necessary.

8.3 In liaison with the Signaller, operate the equipment and observe correct operation of the lock.

END

Includes:	Contact Finger & Microswitch Types (All makes)
Excludes:	All other types of Circuit Controllers

If a circuit controller is found to be operating incorrectly or is incorrectly adjusted, it shall be treated as faulty and taken out of service immediately.

Adjustments shall only be made by a competent person, who is authorised to adjust and test this equipment.

Allen Bradley microswitch type circuit controllers are usually sealed after installation and therefore require no internal maintenance. However, access to the cams can be gained for adjustment purposes.

Most circuit controllers are rotary actuated. Ex-WR style contact boxes are not, the arm travel on these is linear, not rotary.

SERVICE A

1. Exterior (All Types)

1.1 Examine and dust exterior casing.

1.2 Examine fixing screws and bolts.

1.3 Check the linkage to the circuit controller. Lubricate as necessary.

2. Internal (All Types except Allen Bradley)

2.1 Examine the interior and cover.

Look particularly for contamination by metallic dust, dirt, or particles. If any is found, carefully clean and report the condition to your SM(S).

More details on this can be found in NR/SMS/PartC/LV00 (Lever Frames, Lever Locks, & Circuit Controllers - General).

2.2 Check using a plastic ruler or suitably insulated straight edge, that the circuit controller studs do not protrude and touch the cover. See Figure 1.

Replace the circuit controller if the studs are too long. If the circuit controller cannot be replaced immediately, do not refit the lid. Fit a temporary non-conductive lid until the circuit controller is replaced.

Figure 1 – Stud length check

2.3 Check the lid gasket is undamaged and effective.

2.4 Examine drive, pivots, studs, rollers, pins, split pins and drive lock locknuts. Check they are not seized.

2.5 Lightly lubricate (wipe away excess) pivots and pins.

3. Wiring (All Types except Allen Bradley)

3.1 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

3.2 Examine terminations clean and protect as necessary.

4. Contact Finger Type Circuit Controllers

4.1 Examine contact bands/segments and contact fingers.

If any are worn, damaged, or loose, report as corrective maintenance.

a) Clean with a lint free cloth moistened with switch cleaner.

b) Apply a protection agent as required (except contact faces).

c) Apply an approved contact lubricant to the contact bands/segments.

5. Microswitch Type Circuit Controllers

5.1 Check the Allen nuts that secure the microswitch plate to the body.

5.2 Check the microswitch assembly bolts.

5.3 Clean and examine the tappets and microswitch plungers.

5.4 Carefully check the cam roller Allen nuts.

6. Bearings (All Types except Allen Bradley)

6.1 Check and lubricate bearings.

Bearings made from OILITE or nylon shall not be oiled (see NR/SMS/PartC/LV00 (Lever Frames, Lever Locks, & Circuit Controllers - General).

7. Final

7.1 Check for any slackness or maladjustment and that the equipment operates correctly. If any defects are found, the equipment shall be treated as faulty and the Signaller informed.

7.2 Check and carefully replace cover/gasket and secure/lock. Lubricate padlock where fitted.

7.3 Protect exposed external screw threads with adhesive type grease.

7.4 Operate equipment and observe correct operation.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LV41		
Combined Lock & Circuit Controller		
Issue No: 04	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Combined Lock & Circuit Controller
Excludes:	Individual Lever Locks and Circuit Controllers

General

If a circuit controller is found to be operating incorrectly or is incorrectly adjusted, it shall be treated as faulty and taken out of service immediately.

Adjustments shall only be made by a competent person, who is authorised to adjust and test lever locks.

SERVICE A

1. Exterior

1.1 Examine and dust exterior casing.

1.2 Examine fixing screws and bolts.

2. Internal

2.1 Remove the cover and examine interior of the lock and the interior of the cover.

Look particularly for contamination by metallic dust, dirt or particles. If any is found, carefully clean and report the condition to your SM(S).

More details on this can be found in NR/SMS/PartC/LV00 (Lever Frames, Lever Locks, & Circuit Controllers - General).

2.2 Examine drive, pivots, rollers, pins, split pins, locknuts and studs.

2.3 Lightly Lubricate (wipe away excess), drive, pivots, rollers and pins.

3. Wiring

3.1 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

3.2 Examine terminations. Clean and protect as necessary.

4. Contacts (Bands, Segments and Fingers)

4.1 Examine contact bands/segments and contact fingers. If any are worn, damaged or loose, report as corrective maintenance.

4.2 Clean with a lint free cloth moistened with switch cleaner.

4.3 Apply a protection agent as required (except contact faces).

4.4 Apply an approved contact lubricant to the contact bands/segments.

5. Bearings

5.1 Check and Lubricate bearings.

Bearings made from OILITE or nylon shall not be oiled (see NR/SMS/PartC/LV00).

6. Final

6.1 Carefully replace cover and secure/lock.

6.2 Check absorbent wrap is effective (where required) and renew as necessary.

6.3 In liaison with the Signaller operate the equipment and observe correct operation of the lock.

SERVICE B

7. Lock and Lock Slide

7.1 Remove the covers.

7.2 Examine lock (where accessible).

7.3 Examine lock slide (blade) notches and force down pins (if fitted).

7.4 Examine notches and depressions in the lock slide, remove any dirt or oil.

7.5 Where necessary (damp conditions), rub a small amount of mineral oil onto the lock slide to provide an anti-rust film.

7.6 Check for correct operation throughout the full movement:

a) Lock dog operates freely.

b) Force down feature (if fitted).

c) Economiser switch (if fitted).

d) Lock proving/checking contacts.

Check that the lock properly engages in the notch. If slackness or maladjustment is found, correction and retesting shall be carried out by a person authorised to work on electric locks.

7.7 Check that spring driven contacts fully operate and do not stick when depressed.

8. Final

8.1 Check for any slackness or maladjustment and that the equipment operates correctly.

If any defects are found, treat the equipment as faulty and inform the Signaller.

8.2 Check and carefully replace cover/gasket and secure/lock. Lubricate padlock where fitted.

8.3 Protect exposed external screw threads with adhesive type grease.

8.4 Check absorbent wrap is effective (where required) and renew as necessary.

8.5 In liaison with the Signaller operate the equipment and observe correct operation of the lock.

END

Includes:	Single Line (Tablet/Token) Instrument, Key Release Instrument, Annett's Key Instrument (including Western region type)
Excludes:	Any token that is not associated with a release instrument and Token instruments configured to WR E10K standard

General

If you find this equipment to be operating incorrectly, tell the Signaller. Take the instrument out of service straight away.

You shall only repair, adjust, or test this equipment if you have been authorised as competent to do so.

SERVICE A

1. Keys & Tokens

1.1 Check all keys or tokens. In particular:

a) Check the engraving for the section or release.

b) Look for signs of damage.

2. External

2.1 Examine fixing screws, setscrews and bolts. It should not be possible to open or tip the instrument.

2.2 Dust and examine the exterior, including key-ways.

2.3 Check external cables and wires. Check that:

a) Insulation is not damaged or degraded.

b) Wires are supported.

3. Internal

3.1 Unlock and carefully remove the cover. Examine the interior and cover.

Look particularly for contamination by metallic dust or particles. If you find any, report it to your SM(S) immediately.

3.2 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

3.3 Examine the terminations. Clean and protect as necessary.

3.4 Dust the interior.

3.5 Examine the contacts/bands/segments. If any are worn, damaged or loose, report as corrective maintenance.

a) Clean with a lint free cloth moistened with switch cleaner.

b) Apply an approved protection agent as required (except contact faces).

c) Apply an approved contact lubricant to the contact faces, as required.

3.6 Examine the lock notch.

a) Remove any dirt and oil.

b) Look for wear.

3.7 Where necessary (damp conditions), rub a small amount of mineral oil onto the lock slide face to provide an anti-rust film.

3.8 Check for correct operation of the lock throughout the full movement.

3.9 Check by operation of the key to the first position, the lock proving/checking contacts correctly operate.

4. Plunger

4.1 Dust the mechanism.

4.2 Examine the mechanism.

4.3 Lightly lubricate hand plunger with machine oil, wipe away excess.

5. Indicator/Galvanometer

5.1 Clean the glass.

5.2 Check the clarity of the labelling.

5.3 Observe the needle operates correctly. Check that it pivots smoothly. If needles/ banners are damaged, inform the Signaller and report as corrective maintenance.

5.4 Examine fixings, check that the indicator unit is secured to the main body.

6. Bell or Gong

6.1 Dust and examine exterior.

6.2 Carefully remove the cover and carefully dust interior.

6.3 Examine interior mechanism, pay particular attention to:

a) Springs and contacts.

b) Trigger mechanism.

c) Terminations and wires.

d) Fixings.

6.4 Check wires cannot be trapped or damaged; carefully replace and secure (lock) cover.

6.5 Ask the Signaller to operate the instrument and observe correct operation.

6.6 Carefully replace the instrument cover making sure that no wires become trapped.

Secure the instrument.

Lubricate the lock as required.

6.7 Observe correct operation of the instrument throughout the operating cycle.

SERVICE B

7. Tokens

7.1 Count the number of tokens in the system. Check that the correct number are in the instruments, they are of the correct configuration, undamaged and any lettering is legible.

The count should be undertaken in liaison with the other Signaller(s) at the other instrument(s) in the system.

Where 'No Signaller Key token' systems exist, all instruments in the system should be visited in the same shift.

Allow for any token issued to a train passing through the section.

8. Function test

8.1 Carry out the required NR/SMTH defined test from the following:

a) TOKEN BLOCK CONTROLS TEST.

b) TABLET BLOCK CONTROLS TEST.

c) NO SIGNALLER KEY-TOKEN BLOCK CONTROLS TEST.

Or

d) MECHANICAL LOCKING FUNCTION TEST to check the release function is working as designed.

9. Annett's Key Instrument (Western Region type)

9.1 Disconnect one wire from the lock proving contacts and make the contact open-circuit.

9.2 Measure the resistance between the terminals of the proving contact assembly using a megger (or similar instrument).

If the resistance is less than 100kΩ#, you shall take the instrument out of service and tell your SM(S) straight away.

9.3 Reconnect the wire and restore the contact.

9.4 Disconnect one wire from a pair of commutator contacts and make the contact open-circuit.

9.5 Measure the resistance between the terminals of the commutator contact using a 1000V insulation tester (e.g. Megger).

If the resistance is less than 100kΩ#, you shall take the instrument out of service and tell your SM(S) straight away.

9.6 Repeat the measurement for each pair of contacts.

9.7 Check that the lock dog drops freely into the notch and that the armature bearings are free from oil.

NOTE: ***#*** *If either resistance measurement is less than 1MΩ, you shall tell your SM(S). The SM(S) shall arrange to replace the insulation material.*

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LV52		
Single Line Staffs and Tokens		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	All staffs and tokens for single line use that are not associated with a release instrument
Excludes:	Any tokens from a release instrument

SERVICE A

1. Inspection

1.1 Examine the staff/token and (if provided) the associated holder.

1.2 Check there are no signs of wear or damage to the staff/token and the wording is clear and legible.

1.3 Check (if provided) the associated holder for wear and damage.

1.4 Report any deficiencies found as corrective maintenance.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/LV53		
Token Instrument WR E10K		
Issue No: 03	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Electric token instrument configured to WR E10K standards
Excludes:	All other token instruments

General

Changing of instrument configuration between these types shall only be carried out by authorised servicing agents.

Both manufactures of instrument can work together in the same token system, and can generally be interchanged if necessary, caution is needed when doing this as different terminal numbers might be used, particularly with the section signal release contact mechanisms.

Instruments supplied after the mid 1980's might have 'Klippon' plug coupler connections which have universal terminal numbering irrespective of manufacture.

At some sites which require an intermediate or auxiliary instrument, a terminal instrument with an external 'switching' relay has been provided.

Changing of instrument configuration between these types requires signalling design and may only be carried out when authorised by the infrastructure controller.

Two principal manufactures produced this type of Electric Token Instrument.

GW Type: This instrument was designed and originally produced by the former GWR but was eventually produced by Tyers for the GWR and its successors.

Identifying features include cast 'knob' and flush mortice lock on hinged cover lid, 'brass' plunger and nameplate, an external instrument number, 'butterfly' operated section signal release, and heavy solid appearance.

When manufactured by Tyers, it is known as a No 9 instrument, and will bear Tyers insignia.

Tyers Type: The instrument was designed and produced by Tyers for sale to the British and overseas railways, but also supplied versions to the former BR(WR).

Identifying features include one-piece cover lid with side handles secured by a padlock, non-metallic plunger, 'chrome' nameplate, and lighter alloy casting with a smaller base than GW pattern.

In areas other than GW automatic section status indicators might replace the manual Token In/Out switch. It is known as a No 12 instrument.

Those manufactured for WR use are a style 12A6 terminal instrument and a style 12E8 Intermediate Instrument.

The section signal release arrangements and commutator configurations on both manufactures of instrument are unique to GW areas. The commutator contact settings are set out in the table below. Instruments manufactured or adapted for use elsewhere are unlikely to be compatible with them.

Both manufactures are available as Terminal and Intermediate/Auxiliary types and may also be modified for Remote Operator operation (NSKT/NSTR).

Contacts Settings for Token Instruments used with BR WR E10K Control Circuits

Instrument	Phase	Position	Contacts Made
GW /TYERS Term. (inc Insts mod' with ext'l relay as Int/Aux)	Even	Normal	1-2, 3-4, 6-7- 8
		Withdraw	1-2, 3-4, 5-9
	Odd	Normal	1-4, 2-3, 6-7- 8
		Withdraw	1-4, 2-3, 5-9
GW Int/Aux	Even	Normal	3-4, 5-6.
		Withdraw	1-3, 2-5, 6-7.
	Odd	Normal	3-6, 4-5.
		Withdraw	1-5, 2-3, 6-7.
TYERS Int/Aux	Even	Normal	2-3, 4-5.
		Withdraw	1-2, 5-6, 3-23, 4-24.
	ODD	Normal	2-4, 3-5.
		Withdraw	2-21, 5-26, 3-23, 4-24.

SERVICE A

Liaise with the Signaller before turning or withdrawing tokens, lifting the lock or making/breaking any contacts.

1. External

1.1 Check all tokens for correct colour and engraving. Remove loose pieces of paint.

1.2 Examine instrument fixings (including any balancing magazine attachment or blanking plate) to check the instrument is secure and cannot be tipped.

1.3 Check that illuminated indicator/galvanometer covers are intact.

1.4 Dust and examine exterior including keyways.

1.5 Examine external wires and cables. Check that insulation is not damaged or degraded, and that wires and cables are not 'trapped' and are supported and protected from mechanical damage.

1.6 Examine keyways and aperture for signs of distortion or any damage consistent with an attempt to irregularly withdraw a token.

1.7 Check that the token configuration plate within the aperture is tight by inserting a heavy screwdriver into the key fulcrum guide and gently applying upward pressure against the configuration spigot.

2. Balancing Magazine (If Provided)

If magazine not attached to instrument go to 2.6

2.1 Check that a token can be moved between the instrument and magazine keyways, and that the magazine keyway is not distorted or damaged.

2.2 Check that the back (magazine) locking bolt and neither locking slide can be moved until the front (instrument) locking bolt has been pushed fully down.

2.3 Detach magazine from the instrument, and check that locking bolts on both magazine and instrument are locked down and fully closing keyway.

2.4 Check that configuration pins are secure and not damaged. If an adjacent instrument for an adjoining token section is provided, confirm that the magazine cannot be attached to that instrument.

2.5 Attach magazine to correct instrument and padlock instrument locking bolt in the raised position. Go to section 3.

2.6 Check that the locking bolt is fully closing the keyway, and that the configuration pins are secure and not damaged.

3. Internal

3.1 Carefully unlock and withdraw the instrument cover.

GW Instrument covers are susceptible to damage and distortion if the hinge lid is not opened carefully, making it difficult to re-secure the cover. If the lock is stiff apply a small amount of an approved lubricant wiping away any excess.

3.2 Examine the internal surfaces of the instrument, cover, and sides for flaking paint or metallic dust and particles. If you find any, attempt to ascertain to the source and inform your supervisor.

3.3 Examine internal wires and cables. Check that insulation is not damaged or degraded, and that wires and cables are not 'trapped' and are supported and protected from mechanical damage.

3.4 Check that heater (if fitted) is working, and that all wiring is clear of it.

3.5 Examine all cast parts for signs of cracking or misalignment; if you find any report it to your SM(S).

3.6 Dust the interior of instrument.

3.7 Examine all springs, fixing bolts and springs for security.

3.8 Examine the commutator, ensuring that all contact fingers, segments and insulated bridge strips are secure and intact.

Tyers Instruments only:

3.9 Check that the section signal release 'flipper' contact (11 on terminal instruments and 27 (where fitted) on intermediate/auxiliary instruments) has the underside insulant intact and is approximately horizontal.

3.10 Test that when deflected up and down slightly it is returned by the leaf spring to the horizontal.

3.11 Check that the insulant is present on the roller contact, and that it is free from metallic dust.

GW Instruments only:

3.12 Check that the 'butterfly' at the back of the commutator is secure, and that the faces which operate the section signal release mechanism are square and not grooved.

3.13 Check that the mechanism push rod is free from oil and corrosion and is held against the bottom strip by the coil spring.

3.14 Check that the section signal release contacts (right-hand pair) are not made.

All Instruments

3.15 Replace cover, ensuring that locating spigots are correctly seated, and not trapping any wiring. Re- lock the instrument.

3.16 Test operation of instrument, checking that illuminated indictors/galvanometers operate correctly, and that a token can be withdrawn. Replace token into the instrument.

SERVICE B

The angular references below are in an anti-clockwise direction with the 0° referenced when a token is first raised within the instrument and pushed fully into the commutator aperture.

With all the steps listed below it will be necessary to hold the token firmly throughout, only releasing it when stated. It is particularly important not to allow the token to turn in the opposite direction to that required in the sequence of steps.

If this is inadvertently done it will be necessary to return the token to the 0º position, and to start the sequence of steps again.

To carry out this service you will need to take a short possession of the token system.

Refer to the table in the general section to ascertain the contact numbers for the commutator positions for each type of instrument.

4. Tyers Instruments (No 12) only

4.1 Carefully unlock and withdraw the instrument cover.

GW Instrument covers are susceptible to damage and distortion if the hinge lid is not opened carefully, making it difficult to re-secure the cover. If the lock is stiff apply a small amount of an approved lubricant wiping away any excess.

4.2 Slowly depress the plunger, checking that there is enough, but not excessive pressure, on the contact arms and springs.

4.3 Clean pitted or dirty contacts if necessary. Check that plunger ‘normal’ contacts break well before the ‘depressed’ contacts are made. When the plunger is released, confirm that it springs fully back to its normal position.

Maladjusted plunger contacts can lead to a Signaller being able to irregularly release his own token.

4.4 With no token in the aperture check that the lock armature cannot be raised fully to the pole pieces.

4.5 Check from within the instrument that the commutator cannot be manually turned more than 1/8th of a turn, this equates to 10 to 15mm of movement. If the movement exceeds this you should advise your SM(S).

4.6 Raise a token into the aperture and turn slowly anti- clockwise to the lock position.

4.7 Check that the token remains in the lock position when grip is released. If the token does not stay in that position, check the registration plunger/disc for wear, and inform your SM(S).

4.8 Check that whilst the token remains in the lock position, the lock dog is not binding. (A clearance of about 1mm between the face of the lock dog and the face of the locking disc exists for this purpose).

4.9 Check that the token cannot be turned past the lock position.

4.10 Check that the flipper contact (where fitted) is approximately horizontal, and about 2-3mm clear of the commutator segment.

4.11 Manually lift the lock and turn the token approximately 10º anti-clockwise.

4.12 With the lock armature fully raised to the pole pieces, check that there is a small clearance of around 1mm between the lock dog and the top surface of the locking disc.

4.13 Turn the token a further 10º anti-clockwise.

4.14 Check that the flipper top face is making contact with the commutator segment, and that the roller contact metallic face is making with the end segment.

4.15 Turn the token a further 10º anti-clockwise.

4.16 Check that the lock dog has dropped away from the pole pieces.

4.17 Turn the token a further 40º anti-clockwise.

4.18 Check that the flipper is no longer in contact with the segment band and has returned to the horizontal position.

4.19 Turn the token anti-clockwise to a point about 10º before the face of the token is standing vertical. Whilst turning the token check that the pole change contacts break and remake in the opposite phase.

4.20 Check that the lock dog force down is effective by attempting to manually lift it, and that the token cannot be withdrawn from the aperture.

4.21 Turn the commutator further anti-clockwise, and Check that the token cannot be turned past the point where the token face is vertical.

4.22 Withdraw the token from the aperture, and place to one side.

4.23 Repeat steps 4.1 to 4.22 for the opposite phase by using a second token.

4.24 Place one of the withdrawn tokens back into the aperture.

4.25 Turn the token a 30º clockwise.

4.26 Check that the flipper contact bottom insulated face is making contact with the commutator segment, and that the roller contact has turned so that the insulated face is making with the end segment.

4.27 Turn the token a further 80º clockwise.

4.28 Check that the flipper has been released by the commutator segment and sprung back to the horizontal position.

4.29 Check that the lock dog falls cleanly into the port.

4.30 Turn the token further clockwise until face is vertical.

4.31 Check that the token cannot be turned any further clockwise.

4.32 Withdraw the token from the aperture and lower into a storage slot.

4.33 Repeat steps 4.23 to 4.31 for the opposite phase with the remaining token that was withdrawn from the instrument.

4.34 Lubricate the locating plunger with a small quantity of light machine oil, wiping away any excess.

Under no circumstances shall lubricant to be applied to any part of the commutator lock mechanism.

5. GW Instruments only (No 9)

5.1 Carefully unlock and withdraw the instrument cover and side plates.

5.2 Slowly depress the plunger, checking that there is enough, but not excessive pressure, on the contact arms and springs. Clean pitted or dirty contacts if necessary.

5.3 Check that plunger ‘normal’ contacts break well before the ‘depressed’ contacts are made. When the plunger is released, confirm that it springs fully back to its normal position.

5.4 Maladjusted plunger contacts can lead to a Signaller being able to irregularly release his own token.

There is a tendency for the brass handled plungers on the GW instruments to ‘stick’ in due the presence of metal polish on the shaft. Such deposits shall be removed with an approved cleaner.

5.5 With no token in the aperture check that the lock armature cannot be raised fully to the pole pieces.

5.6 Check that the commutator cannot be manually turned without a token in the aperture.

5.7 Raise a token into the aperture and turn slowly anti- clockwise to the lock position.

5.8 Check that the token remains in the lock position when grip is released. If the token does not stay in that position, check the registration bars/spring/disc for wear, and inform your SM(S).

5.9 Check that whilst the token remains in the lock position, it is not binding against the lock dog. (A clearance of about 1mm between the face of the lock dog and the face of the locking disc exists for this purpose).

5.10 Check that the 'butterfly' at the back of the commutator is NOT contacting with the bottom face of the cam on the section signal release assembly.

5.11 Manually lift the lock and turn the token approximately 10º - 15º anti-clockwise.

5.12 Check that the butterfly has now raised the cam on the section signal release mechanism far enough to cause the section signal release contacts (right-hand pair) to make.

5.13 Check that the cam face is fully in contact with the face of the butterfly.

5.14 Turn the token a further 25º anti-clockwise.

5.15 Check that the section signal release contacts are still made.

5.16 Turn the token anti-clockwise to a point about 10º before the face of the token is standing vertical. Whilst turning the token check that the pole change contacts remake in the opposite phase.

5.17 Check that the lock dog force down is effective by attempting to manually lift it, and that the token cannot be withdrawn from the aperture.

5.18 Check that the butterfly is clear of the cam on the section signal release assembly, that the push rod has fully returned to the bottom stop, and the section signal release contact has broken by at least 2mm.

5.19 Turn the commutator further anti-clockwise and check that the token cannot be turned past the point where the token face is vertical.

5.20 Withdraw the token from the aperture, and place to one side.

5.21 Repeat steps 5.1 to 5.20 for the opposite phase by using a second token.

5.22 Place one of the withdrawn tokens back into the aperture.

5.23 Turn the token 40ºclockwise.

5.24 Check that the butterfly has pushed the cam fully in on the section signal release assembly, and the section signal release 'hold up' contacts (left-hand pair) are broken by at least 2mm.

5.25 Turn the token 50º clockwise to the lock position.

5.26 Check that the lock dog falls cleanly into the port, and that the cam on the section signal release assembly remains fully pushed in.

5.27 Turn the token 30º clockwise.

5.28 Check that the section signal release assembly cam has been released and the section signal release 'hold up' contacts (left-hand pair) re-made.

5.29 Turn the token further clockwise until face is vertical.

5.30 Check that the token cannot be turned any further clockwise.

5.31 Withdraw the token from the aperture and lower into a storage slot.

5.32 Repeat steps 5.22 to 5.31 for the opposite phase with the remaining token that was withdrawn from the instrument.

6. Instruments not fitted with an internal heater which are situated in an unheated environment and have voltages higher than 24volts (nom) present

6.1 Insulation test with a 500v tester between each adjacent unconnected contact finger and between each adjacent segment, and from each one to the instrument housing. If any values of less than 1MΩ are found, attempt to ascertain to the reason and inform your SM(S).

To carry out this step it will be necessary to turn the commutator with a token to various positions to check that the segments/contact fingers under test are not in contact with each other; and to also isolate the fingers.

If such isolation requires removal of wires the provisions of the Signalling Maintenance Testing Handbook (NR/SMTH) shall be used.

6.2 Check that the lubricating holes at each end of the commutator are clear and place a small amount of light machine oil into each, wiping away any excess.

6.3 Smear a small amount of lithium-based grease on the corners of the commutator registration disc where contact is made with the registration bars.

6.4 Clean contacts and segments, if necessary, using a cleaner.

6.5 Check that all contacts have enough, but not excessive tension.

6.6 Move the Token Section Switch (where provided) to each position, check that the contacts make and break correctly, and that the switch does not spring away from any position.

6.7 Where a neon spark quench is connected across the lock coils, check that is effective by arranging for a token to be electrically released from the instrument and observing the neon to flash when the lock de-energises.

6.8 Replace the instrument top and sides, checking that wiring cannot become trapped. RE-LOCK the instrument.

6.9 Test operation of the instrument, both for sending and receiving a release. Check that illuminated indicators and galvanometers operate correctly without sticking in one position. Replace token once the test is complete.

7. System Test

Carry out NR/SMS/PartB/Test/301 (WR E10K Token System Test).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/LV99		
Lever Frame Overhaul		
Issue 03	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	All types of lever frames
Excludes:	

Competent, qualified, locking staff familiar with the type of frame shall only carry out this work.

This work requires a method statement. Testing of lever frames shall only be carried out by persons who are certified for this task, competent and experienced in the type and complexity of the frame under test.

Simple ground frames (e.g. 1 releases 2, 2 reverse locks 1) that can be tested by a competent technician using either a locking table or the layout diagram/plate legends.

The terminology used refers to tappet frame components. The principles apply to all types of cam, tumbler / twist rocker and soldier locking.

Overhaul Requirements

Typical overhaul frequencies can be found in appendix A

1.1 All levers shall have paint removed

- All trigger pins and holes to be examined for excessive wear and replaced as necessary.
- All back rods and springs to be examined for excessive wear and replaced as necessary.
- All Quadrants shall be examined for excessive wear and over stroke plates where necessary. (Function and locking test of affected lever required).

1.2 All Bearings and spindles shall be examined for excessive wear and replace as necessary.

1.3 Locking drive devices shall be examined for excessive wear and replaced as necessary (locking test of affected lever required).

1.4 Lever Tails shall be examined for excessive wear and replaced as necessary (function test of affected equipment required).

1.5 All levers shall be painted in accordance with NR/SMS/LV00.

1.6 Pull plates shall be examined for damage and wear. Replace as necessary.

2 Removal of Locking

2.1 Disconnect the following:

- The locking.
- Points and signals that are connected to the lever frame.
- Electric locks .

Lock Blade

2.2 Remove Lock Slide from base casting.

2.3 Clean and examine lock slide check throw down studs are not loose or worn, check there is no damage to the controller drive slot or gear. (replace or File as necessary).

2.4 Clean and Examine drive rod and pins for any wear (Replace as necessary).

2.5 Clean and examine base for any cracks or damage.

2.6 Check that the base is securely fitted to the controller table.

2.7 Lightly oil lock blade and re fit. (Check the blade runs freely and that over-stroke pins or blocks are not fowling at either end of the travel).

2.8 Check new split pins are fitted to drive pins and opened to 45 degrees.

2.9 Remove lids / straps holding locking.

2.10 Check stamping of all components.

2.11 Remove and correlate to the diagrams:

- All locking bars.
- Packing pieces.
- Locks and spacers.
- Tappets.

Lock Assembly

2.12 Remove clean and examine lock dog ramp for wear burr's, File off rough edges, renew dogs where necessary

2.13 Check lock adjusting screw and lock pivoting pins for wear or distortion.

2.14 Check that dowel pins are fitted to either the lock or the base (Mostly Westinghouse D and L type Models)

2.15 Check that armature piece is securely fixed to armature arm

2.16 Check pivot pins and bearing holes of the armature and laminations for any excessive play

2.17 Check nylon roller at lock end of armature arm (L Type Only)

2.18 Lock proving contacts should be clean and undamaged and provide good tension to check a good contact, spring pressures are based on experience.

2.19 On completion of the lock checks before the lock is rewired, an insulation resistance test should be carried out between all terminals and base frame work not less than 5 Megohms.

2.20 When lock proving is provided each lock proving contact should be tested to the frame with the lock in the de energised position.

2.1 Test coils for resistance:

Westinghouse : D4/D6 (DE Coils)		Westinghouse : D4/D6 (coil)		Westinghouse : L type	
Volts	Ohms	Volts	Ohms	Volts	Ohms
10	10	110 50hz	2.8	1/17/6 12v dc	10
20-24	50	110 75hz	1.8	1/1 24v dc 7/8	55
50	109	110 50hz old pattern	6	1/17/9 50v dc	270
xxxxxxxx	xxxxxxxx	110 50hz old pattern	3	2/9/2 110v ac 2/9/12 12v dc	4

3 Economiser

3.1 Carefully clean and examine all individual parts for wear ., particular attention being given to all insulations including the spring depression roller on GA Type.

3.2 Replace burnt or damaged contacts, file contact nibs where possible.

4 Controller

4.1 Clean and examine contact segments for wear, burns. Renew where necessary, check segments for correct position.

4.2 Clean and examine contact springs, keepers for wear, distortion.

4.3 Polish contact nibs, (File and shape surfaces were necessary) or renew contact spring complete and check for sufficient spring pressure.

4.4 Check controller operating spindle and bearings for damage or excessive wear.

4.5 Clean and examine actuating drive gear or roller (check free operation).

4.6 Renew any worn or badly pitted bands (try to clean burnt bands with fine emery cloth where possible).

4.7 Light mineral oil to be used on bearings and drive gear.

5 Component Overhaul

5.1 Clean all components.

5.2 Check security of all rivets and studs (fastenings).

5.3 Thoroughly scrape, Wash and clean the locking boxes.

5.4 Examine all castings for fractures or breakages.

5.5 Check the security of attachment of the locking boxes/guide racks.

5.6 Examine boxes for damage around tappet ways, especially front and back.

5.7 Examine tappets for worn / oversize notches and wear on bevels. Check for

conflicting notches.

5.8 Examine locking bars for damage and slack locks.

5.9 Check loose lock stamping.

6 Covers

6.1 Lock and controller covers should be cleaned and inspected for any damage or loose pins and re painted where necessary.

7 Re-instatement of Locking

7.1 Correlate all locking to diagram before returning to the frame.

7.2 Check the stamping.

7.3 Check that no redundant locking is returned to the frame.

7.4 Check packing pieces and packing bars are correctly stamped.

7.5 Check each bar has been returned and test on installation.

7.6 All locks will “fit” their notches and there shall be no excess slack. The amount of slack or slog on lever locking frames varies.

7.7 Only experience can tell if it is correct. Slack is there to reduce wear on direct lever locking frames. The notch size is usually cut larger than the lock.

7.8 Check each lock travels correctly.

7.9 Conditional locking cannot lose stroke / travel across the slides. (tappet or bridge).

7.10 Check locks do not foul tappets when operating slides.

7.11 As locking is installed, Check for conflicting notches on the tappets.

7.12 Check the following on tappet locking frames:

- All locks can fit in all ports of a tappet simultaneously.
- Multiple locks on the same bar impart the same travel to all opposing locks on the same bar.
- Any conditional locks are correctly set with equal shoulders and no loss of travel occurs especially when conditions occur in series.
- Conditional locks are correctly lipped so that the bar travel is not impeded by the lip hitting the tappet face.

7.13 Check the following on pre 43 and MR tappet frames:

- Any locks in adjacent channels have upside down lip locks fitted so that the sliding bridge does not collide with a lock in the next channel.

7.14 Check the following on LNWR tumbler frames:

- All locks are set at the correct clearance from the hook rack.
- The conditional ‘dart’ type locks do not permit a half release of a function when the conditional lever is in mid position.
- All locks enter the racks without forcing the rack vertically.

7.15 Check that any spring loaded or weighted locks operate correctly.

8 Sequential / Rotation Locking

8.1 Check noses of locks and notches in tappets for rounding / wear.

8.2 Check notches are correct shape and the locking becomes effective correctly to correspond with the lever position.

9 Final Checks

9.1 Check that all shockproof washers, circlips, and lock plates are fitted, and that all split pins are in and opened to 45 degrees, nuts and set screws are secure.

9.2 Check that all moving parts operate freely.

9.3 Carry out a full correlation of the lever bands and check there are no overlapping bands.

9.4 Check that you have the correct lock position and that the lock operates correctly.

9.5 Check that the economiser is open at the end of each travel.

9.6 Check that any force down features work correctly.

9.7 Check that all SMTH testing has been carried out, and that all records have been completed.

10 Testing

10.1 Carry out a full frame test

After re-assembly, when each bar has been individually tested, a full test is required after replacement of all packing pieces, packing bars and holding down strap / lids has occurred.

On some frames it is possible to work on one locking box at a time. The locking for each box can be separately coloured on the locking sheet or separate sheets produced for each box.

Appendix A – Expected Overhaul Maintenance Tasks Frequencies

Frame type	Frequency (years)				Remarks
	4	3	2	1	
All Frames over 100 years old				X	Irrespective of type
Dutton 1893 pattern			X		
			X X		

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/MP01		
Panel Multiplexer - TEML41 (AN)		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	TEML41 PMUX systems at Aston. Interface equipment and associated cubicles contained in equipment or relay rooms
Excludes:	All other Panel Multiplexers, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The SSI panel multiplexer forms the interface between the Signaller's controls and a solid-state interlocking.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies

7.1 For systems A and B Measure the DC output voltages from all the power supply units.

The measurements should be taken at the 2BA terminals on the rear of the sub-racks.

For duplicated supplies, switch off the other supply before taking measurements.

If the voltages are out of tolerance, the relevant unit shall be adjusted or replaced.

Supply	Volts	Limits	Ripple	Test Point
Logic A (LHS)	+5V	5.1V to 5.25V	<50mV	5V1 & 0V1
Logic B (RHS)	+5V	4.75V to5.25V	<50mV	5V2 & 0V2
Comms A	+5V	5.1V to 5.25V	<50mV	5CB1 & 0V1
Comms B	+5V	5.1V to 5.25V	<50mV	5CB2 & 0V2
Alarm A	+24V	23.4V to 24.6V	<50mV	Alarm Common Terms
Alarm B	+24V	23.4V to 24.6V	<50mV	Alarm Common Terms

Supply	Volts	Limits	Ripple	Test Point
Output A	+12V	11.4V to 12.6V	<100mV	Output Common Terms
Output B	+12V	11.4V to 12.6V	<100mV	Output Common Terms
Input A	+24V	24V to 26V	<100mV	Input Common Terms
Input B	+24V	24V to 26V	<100mV	Input Common Terms

Table 1 - DC Voltages

8. Final

8.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

8.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

9. Equipment Cubicles

9.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

10. Control and Interface Equipment

10.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

10.2 If provided, disconnect and clean all keyboards as necessary.

10.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

10.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

10.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

10.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

11. System Change Over

The following tests shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

11.1 Check which of the duplicated systems is on line (A or B). This shall be indicated on the status card. Observe all indications are as shown in Table 4.

11.2 Using the key switch on the status card change control to the hot standby system.

11.3 Observe that the changeover has successfully taken place (status card) and that the indications as shown in Table 4 and on the signalling panel Table 3 are correct.

11.4 Check that the system is operational by selecting some routes on the Signaller's panel and observing the responses.

11.5 Check the Technicians terminal print out for any on-going panel multiplexer alarms.

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

LED	State
SPA Fail	Extinguished
SPB Fail	Extinguished
TEML41 Fault	Extinguished

Table 2 - System Status Panel

LED	State
Critical Alarm	Extinguished
Non-Critical Alarm	Extinguished
Normal Working Failed	Extinguished
Indications Failed	Extinguished

Table 3 - Signalling Panel

Card	Function	Indication
System Processor	TD1 (4Tx channel monitor) RD1 (4Rx channel monitor)	Normally Off. TD3 & RD3 will flash when message is sent to fault terminal
System Processor	PGM (Program running)	Illuminated (Slight Flicker)
General Processor	TD1 (4Tx channel monitor) RD1 (4Rx channel monitor)	Flashing when data is being exchanged between SSI & TEML41
General Processor	PGM (Program running)	Illuminated (Slight Flicker)
Universal Input	32 LED's indicating I/P status	Input Made: extinguished Input Open: Illuminated
Universal Output	32 LED's indicating O/P status	Output On: Illuminated Output Off: Extinguished
Status	1 to 24 O/P Register Bits	Refer to Manual
Status	Loc PSU	Extinguished
Status	Clock	Flashing (1 second)
Status	Master/Slave A/B	A will show Master & B Slave or vice-versa
Status	Power	Illuminated (Green)

Table 4 - System Status

END

Includes:	WBS Type S2, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	WBS Type S2 (TDM) and all other Panel Multiplexers, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The SSI panel multiplexer forms the interface between the Signaller's controls and a solid state interlocking.

This system was developed in the late 1970's. It is an asynchronous system using simplex or duplex as a transmission mode. The system is based on microprocessor technology.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

System Tests

On duplicated systems invasive tests shall be conducted on the off-line system.

To test the current on-line system, a change-over shall be forced to change the on-line systems over.

On non-duplicated systems the tests shall be conducted under a system occupation.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies

7.1 Measure the DC voltages of the power supplies associated with the system. Measure using a Digital voltmeter or an oscilloscope the AC ripple on the DC output. Check they are within the limits as shown in Table 1.

Power Unit	Supply Voltage	Limits	Ripple
12v PSU1&2	+12V	11.5V to 12.8V	<50mV
24v PSU1&2	+24V	23.5V to 24.5V	<100mV

Table 1 - DC Power

The PSU's cannot be adjusted. If any of the voltages or ripples are outside the limits, the relevant power unit shall be replaced and re-tested.

8. Final

8.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

8.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

9. Equipment Cubicles

9.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth

10. Control and Interface Equipment

10.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

10.2 If provided, disconnect and clean all keyboards as necessary.

10.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

10.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

10.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

10.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

11. Duplicated Power Supply Units (PSU) Associated with S2 Housings

The following tests shall be conducted under a system occupation or during a quiet traffic period in liaison with the Signaller.

11.1 Disconnect the 110V AC feeds to one of the PSUs.

11.2 Check that the S2 system continues to operate correctly.

11.3 Measure the DC output and using a digital voltmeter or an oscilloscope the AC ripple voltage of the remaining PSU.

11.4 Check that the ripple voltage does not exceed 50mV.

11.5 If this voltage is exceeded, change the PSU.

11.6 Observe that the DC output indicator lamp(s) of the un-powered PSU are extinguished. If any remain illuminated, the PSU shall be replaced.

11.7 Repeat 11.1 to 11.6 for each PSU.

12. Change Over Alarms

This system normally operates on system 1, switching to system 2 only in the event of a failure of system 1.

12.1 Disconnect the link between the SSI PPM1 and S2 system 1 or power down PPM1.

a) Observe that the 'Non-Critical' alarm operates, and the correct fault messages appear on the Technician's terminal.

b) Observe that the panel controls and indications continue to operate correctly.

c) Re-connect the link.

12.2 Disconnect the link between the SSI PPM2 and S2 system 2 or power down PPM2.

a) Observe that the 'Non-Critical' alarm operates, and the correct fault messages appear on the Technician's terminal.

a) Observe that the panel controls and indications continue to operate correctly.

b) Re-connect the link.

12.3 Remove the cleared faults from the SSI Technician's terminal memory.

13. Line Levels (Systems with Modems Only)

13.1 If modems are fitted (if the SSI interlocking is remote from the panel multiplexer).

Non- Manchester systems only

13.2 Using the adaptor plug (Appendix B) set the office modem A to continually transmitting. Measure using a meter the modems transmit level at a convenient point, they should be between 11.4dBm and –16dBm.

At the field(s) locations, measure using a meter the received level at a convenient point they should be no lower than –40dBm.

13.3 Remove the adaptor plug from modem A and repeat 13.2 and 13.3 for modem B.

Where Line Matching Units (LMU) is fitted the signal shall be measured on the modem side of the LMU.

13.4 Disable the office modems and set one of the fields modems to transmit (Appendix B).

Measure using a meter, the transmitted level at a convenient point, they should be between -11.4dBm and –16dBm.

At the office locations, measure using a meter the received level at a convenient point they should be no lower than –40dBm.

13.5 Repeat 13.4 for each of the field modems.

Where Line Matching Units (LMU) is fitted the signal shall be measured on the modem side of the LMU.

13.6 Set all the modems back to normal operation and confirm using the office alarm panel that the system is operating correctly.

Manchester Systems Only

The following tests shall be conducted under a system possession.

13.7 The modem line levels shall be measured with a constantly transmitting data signal. Use either the adaptor plug shown in Appendix B, modem test set, or the modems own test facilities (check the modem manual).

13.8 Set the office modem A to continually transmitting data. Measure using a meter (VF meter) the modems transmit level at a convenient point; they should be between –11.4dBm and –16dBm.

At the field locations, measure using a meter the received level at a convenient point, they should be no lower than –40dBm.

13.9 Check that the alarm fault indication panel for the processor housing is showing the relevant alarm, e.g. 'link failure'.

Check the audible/visual LED indication alarms on Signallers desk and also on corresponding processor alarm panel (also ref section 6- System Changeover).

Not all processors are duplicated, check on drawings.

13.10 Set the field modem A to transmit data. Measure using a meter the modems transmit level at a convenient point; they should be between –11.4dBm and –16dBm.

At the office locations, measure using a meter the received level at a convenient point, they should be no lower than –40dBm.

13.11 Repeat 13.8 & 13.9. for modem B.

Where Line Matching Units are fitted the signal shall be measured on the modem side of the LMU.

13.12 Set all the modems back to normal operation and confirm using the office alarm panel that the system is operating correctly.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

System	Indication	Status
Critical alarm	Red	Extinguished
Non-Critical Alarm		
Normal Working Failed		
Indications Failed		

Table 2 - Signaller's Panel

LED Position and Colour	Indicating	State
Top Red	Highway OK	Regular Flashing
Lower Red	Program OK	Illuminated
Top Yellow (x2)	Data Tx Data Rx	Continuous Flickering
Lower Yellow (x2)	Data Tx Data Rx	Extinguished #
DIP Card Top Red	Highway A	Regular Flashing
DIP Card Lower Red	Highway C	
DOP Card Top Red	Highway A	
DOP Card Lower Red	Highway C	

Table 3 - Scanner Cards in S2 Housing

Not used on this system

LED	Indicating	State
On Line Scanner	A or C system on line	One illuminated only (A or C)
PSU1&2 (12v)	110v (White)	Illuminated
	12v (Green)	
PSU3&4 (24v)	110v (White)	Illuminated
	24v (Green)	

Table 4 - Fuse/Status Panel

LED	Indicating	State
PWR	Power	Illuminated
DTE	Data Terminal Equipment	
RXD	Receive Data	Flashing
TXD	Transmit Data	

Table 5 - Modems (if provided)

APPENDIX B - Modem Connections for Continuous Transmission

The configuration of the modem 9-way 'D' connector is as follows:

Pin	Signal
2	Tx Ready
3	Rx Data
4	RTS (Ready to Send)

Pin	Signal
5	CTS (Clear to Send)
6	DTR (Data Terminal Ready)
7	Ground (0V)

Table 6 - Modem configuration

A line pair can be tested by disconnecting the 'DTE' D-type connector at the rear of the 'end of the line' modem (this can be the office modem or the furthest away field modem) and replacing it with a D-type male plug with the internal connections configured Pin 4 connected to Pin 6.

This can set the modem to continually transmitting at 1300Hz (mark).

The modem launch level and receive levels along the line can now be measured at a convenient point in the S2 cabinet (refer to the site diagrams).

If there is a miniature switch fitted to the D-type plug (this is between Pin 2 and Pin 6) the modem can be set to transmit either 'mark' (1300Hz) or 'space' (2100Hz) to check the frequency attenuation of the line.

END

Includes:	Vaughan Harmon, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Panel Multiplexers, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The SSI panel multiplexer forms the interface between the Signaller's controls/indications and a solid-state interlocking.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

System Tests

On duplicated systems invasive tests shall be conducted on the off-line system.

To test the current on-line system, a change-over shall be forced to change the on-line systems over.

On non-duplicated systems the tests shall be conducted under a system occupation.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies

7.1 Measure using a meter on both the 'A' and 'B' processors the following voltages. Check they are within the stated limits (See Table 1):

Source	Voltage / Ripple	Limits
Logic	+5V DC / <1%	+4.9V to +5.5V DC
Logic	+7V DC / <1%	+6.3V to +7.7V DC
I/F	-12V DC / <1%	-10.8V to -13.2V DC
External	+12V DC / <1%	+10.8V to +13.2V DC
Auxiliary	+48V DC / <1%	+45.2V to +52.8V DC
Incoming Mains	110V AC @ 50Hz	99v to 121V AC @ 47Hz to 64Hz

Table 1 – Power Supply Voltages

8. Final

8.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

8.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

9. Equipment Cubicles

9.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

10. Control and Interface Equipment

10.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

10.2 If provided, disconnect and clean all keyboards as necessary.

10.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

10.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

10.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

10.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

11. System Change Over and Alarms

11.1 Check that the processor indications are as listed in Appendix A.

a) With the co-operation of the Signaller force a changeover of the system and observe the processor indications remain as listed in Appendix A (on line & off line shall now be reversed).

b) Return the changeover switch to its original position and observe the processor indications remain as listed in Appendix A.

11.2 Disconnect the links as listed in Table 2 below, in turn.

a) Observe that the 'Non-Critical' alarm operates, and the correct fault messages appear on the Technician's terminal.

b) Observe that the panel controls and indications continue to operate correctly.

Re-connect the link before proceeding with the next link, checking that indications remain constant:

Alarm Message
Data + PPM1 to Panel Multiplexer Port 'C'
Data - PPM1 to Panel Multiplexer Port 'C'
Data + Panel Multiplexer Port 'C' to PPM1
Data - Panel Multiplexer Port 'C' to PPM1

Table 2 – Message Content

11.3 Repeat 11.2 using PPM2 & Panel Multiplexer Port 'D'.

11.4 Clear the fault memory on the Technician's terminal and check no faults are left on the system.

12. Serial Test

12.1 This test shall only be carried out on the standby system as it could evoke a system change over.

12.2 Perform a 'Back to Back' serial test to coincide with the changeover test so both channels can be checked.

12.3 Clear the fault memory on the Technician's terminal and check no faults are left on the system.

13. Line Protection and Route Selection

13.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

13.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

14. Spares

14.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

14.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S) Test the operation of the cards/units in the test rack.

15. Final

15.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

15.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

LED	State
Watchdog	Illuminated
Select	Illuminated
Available	Illuminated
Power	Illuminated
Fault	Extinguished
Halt	Extinguished
C Port	Flashing Red/Green
D Port	Flashing Red/Green

Table 3 - On Line Processor

LED	State
Watchdog	Illuminated
Select	Extinguished
Available	Illuminated
Power	Illuminated
Fault	Extinguished
Halt	Extinguished
C Port	Illuminated Red
D Port	Illuminated Red

Table 4 - Off Line Processor

LED	State
I/F (A&B Processors)	Illuminated Yellow
Logic Status	Illuminated Yellow
'IN' Control Processor Scan	Flashing Red
'STANDBY' Processor Scan	Extinguished

Table 5 - Digital Output Modules

LED	State
I/F (A&B Processors)	Illuminated Yellow
Logic Status	Illuminated Yellow
'IN' Control Processor Scan	Illuminated Red
'STANDBY' Processor Scan	Illuminated Red

Table 6 - Digital Input Modules

LED	State
External Power Supply	Illuminated Green
Auxiliary Power Supply	Illuminated Yellow

Table 7 - External and Auxiliary Power Supplies

END

Includes:	GEC Type RM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Panel Multiplexers, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

GEC Type RM equipment can also be referred to locally as SDT and SIGNET.

The SSI panel multiplexer forms the interface between the Signaller's controls and a solid-state interlocking.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

Some of the following tests do not require a possession of the system but it is recommended they are performed within a system possession unless the duration of occupation is limited, and the Signaller is in agreement.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. General Checks

7.1 Observe the system status LEDs on the Signaller's panel, check they are as show in Table 1:

System	Indication	Status
Critical Alarm	Red	Extinguished
Non-Critical Alarm		
Normal Working Failed (Delayed)		
Indications Failed		

Table 1 – Signallers LED Status

7.2 Ask the Signaller if they are aware of any faults present on the system(s).

7.3 Check that the audible SSI alarm is silent.

7.4 Check there are no current panel multiplexer faults recorded by using the SSI Technician's terminal.

7.5 Observe the LED Indications on each card in the PMUX rack for alarm conditions, check that they are as shown in Table 1

Card	Indication/Function	State
Alarm Unit	Sys OK Indication	Illuminated
	All other indications	Extinguished
Microcomputer JM25XX	LED's 1-8	Extinguished
Memory Extension	N/A	N/A
Highway Buffer Unit	LED's A0-A10 [1] *	Pulsing
	LED's D0-D7	
	RD LED	
	WR LED	
	RESET LED	Extinguished
	COMPARE LED	Illuminated
Input Buffer Units (Single)	LED 1	Pulsing
Input Buffer Units (Double)	LED 1	Pulsing
	LED 2	
Transistor Output Buffer Units	LED 1	Pulsing
Single PSU (JD1076)	+5v LED	Illuminated
Triple PSU (JD1077)	+12v LED	Illuminated
	+5v LED	
	-12v LED	
Battery Backed Triple PSU (JD1077)	+5v LED	Illuminated
	+12v LED	
	-12v LED	
	Batt OK LED	

Card	Indication/Function	State
Output Changeover Unit (Dual Systems Only)	LED 1	Pulsing
	LED 2	Illuminated (Online unit only)
	LEDs 7,8,3,4 (not used)	Extinguished
	LEDs 5, 6	Illuminated

Table 2 – LED Indications

[1]* ***NOTE:*** *LED's A7-A10 might be extinguished for smaller systems of less than 4 subracks.*

8. Power Supplies

8.1 In the order as listed in Table 3 below, using a meter and/or oscilloscope, measure the microcomputer power supply and sub rack PSU DC output voltages and the AC ripple voltages. Compare the readings with the previously recorded results.

Card/Test	Terminals		DC Voltage Limits	AC Ripple
	+Ve	-Ve		
Microcomputer JM25XX +5V Supply Check	TP4	TP1or TP6	+4.95V to+5.25V	<50mV
Single PSU +5v Output Check	TP2	TP1	+5.15V to+5.25V	
Triple PSU +5V Output Check	TP2	TP1	+5.15 to+5.45V	
Triple PSU +/- 12V Output Check	TP4 [2]* TP3 [2]*	TP1 [2]* TP1 [2]*	+10V to+14 V-10V to-14 V	

Table 3 – Voltages

If any of the voltages are found to be outside the limits, adjust or change the relevant power unit and re-test all units.

[2]* ***NOTE:*** *TP located on back of PSU on some systems.*

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

10. Equipment Cubicles

10.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

11. Control and Interface Equipment

11.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

11.2 If provided, disconnect and clean all keyboards as necessary.

11.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

11.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

11.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

11.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

12. Power Supplies

12.1 Measure the AC supply voltage to all the power supply units and confirm it is between 105V to 120V.

13. System Changeover (Dual Systems Only)

The following test shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

13.1 Check that the processor indications are as listed in 7.1 and 7.5.

13.2 Check that SW1 on both Output Change-Over Unit cards are set at AUTO.

a) Identify which Output Change-Over Unit card is in ONLINE by observing which one has LED 2 lit (Com Line Output indication).

b) Push SW1 on this card over to the OFF position.

c) Observe that within 3 seconds control passes over to the OFFLINE Output Change-Over Unit card.

NOTE: *This should be confirmed by LED2 illuminating on the card newly in control and extinguishing on the card previously in control.*

d) Return SW1 on the OFFLINE card back to the AUTO position.

13.3 Observe the processor indications remain as listed in 7.1 and 7.5.

14. Monitor Card

14.1 Test the operation of the Monitor card by checking a convenient signalling function whilst it is being operated.

15. Line Protection and Route Selection

15.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

15.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

16. Spares

16.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

16.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S) Test the operation of the cards/units in the test rack.

17. Final

17.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

17.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/MP05		
Panel Multiplexer - GE		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	GE Panel Multiplexer, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Panel Multiplexers, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The GE Panel Multiplexer, PMux, is used to interface a panel to a Solid-State Interlocking (SSI).

It consists of a Delphin1024 enclosure that is connected via a dual serial links to the SSI.

The PMux database maps the serial data to the relevant digital inputs and outputs and this is used to generate the digital outputs (indications) displayed on the Signaller's panel.

Similarly controls set by the Signaller are read by the PMux digital inputs and sent serially to the SSI.

Each enclosure is fitted with dual power supplies and processor modules operating in a control/standby configuration accessing common input and output modules.

The control/standby status of the office and field end processor modules is controlled by the changeover and alarm module, CCO.

The module provides for both an automatic and manual changeover facility.

The CCO module can also provide digital outputs and inputs to drive the half system and total system failure alarms on the Signaller's panel.

The input and output modules, CMI-x and CMO-x, are common to both processor modules and are scanned sequentially.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Visual Checks

7.1 Check that the interface and logic indication LEDs on the CPW power are lit.

7.2 Check that the power indication LEDs are lit on the following modules:

a) CMP-P2.

b) CCO.

c) CSC.

d) CMI.

e) CMO.

7.3 Check that the Watchdog (WD) LED is flashing and Available (Av) LED is lit on both CMP-P2 modules. One of these modules is selected as being in control and this is indicated by the ‘Sel’ LED being lit on the selected module.

7.4 Check that both the scan LEDs are lit on all configured input modules.

7.5 Check that the scan LED representing the CMP-P2 selected as being in control is either on or flashing on the configured CMO modules. Note: either state is acceptable, both scan LEDs off is not.

7.6 Check that the power LEDs are lit for any other external power supplies where these have been supplied.

7.7 Where fitted, check status of surge protector units and take action as follows:

a) Green lit only – Full protection – No action.

b) Green and Red lit – Reduced protection – Replace unit within one week.

c) Red lit only – No protection – Replace unit immediately.

8. Changeover

NOTE: *Inform Signaller before proceeding.*

8.1 Check for faults by observing the fault light on either processor is not lit and clear before proceeding.

8.2 Force a changeover to the standby CMP-P2 module using the switch on the front panel of the CCO module.

8.3 Check that the standby CMP-P2 module is now in control by observing that the 'Sel' LED is lit.

The CMP-P2 module that was previously in control should now be in standby mode and this can be checked by observing that the 'Sel' LED is no longer lit and the 'WD' LED is still flashing.

8.4 Check that the scan "LEDs" on the CMO modules now represent the newly selected processor module.

8.5 Check that the changeover switch is returned to the auto position and that any alarms that can have been raised have been cleared by using the Alarm / Ack switch on the CCO module.

8.6 Confirm that no faults have been introduced onto the system by checking the EFA LED is out.

8.7 Check for system faults by looking at the fault LED.

8.8 Record the details on the record card.

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

10. Equipment Cubicles

10.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

11. Control and Interface Equipment

11.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

11.2 If provided, disconnect and clean all keyboards as necessary.

11.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

11.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

11.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

11.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

12. Testing

12.1 Measure the voltages on the test points at the front of both of the CPW power supplies. The values obtained shall be:

a) between 6.5Vdc and 7.5Vdc for the 7VL logic test points.

b) between 11.5Vdc and 12.5Vdc for the 12VIF interface test points (on CPW-A).

c) between 23Vdc and 25Vdc for the 24VIF interface test points (on CPW-D).

Record the voltages measured on the record card, if outside the specified range change the CPW-A.

12.2 Where fitted, measure the voltages on external power supplies. The values obtained shall be:

a) between 10.5Vdc and 13.5Vdc for an external 12V supply.

b) between 21.5Vdc and 26.5Vdc for an external 24V supply.

c) between 44Vdc and 63Vdc for an external 48V supply.

Record the voltages measured on the records card, if outside the specified range change the power supply.

13. Line Protection and Route Selection

13.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

13.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

14. Spares

14.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

14.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

15. Final

15.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary, locked.

15.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/OD01		
Manually Controlled Crossing-Obstacle Detector (MCB-OD) Honeywell Radar Scanner		
Issue 02	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Honeywell Radar scanner equipment
Excludes:	Lidar scanner (See NR/SMS/OD02) other crossing equipment

SERVICE B

1. Honeywell Radar Scanner

1.1 Check the RADAR is firmly mounted. Observe that it does not move when lightly pushed.

1.2 Check each RADAR Reference Reflector is firmly mounted. Observe that the post does not move when lightly pushed.

DO NOT push the Reference Relfector itself as they are easily bent and once bent will need replacing.

1.3 Check the RADAR scanner and Reference Reflectors for signs of external damage.

1.4 Check barrier machine deflector plates are present. Oil spring loaded hinges.

1.5 Check for noise and vibrations when scanning. If RADAR is very noisy when operating report this.

1.6 Check the Surveillance Area and line of sight to each Reference Reflector are clear of obstacles,

For example vegetation, building materials, ballast build up.

a) Remove these obstacles from the Surveillance Area and Buffer Zone.

1.7 Check the internal temperature.

This requires running RWMON software, which shall only be done if competent (using RWMON will cause the RADAR to ignore commands from the crossing)

1.8 Measure and record the return voltage of each Reference Reflector and compare to previous readings.

a) If the voltage has changed by more than 0.2V, set up Reference Reflector to achieve a voltage as close to 1.9V as possible.

1.9 Check any Deflector plates are present as required by RADAR set up record (e.g. Rear Deflector plate, “cheese wedge” deflectors, any bespoke defelctor plates).

1.10 Walk test the Surveillance Area using RWMON software.

Details are in the Installation and Set Up Manual.

1.11 Exit Test Mode **DO NOT** leave RWMON running on DVR and Diagnostic Unit.

SERVICE C

2. Battery Replacements

2.1 Save protocol and error logs before any attempt to power down and replace batteries.

2.2 Replace the two CR2430 batteries for the internal clock and protocol storage within the Control Module.

2.3 Set up time and date.

2.4 Record battery change.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/OD02		
Redscan RLS-3060 LIDAR Scanner		
Issue No: 05	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	LIDAR scanners used at level crossings e.g. RLS3060 and RLS3060SH
Excludes:	All other types of obstacle detection equipment

SERVICE B

1. LIDAR Scanner

1.1 Check the shutters open and close and leave open for the rest of the tests if possible, or close if a train is to pass over the crossing.

They should take approximately 2 seconds to open and 2 seconds to close.

1.2 Clean the lens with a baby wipe, then dry with a clean tissue, then spray a clean dry tissue with BEESWAX based furniture polish and wipe over the lens, do not leave streaks of wax on the lens.

DO NOT use a silicone (general purpose) based polish, only use a beeswax-based furniture polish.

1.3 Check the LIDAR post does not move when lightly pushed.

1.4 Check the scanner lens and housing for signs of external damage.

1.5 Check that the follower relay (or equivalent) for the scanner de-energises to indicate occupied when an object (person or Test Target) is placed in the scanners Detection Area.

1.6 Check the follower relay (or equivalent) for the scanner energises to indicate the crossing is clear when the scanners Detection Area becomes clear after being occupied.

1.7 Check the follower relay diodes (where shown on circuit diagrams) visually for signs of damage.

1.8 Carry out NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD): Testing and Calibration) – use the Functional Test relevant to the type of ELD or carry out NR/SMS/PartB/Test/051 (Busbar Earth Tests) on the B24 bus bar.

1.9 Monitor busbar voltage as the barrier rise, checking that the voltage does not drop below 18V dc.

When using a Fluke TPWS meter set to DC volts, select '*Fast Min/Max*' function.

NOTE: *On other meter types or styles the selection of fast sampling mode might be different.*

Inform (SM)S and investigate to find the cause if below 18V dc.

NOTE: *If Min voltage is greater than 14V but less than 18V, even after any obvious defect is repaired and the test performed again, then the battery and charger should be changed within 13 weeks.*

If Min voltage is less than 14V, there is a risk of a LIDAR becoming unresponsive, and additional checks should be made immediately to identify and fix the reason e.g. loose or high resistance connections, failed cell, group of cells or charger, or incorrectly set up charger, if no obvious cause can be found then replace the battery and charger within 4 weeks.

If no Low Level LIDAR is provided, the risk of a High Level LIDAR becoming unresponsive is mitigated by the Honeywell RADAR. If two LIDAR scanner detection areas overlap significantly (e.g. two High Level or two Low LEVEL LIDARs) the risk is also mitigated by the presence of the other LIDAR scanner at the same height i.e. Low or High. The worst case is a crossing with Low Level LIDAR where the Low-Level LIDAR detection area overlaps only cover a small proportion of the combined Low Level Detection Area.

1.10 Check the beam height at the beam height setting up points as shown on the Detection Area Diagram. Compare the beam heights to the previously recorded heights on the Detection Area Diagram.

If adjustment is required, this shall only be carried out by staff with LIDAR Set Up competency.

Any variation of up to ± 50mm is not uncommon and requires no further action.

1.11 Using Redscan Manager, check the Ethernet connection to the scanner is communicating with the scanner.

1.12 Check the Redscan Manager view is as expected, e.g., no spurious false detections (vegetation), no dirt on lens, no SO or AM error code with shutters open.

1.13 Check the LIDAR Detection Area (i.e. combined Detection Area of all LIDAR scanners) by Internal Walk Test with barriers down.

This requires Redscan Manager and changing to different scanners where overlaps have been created whilst a person walks the perimeter of the crossing surface with the barriers down.

1.14 Check whilst observing Redscan Manager that there are no false detections when the boom and skirt are pushed inwards and held for 1 second minimum at the tips of each barrier and every 2m along each barrier.

If any false detections occur, adjust the Detection Area as necessary.

Any remedial adjustments require the LIDAR setup completing.

1.15 Close shutters.

1.16 Check trespass guard is in place.

END

ALL POINT SYSTEMS

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

More information on point equipment can be found in NR/L3/SIG/19047.

DEFECTS

Any defects found or repairs and/or adjustment made to correct defects shall be reported as corrective maintenance.

STRUCTURE OF THE POINT SMS SUITE

The SMS suite is structured into the various components that form a point installation. The includes/excludes section lists what each SMS applies to. Your work order can tell you what SMSs and which service to carry out on the point installation.

SWITCH OPENING

The nominal standard switch opening between the switch and stock rail at the toe is detailed in NR/SMS/Part/Z02.

The dimension can vary between sites but shall not normally exceed the specified range. Corrective maintenance action shall be arranged where switch opening is found to be out of tolerance.

TEMPORARY PACKING

The provision of extra (temporary) packing is permitted as an interim measure until the gauge can be restored.

The maximum permitted thickness of temporary packing is 3.5mm. On conventional point machine layouts, packing shall be fitted between the switch extension piece and the switch rail.

For UIC54 / RT60 switches and switch diamond layouts, refer to the applicable mechanical layout drawing (BRS-SM****).

POINT NUMBERS

The point number is fixed to the sleeper at each point end close to the toe of the normally closed point switch.

Where this is not physically possible (e.g. double slip layout), an arrow is fixed between the number and the normally closed point switch, pointing to it. If you are in any doubt which is the normally closed switch, ask your SM(S).

The numbers are orientated to that they can be read when looking at them in the same direction as though you were about to pass over the points in a facing direction.

Point numbers can also be displayed on each point machine and power pack. Care shall be taken to replace the correct covers following removal.

If the lie or identification of points is not clear on site, report this to your SM(S). The official signalling record diagram shall be used to clarify the actual layout.

HYDRO-PNEUMATIC POINTS

These are often referred to as Train Operated Points and are trailable self-restoring points.

The lie of the points is indicated to the driver of a train by a Points Detected Normal Indicator, which can be an elevated position light signal or a single white or yellow light.

SECURITY OF FASTENINGS

Nuts and bolts that that are used to secure fixed, adjustable or lock stretcher bars to the rail, or to bolt the various components that make up a stretcher bar assembly shall have their security checked by the application of a calibrated torque wrench set as detailed in NR/SMS/PF01.

The primary and secondary locking devices on tubular stretcher bar assemblies do need to be checked for security.

The security of other fastenings not associated with these items (e.g. point machine fixings to bearers and adjustable nuts on detector rods) can be checked by the application of a short handled spanner (a nut that is tight cannot move with a minimal application of pressure from the handle of the spanner).

A short handled spanner is defined as one having a handle between 16 & 17 inches (400mm & 450mm) in length.

If you are in any doubt about how to check the security of any fastenings on point systems or you have any doubt about any fastenings on a point system you shall ask your SM(S). If the safe running of trains is affected you shall report it to the signaller immediately.

MECHANICAL POINTS

GENERAL

The maintenance of any set of points shall require the whole route to be examined from the lever tail to the points. At times, especially if detectors are being maintained, both point and signal NR/SMS can be involved.

A clear understanding shall be reached with the Signaller before any maintenance commences. It is good practice to make an entry in the Block / Occurrence Book on arrival at the signal box. Check at all times the signaller is aware of your presence.

No point lever shall be moved without the permission of the Signaller.

It can help with maintenance if the points are operated by the S&T technician, with the Signaller's permission, before maintenance commences; and then operated again, by the same Technician, at the completion of maintenance.

The Signaller shall also operate the points.

Rodding

Rodding shall be laid out in the straightest manner available. There shall be a minimum of changes of direction.

Any suggested improvements to the rodding run shall be made via your SM(S).

Rodding can be either channel or round type, or a mix of both.

The rodding run shall at all times be clear of debris and vegetation, which shall be cut back and killed. Anticipate growth, particularly in spring and summer.

Adjacent objects (rail ballast etc.) can interfere with the operation of the rodding and shall be removed.

Check that in track circuited that the correct insulations are fitted.

Third and fourth rails in electric traction areas need special care. Under no circumstances shall the rodding come into contact with the rail.

Rodding stools shall generally be no more than 9 feet (2.75m) apart.

The rodding run shall be parallel to the line and is usually approximately 6 inches (150mm) below rail level. Local circumstances and conditions can vary this figure.

Orange piping was not designed for rodding and shall not be used for this purpose when crossing the line. Plastic rail clips can be used as a temporary solution to prevent short circuits.

At level crossings, ducting is required for rodding, driving points or gates.

All ducting shall be kept clear of debris and rubbish.

STROKE

At no point in the rodding run shall stroke be gained.

The lever frame always provides sufficient stroke to operate points at any distance.

Loose fittings or slack pins can cause stroke to be lost.

Stroke shall be lost at the end of the rodding run. The final drive crank, (12" x 15") shall be adjusted to achieve this.

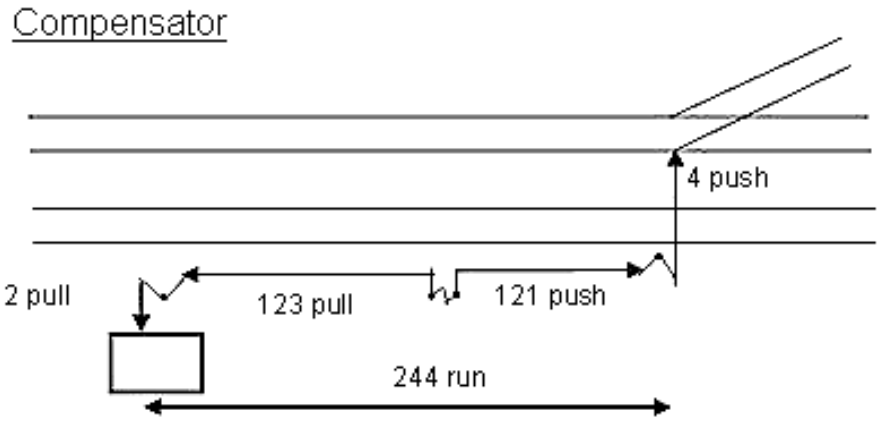
COMPENSATION

Compensation is required for all rodding runs over 10 yards (9.14m) in length. The simple rule for compensation is the amount of pull equals the amount of push.

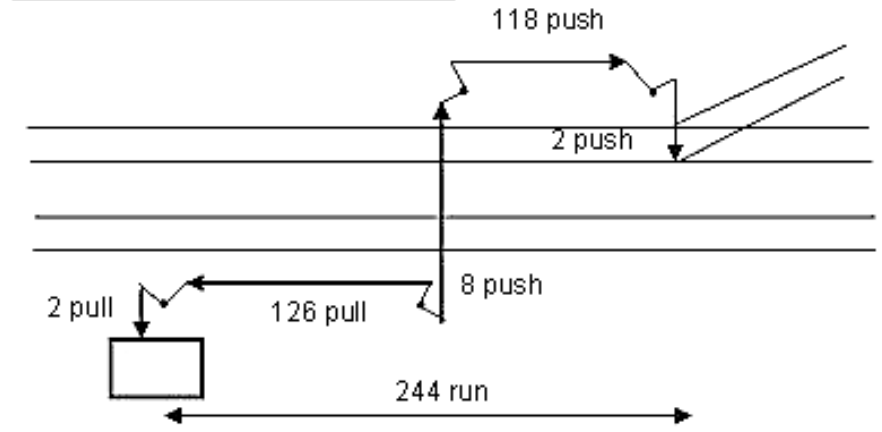
Compensation is required because variations in temperature cause the rodding to expand or contract. If "fixed" at the lever, the maximum length of rodding (350 yards / 320m) could move more than 6 inches (150mm) this would easily open a set of points.

The rodding within the signal box can generally be ignored from any compensation calculations. The amount is small and the temperature stable.

EXAMPLES OF COMPENSATION



2 + 123 = 125 pull
121 + 4 =125 push



2 + 126 = 128 pull
8 + 118 + 2 = 128 push

> The calculations are based on amount of pull shall equal the amount of push not the total distance of the run.

CRANKS AND COMPENSATORS

Cranks and compensators are used to change the direction of rodding or swap the travel (i.e. from push to pull).

There are two basic types of compensator; horizontal, the most common, and vertical, only a few of which remain. Both types change the direction of travel and are essential to correctly compensate a rodding run.

There are many varieties of crank, most of which have more than one name. Most types change the direction of the rodding through 90°.

Pedestal cranks are usually found in the signal box, under the frame, changing the vertical drive from the frame to a horizontal drive towards the front plank.

When space is at a premium, accommodating cranks (originally of three heights), are used to turn the rodding.

Accommodating cranks have a curved arm or arms, any single stud crank can be fitted to one of the three heights of base.

Relief cranks are not in common use but are used to turn rodding through an angle (not 90°), generally to cater for points around a curve in the track.

Adjustable cranks (or 12" x 15" cranks), are used as the final drive to points to reduce the travel from the rodding run.

On all cranks, except on back drives, the outermost hole shall be used. This provides maximum stroke and results in minimum effort required to operate.

ADJUSTMENT

All points that are ‘hard to operate shall be reported as corrective maintenance.

Adjustments to points indicate either:

A) THE POINTS ARE MOVING OR GOING OUT OF GAUGE. OR

b) The rodding run is losing stroke.

Therefore there is wear in the pins, the cranks are moving on their bases or the rodding stools are allowing the run to rise and fall.

POINT FITTINGS

All points, when adjusted, shall fit well up to the stock rail on either side without excessive force being required.

The blades shall neither stop short; leave a neither gap nor over travel attempting to push the stock rail (Nip).

Too much ‘nip’ can cause serious wear on the lever frame and can injure the Signaller. It also causes unnecessary wear on point rodding and fittings.

In mechanical signal boxes, the 'A' end of the point is nearest the signal box. The 'B' and subsequent ends are further away.

Pins, bushes, joints, crank bosses, if worn, can all cause loss of travel. Loose rollers and stools and any crank base, if loose, loses travel.

All rodding shall be correctly fastened; no bolts shall be missing or loose.

Adjustable crank sleeves shall be tight and correctly fastened using both sets of screws. Lock nuts are usually provided. These shall also be secure.

Benches / foundations can be timber, concrete or steel. All shall be checked during operation of the points to check that no movement is taking place and all fastenings are secure.

LOCK AND CLEARANCE BARS

These are typically 50 feet (15m) in length and are supported on pivoted arms, which are bolted to the stock rail.

If any of the arms or clips are distorted or damaged the lock bar can become sufficiently distorted to be ineffective.

Worn pivot pins can allow the bar to become displaced and potentially enable the bar to be lifted under a train.

Washers shall be fitted to reduce side play and worn pins shall be replaced.

Excessively worn rails or faulty operation shall be reported as corrective maintenance.

If it becomes necessary to remove a clip or arm, it shall be replaced as soon as possible to prevent false operation. Always check that spares are available before dismantling the assembly.

The rodding from an operating lever is always connected at the opposite end of a lock bar to the lock plunger. This checks that if the equipment becomes disconnected from the operating Lever, the presence of a vehicle shall prevent the lock plunger from being withdrawn.

If temporary repairs require alternative arrangements to be put in place, the above safe method of operation shall be maintained.

LUBRICATION

Excess lubrication causes dirt to accumulate and can cause wear. Lack of lubrication can also cause wear.

The rodding run and rollers can only be lubricated using dry film lubrication. Use of other lubricants is prohibited.

Cranks and compensators require a minimum of lubrication.

The most suitable lubricant shall be used at all times. No item of equipment needs flooding. The correct amount shall be applied after old lubricant has been wiped / scraped away / removed.

All excess oil and grease shall be wiped away before completion of work to prevent dust collecting.

Crank centre bosses can seize. If there is any doubt about adequate spread of grease or oil, the cranks shall be de-assembled, cleaned, re-assembled, and re-lubricated.

Check that all nipples are clean and permit grease to pass.

Oil holes shall be kept clean and covered when possible.

End

Includes:	Point Rodding, Insulation, Crank, Compensator, Facing Point Lock, Mechanical Detector, Depression Bar, Lifting Bar, Adjuster, Joint, Lug, Extension Piece, Assister, Cover, Number Plate
Excludes:	Point fittings (see NR/SMS/PartC/PF01). Electrical Detectors (see NR/SMS/PartC/PD01). Mechanical detectors (see NR/SMS/PartC/PD03). Hand Points.

GENERAL

Any nut tightening or adjustments shall be reported.

REGULAR TESTS

1. Facing Point Locks

1.1 If provided, carry out NR/SMS/PartB/002 (FPL Test (Mechanical)).

1.2 If fitted examine lock faces and plungers.

SERVICE A

2. General

2.1 In liaison with the Signaller operate the points from the signal box and check for correct operation without excessive force being required.

NOTE: *More details can be found in NR/SMS/PartC/PA00 (Point Equipment: General).*

2.2 Remove vegetation and debris from cranks and rodding run and surrounding area.

2.3 Check all moving components are un-obstructed when operated.

3. Rodding Run

The rodding run and its fittings shall only be lubricated with dry film lubrication. Other lubricants are prohibited.

3.1 Check alignment and levels throughout.

3.2 Check for irregular movement of the stools during operation of the points. Report any movement, which is causing loss of stroke to your SM(S).

3.3 Check all roller-fixing bolts, pins and split pins.

3.4 Check freedom of movement of wheels on rollers.

3.5 Examine fishplates, joints and fixings. Check pins and split pins.

3.6 Examine rodding that passes under the rails. Check that any joints in the rodding are at least 305mm (1ft) clear of any rail for both normal and reverse lie of the points. The bolts on fishplates can jam under the rail; report any problems to your SM(S).

4. Cranks and Compensators.

4.1 Check that all moving parts are not obstructed and are clear of ballast. Rectify as necessary.

4.2 Check the installation is securely fitted, look for:

a) Loose crank bases.

b) Worn cranks.

c) Seized cranks.

d) Loose adjustable sleeve on cranks.

e) Worn cotter pins.

f) Rectify as necessary. Loose or worn fittings can impair the operation of the points.

4.3 Scrape, wipe and clean as necessary. Lubricate bearings and cotter pins. Items fitted with grease nipples, shall have new grease pumped in, to expel the existing grease in the bearing/pin. Grease filled automatic lubrication can also be used.

Oil lubricated cranks shall have new oil added to flood the bearing/pin. Any bearing covers (e.g. 'Top Hats') shall be replaced or renewed if missing. Dry film lubrication can also be used.

Excess grease and oil shall be wiped away.

4.4 Check operation of each crank.

4.5 Observe position of cranks in both normal and reverse positions.

4.6 Check each crank and compensator is correctly set up.

NOTE: *The crank should be at 90° when the points are halfway and should travel equal distances each side of this for normal and reverse positions.*

4.7 Check compensators are set up correctly and can operate at all temperatures. The arms shall be parallel (approximately depending on temperature) when the points are halfway.

5. Nuts and Screw Threads.

5.1 Check all nuts and lock nuts are secure and tight.

Lightly lubricate the exposed threads with grease or dry film lubrication. Do not allow lubricant to come in contact with the nut faces.

The nuts shall not move by application of a short-handled spanner.

More details on nuts & bolts can be found in NR/SMS/PartC/PF01 (Point Fittings). Report any damage as corrective maintenance.

6. Insulations.

6.1 Check insulations. Report any damage as corrective maintenance.

7. Points.

7.1 Observe correct operation.

7.2 Check fittings are not under excessive strain when the lever is operated.

7.3 Check the throw of the points. Details of point openings are given in NR/SMS/PartZ/Z02 (Point – Reference Values).

7.4 Check each point blade fits correctly to the stock rail.

The blade shall fit up correctly to the stock rail without excessive force. Adjustment might be required.

Before any adjustment to the points is carried out check the gauge of the track. This indicates whether the adjustment is to cater for a gauge error. After adjustment check the travel again.

7.5 Examine lock faces and plungers.

7.6 Look for vertical movement in cross rods driving the points. This can indicate the travel is incorrect.

8. Final Checks and Tests

8.1 If provided, carry out NR/SMS/PartB/002 (FPL Test (Mechanical)).

The final check before completion of the work is for the Technician to operate the points again from the signal box.

Also request the Signaller operates the points to their satisfaction.

Typical Drawing: Mechanical Point Components (Not to Scale)

Points shown unlocked.

Soleplate & sleepers omitted for clarity.

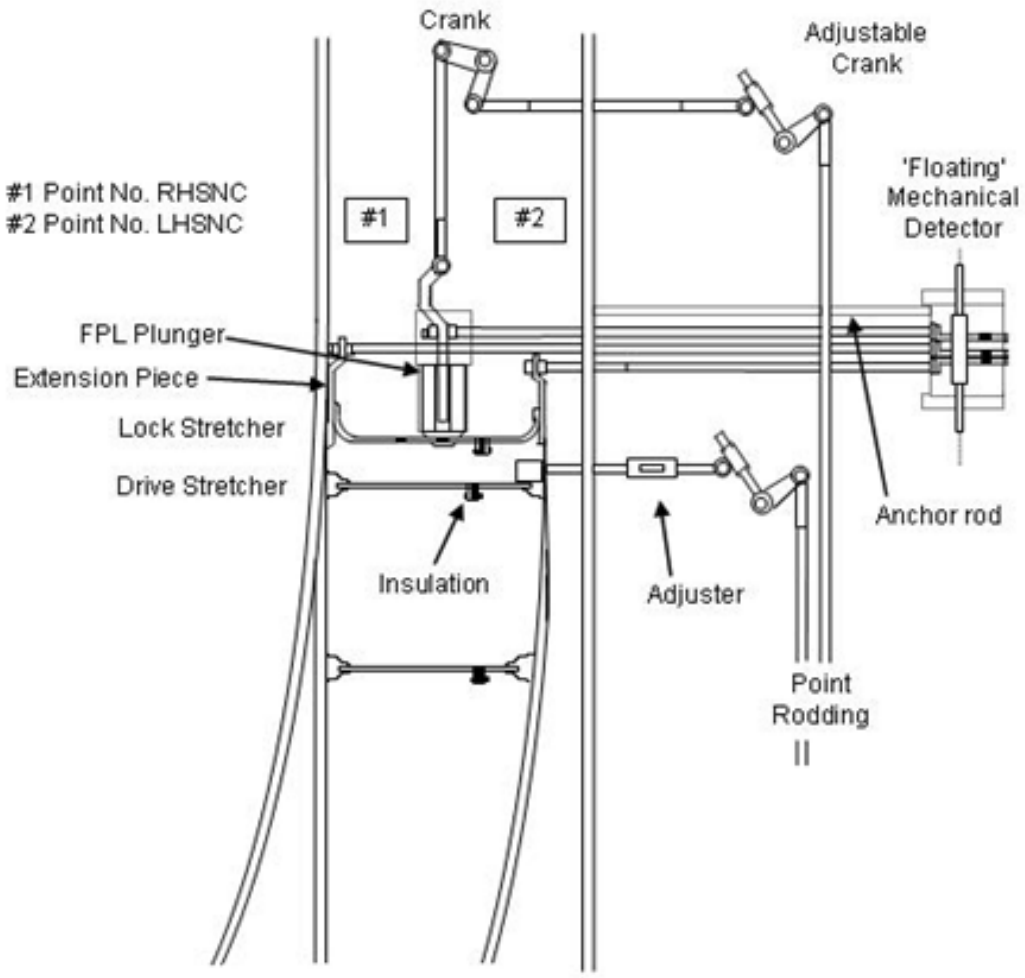


Figure 1 – Mechanical Point Components

END

Includes:	Siemens Point Adapter Modules, Motor Power Modules, and Point Detector Modules fitted inside trackside apparatus cases or equipment and relay rooms
Excludes:	Any other module types

General

Any corrective maintenance issues shall be undertaken as detailed in NR/SMS/PartA/A02 (Preventative & Corrective Maintenance).

SERVICE A

1. Points Adapter Module (PAM)

1.1 Check the following items on the Points Adapter Module:

a) The transformer, internal / external module fixings are tight, secure, and not damaged or corroded.

b) All internal components (modules, wires etc.) are intact and undamaged including trunking and loomed wires.

c) There is no chaffing on incoming cabling.

d) All plug couplers between modules are secure.

e) Earthing connections in the PAM are secure.

f) All glands are sealed and clamped are tight.

g) All relevant LEDs are illuminated.

h) The condition of the block Varistor the status windows should be showing green.

i) The operation of the internal light.

1.2 Carry out NR/SMS/PartB/Test/201 (Siemens Point Module Correspondence Test).

SERVICE B

2. Equipment Serviceability

2.1 Check (if applicable) that both the Motor Power Module and the Point Detector Module are within their service dates.

Any modules outside their service date or shall be outside their service date before the next service B shall be reported to your SM(S) and on your work order.

3. Equipment Tests

3.1 Carry out NR/SMS/PartB/Test/053 (Earth Leakage Detector (ELD): Testing and Calibration).

3.2 Carry out NR/SMS/PartB/Test/202 (Siemens Point Detection Module Test).

3.3 Carry out NR/SMS/PartB/Test/203 (Siemens Point Module Running Current Test).

END

1. Introduction

More information on clamp locks can be found in the Clamp Lock Handbook NR/L2/SIG/11774.

1.1 In-Bearer Clamp Lock (IBCL)

The IBCL without a supplementary drive provides a fully tampable S&C. Mechanical supplementary drives can be fitted to these systems.

1.2 Hy-Drive Points System

Installations fitted with IBCL and SO hydraulic supplementary drive are known as a Hy-Drive point system. These are fitted to both NR56v and NR60 layouts. The pump unit on the Hy-Drive system is a twin motor variant which is not interchangeable with the single motor pump unit that is fitted to RCPL / IBCL.

1.3 Clamp Lock Mk 3

The development undertaken on the Mk 3 Clamp Lock has brought about several subtle upgrades to the Mk 2 equipment. There have been changes made to the coatings, materials and geometry of the components. The changes have resulted in a system that has different maintenance requirements. Clamp Lock Mk 3 has been designed to be lubrication free, with the exception of the autolube system that applies lubricant to the slideway.

NOTE: *The ROSE process has not been applied to Mk 3 equipment so sits outside of the RCM maintenance regime (Services V1, R1 and R2)*

1.4 Lubrication for Mk 2 equipment only (See Figure 1)

NOTE: *Mk 3 equipment does not require any type of lubricant applied to any of the lubrication points described in this section*

The lock arm bush is designed to rotate on three bearing surfaces: the pivot pin, the lock arm, and the detector lug. It is essential that all three surfaces are properly lubricated.

Spray the areas arrowed in the following photograph.

Note that the arrows indicate the lubrication points.

It should be possible to rotate the lock arm bush.

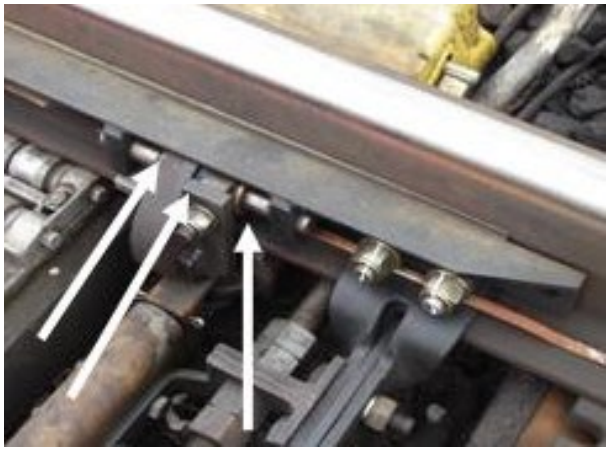


Figure 1 - Mk 2 pivot pin lubrication points

This is most easily done when the switch rail is fully open. If this cannot be done, and the parts are not readily freed, an extra coat of spray lubricant should be applied and left to penetrate for up to one week.

If after this treatment the lock arm bush still does not rotate, it shall be reported as corrective maintenance so that the associated parts can be disassembled and cleaned.

Once reassembled and new lubrication has been applied, the lock arm bush should now freely rotate.

If, however the bush still does not rotate, or damaged components are found, arrangements shall be made to rectify the situation.

1.5 Document References

Refer to the relevant sections in the Clamp Lock Installation Manual suite for instructions, See Table 1.

Clamp Lock Variant	S&C Design	Switch Opening	Supplementary Drive	Document Number
RCPL	CEN56 Full-Depth / UIC54 Shallow Depth	110	Mechanical	SRB0201ra
IBCL Mk 2	NR60 Mk 1	110	Mechanical / Hy-Drive	SRA0101ra
	NR56v	110	Mechanical / Hy-Drive	SRC0301ra
IBCL Mk 3	NR60 Mk 2	130	Mechanical	E05-01RA-1
		110	Hy-Drive	F06-01RA-1
	NR56v	110	Hy-Drive	G06-01RA-1
		110	Mechanical	H06-1RA-1

Table 1 – Document References

END

Includes:	Rail Clamp Point Lock (RCPL), In-Bearer Clamp Lock (IBCL)
Excludes:	Any other type of hydraulic points

General

The equipment shall not be operated electrically until any adjustments have been proved by hand pump operation.

Any tightening of nuts or adjustments shall be reported.

For clamp lock lubricated with dry film lubrication refer to Appendix C for lubrication process.

If degreaser is used on the clamp lock mechanism care should be taken to avoid application on the adjustable tie bar threads. Use of degreaser in this area can affect the factory applied grease contained within the tie bar.

See NR/SMS/PartA/A04 (Method Statement Summary) for information on safe working on point systems.

See NR/SMS/PartZ/Z02 (Point Reference Values) for all torque values used in this document.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Test).

SERVICE A

2. Pump Unit (all types)

2.1 Check the concrete base, power unit mounting and fixings.

NOTE: *The pump unit should be reasonably level (to the eye) and secure.*

2.2 Check the visible tail cable and route.

2.3 Remove the pump unit cover.

2.4 Check that the pump unit cover opens freely, lubricate as necessary.

2.5 Check the manual control selection mechanism and solenoid valve block. Check that the normal/reverse selector cannot be operated with the switch turned to ‘Power’.

2.6 Turn pump to “Manual” Position.

2.7 Check that the switch cannot be turned to power whilst operating the normal/reverse selector.

2.8 Examine cable entry, cable gland and tail cable sheath.

2.9 Clean and examine terminals, terminal block assembly and fixings. Protect as necessary.

2.10 Examine internal wiring.

NOTE: *Hydraulic fluid can cause degradation of insulation.*

2.11 Clean and examine the pump unit, motor assembly and all fixings. Look for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

NOTE: *Unused ports should be sealed to prevent fluid from being expelled from the reservoir.*

2.12 Check for leaks.

NOTE: *Power packs are labelled:*

- MN, MR – Main Normal, Main Reverse.
- BN, BR – Supplementary Normal, Supplementary Reverse.

Power packs fitted with Snorkel Valves have a label saying ‘Snorkel Valve Fitted’ or a blue patch fixed to the power pack body.

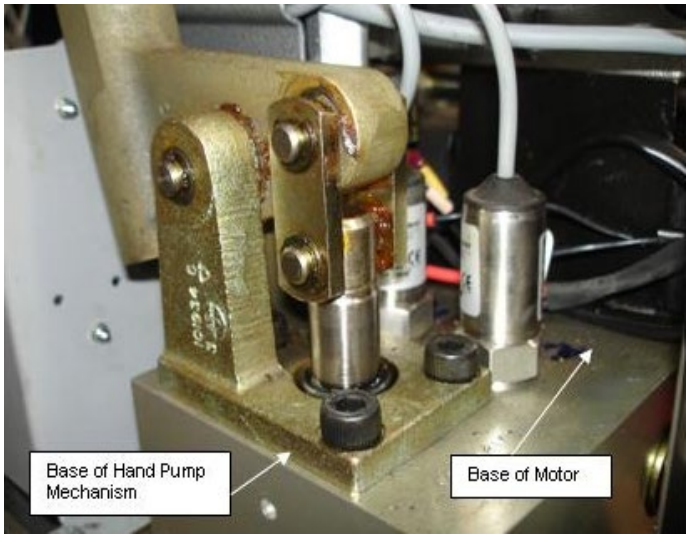


Figure 1 – Base of hand pump mechanism

2.13 Examine the motor brushes. Brushes shall slide freely in the holders and seat fully on the commutator. Brushes shall be replaced when worn to 10mm in length.

This task does not apply to brushless motors.

2.14 Check the hydraulic fluid level and (where fitted) the level indicator. If a top up greater than 0.5 litres is required check for leaks in the hydraulic system, rectify as required. If a leak cannot be found, report as corrective maintenance before the end of the shift. If more than 1 litres is required, carry out NR/SMS/PartB/Test/015 (Test for Air in the System).

2.15 Examine hydraulic ram hoses and connections. Pay particular attention to:

a) Signs of leakage.

b) Chafing and damage.

c) Security.

d) Significant corrosion.

Do not over tighten hose connections.

2.16 Check that the hose length does not exceed the requirement for purpose. Beware of excess length of hose being wrapped around the power pack. Report as corrective maintenance any hose with excessive length.

2.17 Check the locking wires on hose connectors are installed correctly.

2.18 Examine the manual override pins for signs of contamination/corrosion. Clean the manual override pins and apply mineral oil to the pins.

2.19 Operate the normal/reverse selector a number of times and check that it does not stick or remaining depressed following operation.

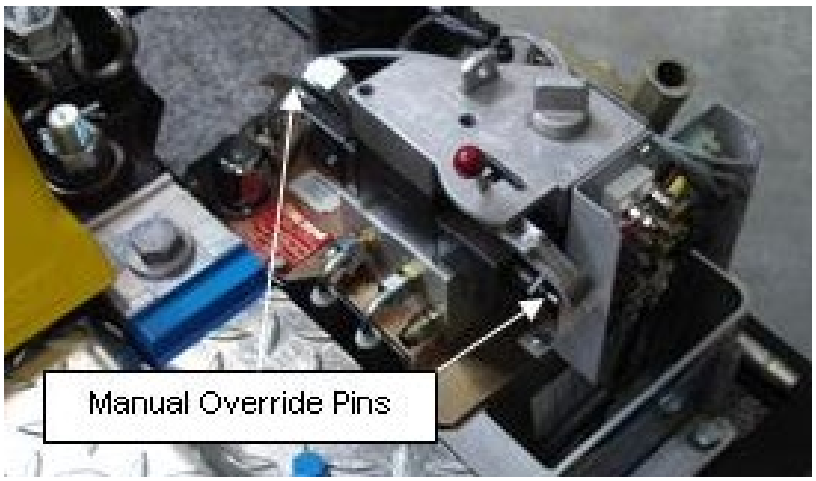


Figure 2 - Pump unit manual override pins

2.20 Refit the cover to the unit and lock with a RKB221 padlock. Check that a RKB222 padlock is fitted to the local control unit hinged lid.

Hy-Drive Systems

2.21 Check hose connections for signs of leakage or damage. Check that the locking wires are intact on the supplementary drive distribution manifold fitted on the in-bearer centre thrust bracket.

3. Lock & Detector Mechanism (Clamp Lock Body, All variants)

3.1 Remove and examine cover pins and covers.

3.2 Clean and examine the following on the lock body assembly:

a) Body casting (or fabrication).

b) Rail adapter blocks.

c) Micro-switches.

d) Terminal Blocks.

3.3 Check the fixing bolts (2) and confirm they are not loose.

3.4 Check the top Allen screws (2) that secure the microswitch plate to the body and confirm they are not loose.

3.5 Check the micro-switch assembly bolts (2) and confirm they are not loose.

3.6 Check cable glands, cable cores, wiring and terminations. Protect terminals as necessary.

3.7 Examine tappets (2) and microswitch plungers (2).

3.8 On the exterior of the lock body, examine the lock body cam follower pivot pin, tab washer, and hex screw. Check that they are secure and not corroded.

3.9 Remove fire risks and potential obstructions from the area of the mechanism and within the hollow bearer.

Installations with Auto-lube canisters only:

3.1 Check there is enough lubricant still in the canister and that the flexible hoses (if fitted) to the lock bodies are not damaged. Rectify as necessary.

NOTE: *Details of how to change the Auto-lube canister and minimum fill levels can be found in Appendix A for Grease-O-Matic systems or Appendix B for Simalube systems.*

4. Lock & Detector Mechanism (Clamp Lock Body, Mk 1 Only)

4.1 Check the following:

a) Heater mounted stud bolts.

b) Locating studs (113lb rail).

c) Support Bracket.

d) Lock body bolts (6 each side).

e) Tab washer and spirol pin.

4.2 Examine the rail close to the lock body. Report as corrective maintenance significant wheel burns, rail defects, and poor permanent way.

4.3 Check the body for obvious signs of cracking, carry out NR/SMS/PartB/Test/017 (Mk1 RCPL - Clamp lock - Testing for Cracking).

4.4 The cam lock follower pivot and drive lock slide/ drive bracket coupling shall not be lubricated.

5. Switch Rail Bracket Assembly (Open Switch)

5.1 Examine switch rail bracket assembly and fixing bolts. Verify the bolts are torqued in line with NR/SMS/PartZ/Z02 (Point Reference Values) and that the bolts protrude through the lock nuts.

5.2 Clean, examine and check for security the following:

All variants

a) Lock arm pivot-pin, bushes and split pins (2).

b) Pivot pin is free to rotate.

c) Lock arm and detector blade are free to slide on the pivot pin.

d) Fixed cam (should be secure).

e) Drive lock slide and slide-way.

Mk 1 & Mk 2 only

- Drive lock slide / bracket coupling pin and bolt.

Mk 3 only

a) Spherical Bearing is free to articulate.

b) Drive lock slide / actuator coupling.

NOTE: *Movement of the lock arm does not prove the 3mm to 6mm lock arm clearance on both sides of the lock arm.*

5.3 **Mk 1 & Mk 2 only** – – Lubricate using dry film lubricant, grease or spray as necessary the following wearing surfaces:

a) Fixed and adjustable cams.

b) Lock arm.

c) Locking piece.

d) Lock arm pivot.

5.4 Check for wear on the fixed cam and adjustable cam. Report wear as corrective maintenance.

NOTE: *Wear occurs at the field side end of the adjustable cam where the LH cam follower sits with the points open. This can be detected by the LH cam follower lowering as the switch rail reaches the open position. The detection test and cam follower screw length checks also indicate cam follower wear.*

6. Switch Rail Bracket Assembly (Closed Switch)

6.1 Wipe, examine and lubricate the cam adjusting screw.

6.2 Check the clearance between top of drive lock slide coupling and bottom of lock arm (4mm - 12mm). See Figure 3.

Figure 3 - Drive Lock Slide / Actuator Clearance (Mk 3 equipment shown)

6.3 Check the drive lock slide 'fully locked' position.

Clamp Lock Variant	Drive lock slide protrusion
Mk 1	Flush (+/- 5mm) with the end of the lock body
Mk 2	25mm – 30mm
Mk 3	> 71mm

Table 1 – Drive lock slide protrusions

6.4 Gauge 3mm – 6mm clearance between the drive lock arm and the drive lock slide.

6.5 Repeat 5.1 to 6.4 for the opposite position of the points.

7. Hydraulic Fittings (Four Foot)

7.1 Check the locking wires on hose connectors are intact.

7.2 Clean and check the hydraulic rams for leaks, in both normal and reverse positions.

7.3 Clean and examine the following:

All variants

- Centre thrust bracket, fixing bolts and spirol pins (if fitted).

Mk 1 & Mk 2 only

a) Ram cover plates (2) and fixing bolts (4).

b) Ram thrust plate, packing pieces, split pins (2) fixing bolts (2) and washers.

Mk 3 only

a) Actuator ram piston surface.

b) Actuator socket mounting bolts (4) on the centre thrust bracket.

7.4 Mk 3 only – check the lock nuts on the actuator adjuster collar and adjuster locking pin.

7.5 Mk 1 & Mk 2 only – examine the following on the tie bar:

a) Nuts and bolts.

b) Welds.

c) Lock nuts and screw thread.

7.6 Check all the nuts on tie bars (especially locking nuts) are tight. Rectify as necessary. The minimum clearance between tie bar components (welds, nuts etc) and rams / thrust brackets is 3mm.

8. Final Tests and Checks

8.1 Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Test).

8.2 Check that the tab washers for the locking piece retaining screws are present and bent over.

8.3 Restore to power operation.

8.4 Refit all covers and Lubricate padlocks (RKB 221 and 222 padlocks on the lock body, pump unit cover and local control lids).

8.5 If provided:

Visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

8.6 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Check that the centre thrust bracket does not move during operation.

8.7 Observe correct operation.

SERVICE B

9. Clamp Lock Body

9.1 Check the cam follower tappet screws protrude no more than 25mm.

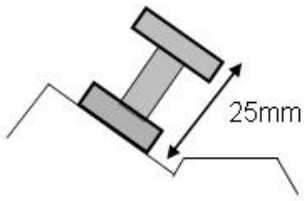


Figure 4 – Tappet Screw Adjustment

9.2 Check with the switch rail open approximately 25mm, that the Left-Hand and Right-Hand tappets are level.

Mk 1 Fabricated Body

9.3 Clean the body frame as necessary.

9.4 Examine the Spirol pins; Check they are flush with lock body.

9.5 Check that the clamp lock support bracket is fitted.

9.6 Examine the lock body and welds for cracking.

9.7 Carry out NR/SMS/PartB/Test/017 (Dye Penetrate Test or Eddy Current Test).

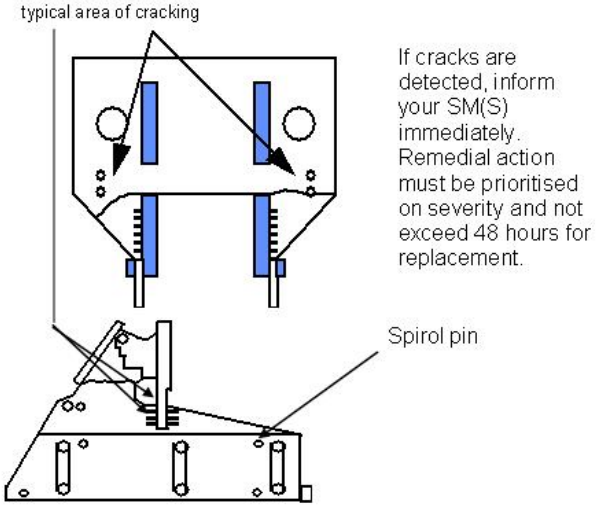


Figure 5 – Mk 1 Fabricated Lock Body

10. Disconnection Boxes (if Provided)

10.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

10.2 Refit the lid and (if provided) padlock, check they are fitted securely.

11. Final Tests and Checks

11.1 Check power pack motor brushes are free to slide in their holders and replace if less than 10mm in length.

11.2 Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Tests – Clamp Lock)

11.3 Carry out NR/SMS/PartB/Test/013 (Detection Test (Clamp Lock).

11.4 If any of the tests in 11.2 or 11.3 fail, carry out the NR/SMS/PartB/Test/014 (Lock and Detector Full Test (Clamplock).

11.5 Select 'Power' and ask the Signaller to operate the points with an obstruction placed in the open switch rail. Check the time cut-out operates (6-9s). Check the centre thrust bracket for movement during operation.

If not monitored by ELD:

11.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

11.7 Ask the Signaller to restore the points and remove the obstruction.

11.8 Refit and lubricate the padlocks (RKB 221 and 222 padlocks on the lock body, pump unit cover and local control lids).

11.9 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

12. Local Policy Requirement 1

12.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.

SERVICE V1

Includes:	Rail Clamp Point Lock (RCPL) Mk 2 and In-Bearer Clamp Lock (IBCL)
Excludes:	Rail Clamp Point Lock (RCPL) Mk 1 and IBCL Mk 3, or any other type of hydraulic points

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

13. Visual Checks

13.1 Check for potential fire risks and obstructions around the S&C and within close proximity of the POE mechanism and fittings.

13.2 Check sleeper beds are clear of any obstructions.

13.3 Check cables and cable routes for any visible damage and are clear from any rodding runs.

13.4 Check hydraulic fluid level.

a) If hydraulic fluid level is low check for evidence of leaks / oil loss at the hydraulic components including supplementary drive in Hy-drive systems e.g. the Rams, hoses, and their connections (Particularly at spigots and centre thrust bracket).

b) Look for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

c) If a top up greater than 0.5 litres is required check for leaks in the hydraulic system, rectify as required. If a leak cannot be found, report this to your SM(S) before the end of the shift.

d) If more than 1 litre is required NR/SMS/PartB/Test/015 (Clamp Lock : Test for Air in the System).

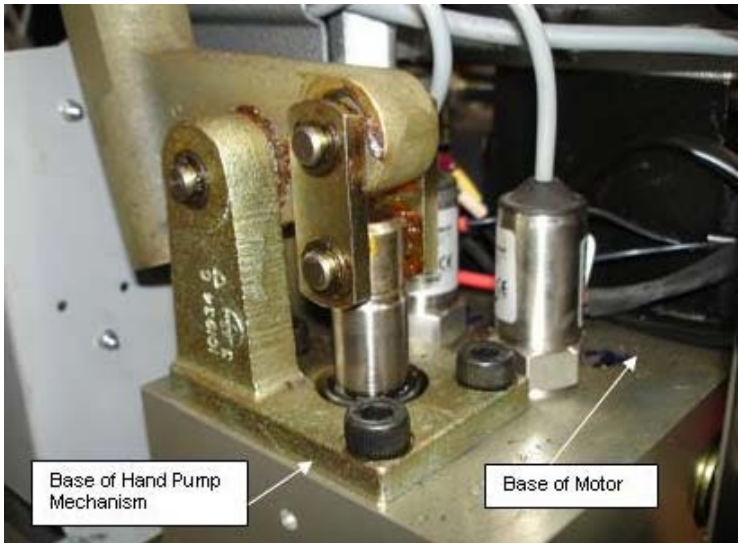


Figure 6 – Base of hand pump mechanism

13.5 Examine 'open' switch rail bracket assembly and fixing bolts. Check that the bolts protrude through the lock nuts.

13.6 Check for tightness using torque values shown in NR/SMS/PartZ/Z02 (Point Reference Values). If any fixing nut/bolt require tightening, then this shall be reported.

13.7 Repeat for opposite switch rail bracket.

14. Drive slide lubrication

14.1 Check level of lubricant in auto lube canister. If empty, replace.

14.2 Check drive slides and slideways are lubricated, if not check function of auto lube delivery system.

14.3 If no auto lube fitted, manually lubricate drive lock slides and slideway.

14.4 Details of how to change the Auto-lube canister can be found in Appendix A & B.

14.5 Check Power Pack lid is not seized or damaged and lubricate.

14.6 Check all covers are fitted, secure and not damaged.

14.7 Check correct padlocks are fitted to the pump unit and detection mechanisms.

15. Regular Tests

15.1 Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Test).

15.2 Report any adjustment / replacement / further work being carried out to remove the defective condition within the POE.

15.3 Report any hydraulic hoses that are not the correct length.

15.4 Observe the operation of the points and investigate any issues found.

Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection has been obtained.

SERVICE R1

These tasks should be performed in addition to the VISUAL CHECKS (V1) tasks.

16. Remote Condition Monitoring

If the points that you have requested to work on are fitted with Remote Condition Monitoring, check that the asset has been placed into maintenance mode prior to commencing work.

Prior to commencing work, previous current traces should be made available from the Remote Condition Monitoring system and checked for any abnormalities.

Also, on completion of the work new traces should be recorded and viewed so they can be compared with the traces produced before the maintenance activity.

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

DO NOT lubricate the Cam Follower Pivot Pin.

DO NOT lubricate the Insulated Drive Lock Slide / Drive Bracket Coupling.

Figure 7 - Drive Lock Slide / Drive Bracket Coupling

17. Switch Rail Bracket Assembly (Open Switch Rail)

The following maintenance shall be completed with the points in both the Normal & Reverse position.

17.1 Turn the control switch on the Power Pack to Manual. (See figure 8).

DO NOT use degreasing/ solvent agents.

17.2 Clean all exposed components.

17.3 Check the Pivot Pin is free to rotate.

17.4 Lock Arm Bush is Free to rotate on the Detector Lug and Lock Arm.

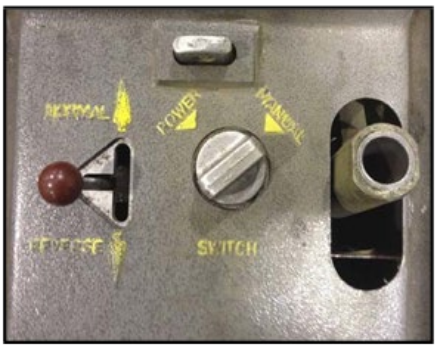


Figure 8 – Power pack Control switch

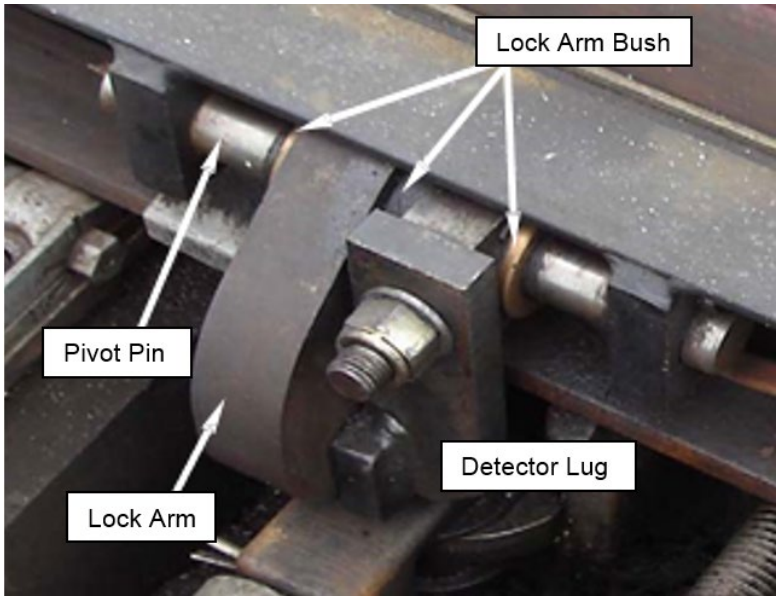


Figure 9 – Mk 2 Switch Rail Bracket Assembly

18. Lubrication – Mk 1 & Mk 2 only

18.1 Lubricate using dry film lubricant, grease or spray as necessary the following wearing surfaces:

a) lock arm.

b) fixed cam.

c) adjustable cam.

d) locking piece.

e) drive lock slide.

f) detector blade lug at the point of pivot on the switch rail bracket pin, cam adjusting screw.

18.2 Lubricate the Lock Arm Pivot-Pin and Lock Arm Bush as shown in Figure 10.

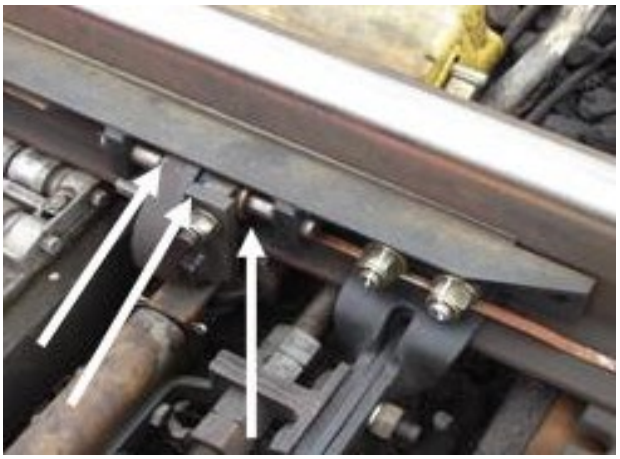


Figure 10 – Mk 2 Pivot Pin Lubrications Points

Lubrication Advice – Mk1 / Mk2 only. Does not apply to Mk3 equipment

The lock arm bush is designed to rotate on three bearing surfaces: the pivot pin, the lock arm, and the detector lug.

It is essential that all three surfaces are properly lubricated. Dry film lubrication spray - Interflon Lube TF is the preferred lubricant. Rocol Clamp Lock lubricant in spray cans can also be used.

The can shall be shaken well before each use. Spray the areas arrowed in Figure 10.

It should be possible to rotate the lock arm bush. This is most easily done when the switch rail is fully open. If this cannot be done, and the parts are not readily freed,

an extra coat of spray lubricant should be applied and left to penetrate for up to one week.

If after this treatment the lock arm bush still does not rotate, report as corrective maintenance so that the associated parts can be disassembled and cleaned.

Once reassembled and new lubrication has been applied, the lock arm bush should now freely rotate. If the bush still does not rotate or damaged components are found, rectify the situation.

18.3 Examine the manual override pins for signs of contamination/corrosion. Clean the manual override pins and apply mineral oil to the pins.

Operate the normal/reverse selector a number of times and check that they do not stick or remaining depressed following operation.

Figure 11 – Manual Override Pins

18.4 Switch Rail Bracket Assembly

a) Check for flattening of split Pins against the Switch Rail Bracket Lugs and replace as necessary.

b) Check centre thrust bracket for dynamic movement (dynamic test).

Figure 12 - Split Pins and Switch Rail Bracket Lugs

19. Final Checks

19.1 Restore to power operation.

19.2 Refit all covers and Lubricate padlocks (RKB 222 padlock on the local control lid).

19.3 Report any adjustments made, components replaced or out of specification items on a WAIF.

Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection has been obtained.

19.4 Observe the operation of the points and investigate any issues found.

19.5 Where Remote Condition Monitoring has been fitted check with local RCM team to confirm asset trace has not deteriorated following maintenance, if no issues take out of maintenance mode.

SERVICE R2

These tasks should be performed in addition to the Visual checks (V1) and Service (R1).

20. Operation

20.1 Test manual operation by pumping the points to the opposite position and then back to the original position.

20.2 Check for smooth operation of the Clamp Lock when the points are being pumped across.

20.3 Examine for any signs of abnormal operation and whether the points are difficult to operate during the manual operation.

20.4 Examine the pump unit and detector mechanism cable glands / plug couplers for security.

20.5 Examine the concrete base, power unit mounting and fixings.

NOTE: *The pump unit should be reasonably level (to the eye) and secure.*

20.6 Examine hydraulic rams, hoses and connections, including back-drive on Hy-drive systems. Check for:

a) Chafing and damage.

b) Security.

c) Significant corrosion.

20.7 Examine the pump unit and detector mechanism cable, internal wiring and terminations for damage, degradation, contamination and security.

20.8 Check the torque of the lock body rail bolts.

Where fitted, check that cartridge (pencil) lock body heater is secured correctly. See Figures 13 and 14.

Figure 13 – Pencil Heater

Figure 14 – Pencil heater fitted into lock body

20.9 Check the gap between top of drive lock coupling & bottom of lock arm is greater than 4mm. See Figure 15.

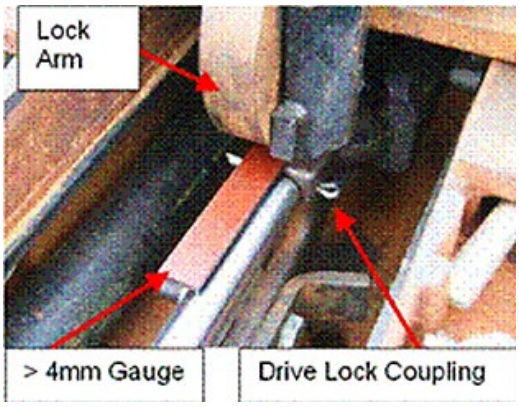


Figure 15 – Lock arm clearance

20.10 With switch rail bracket in the closed position check the drive lock slide 'fully locked' position. See figure 16.

NOTE: *Mk2 – lock slide protrudes approx. 25mm - 30mm beyond the lock body.*

Repeat 20.10 for opposite position.

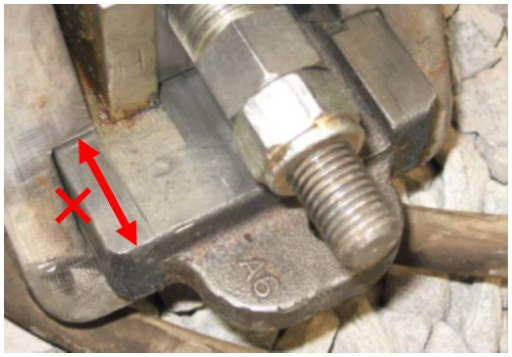


Figure 16 – X = 25mm – 30mm (Mk 2 Only)

20.11 Check the lock arm bush position on the pivot pin is correct. See Figure 17.

NOTE: *The lock arm bush should be relatively central, as pictured in Figure 17 and not too close to the switch rail bracket bushes.*

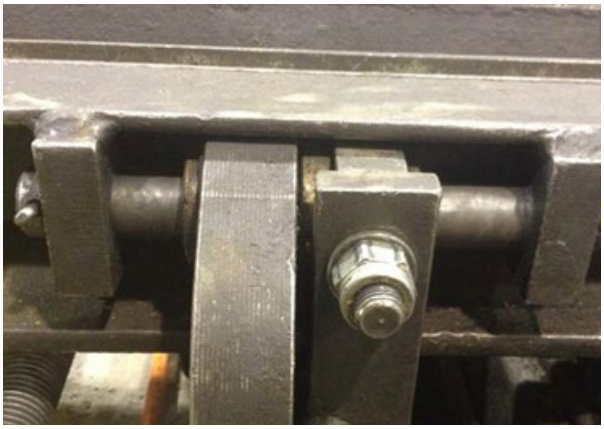


Figure 17 – Lock arm bush position

20.12 Examine tie bar for corrosion & signs of movement at the central lock nut.

NOTE: *Any threaded joints, which appear to be 'bleeding' a red rust solution could be due to some kind of fretting process.*

Check there is a 3mm clearance between tie bar, rams and thrust brackets. Apply a check-torque to the adjustable tie bar lock-nut.

NOTE: *A special fitting is required for this nut: PADS No. 039/052030*

20.13 Check micro-switch bellows for damage (see Figure 18).

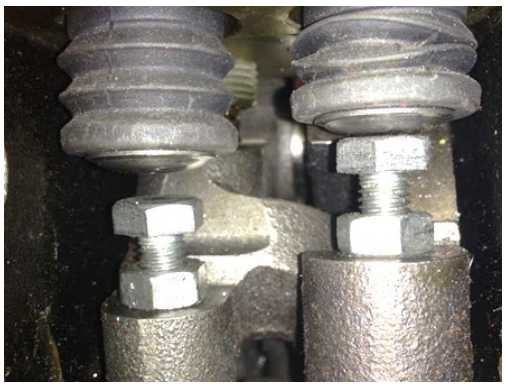


Figure 18 – Micro-switch bellows damage

20.14 Check cam follower tappet screws do not protrude more than 25mm (See Figure 19).

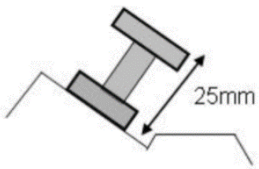


Figure 19 - Cam Follower Tappet Screw

20.15 Check with the switch rail open approximately 25mm, that the Left-Hand and Right-Hand tappets are level.

20.16 Where points are remote condition monitored, apply meter to measure motor supply voltage.

Where a pressure test port is available:

NOTE: *This test can be completed in conjunction with 20.19 below*

20.17 Connect pressure gauge to test port, operate points, hydraulic pressure should read between 95-105 bar. After 1 minute pressure should not fall below 60 bar.

If readings are below these parameters, then check relevant hoses and ram for leaks.

If no leaks are present, report to your SM(S) to arrange renewal of pump unit.

20.18 Repeat 20.17 for opposite position.

20.19 Select 'Power' and ask the Signaller to operate the points with an obstruction placed in the open switch rail. Check the time cut-out operates (6-9s). Note the motor supply voltage at this time. (For comparison with task 21.7).

20.20 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted. Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation. Check the following:

a) Terminations for security, corrosion, arcing, and risk of short circuit / disconnection and protect as necessary.

b) Cable glands are fitted and effective.

20.21 If not monitored by ELD, carry out a NR/SMS/PartB/Test/052 (Dynamic Earth Test).

20.22 Report any adjustments made, components replaced or out of specification items on a WAIF.

21. Final Check & Tests

21.1 Check Power Pack motor brushes are free to slide in their holders and replace if less than 10mm in length.

21.2 Carry out NR/SMS/PartB/Test/003 (Facing Point Lock Test).

21.3 Carry out NR/SMS/PartB/Test/013 (Detection Test – Clamp Lock).

21.4 If any of the tests in 21.2 or 21.3 fail, carry out the NR/SMS/PartB/Test/014 (Lock and Detector Full Test – Clamp Lock).

21.5 After completion of the service, switch the Power Pack to Power.

21.6 Observe the operation of the points and investigate any issues found.

21.7 Refit all covers and Lubricate padlocks (RKB 221 and 222 padlocks on the lock body, pump unit cover and local control lids).

21.8 Where RCM is fitted check with the local RCM team to confirm asset trace has not deteriorated following maintenance.

NOTE: *Nominal operation motor current at.*

- 110v = 7.0 Amps
- 90v = 5.9 amps
- 130v = 8.5 amps

Any variation should be investigated.

21.9 If there are no issues, take out of maintenance mode.

21.10 Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection has been obtained.

22. Local Policy Requirement 2

22.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.

APPENDIX A - Replacement of the Grease-O-Matic Auto-lube Canister.

To be replaced when level reaches 20ml. (Note not compatible with dry film lubrication systems).

1. Remove the plastic canister from the rail clip.
2. Unscrew the old canister and attach the new canister to the 45° connector.
3. Activate the Auto-lube canister by aligning the white arrow the selection 12 dispense value, once aligned push the red button. Rotate the black knob clockwise until a 'click' is heard (approximately 6 turns).
4. Push the new canister back into the rail clip. Check that the grease level indicator is visible.

Figure 20 – Auto-lube Canister

APPENDIX B - Replacement of the Simalube Auto-lube Canister.

To be replaced when empty. (for dry film lubrication systems only)

1. Remove the plastic canister from the rail clip if applicable
2. Unscrew the old canister, cut off the small yellow nipple and attach the new canister to the connector.
3. Activate the canister by aligning the white arrow with the 12-marker value, using an Allen key
4. Push the new canister back into the rail clip if applicable. Check that the lubricant level indicator is visible.

APPENDIX C - Dry film Lubrication application and maintenance.

Dry film lubrication practices require to be briefed by a competent person prior to use and applied in a controlled manner.

1. Initial application of dry film lubrication requires the removal of old lubricant types with an evaporating degreaser (Interflon Metal Clean/EM30+). Surfaces should be clean and dry before application of lubricant.

NOTE: *Once converted to dry film, refer to step 4.*

2. Interflon Lube TF should be applied to the bush and pin area as directed and to the manual override pins within the pump unit. Lube TF might also be used on locks and hinges as required. The lubricant should be allowed time to penetrate prior to wiping away any excess.

3. Interflon Lube EP should be used on all other surfaces as directed above. Any excess should be wiped away.

4. For maintenance activities, dry film lubrication should not be degreased. However, the application of further dry film lubricant will allow for cleaning and restoration of lubrication to the equipment. Exposed surfaces should have excessive lubricant wiped away. Lube TF and Lube EP should be used as described above.

5. Fitting of the Simalube auto lube system requires the flushing of old grease from the system or the fitting of new unfilled pipes. A flushing pump is available. Once clean the pipework requires priming with Interflon Lube EP before fitting the Simalube unit. This should be done as outlined in Appendix B.

NOTE: *If dry film lubricant has been cross-contaminated with other lubricants then a process restart using initial application degreaser should be started as above.*

END

General

Yard points are hydraulic operated points that use a clamp lock pump unit driving a set of simple rams to move the points. There is no facing point lock so the points are trailable and detection is done with a standard BR998 detector.

The equipment shall not be operated electrically until any adjustments have been proved by hand pump operation.

SERVICE A

1. Pump Unit

1.1 Check the concrete base, power unit mounting and fixings. The pump unit shall be reasonably level (to the eye) and secure.

1.2 Check the visible tail cable and route.

1.3 Check that the normal / reverse selector cannot be operated with the switch turned to ‘Power’.

1.4 Turn to ‘manual’ position.

1.5 Examine cable entry, cable gland and tail cable sheath.

1.6 Clean and examine terminals, terminal block assembly and fixings. Protect as necessary.

1.7 Examine internal wiring. Hydraulic fluid can cause degradation of insulation.

1.8 Clean and examine the pump unit, motor assembly and all fixings.

1.9 Check for signs of leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

1.10 Check unused ports are be sealed to prevent fluid from being expelled from the reservoir. Check for leaks.

Smiths Industries power packs are labelled:

a) MN, MR – Main Normal, Reverse.

b) BN, BR – Supplementary Normal, Reverse.

1.11 Check power packs fitted with snorkel valves have a label or blue patch fixed to the power pack body.

1.12 Check the hydraulic fluid level and level indicator (where fitted). Top up as necessary. Report any top up greater than 0.5 litres before the end of the shift.

1.13 If more than 1 litre is required, Carry out NR/SMS/PartB/Test/015 (Test for Air).

1.14 Examine hydraulic ram hoses and connections. Pay particular attention to:

a) Signs of leakage.

b) Chafing and damage.

c) Security.

NOTE: *Do not over tighten hose connections.*

1.15 Check that the hose lengths are excessively long, If they are, advise your SM(S).

1.16 Check the locking wires on hose connections are intact.

1.17 Lightly Lubricate hand pump and selector mechanism (guides, pivots, and joints).

1.18 Check and refit cover to unit.

2. Hydraulic Fittings

2.1 Check the locking wires on hose connectors are intact.

2.2 Clean and check the hydraulic rams for leaks, in both normal and reverse positions.

2.3 Clean and examine:

a) Ram fixing brackets and fixing bolts.

b) Tie Bar fixing nuts & bolts.

Bolts shall be of correct length to accommodate the lock nut thread.

3. Final Tests and Checks

3.1 Carry out NR/SMS/PartC/PD01 (BR 998 Detector) Service A and any associated tests.

3.2 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3.3 Refit all covers and lubricate padlocks (RKB 222 padlock on the local control lid).

3.4 The final check before completion of the work is to request the Signaller to operate the points to normal and reverse positions (twice if possible), while observing the movement of the points is correct and in the absence of a Facing Point Lock, that the switch blades fully close up to the rail.

SERVICE B

4. Pump Unit

4.1 Turn to 'Manual' position.

4.2 Examine (where possible) the motor commutator. Clean with a lint free cloth moistened with cleaning fluid. The motor commutator shall be a light coffee colour.

4.3 Check the motor brushes slide freely and seat fully on the Commutator. If the brush is less than 10mm long it shall be renewed.

NOTE: *This task does not apply to brushless motors.*

5. Disconnection Boxes (if Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Final Tests and Checks

6.1 Carry out NR/SMS/PartC/PD01 (BR 998 Detector) Service B and Tests called by that SMS.

6.2 Select 'Power' and ask the Signaller to operate the points with an obstruction placed in the open switch rail. Check the overload cut-out operates (6-9s).

6.3 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

6.4 Ask the Signaller to restore the points and remove the obstruction.

6.5 Refit and lubricate the padlocks (RKB 222 padlock on the local control lid).

6.6 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). At the same time observe the movement of the points is correct and in the absence of a facing point lock, that the switch blades fully close up to the rail.

END

Includes:	Chairlock point mechanism CE, EP valve point auxiliary (D) valve, fitted on Northern City Line (NCL)
Excludes:	All other types of Point Machine

General

Nuts that are tight shall not move by the application of a short-handled spanner.

REGULAR TESTS

1.1 Carry out the facing test point in accordance with the equipment specification.

SERVICE A

2. Chairlock

2.1 Wipe and examine the valve fixing brackets including fixing bolts.

2.2 Examine and lightly lubricate the (D) valve and cover plate retaining clamp screws. Check that the lock nut is tight against the clamp (Auxiliary Valve only).

2.3 Examine the air inlet pipe connection.

2.4 Examine the air outlet flexible hose connection.

2.5 Examine the flexible hose connections together with the jubilee retaining clips.

2.6 Clean and examine the valve caps and lightly lubricate the cap threads with oil.

2.7 Wipe and examine the magnetic valve stem and lightly lubricate with oil.

NOTE: *Prise aside the valve retaining clip to extract the valve. This can be clearly seen in place and engaged, on the top surface of the valve before replacement of the cap.*

2.8 Visually check the electromagnet, transformer and rectifier, together with the associated wiring and terminations on the inside of the glass case.

NOTE: *The valve cores shall not be removed.*

2.9 With the air supply turned on, check the valve and connections for air leaks.

2.10 Isolate the EP valve calling circuit by removing the fuses, links, or OCB's.

2.11 Isolate both ground lock and cylinder air supplies and the 1 ½ inch air main.

2.12 Remove all retained air pressure by slowly depressing the valve magnets manually to open the exhaust ports until all the air is heard to escape.

Do not depress the armature completely as this might cause partial operation of the Auxiliary D valve from the called position.

2.13 Remove all valve stems.

2.14 Place a point scotch between the open switch and its stock rail.

2.15 Examine the drive tie rod, drive bar, lock crank and connections. Adjust and tighten where necessary. Lubricate crank pins with oil.

2.16 Examine the lock arm bracket, fastenings and switch rail packing, adjust and tighten where necessary.

2.17 Examine the switch detection rod, setting/locking nuts and sleeve nut. Tighten where necessary. Lubricate the visible threaded portion of rod.

2.18 Examine the switch detection lever, crank pin and split pin. Lubricate the pin with oil at the nipple provided.

2.19 Examine the Chairlock holding down and stock rail bolts. Tighten where necessary.

2.20 Examine each Chairlock for body cracks.

2.21 Examine the main cover and fixing. Lightly lubricate the fixing screw with oil. Check that the sealing gasket is secure and effective.

2.22 Examine the air cylinder mounting bracket and holding down bolts. Tighten where necessary.

2.23 Lubricate the air cylinder with oil at the nipples provided and examine the cylinder for air leaks. Any air leaks detected shall be reported as corrective maintenance.

2.24 Examine the ram bellows for wear and check the fixing clips are in good condition.

2.25 Examine the manual (crowbar) operation attachment for security.

2.26 Examine the air cylinder pipe connections, securing clips and hoses for damage and leaks, particularly those resulting from the effects of conductor rail arcing or ballast pressure.

Check that the hoses are not buried under ballast and are clear of the conductor rail and any moving parts of the point layout.

2.27 Examine the ground lock air cylinder pipe connections and hose together with the T piece connection on the valve side of the points, for any damage or leaks.

2.28 Examine the 'paddle' terminations and fixing clamps.

2.29 Examine the circuit controller fixing and insulations.

2.30 Examine the circuit controller contacts. Clean the contacts with a lint free cloth moistened with a approved cleaner.

2.31 Examine the ground lock.

2.32 Examine the cam top bearing fixing. Check that the locking tabs are correctly set.

2.33 Examine the switch detection cam fixing and split pin.

2.34 Lubricate (using an oil gun), the following:

a) Ground lock nipple.

b) Cam point bearing cup.

c) Cam follower coupling.

d) Cam, faces and rollers.

2.35 Lubricate the slide chairs with approved lubricant.

2.36 Remove all rubbish and fire hazards around the mechanism, cables, and air hoses.

2.37 Repeat items 2.14 to 2.36 for the opposite chair lock.

2.38 Remove the point scotch from between the open switch and its stock rail.

2.39 Reconnect all valve stems, air supplies, and the EP valve calling circuit.

2.40 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

2.41 Observe the correct operation of the points from the controlling point when all work is complete, and all covers replaced and padlocked.

SERVICE B

3. Glass Enclosed Electro Pneumatic Valve and Point Auxiliary (D) Valve.

3.1 Examine and clean the air filters.

4. Disconnection Boxes (if Provided)

4.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock, check they are fitted securely.

END

Includes:	JOSS Lock Points
Excludes:	All other type of hydraulic points

GENERAL

The equipment shall not be operated electrically until any adjustments have been proved by hand pump operation.

Nuts that are tight shall not move by the application of a short handled spanner.

REGULAR TESTS

1. Facing Point Lock & Fluid Level

1.1 Carry out NR/SMS/PartB/Test/001 (FPL Tests (Machine)).

1.2 Check the hydraulic fluid level and level indicator (where fitted). Top up as necessary. Report any top up greater than 0.5 litres before the end of the shift.

If more than 1 litre is required, NR/SMS/PartB/Test/015 (Clamp Lock: Test for air in the system).

1.3 Check the RKB 222 padlock is fitted to the Local Control hinged lid.

SERVICE A

2. Pump Unit (all types)

2.1 Check the concrete base, power unit mounting and fixings. The pump unit shall be reasonably level (to the eye) and secure.

2.2 Check the visible tail cable and route.

2.3 Remove the pump unit cover

2.4 Check that the normal / reverse selector cannot be operated with the switch turned to ‘Power’.

2.5 Turn to ‘manual’ position.

2.6 Examine cable entry, cable gland and tail cable sheath.

2.7 Clean and examine terminals, terminal block assembly and fixings. Protect as necessary.

2.8 Examine internal wiring. Hydraulic fluid can cause degradation of insulation.

2.9 Clean and examine the pump unit, motor assembly and all fixings.

2.10 Look for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

2.11 Unused ports shall be sealed to prevent fluid from being expelled from the reservoir. Check for leaks.

Smiths Industries power packs are labelled:

a) MN, MR – Main Normal, Reverse.

b) BN, BR – Supplementary Normal, Reverse.

2.12 Check power packs fitted with snorkel valves have a label or blue patch fixed to the power pack body.

2.13 Examine the motor brushes, renew as necessary. They shall slide freely in their holders and seat fully on the commutator.

NOTE: *This task does not apply to brushless motors.*

2.14 Check the hydraulic fluid level and level indicator (where fitted). Top up as necessary. Report any top up greater than 0.5 litres before the end of the shift.

If more than 1 litre is required, carry out NR/SMS/PartB/Test/015 (Clamp Lock: Test for air in the system).

2.15 Examine hydraulic ram hoses and connections. Pay particular attention to:

a) Signs of leakage.

b) Chafing and damage.

c) Security.

Do not over tighten hose connections.

2.16 Check that the hose length does not exceed the requirement for purpose.

Beware of excess length of hose being wrapped around the power pack. Arrange for excess length hoses to be replaced.

2.17 Check the locking wires on hose connectors are intact.

2.18 Lightly lubricate hand pump and selector mechanism (guides, pivots, and joints).

2.19 Check and refit cover to the unit.

3. Point Mechanism Exterior (Cover on).

3.1 Examine the machine covers, studs, and padlocks.

3.2 Check the visible tail cables and route.

3.3 Check the air pipes and connections for leaks.

3.4 Check the baseplate and castings for cracking. Operate the machine under power and check that it is secure. Tighten as necessary.

3.5 Remove any potential obstructions and fire risks.

3.6 Clean and apply an adhesive grease to the point drive and lock and detector movements.

4. Point Mechanism Interior (Covers Removed)

4.1 First isolate the machine.

Examine the hydraulic actuators to point drive (lug, split pin and locknut).

4.2 Clean and examine the:

a) Base assembly and fixings.

b) Point Drive.

c) Escapement.

d) Lock assembly.

e) Baseplate castings, rivets, and fixings.

f) Point drive bar and slider plates.

g) Escapement pivot and bolts.

h) Throw bar, drive lug and split pin.

i) Rollers and grease nipples.

j) Lock blades, lock dogs, and notches chamfering, and swarf indicates the points are out of adjustment.

k) Connection to the detector box (lug, bolt, and split pin).

4.3 Lubricate with a lithium grease the point drive and lock movement grease nipples.

4.4 Lubricate with oil the wearing surfaces of the drive mechanism.

5. Contact Assembly (Style HV)

5.1 Remove the cover; check the seal and the casting.

5.2 Check that the drain holes and ventilators are clear. Remove accumulated moistures and debris.

5.3 Clean and examine the following:

a) Locking bar and dogs.

b) Lock slide and notches. Look particularly for wear (swarf) and chamfering (bright corners).

c) Detector slides and notches.

d) Guides, rollers and fixings.

e) Cover plate and fixings.

5.4 Lubricate the slides with lithium grease.

5.5 Fill the oil cups with mineral oil.

5.6 Examine the detector actuators, rollers, pivots, and split pins. Lubricate with a mineral oil. Rollers shall fully engage in the notches and rotate freely.

5.7 Examine the shuttle mechanism, pay attention to:

a) The moving block and return spring assembles.

b) Terminal blocks and fixings. Tighten and protect as necessary.

c) Contacts and springs, clean and protect as necessary. Protection shall not be applied to contact faces.

d) Cables, cable entries, wiring and terminations.

5.8 Where fitted, check the heaters.

6. Test and Final Checks

6.1 Carry out NR/SMS/PartB/Test/001 (FPL Tests (Machine)).

6.2 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

6.3 Replace all the covers and secure using padlocks. A RKB222 shall be fitted.

6.4 The final check before completion of the work is to ask the Signaller to operate the points normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

7. Pump Unit

7.1 Turn to manual position.

7.2 Where possible, examine the motor commutator. Clean with lint free cloth moistened with cleaning fluid. It shall be a light coffee colour.

7.3 Check power pack motor brushes are free to slide in their holders and replace if less than 10mm in length.

NOTE: *This task does not apply to brushless motors.*

8. Point Mechanism - General

8.1 Clean and wipe the machine and cover.

9. Disconnection Boxes (if Provided)

9.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

9.2 Refit the lid and (if provided) padlock, check they are fitted securely.

10. Local Policy Requirement

10.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed.

11. Final Checks and Tests

11.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests (Electrical Detectors)).

11.2 Carry out NR/SMS/PartB/Test/001 (FPL Tests (Machine)).

11.3 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

11.4 Replace covers and secure using padlocks. An RKB222 shall be used.

11.5 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

Includes:	Hydraulic Derailers (Type BRB 817) powered by SPX Hydraulic Pumps and Actuators
Excludes:	All Other types of Derailer

GENERAL

The equipment shall not be operated on power until any adjustments have been proved by hand pump operation.

Hydraulic Derailer's use a standard Clamplock pump unit and a pair of Clamplock rams to drive a Derailer mechanism. Detection is accomplished using a standard circuit Controller or a 998 unit. See Figure 1.

Figure 1 – Hydraulic Derailer Type BRB 817

SERVICE A

1. Derailer Unit

1.1 Remove the pump unit cover and turn to "Manual" before carrying out close inspection.

1.2 Examine the derailer for signs of cracking or damage.

1.3 Check the unit is correctly aligned

1.4 Check the torque settings of the nuts for the bolts holding the derailer mechanism to the rail at 80Nm

1.5 Check the unit is not obstructed by ballast.

2. Actuator Mounting Frame

2.1 Clean the frame holding the rams and check it is secure on its base and fixings.

2.2 Check for slackness in the mechanical connections by rocking the derailer mechanism by hand.

2.3 Clean and check the hydraulic rams for leaks.

Check the locking wires on hose connectors are intact.

2.4 Check that when operated the driving crank between the Hydraulic Pump Unit and connecting rod, operates smoothly.

Confirm that the driving angle does not interfere with the Detector Box.

2.5 Check that the crank is greased and is fitted with respective grease nipples in the crank stud and joint pins.

3. Pump Unit

3.1 Check the concrete base, power unit mounting and fixings. The pump unit shall be reasonably level (to the eye) and secure.

3.2 Check the visible tail cable and route.

3.3 Check the manual control selection mechanism and solenoid valve block.

3.4 Check the normal/reverse selector cannot be operated with the switch turned to 'Power'.

3.5 Examine cable entry, cable gland and tail cable sheath.

3.6 Clean and examine terminals, terminal block assembly and fixings. Protect as necessary.

3.7 Examine internal wiring. Hydraulic fluid can cause degradation of insulation.

3.8 Clean and examine the pump unit, motor assembly and all fixings.

a) Look for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

b) Unused ports shall be sealed to prevent fluid from being expelled from the reservoir. Check for leaks.

3.9 Examine the motor brushes, renew if less than 12mm. They are designed to slide freely in their holders and be seated fully on the Commutator.

NOTE: *3.9 do not apply to brushless motors.*

3.10 Check the hydraulic fluid level and level indicator (where fitted). Top up as necessary.

Report any top up greater than 0.5 litres before the end of the shift.

3.11 If more than 1 litre is required, carry out NR/SMS/PartB/015 (Clamp Lock: Test for air in the system).

3.12 Examine hydraulic ram hoses and connections. Pay particular attention to:

a) Signs of leakage.

b) Chafing and damage.

c) Security.

Do not overtighten hose connections.

3.13 Check that the hose length does not exceed the requirement for purpose. Beware of excess length of hose being wrapped around the power pack. Arrange for excess length hoses to be replaced.

3.14 Check the locking wires on hose connections are intact.

3.15 Lightly Lubricate hand pump and selector mechanism (guides, pivots and joints).

3.16 Check switch is turned to “Power” and refit cover to unit.

4. Additional Services (If Required) and Final Checks

4.1 Where a Circuit Controller is used as detection, carry out NR/SMS/PartC/LV31 (Circuit Controllers) - Service A.

4.2 Where a 998 Detector is used for detection, carry out NR/SMS/PartC/PD01 (BR998 Detector) - Service A. (Detection Tests in PD01 are not applicable to derailers)

4.3 The final check before completion of the work is to ask the Signaller to operate the derailer to normal and reverse positions (twice if possible), while observing the movement is correct.

SERVICE B

5. Pump Unit

5.1 Turn to ‘Manual’ position.

5.2 Examine (where possible) the motor commutator. Clean with a lint free cloth moistened with cleaning fluid.

The motor commutator should be a light coffee colour.

5.3 Examine the motor brushes, renew if less than 12mm. They are designed to slide freely in their holders and be seated fully on the Commutator.

NOTE: *5.2 & 5.3 do not apply to brushless motors.*

5.4 Lubricate padlocks (RKB 222 padlock on the Pump Unit local control lid).

6. Additional Services (If required)

6.1 Where a Circuit Controller is used as detection, carry out NR/SMS/PartC/LV31 (Circuit Controllers) - Service B.

6.2 Where a 998 Detector is used for detection, carry out NR/SMS/PartC/PD01 (BR998 Detector) - Service B. (Detection Tests called in PD01 are not applicable to derailers.)

7. Detection Test

7.1 Carry out the derailer detection test as described in NR/SMS/PartB/Test/020 (Hydraulic Derailer (Type BRB 817) Tests)) - Section 2.

8. Final Checks

8.1 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests), unless monitored by ELD or fed directly from SSI module.

8.2 Refit and lubricate the padlocks (RKB 222 padlock on the local control lid).

8.3 Ask the Signaller to operate the derailer to normal and reverse positions (twice if possible), while observing the movement of the derailer is correct.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/PB19		
Mechanically Operated Derailer (Cambois, Keithley and Whitby)		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Derailers connected to Lever frames (Cambois Keithley Whitby)
Excludes:	All other Hydraulic Derailers – Non-Interlocked Derailers

GENERAL

Mechanical Derailer's use a standard mechanical channel rod connections to drive a Derailer mechanism. Detection can be accomplished using a standard circuit Controller or a 998 unit (NR/SMS/PartC/PD01) or with a convention circuit breaker (NR/SMS/PartC/LV31) or a mechanical detector (NR/SMS/PartC/PD03) as applicable.

SERVICE B

1. Derailer Unit

1.1 Examine the derailer for signs of cracking or damage.

1.2 Check the unit is correctly aligned.

1.3 Check the torque settings of the nuts for the bolts holding the de-railer mechanism to the rail at 80Nm.

1.4 Check the unit is not obstructed by ballast.

1.5 Check, when operated, the driving crank between the connecting rod operates smoothly and that the driving angle does not become chocked.

1.6 Check that grease nipples are fitted in the crank stud and joint pins.

1.7 Lubricate the bearings and grease the crank(s).

1.8 Check the drive does not interfere with the detector box connections.

2. Additional Services and Final Checks

2.1 Where a circuit controller is used as detection, carry out NR/SMS/PartC/LV31, (Circuit controllers) - Service A.

2.2 Where a 998 Detector is used for detection, carry out NR/SMS/PartC/PD01 (BR998 Detector) - Service A, (Detection Tests in PD01 are not applicable to Derailers).

2.3 The final check before completion of the work is to operate the derailer to normal and reverse positions (twice if possible), while observing the movement is correct.

END

Includes:	Train Operated (Hydro-Pneumatic) Points
Excludes:	All other Train Operated Points

The equipment shall not be operated electrically until any adjustments have been proved by hand pump operation.

Nuts that are tight shall not move by the application of a short handled spanner.

Any tightening of nuts or adjustments shall be reported as a corrective maintenance as per NR/SMS/PartA/A02 (Preventative & Corrective Maintenance).

SERVICE A

1. General

1.1 Remove fire risks and potential obstructions from the area of the mechanism.

1.2 Examine the following:

a) Accumulator and hand pump case castings. Look particularly for cracking.

b) Ramps and fixings.

c) Guard assemblies.

d) Fixings - check all bolts are tight.

1.3 Examine accumulator, actuators and hand pump unit. Remove any foreign bodies Look for signs of hydraulic fluid leakage.

1.4 Check the position of the pressure gauge needle in the accumulator unit.

Warning: If the needle is in the RED sector, the apparatus shall be treated as failed, taken out of service and the Signaller informed immediately.

1.5 Carry out NR/SMS/PartB/Test/018 (Train Operated Points Detection Test).

1.6 Hand-pump the points to the reverse position. Operate the valve and observe the points return to the normal position within 17-20 seconds.

1.7 Check a RKB222 padlock is fitted to the hand pump unit.

1.8 Lubricate hinges and padlocks.

SERVICE B

2. Exterior

2.1 Clean accumulator and hand pump units.

2.2 Examine all bolts and set screws.

Typical Drawing

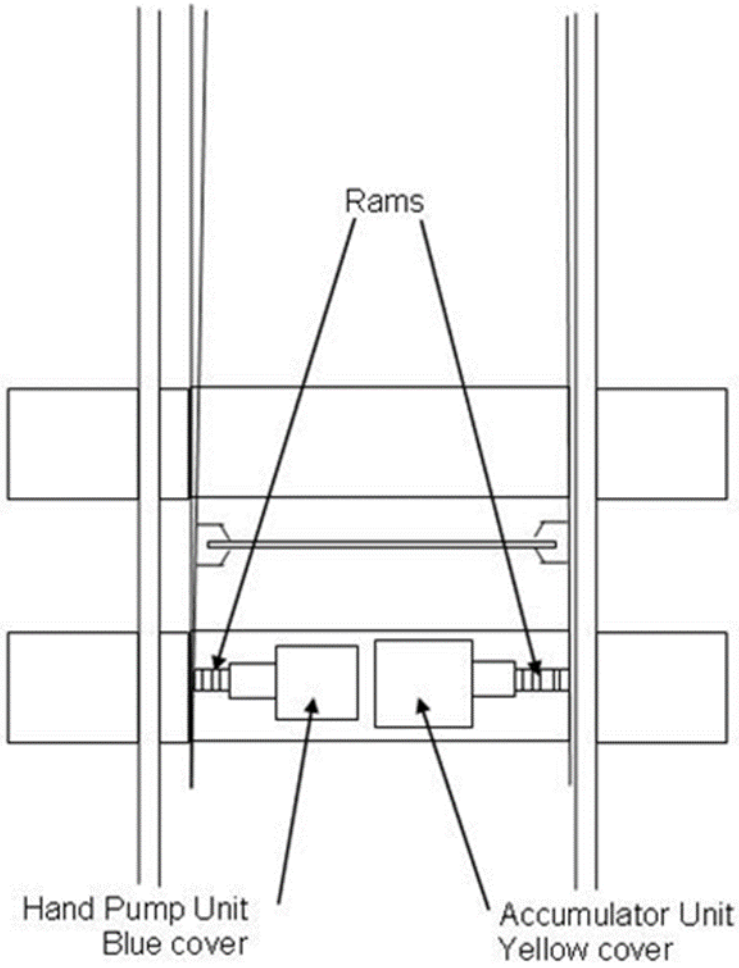


Figure 1 – Accumulator Layout

END

Includes:	HW1000, HW2000 Style point drive machines
Excludes:	Point inspections, Point fittings and Supplementary drives

GENERAL

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

Any tightening of nuts or adjustments shall be reported as corrective maintenance.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. Exterior

2.1 Observe the point machine operation under power. Check that there is no movement relative to the bearers. If movement is observed, tighten fixing bolts to 100-120Nm.

2.2 Remove the covers, clean and examine lock and detector blades, throw bar and insulations. Check all nuts are tight.

2.3 Check the machine covers for cracks and damaged, loose, or missing components.

2.4 Remove fire risks and potential obstructions.

2.5 Examine and lubricate the crank handle cut out contact cover plate and hinge.

2.6 Check the visible tail cables and route. Check that cables are not trapped or covered by P/Way materials.

3. Interior Mechanism (Cover removed)

3.1 Examine the crank handle cut-out contact. Check that when the crank handle is inserted the contact breaks.

Operation of the crank handle cut-out contact isolates the machine.

Crank handle cut-out broken isolating the machine (crank handle removed for clarity). See Figure 1.

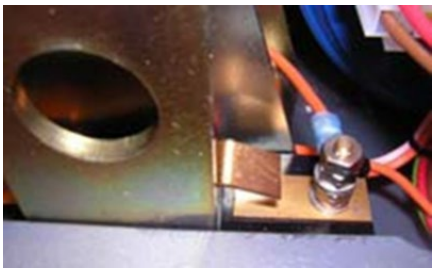


Figure 1 – Crank Handle Contact

The recommended opening of the crank handle cut-out contact is 6mm.

3.2 Operate the machine via the crank handle and examine the lock dog. Look particularly for wear (swarf) and chamfering (bright corners).

The lock dog is shown mid stroke. Heads of split pins can be seen above the lock slide rollers. Figure 2.

NOTE: *The detection slides have been removed in Figure 2.*

Figure 2 – Lock Dog

With point switch fully closed (x), there shall be a 1.5mm clearance on each lock face (y & z).

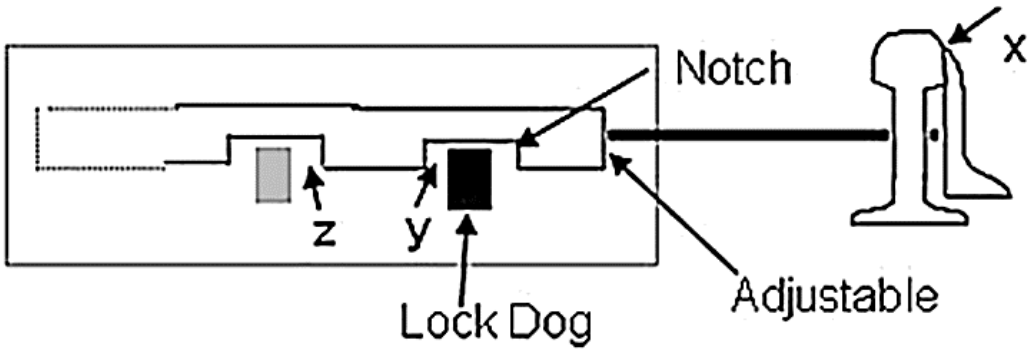


Figure 3 – Lock Slide and Dogs (not to scale).

Temperature changes can cause expansion/contraction of the detector rod and result in a tight lock.

3.3 Examine the nut on main gear stud in centre of bevel gear casting.

3.4 Examine the resistor and rectifier/diode units.

3.5 Examine the cable cores, internal wiring, terminals, and plug couplers. Clean and protect as necessary.

3.6 Examine the following:

a) Tail cable sheath.

b) Tail cable plug coupler.

c) Cable gland and blanking plates.

d) Drain holes.

3.7 Check the heaters.

3.8 Wipe and examine locking bar wear plates and bolts.

3.9 Remove the gear train cover. Report as corrective maintenance any missing or loose (unable to correctly fasten down due to sheared bolts) gear train covers.

3.10 Examine the following:

a) Clutch springs and nuts (HW1000).

b) Magnetic clutch (HW2000).

3.11 Examine holding bolts on:

a) Motor (3 fixing bolts plus casing through bolts).

b) Intermediate gear train.

c) Throw bar retainer plate.

d) Bevel gear casting.

e) Contact Assembly.

3.12 Check the tightness of the four corner bolts securing the Detection Frame.

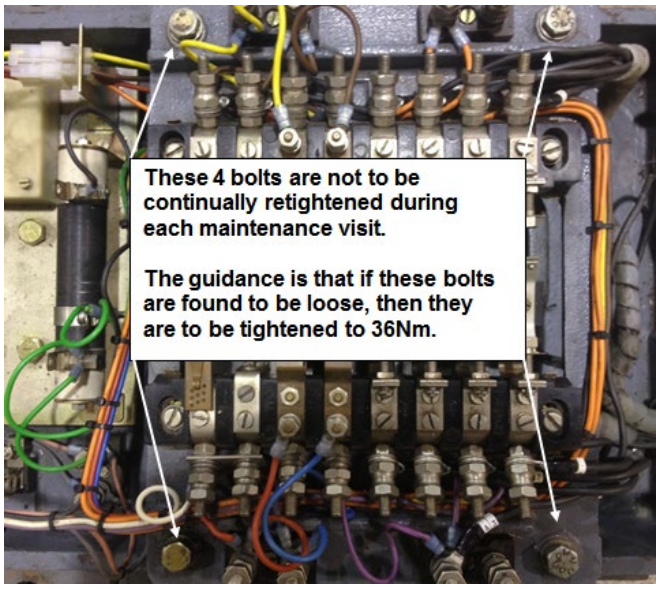


Figure 4 – Detection Frame bolts

3.13 Check that the spirol pin securing the pinion gear to the motor shaft is in place and secure.

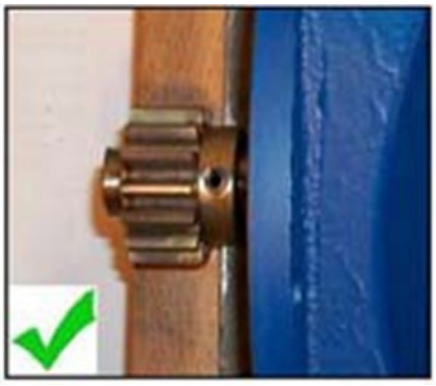


Figure 5 – Correct spirol pin position

Figure 6 – Spirol pin working loose

3.14 Examine the ball races and retaining screws on gear train. The presence of swarf indicates a problem.

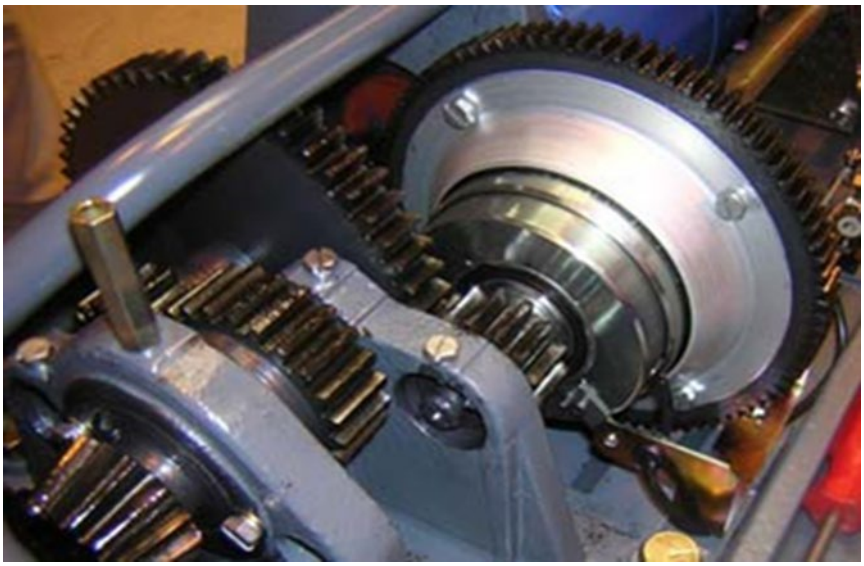


Figure 7 - Gear train on a HW2000 machine with the gearbox cover removed

3.15 Lubricate the gear teeth with lithium grease.

3.16 Lubricate the gear train cover retaining with lithium grease screws, then replace the gear train cover.

3.17 Check, clean and lubricate the bearing surfaces of the throw bar, locking bar, lock, and detector blades with dry film lubricant (EP) or lithium grease.

3.18 Check, clean and lubricate the external surfaces of the throw bar, locking bar, lock, and detector blades with dry film lubricant (EP) or adhesive grease.

3.19 Check, clean and lubricate the throw bar and detection rollers with dry film lubricant (EP) or oil.

4. Contact Assembly

4.1 Check where visible split pins on the following:

a) Detection roller.

b) Lock slide connection arms.

c) Lock arm roller.

Split pins in situ can be seen in the picture of the lock slide in Figure 2.

4.2 Observe the rollers whilst winding the machine. Rollers shall rest on bottom of notches in both N & R positions and rotate freely.

An image of the lock slide roller split pins can be seen in Figure 2.

Figure 8 - Rollers

The rollers can be seen below the contacts (See Figure 8) from a HW1000 machine. Note that the lock slide is mid-stroke and the detection slides have been removed.

4.3 Check the contact centre fixing screws.

4.4 Examine the following:

a) Motor control and detection contacts. If the motor control contact has been fully plated (i.e., to include the braid) it requires replacement.

b) Snubbing contacts (HW1000).

c) Magnetic clutch contacts (HW2000).

4.5 Contacts that are worn or show signs of arcing shall be cleaned or replaced as required.

4.6 Check the contact fingers. Clean as necessary.

4.7 Do not apply any lubrication to the contact surfaces.

5. Tests and Final Checks

5.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

5.2 Remove the crank handle and confirm the crank handle cut-out contacts are closed. Observe the operation of the points in both directions under power operation.

5.3 On HW1000 machines observe that the snubbing is effective.

If the snubbing is not working correctly there can be 'kick-back' on the motor; this is defined as angular movement of the crown gear.

This does not affect HW2000 machines as the motor is disconnected by the electro-magnetic clutch at the end of operation.

5.4 Check for foreign bodies in the machine; replace all the covers and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlock.

5.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

5.6 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

6. General

6.1 Isolate the machine by inserting the crank handle and confirming the crank handle contact breaks.

6.2 Clean the cover (inside and out) and the casting.

7. Motor / Drive Mechanism

7.1 Remove the motor brush/commutator cover and examine the motor commutator (it shall be a light brown/coffee colour).

7.2 Clean as necessary by pressing a clean, lint free cloth moistened with an approved cleaner onto the surface of the commutator and rotating by means of the crank handle.

7.3 Examine the motor brushes and spring retainers.

Brushes shall slide freely in the holders and seat fully on the commutator.

Brushes shall be replaced when worn to 10mm long.

After examination check that the brushes are replaced in their original positions.

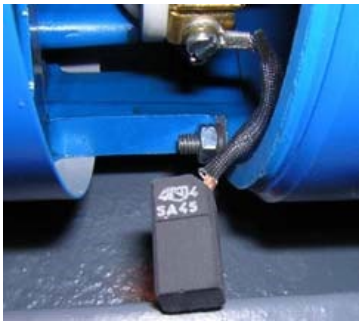


Figure 9 - A new motor brush before insertion in its holder

8. Contacts

8.1 Examine the condition of and clean as necessary using lint free cloth moistened with an approved switch cleaner:

a) Snubbing contact (HW1000).

b) Clutch control contacts (HW2000).

c) Normal and reverse detection contacts.

d) Motor control contacts.

e) Crank handle cut-out contact.

Point Detector Contacts (HW1000 and HW2000)

8.2 Check the following:

a) The springs are not deformed.

b) The open contact; spring (1) bears against adjusting screw (2).

c) The closed contact; spring (3) has approximately 2mm clearance to the head of the adjusting screw (4).

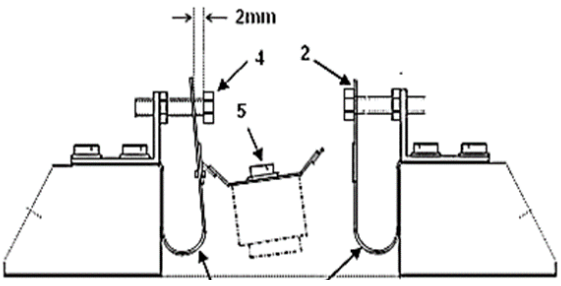


Figure 10 - HW1000 and HW2000 Contacts

d) The screw on the rocker (5) is secure.

e) When the rocker is operated, all detection contacts make at the same time. Check for both normal and reverse positions.

The bending of detection springs is not permitted; any deformed detection spring shall be replaced as corrective maintenance.

Details of adjustments are in Appendix A.

Clutch Control Contacts (HW2000 only)

8.3 Check the following:

a) The closed contact spring is making a good contact on the spring (5).

If not, it shall be replaced as corrective maintenance.

b) The contact (4) does not foul rivet head (1) on spring (2).

c) The open contact (3) is approximately 5mm.

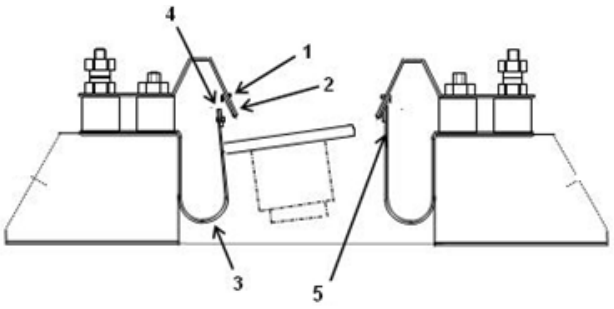


Figure 11 – Clutch Contacts

Motor Control Contacts

8.4 Measure the gap between the fixed contact and the spring contact. The contact gap shall be between 6.3mm and 8mm. If it is more than 8mm, the spring pressure can be too light.

8.5 Check that the open spring contact is free to move.

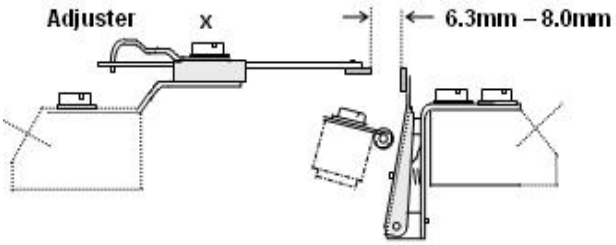


Figure 12 – Motor Contacts

9. Disconnection Boxes (if provided)

9.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

d) Where fitted, check that the plug couplers are fastened so that they cannot vibrate loose.

9.2 Refit the lid and (if provided) padlock, check they are fitted securely.

10. Local Policy Requirement

10.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Detection Loop Test) as directed.

11. Tests and Final Checks

11.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests (Electrical Detectors)).

11.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

11.3 Before completing this task confirm the following:

a) Hands and clothing shall be kept clear of all moving parts whilst carrying out this test.

b) If any adjustments are required to machine, the machine shall be re-isolated. If a meter has been used to complete the drive circuit it shall be unclipped and moved away from the machine.

c) The meter used shall be capable of measuring the currents involved.

Place a current clamp meter around the drive circuit cable or connect a multi-meter across the open cut-out contacts. Record the operating current whilst operating the points N-R and R-N (max 10A). Ignore the initial surge current.

An increase in the current required to operate the machine can indicate an underlying problem.

Any increases shall be investigated as corrective maintenance.

11.4 With an obstruction between switch and stock rail. Record the operating current whilst operating the points N-R and R-N. Observe correct operation of the overload cut out protection within 6 to 9 seconds.

Before adjusting the clutch on a HW1000, if a meter has been used to complete the drive circuit it shall be unclipped and moved away from the machine before any adjustments are made.

The clutch slip current shall be set to 12A ±2A.

NOTE: *The clutch can be adjusted on the HW1000, but not on the HW2000. See Appendix B.*

11.5 Return the point machine to power operation and confirm the crank handle cut-out contacts are closed.

11.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

This can be undertaken as part of the location or equipment room tasks.

11.7 Check for foreign bodies in the machine; replace all the covers and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlock.

11.8 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

11.9 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE V1

12. Visual Inspection

12.1 Check for potential fire risks and obstructions around the S&C and within close proximity of the POE mechanism and fittings.

12.2 Check sleeper beds are clear of any obstructions.

12.3 Check cables and cable routes for any visible damage and are clear from any rodding runs.

12.4 Check the correct padlock is fitted.

12.5 Check the covers are fitted and not damaged.

12.6 Observe the operation of the points and investigate any issues found.

12.7 Check while points are operating that there is no movement relative to the bearers.

12.8 Report any significant wheel burns, rail defects and poor permanent way.

12.9 If applicable, report any adjustment / replacement / further work carried out to remove a defective condition within the POE.

12.10 Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection is obtained.

SERVICE R1

Remote Condition Monitoring

If the points that you have requested to work on are fitted with Remote Condition Monitoring, check that the asset has been placed into maintenance mode prior to commencing work.

Prior to commencing work, it is recommended that the previous current traces are made available from the Remote Condition Monitoring system and checked for any abnormalities.

Also, on completion of the work it is recommended that new traces are recorded and viewed, so they can be compared with the traces produced before the maintenance activity.

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

13. Operation

13.1 Observe the motion of the points, while the Signaller is operating them, look for signs of resistance to movement which could be caused by:

a) Stretcher Bars Bowing.

b) Roller set-up.

c) Supplementary Drive set-up.

d) Overdriving.

e) Contaminated base plates.

f) Binding kicking strap.

13.2 Observe the point machine operation under power. Check that there is no movement relative to the bearers. If movement is observed, tighten fixing bolts to 100-120Nm.

13.3 Once the Signaller has confirmed you have possession of the points, insert the crank handle and check that the cut-out contact is broken.

13.4 Remove the covers and observe the travel of the Lock and Detector Blades and Throw bar.

13.5 Check tightness of the four bolts securing the bevel gear mounting plate, Figure 13.

13.6 Check the tightness of all other point machine fixings.

13.7 Check the Spirol pin securing the pinion gear to the motor shaft is in place and secure, Figures 14 and 15.

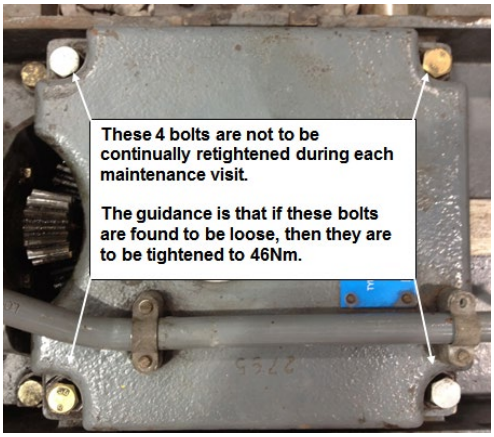


Figure 13 – Mounting plate bolts

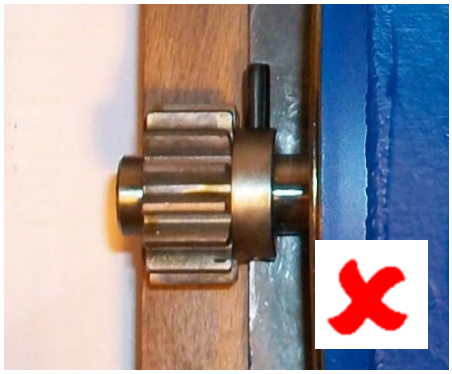


Figure 14 – Incorrect fitting

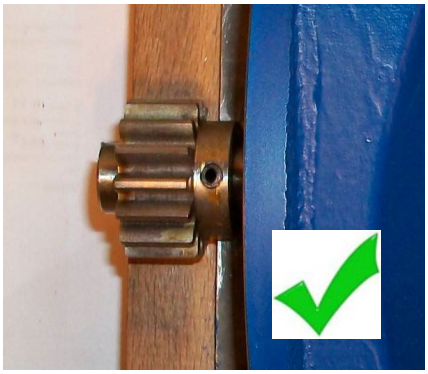


Figure 15 – Correct fitting

13.8 Check the tightness of the four corner bolts securing the Detection Frame.

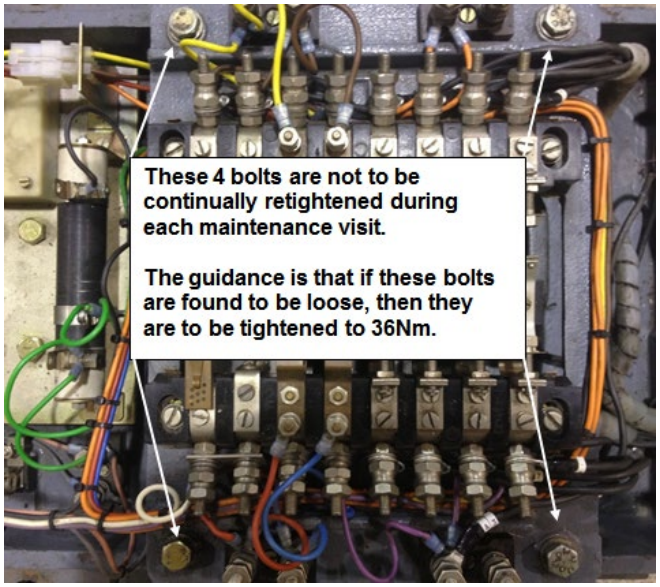


Figure 16 – Detection Frame bolts

13.9 Examine the Lock blades notches for signs of swarf or impact damage.

13.10 Examine the Point Machine case for signs of cracking.

13.11 Check the wiring is secured of to prevent it being damaged and kept away from moving parts.

13.12 Check cable glands / plug couplers securely hold the cables and are preventing water ingress.

13.13 Where fitted, check that Plug Couplers are correctly fastened so that they cannot vibrate loose.

Figure 17 – Plug Couplers

13.14 Lubricate the Lock and Detector Blades, Throw-bar, Gear teeth, Crank handle Cut-Out Mechanism and Padlock.

13.15 Examine all the contacts for signs of wear, arcing or deformation - clean or replace as necessary.

13.16 Check that the Cut-out contact is made.

13.17 Report any adjustments made, components replaced or out of specification items on a WAIF.

13.18 Replace the covers and lids.

13.19 Before leaving site arrange for the Signaller to operate the points in both directions and confirm the Signaller obtain detection.

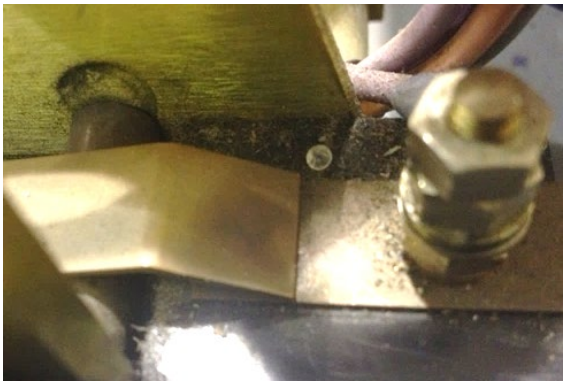


Figure 18 – Cut-out Contact

13.20 Where Remote Condition Monitoring is fitted and work on this set of points has been completed, check with local RCM team that asset trace has not deteriorated following maintenance. If there are no issues take out of maintenance mode.

SERVICE R2

These tasks should be performed in addition to Service R1.

14. Inspection and Service

For HW1000 only

14.1 Check that snubbing stops the motor rapidly and cleanly in both direction when moved on power.

All Types

14.2 Check the motor brushes are, the correct type, free to slide within holder and greater than 10mm in length.

14.3 Check the brush holder is free from excessive carbon and clean commutator so that it's a bright copper colour.

15. Local Policy Requirements

15.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/019 (Detection Loop Test) as directed.

16. Test

16.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

16.2 Carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

16.3 Check all closed contacts are correctly adjusted.

16.4 Check the Motor Control Contacts are correctly adjusted to an opening of between 6.3mm and 8mm.

16.5 Check the split pin has not broken and centre pin has not moved, see Figure 19.

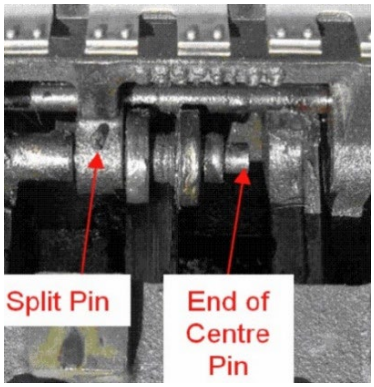


Figure 19 – Centre Pin

16.6 Check the Cotter/Split pins holding the Yoke have not broken, see Figure 20.

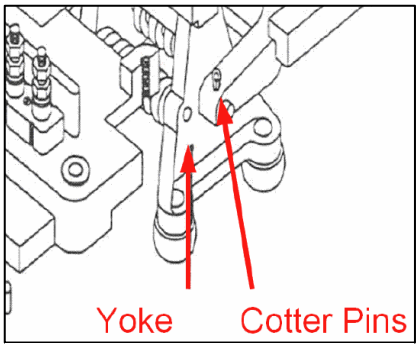


Figure 20 – Cotter Pins

16.7 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

16.8 Report Any adjustments made, components replaced or out of specification items on a WAIF.

16.9 After completion of the service, remove the point handle.

16.10 Check the cut-out contact is made.

16.11 Replace the covers and lids.

16.12 Before leaving site arrange for the Signaller to operate the points in both directions and confirm the Signaller obtain detection.

16.13 Where Remote Condition Monitoring is fitted and work on this set of points has been completed, check with local RCM team to confirm the asset trace has not deteriorated following maintenance. If there are no issues take out of maintenance mode.

APPENDIX A - Adjustment of Contacts

Before adjustment of any contacts investigate why adjustment is required. Other factors can be causing the need for adjustment. Motor contacts wear due to the high currents they carry, replacement can be more advisable. Detection and clutch (on HW2000) contacts should not need adjusting.

Individual Detection Contacts

The fine adjustment of individual detection contacts can be undertaken by the adjusting screw, slacken off the lock nut then using a screwdriver adjust the screw. Tighten the lock nut on completion.

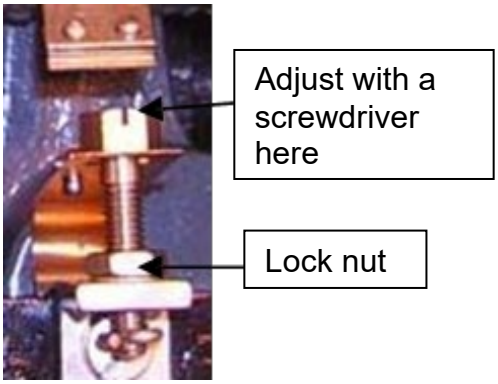


Figure 21 - Detection Contact

Motor Contacts

Loosen the retaining screw enough to lift the retaining spring from the adjustment hole. Move the contact into the required position and tighten down the retaining spring in the new adjustment hole.

Figure 22 - Motor Contact

All Contacts

The contact assembly is factory set and any adjustment affects all the contacts.

Adjustments shall only be undertaken if your SM(S) has deemed you competent and the points are in failure mode.

Release locking tabs.

1. Loosen two screws in contact block assembly.
2. Adjust as required.
3. Retighten screws and turn up locking tabs.
4. Re-measure all contacts.

Figure 23 – Locking Screws

APPENDIX B - Clutch Adjustment

All clutches are pre-set, if adjustments are required further investigations into the reason why should be undertaken before adjustments are made.

HW1000:

The dry plate clutch is adjusted mechanically by increasing or decreasing the clutch spring pressure by means of the four nuts on the clutch gear.

To increase the slip turn the nuts clockwise, conversely to decrease the slip turn the nuts anticlockwise.

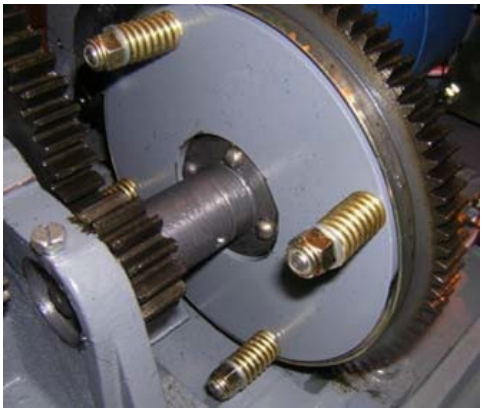


Figure 24 - Mechanical clutch on a HW1000 machine

HW2000:

The electro-magnetic clutch is adjusted by means of a variable resistor.

This clutch cannot be adjusted mechanically.

Figure 25 - Electromagnet clutch on a HW2000 machine

APPENDIX C - Point Layout

- Typical Drawing of a HW Point Layout (Right Hand Machine) not to scale.
- The sole plate and sleepers have been omitted for clarity.

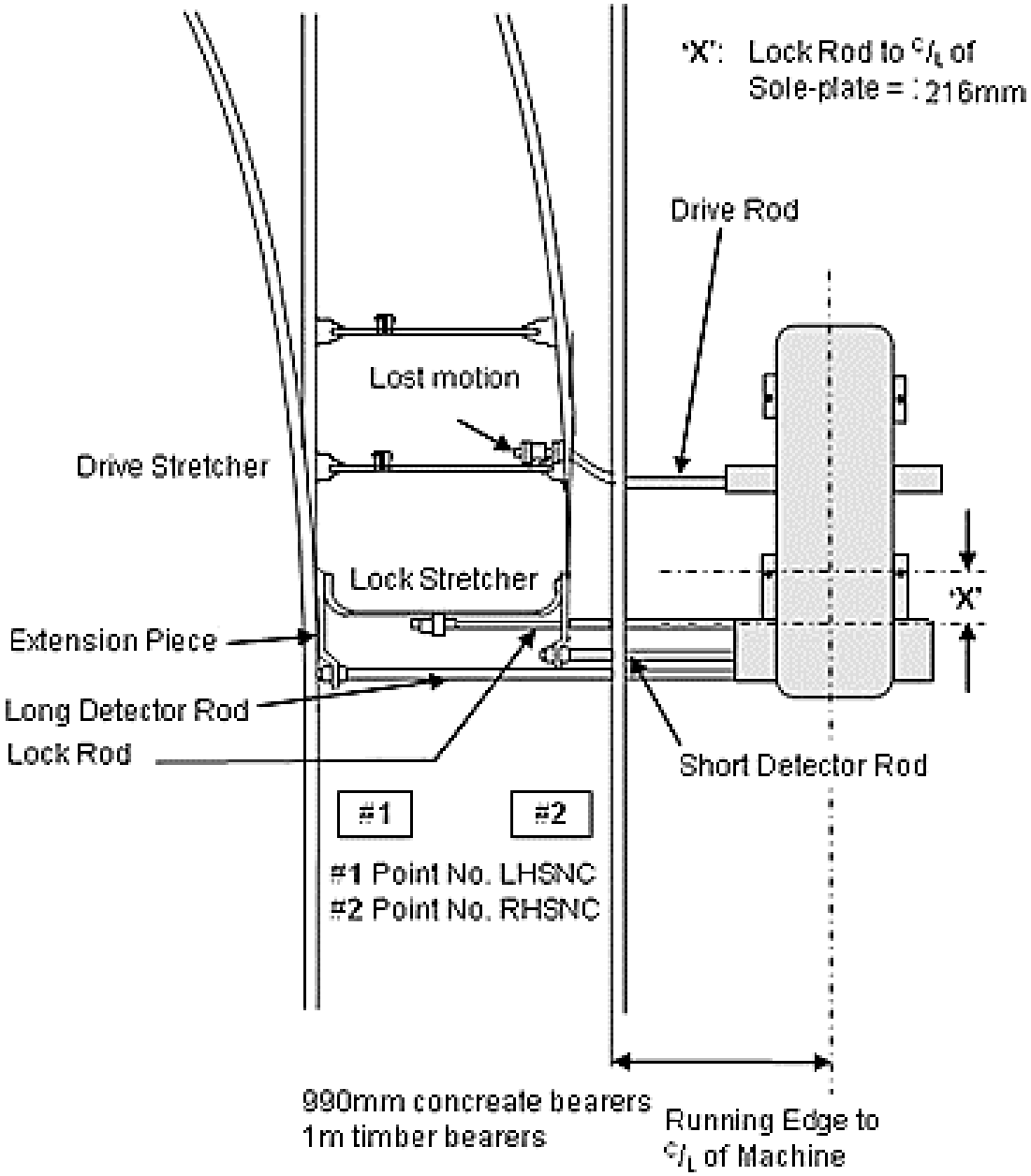


Figure 3 – Point Layout

APPENDIX D - Schematic Diagram of a HW (Left Hand) machine.

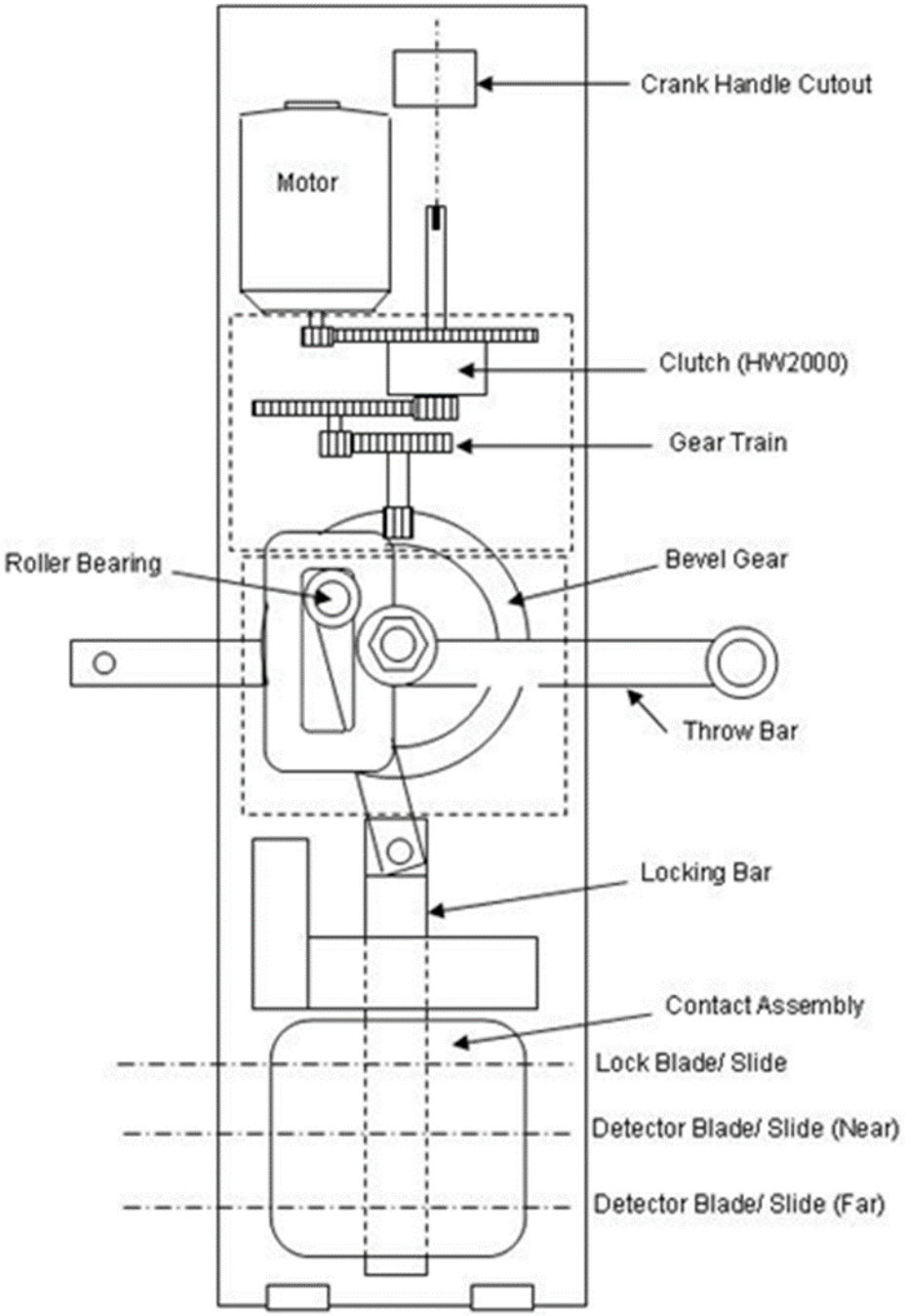


Figure 4 - Schematic Diagram of a HW (Left Hand) machine

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/PC22		
Point Machine MV-GRS Model 5 Style		
Issue No: 5	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Models 5A, 5E and 5P point drive machines
Excludes:	Point inspections, Point fittings and Supplementary Drives.

General

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

Any tightening of nuts or adjustments shall be reported as corrective maintenance.

Further information on these machines is available in the ML Manual JEA50/ML3-1.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. Exterior

2.1 Check and tighten point machine fixings.

Operate machine under power and observe that there is no movement relative to the bearers. If movement is observed, tighten fixing bolts to 100- 120Nm and arrange a re-check at the next visit.

2.2 Clean and examine lock and detector blades, throw bar, and insulations (tighten as necessary).

2.3 Remove cover plates. Clean and protect throw bar, lock, and detector slides with adhesive grease.

NOTE: *Do not allow excessive amounts of grease to enter the machine.*

2.4 Check machine covers and base casting for cracks.

2.5 Remove fire risks and potential obstructions.

2.6 Examine and lubricate crank handle cut out contact cover plate and hinge.

2.7 Check visible tail cables and route. Check cables are not trapped or covered by P/Way materials.

3. Motor Assembly

NOTE: *Before starting any work, isolate the machine using the crank handle cut out. In some areas the cut out is in a separate switch box which can isolate several point ends at once. If in doubt, ask your SM(S).*

3.1 Remove cover plate. Check casting, latch, and water seal.

3.2 Check motor is securely mounted and not damaged.

3.3 Check the following items:

a) Commutator. It shall be a light brown / coffee colour.

b) Brush and brush holder spring assemblies. Moisture and dirt can cause the brushes to stick in the holders, which can result in a motor failure.

c) Terminal blocks, braids, wiring, terminations and insulation.

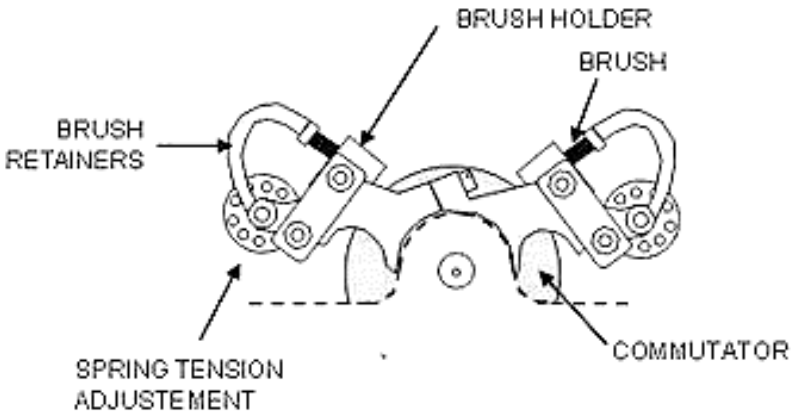


Figure 1 – Brush Holder Assemble

3.4 Check heaters and wiring, where fitted. The commutator and brushes are susceptible to condensation.

3.5 Replace and secure cover with RKB 221 padlock.

4. Drive & Clutch Assembly

4.1 Remove cover, check casting, latch, and water seal.

4.2 Remove moisture and debris from interior of machine casting. Check drain holes are clear.

4.3 Examine casting for cracking.

4.4 Check heaters and wiring, where fitted.

4.5 Clean and examine the clutch.

NOTE: *Where the clutch is fitted with a phosphor bronze bearing, the oil dash-pot should have been removed and the oil feed blanked off.*

Any still fitted shall be reported. Do not refill with oil.

Operate the machine using crank handle.

4.6 Clean and examine gears, wheels, and bearings.

4.7 Check main nut and gear fixings.

4.8 Clean and examine lock plunger, lock dog and throw bar, where visible Look for signs of chamfering and metal swarf.

This indicates that the FPL is incorrectly adjusted.

5. Crank Handle Cut-Out

5.1 Clean and examine the crank handle cut-out mechanism including; casting and fixings, Split pins, pivots, Linkage rods and arms, contact plunger, and insulation

5.2 Check latch operation and contact spring/plunger alignment.

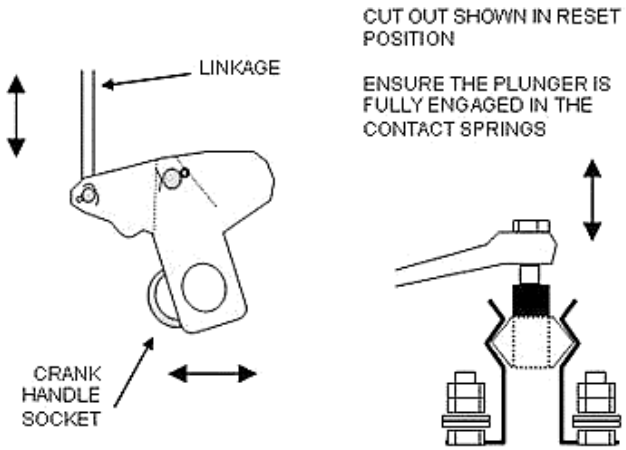


Figure 2 – Crank Handle Operation

5.3 Clean (using a lint free cloth) and examine crank handle cut-out contact, including:

a) Contact springs. These might be subject to arcing.

b) Terminals.

c) Wiring & terminations.

Protect as necessary, excluding contact faces.

6. Contact and Terminal Assembly

6.1 Remove cover; Check casting, latch and water seal.

6.2 Remove moisture and debris from interior of machine casting. Check drain holes are clear.

6.3 Examine casting for cracking.

6.4 Examine tail cable entry and gland.

6.5 Check heater and wiring, where fitted.

6.6 Examine cable cores, internal wiring and terminals. Clean and protect as necessary.

Model 5P Only

6.7 Clean and examine the polarised contactor unit, termination board, and resilient mounts. Disconnection of the contactor causes the detection to become broken.

Model 5A & 5E Only

6.8 Examine the pole changer assemble;

a) Check the wires, terminations.

b) Contact fingers.

c) Check insulation for degradation.

Protect as necessary, excluding contact surfaces.

6.9 Check contact assembly holding bolts and terminal block fixings.

6.10 Check split pins on the following:

a) Detection roller.

b) Lock slide connection arms

c) Lock arm roller

6.11 Examine detection contact adjustment. Rollers shall rest on bottom of notches in both N & R positions and rotate freely.

6.12 Check contact alignment and centre fixing screws.

6.13 Examine motor control and detection contacts: Contacts that are worn, abrased or show signs of arcing shall be cleaned or replaced as required.

6.14 Check contact fingers. Clean and protect as required. Do not apply anything to the contact surfaces.

7. Lubrication

7.1 Lubricate with lithium grease the following items:

a) Lock plunger and throw bar surfaces.

b) Surfaces of lock and detector blades.

c) Gear teeth.

d) Bearing grease nipples.

7.2 Lubricate with mineral oil the following items:

a) Detector carriage rollers.

b) Crank handle linkage pivots.

c) Dash pots on main gears.

d) Dash pot on clutch (where provided).

e) Wick feeds to gear bearings.

f) Ball bearing roller in the upper end of intermediate gear shaft.

g) Driving roller (through the hole in the main gear wheel.

h) Detector rod covers securing bars, latches and padlocks.

8. Tests & Final Checks

8.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

8.2 Reset the crank handle cut-out and detection circuit. Check that the cut-out contacts fully engage.

8.3 Observe correct operation of the machine. There shall not be any excessive ‘kick-back’ on the motor.

8.4 Check for foreign bodies in the machine, replace cover, and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlocks.

8.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

8.6 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

NOTE: *Isolate as for Service A if not already done so.*

9. General

9.1 Clean the cover (inside and out) and casting.

10. Motor Assembly

10.1 Examine the motor commutator (it shall be a light brown / coffee colour). Rotate using the crank handle and clean by pressing a clean, lint free cloth moistened with an approved cleaner onto the surface of the commutator.

10.2 Examine the motor brushes and spring retainers. Brushes shall slide freely in the holders and seat fully on the commutator. The spring retainers shall have a tension of 900 – 1140g (2 – 2 ½ lb).

The tension can be adjusted by unlocking and rotating the knurled wheel. Brushes shall be replaced when worn to 2mm (minimum) from brush holders.

They shall be replaced sooner where points are frequently operated. New brushes require grinding in.

11. Contacts

11.1 Clean using lint free cloth moistened with switch cleaner:

a) Normal and reverse detection contacts.

b) Motor control contacts.

c) Crank handle cut-out contact.

d) Pole changer contacts (Models 5A & 5E only).

12. Point Detector Contacts

NOTE: *Measurements shall be taken using a suitably marked rule. If the gaps are correct, the spring tension is correct.*

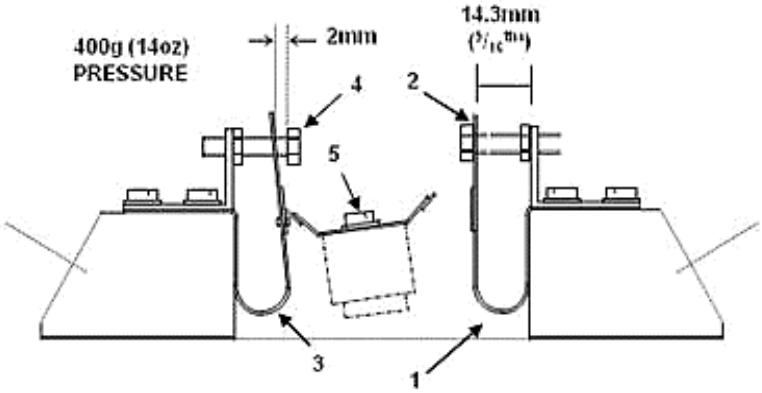


Figure 3 – Detection Contact Layout

12.1 Check the following:

a) Open contact; spring (1) bears against adjusting screw (2).

b) Closed contact; spring (3) has 2mm clearance to the head of the adjusting screw (4).

c) Screw on rocker is secure.

d) When the rocker is operated, detection contacts make at the same time. Check for both positions.

12.2 To adjust contact block alignment, use the following sequence:

a) Release locking tabs.

b) Loosen two screws in contact block assembly.

c) Adjust.

d) Retighten screws and turn up locking tab.

e) Gauge as above.

13. Pole Changer Unit (Models 5A and 5E)

13.1 Check that the contact fingers make a good contact with the control block.

13.2 Check that the magnetically operated member of the pole changer follows the action of the controlling point lever or switch by the following method:

a) Operate the point lever or switch to the opposite position (N-R or R-N).

b) Before the point movement is complete return the lever to its original position.

c) Check that machine action follows the movement of the lever and returns the points to their original position.

13.3 Move the points to the opposite lie and check that the contact fingers make a good contact with the control block.

14. Disconnection Boxes (if Provided)

14.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

14.2 Refit the lid and (if provided) padlock, check they are fitted securely.

15. Tests and Final Checks

15.1 Carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

15.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

15.3 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

Return to power operation

15.4 Clutch test: record the operating current whilst operating the points N-R and R-N (max 10A).

15.5 Repeat test 15.4 but with an obstruction between switch and stock rail. The clutch slip current shall be set to 12A ±2A.

If this is incorrect, adjust the clutch (Appendix A/B). Observe correct operation of the overload cut-out protection (6 - 9s).

This test shall be undertaken using a meter or a current clamp meter capable of measuring the currents involved.

15.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

It is recommended that this test be carried out from the location case or equipment room if possible.

15.7 Check for foreign bodies in the machine, replace cover, and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlocks.

15.8 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

APPENDIX A - Clutch Adjustment Model 5P

1. Loosen the clutch locking screw (General layout), the clutch plate can then be rotated to increase or decrease the clutch pressure as required. Retighten the clutch locking screw.

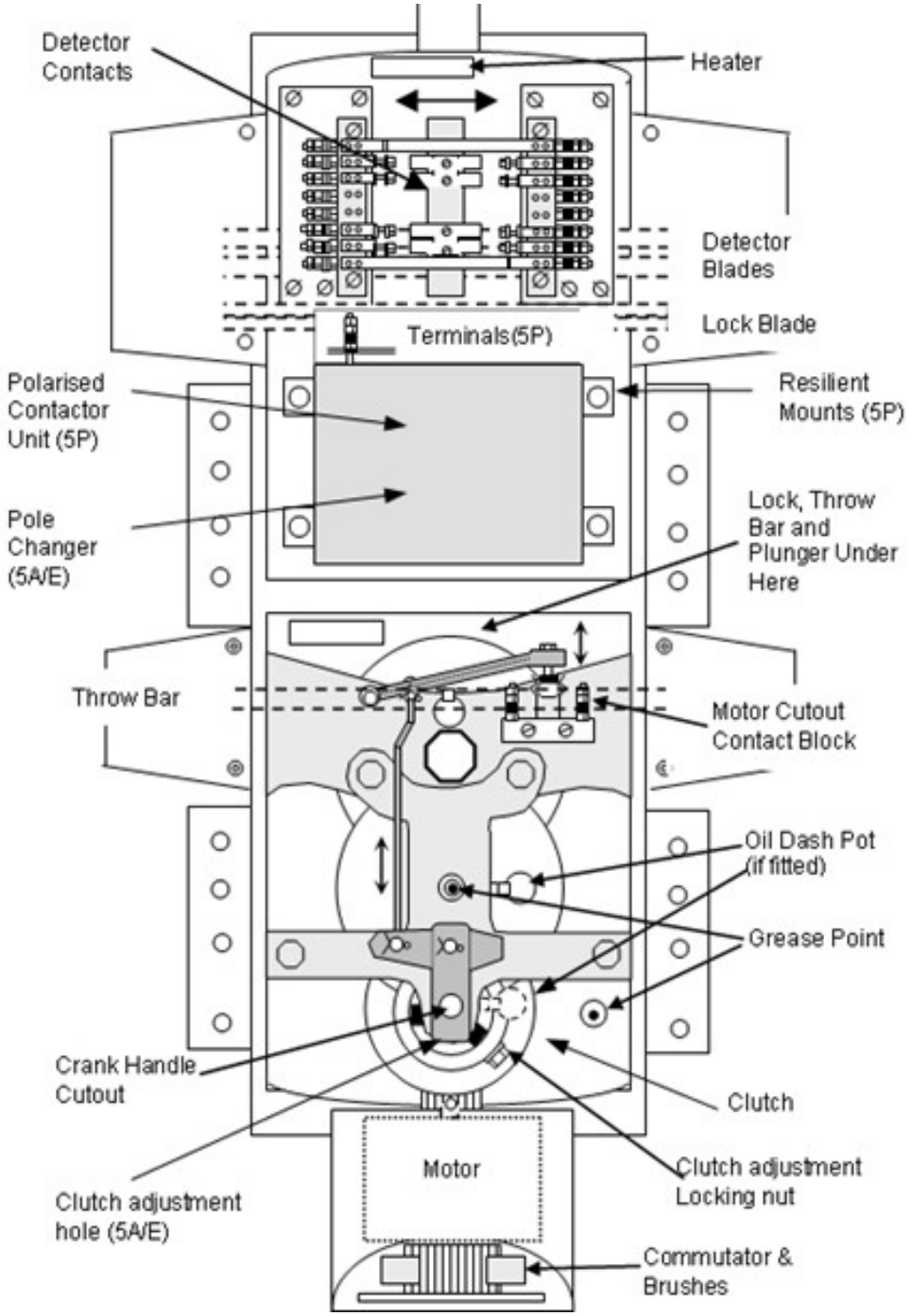
APPENDIX B - Clutch Adjustment Model 5A and 5E

1. Loosen the clutch locking screw (General layout); locate a 5mm pin through the hole in the bracket casting and into one of the holes of the adjusting nut.

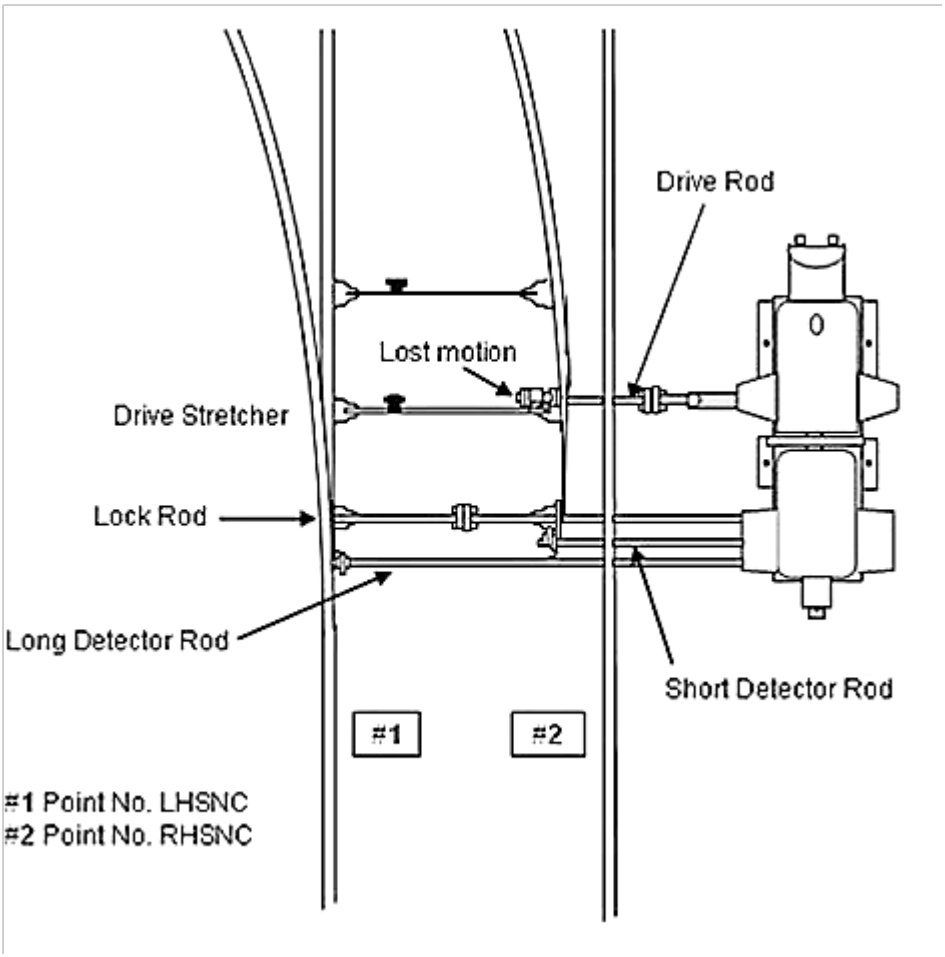
2. Insert the crank handle. To decrease the clutch pressure, turn the crank handle clock-wise, to increase the clutch pressure turn the crank handle anti-clock wise. Retighten the clutch locking screw.

3. If the clutch is so loose that the friction is not enough to tighten the adjusting nut, rotate the clutch body until the friction has increased enough to allow adjustment with the crank handle.

APPENDIX C - General Arrangement (Not to Scale)



APPENDIX D - Typical Drawing: 5P Point Layout – Right Hand Machine
(Not to Scale) (Sole-plate & sleepers omitted for clarity)



END

Includes:	Point Machine SGE Style HB
Excludes:	Point inspections, Point fittings and Supplementary Drives

General

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

Any tightening of nuts or adjustments shall be reported as corrective maintenance.

Further information on these machines is available in SGE Maintenance Manual.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. Exterior

2.1 Check and tighten point machine fixings. Operate machine under power and observe that there is no movement relative to the bearers.

If movement is observed, tighten fixing bolts to 100-120Nm and arrange a re-check at the next visit.

2.2 Remove cover plates and machine covers. Clean and examine lock and detector blades, throw bar, and insulations (tighten as necessary).

2.3 Apply adhesive grease to the throw bar, lock and detector slides.

NOTE: *Do not allow excessive amounts of adhesive grease to enter the machine.*

2.4 Remove fire risks and potential obstructions.

2.5 Check machine covers and fittings for cracks.

2.6 Check visible tail cables and route. Check cables are not trapped or covered by P/Way materials.

3. Interior Mechanism

Before starting any work, isolate the machine using the crank handle contact.

3.1 Clean interior of machine casting, remove moisture and debris. Check ventilators and lid gaskets.

3.2 Examine motor assembly holding bolts & spigots and casing bolts.

3.3 Examine clutch adjustment assembly:

a) Spring.

b) Castellated Nut.

c) Split Pin.

Lubricate with adhesive grease.

3.4 Examine crank handle latch assembly see Figure 1

Lubricate pins and slides with mineral oil. (Illustration shows machine isolated).

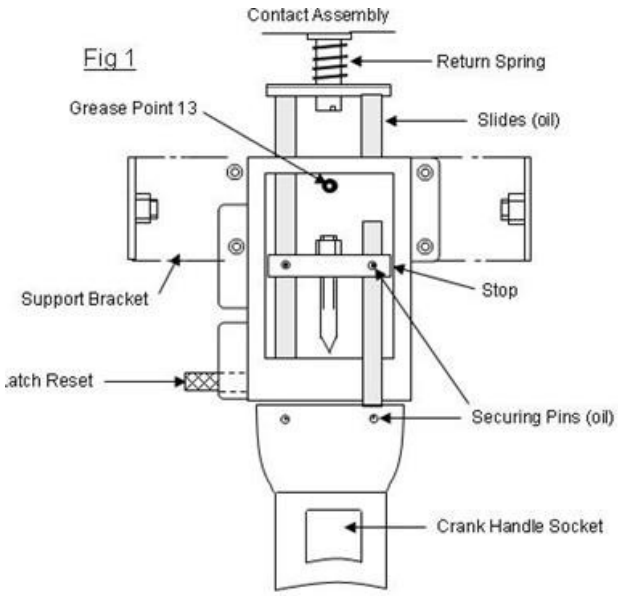


Figure 1 – Crank Handle Latch Assembly

3.5 Examine main and bevel gears and visible parts of throw bar and locking bar assembly.

3.6 Lubricate machine at grease points with lithium grease:

a) Motor bearings.

b) External casing.

c) Drive and throw bar mechanism.

3.7 Fill throw bar dashpots with mineral oil.

3.8 Examine the following:

a) Cable entry.

b) Tail cable sheath.

c) Wiring.

d) Ducting.

4. Motor Control Contact Assembly

4.1 Remove and examine cover plate and fixings.

4.2 Examine cam slot in locking bar, lubricate with lithium grease.

4.3 Check and clean vents and drain holes.

4.4 Examine the following (see Figure 2 for details):

a) Motor control arm pivot and roller.

b) Terminal blocks and fixings, tighten and protect as necessary.

c) Contacts and springs, clean and protect as necessary.

Protection shall not be applied to contact faces.

Contacts that are worn or have signs of arcing shall be cleaned or replaced as necessary.

d) Wiring and terminations.

e) Snubbing resistor.

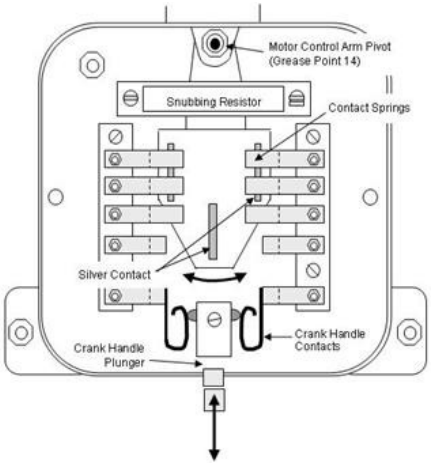


Figure 2 - Motor Control Contact Assembly

5. Lock & Detector Contact Assembly (Quick Acting)

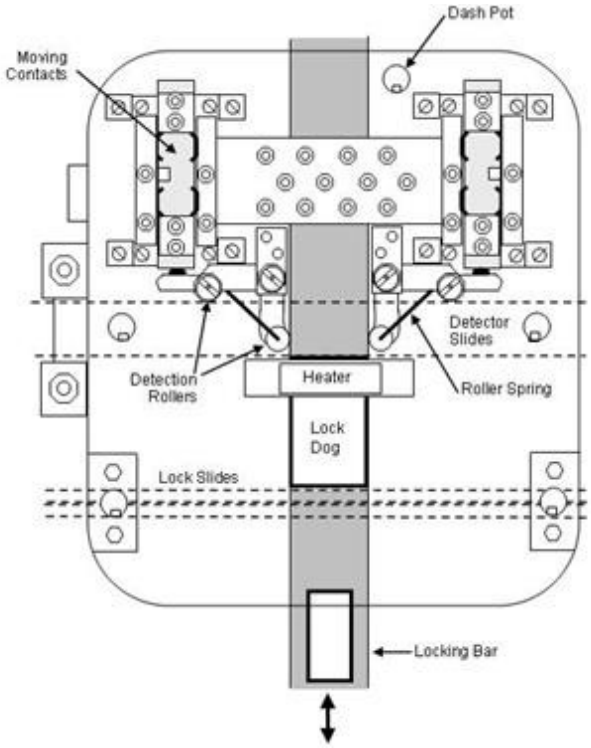


Figure 3 - Lock & Detector Contact Assembly

5.1 Check drain holes and clean moisture and debris.

5.2 Clean and examine: (operate using crank handle).

a) Locking bar and dogs.

b) Lock slides and notches.

c) Detector slides.

d) Cover plates, rubbing plates and fixings.

Look particularly for wear (swarf) and chamfering (bright corners).

With point switch fully closed (x), there shall be a 1.5mm clearance on each lock face (y & z).

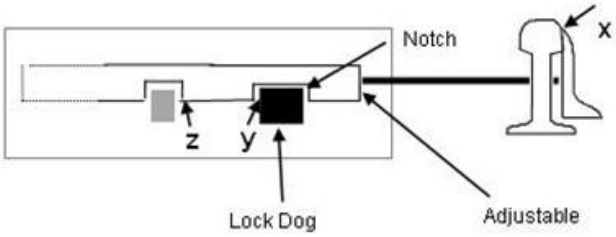


Figure 4 – Lock Blade Layout

5.3 Lubricate slides with lithium grease.

5.4 Fill the 5 dashpots with mineral oil.

5.5 Examine the following:

a) Detector actuators.

b) Rollers, lubricate with mineral oil.

c) Springs.

5.6 Examine the following:

a) Moving contact assemblies.

b) Terminal blocks & fixings, tighten / protect as necessary.

c) Contacts and springs, clean and protect as necessary. Protection shall not be applied to contact faces.

d) Cables, cable entries, wiring and terminations.

5.7 Check heaters, where fitted.

6. Tests & Final Checks

6.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine))

6.2 Reset the crank handle cut-out and observe correct operation of the machine. There shall not be any excessive ‘kick-back’ on the motor.

6.3 Observe the snubbing is effective.

6.4 Check for foreign bodies in the machine, replace covers and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlock and cover hinges.

6.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

6.6 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

Isolate as for Service A if not already done so.

7. General

7.1 Clean the cover (inside and out) and casting.

8. Motor / Drive Mechanism

8.1 Examine the motor commutator (it shall be a light brown / coffee colour). Rotate and Clean by pressing a clean, lint free cloth moistened with an approved cleaner onto the surface of the commutator.

8.2 Examine the motor brushes and holders. Brushes shall slide freely in the holders and seat fully on the commutator. Brushes shall be replaced when worn to within 3mm of brush holders.

New brushes require grinding in.

9. Contacts

9.1 Clean all contacts using lint free cloth moistened with an approved cleaner.

10. Disconnection Boxes (if Provided)

10.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

10.2 Refit the lid and (if provided) padlock, check they are fitted securely.

11. Tests and Final Checks

11.1 Carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

11.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

11.3 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

11.4 Return to power operation.

11.5 Clutch test: record the operating current whilst operating the points N-R and R-N (max 10A).

11.6 Repeat test 11.5 but with an obstruction between switch and stock rail.

Observe correct operation of the overload cut-out protection (6 - 9s).

This test shall be undertaken using a meter or a current clamp meter capable of measuring the currents involved.

The clutch slip current shall be set to 12A ±2A.

The mechanical clutch is adjusted mechanically by increasing or decreasing the clutch spring pressure.

To do this, remove the pin and rotate the castellated nut. When correct, replace the split pin.

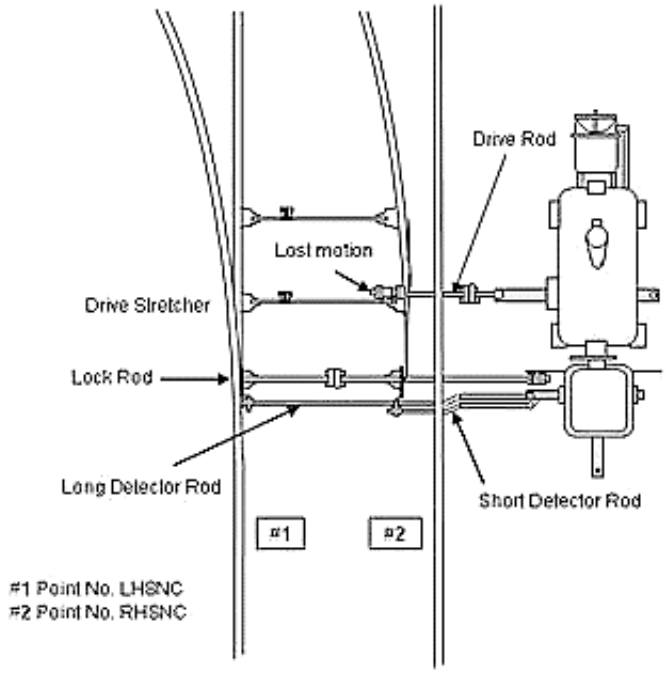
11.7 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

It is recommended that this test be carried out from the location case or equipment room if possible.

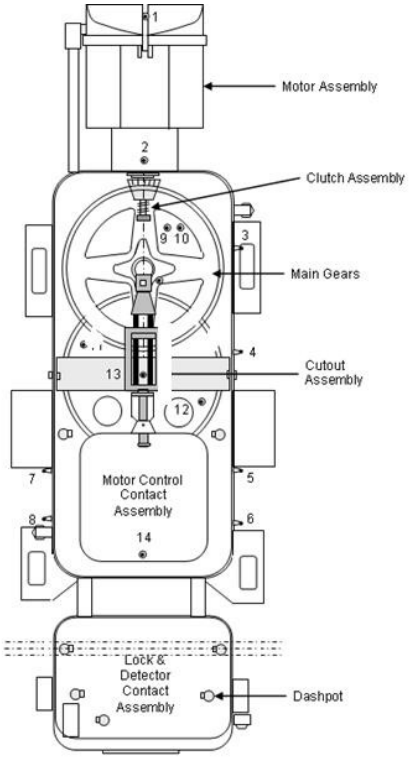
11.8 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

APPENDIX A - Typical Drawing: HB Point Layout – Right Hand Machine

(Not to Scale) (Sole-plate & sleepers omitted for clarity)



APPENDIX B - Grease Nipple Locations



END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/PC33		
Point Machine SGE Style HA		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Point Machine SGE Style HA
Excludes:	Point inspections, Point fittings and Supplementary drives

General

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

The HA point machine was designed for installation with a minimum of ground connection alterations, where replacement of standard BR mechanical point & FPL layouts was required.

A separate detector is provided (See NR/SMS/PartC/PD01 (BR998 Detector) – NR/SMS/PartC/PD02 (Electrical Points Detectors). Further information is available in SGE Maintenance Manual.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. General

2.1 Remove fire risks and potential obstructions.

2.2 Check the visible tail cables and route. Check that cables are not trapped or covered by P/Way materials.

2.3 Remove machine cover, check machine cover and fittings for cracks. Examine lid gasket.

2.4 Check the crank handle access can be removed and replaced correctly.

2.5 Check point machine fixings (4 external, 2 internal).

Operate machine under power and observe that there is no movement relative to the bearers. If movement is observed, tighten fixing bolts to 100- 120Nm and arrange a re-check at the next visit.

2.6 Clean and examine the machine casting.

Remove accumulated moisture and debris and examine casting for cracks. Clear drain holes.

2.7 Check heaters, where fitted.

3. Motor Assembly

Before starting any work, isolate the machine using the crank handle contact.

3.1 Clean and examine motor assembly, including:

a) Field & armature assembly and casing.

b) Spindle bearings and fixing bolts. The motor shall be held securely and shall not rock.

c) Motor terminal block, terminations and wiring.

4. Drive Mechanism

4.1 Clean and examine point and lock drives, including:

a) Main and bevel gears.

b) Worm drive and wheel, spindle bearings and fixings.

c) Drive pin.

d) Contact operating arm and pivot.

e) Cams, cam faces, and fixings.

f) Point drive escapement, crank, pivot and key-way.

The point drive is susceptible to wear in the key-way. This results in slackness of the external drive relative to the machine operation. This can be checked by manually operating the machine.

g) Lock drive, pivots, and key-ways.

4.2 Clean and examine the friction clutch assembly, including:

a) Clutch plate and spring.

b) Castellated clutch tension nut and split pin. The clutch can be adjusted by rotating the castellated nut to loosen or tighten the spring. Always refit the split pin.

5. Crank Handle Cut-Out

5.1 Clean and examine crank handle cut out assembly, including:

a) Bevel gears.

b) Springs and plungers.

c) Hand crank drive.

d) Latch mechanism.

Insert the crank handle and check that the cut-out contacts correctly operate.

Remove the crank handle and check that the contacts do not remake until the latch is reset.

5.2 Examine isolating contacts, terminals, and wiring. These contacts are prone to arcing.

6. Snubbing Mechanism

6.1 Clean and examine:

a) Contact operating pin and escapements.

b) Contact operating levers, pivots, split pins, spring assembly and fixings.

c) Contact blocks and fixings.

d) Slide plates. Work machine by hand and observe correct operation and the mechanism does not bind.

e) Contact springs, mounting blocks, plate, and fixings. These contacts are prone to arcing and might require replacement. Check the springs to confirm a good contact is made with the contact blocks.

f) Terminals and wiring.

7. Snubbing Relay

7.1 Clean and examine:

a) Relay coil / housing and armature.

b) Contacts, terminals and wiring.

c) Mounting plate and fixings.

8. Cables and Wiring

8.1 Examine all wiring and ducting. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

8.2 Examine tail cable gland and insulation.

9. Lubrication

9.1 Lubricate with lithium grease:

a) Worm drive and wheel.

b) Main and bevel gears.

c) Cam faces.

d) Point lock and drive pins.

9.2 Lubricate with adhesive grease:

a) Clutch spring.

b) Surfaces of point and lock drive arms.

9.3 Lubricate with mineral oil:

a) Crank handle selector.

b) Oil points in escapement and crank pivots.

c) Worm drive spindle bearings.

d) Contact arm pivots, spring and slides.

10. Facing Point Lock

10.1 The FPL and associated cranks and rodding shall be maintained to NR/SMS/PartC/PA01 (Mechanical Points).

11. Tests & Final Checks

11.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

11.2 Reset the crank handle cut-out and observe correct operation of the machine.

There shall not be any excessive ‘kick-back’ on the motor.

11.3 Observe that the snubbing is effective.

11.4 Check for foreign bodies in the machine and replace covers. Lubricate the padlock.

11.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

Isolate as for Service A if not already done so.

12. General

12.1 Clean the cover (inside and out) and casting.

13. Motor / Drive Mechanism

13.1 Examine the motor commutator (it shall be a light brown / coffee colour). Rotate and clean by pressing a clean, lint free cloth moistened with an approved cleaner onto the surface of the commutator.

13.2 Examine the motor brushes and holders. Brushes shall slide freely in the holders and seat fully on the commutator.

The correct brush gear position is indicated by a painted line on the brush rocker, which shall line up with a similar mark on the end plate. New brushes require grinding in.

14. Contacts and Terminals

14.1 Clean all contacts using lint free cloth moistened with an approved cleaner.

14.2 Protect terminals and contacts as necessary.

15. Disconnection Boxes (if Provided)

15.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

15.2 Refit the lid and (if provided) padlock, check they are fitted securely.

16. Tests & Final Checks

16.1 Carry out NR/SMS/PartB/Test/011 (Electrical Detection Test (Machine)).

16.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

16.3 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

Return to power operation.

16.4 Clutch test: record the operating current whilst operating the points N-R and R-N (max 10A).

16.5 Repeat test 16.4 but with an obstruction between switch and stock rail. Observe correct operation of the overload cut-out protection (6 - 9s).

This test shall be undertaken using a meter or a current clamp meter an approved of measuring the currents involved.

The clutch slip current shall be set to 12A ±2A.

The clutch is adjusted mechanically by increasing or decreasing the clutch spring pressure. To do this, remove the pin and rotate the castellated clutch tension nut.

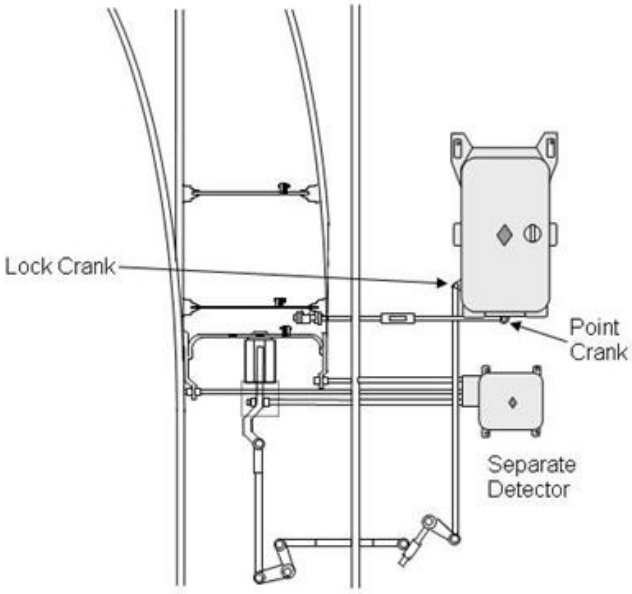
16.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

It is recommended that this test be carried out from the location case or equipment room if possible.

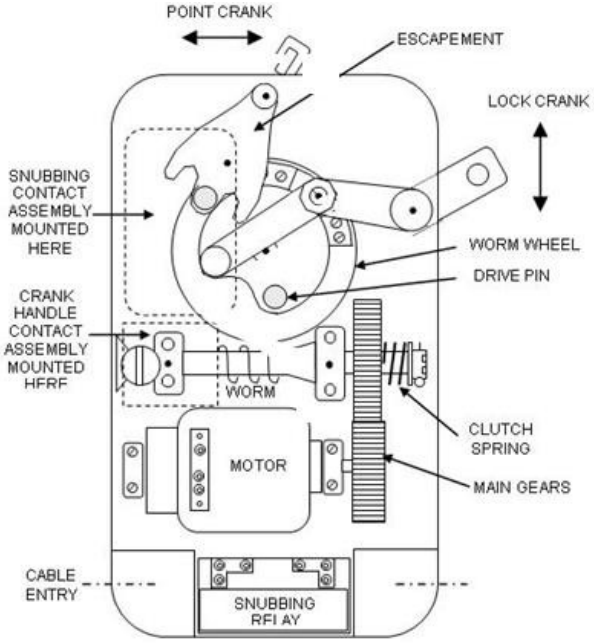
16.7 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

APPENDIX A - Typical Drawing: HA Point Layout – RH Machine with Separate SGE Detector and FPL

(Not to Scale with Sole-plate & sleepers omitted for clarity)



APPENDIX B - Machine Internal Layout



END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/PC41		
Point Machine WRSL Style 63		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Point Machine WRSL Style 63
Excludes:	Point inspections, Point fittings and Supplementary Drives

General

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

Further information on these machines can be found in NR/GN/SIG/19002.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. Exterior (lid closed)

2.1 Check the point machine fixings. Operate the machine under power and check that it does not move on the bearers. If you do see any movement, tighten the fixing bolts to a minimum torque of 100 – 120 Nm and re-check at the next visit.

2.2 Remove the weatherproof covers and clean and examine the lock and detector blades, throw bar and insulation pieces. Tighten the fixings if necessary.

2.3 Smear adhesive grease onto the throw bar, lock, and detector slides.

NOTE: *Do not allow too much grease to enter the machine.*

2.4 Check the base casting for signs of cracking, especially in the area of the crank handle opening. Examine the crank handle cover, knurled screw, and securing bolts.

2.5 Wipe and check the side retainer plates (detector or lock slides and throw bar).

2.6 Remove fire risks and any possible obstructions.

2.7 Check the visible tail cables and route. Check that cables are not trapped or covered by P/Way materials.

3. Interior

Before you start any work, isolate the machine by operating the crank handle cut out.

3.1 Examine the lid and check the gasket is providing a good seal.

3.2 Examine the cable entry, cable cores, internal wiring, and terminals. Clean and protect as necessary.

3.3 Check the drain holes are clear.

3.4 Check the two heaters working.

Not all style 63 machines are fitted with heaters.

4. Interior mechanism

4.1 Use the crank handle to operate the points. Examine the lock dogs and notches. Look for wear (swarf) and chamfering (bright corners).

4.2 Examine the clutch assembly:

a) Spring.

b) Adjustment nut and lock nut.

c) Drive belt.

Check that the vertical play is between 2mm and 5mm.

4.3 Remove the ball-screw cover, then:

a) Check the ball-nut and screw-thread.

b) Clean the ball-nut and lubricate with lithium-based grease (1 grease nipple).

c) Examine the yolk securing bolts. The yolk bolts shall be tightened to 23Nm (17lb.ft).

If the snubbing is not working, the yolk bolts can break when the yolk moves from right to left. This can cause the ball screw to seize.

4.4 Examine the holding down bolts on:

a) Plummer block. (These can break if the snubbing is not working).

b) Escapement crank cover.

c) Circuit controller and Circuit controller contact blocks.

4.5 Clean and examine the following:

a) Lock blades, detector blades and throw bar; Lubricate with lithium-based grease (6 grease nipples and surfaces).

b) Drive slide; lubricate with lithium-based grease (one grease nipple and surface).

c) Escapement crank, escapement drive rollers, throw bar drive roller and plummer block; Lubricate with lithium-based grease (4 grease nipples).

d) Drive screw thrust bearing; Lubricate with lithium-based grease (grease nipple).

4.6 Clean the ball-screw cover; then replace the ball- screw cover.

4.7 Clean the motor casing and examine the motor holding down bolts. Check that the jacking screws at the base of the motor are locked (where fitted).

5. Detector Rocker Arm

5.1 Clean the following:

a) Detector rocker arm pivot. Check that the cir-clip on the centre pivot is intact and correctly positioned. Lubricate with a drop of mineral oil.

b) Rollers. Lubricate rubbing surfaces with a drop of mineral oil.

6. Circuit Controller

6.1 Clean the following:

a) Circuit controller.

b) Camshaft bearings and cams.

c) Push-rods.

The preferred type of push-rods are coloured dark grey. Red push-rods can remain in service providing the 2mm minimum contact openings are achieved.

6.2 Examine the detection contacts:

a) Check that the fixed contacts are secure and lying flat on the circuit controller chassis. If they are not the circuit controller can remain in service providing a gap of 2mm between the fixed and moving contact is achieved. This shall be reported to your SM(S).

b) Gauge the two detection contacts in both normal and reverse positions of the points. Use 2mm non-metallic gauge J13523/2.

When open, there shall be a gap of at least 2mm between the fixed and moving contacts. **If the gap is less than 2mm, the points shall be booked out of use.**

Adjustment of the gap is not permitted in preventative or corrective maintenance.

c) Observe, during manual operation, the detection contacts remain broken throughout the movement.

d) Clean and protect the contact fingers as necessary, excluding contact faces.

6.3 Examine the motor control and snubbing contacts.

a) Check that the contact surfaces are not heavily worn or burned by arcing.

b) Apply contact lubricant as necessary.

7. Centrifugal snubbing

7.1 Examine the centrifugal snubbing switch (where fitted).

a) Check the contacts operate when the pendant is moved by hand.

b) Continue to move the pendant gently until the outer spring is restricted by the backstop (or hold-on coil where fitted).

c) Check the pendant arm does not pass beyond the inner spring.

d) Release the pendant and observe that it returns to the central position.

e) Examine the hold-on coil and wing armature (where fitted).

f) Lubricate the back of the snubbing contacts and pendant striker with a slight smear of silicone grease (except where Nylon rollers are fitted to the striker).

8. Tests and Final Checks

8.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

8.2 Reset the crank handle cut-out contacts and observe the operation of the points in both directions from the signal box. Check the following:

a) Motor drive.

b) Snubbing.

This can easily be checked by observing the pulleys at the end of the stroke. If the snubbing is performing correctly, they will stop rapidly and cleanly. If, the snubbing is faulty the drive side will contact its end stop. This will cause 'wind up' of the ball screw and the pulleys will be seen to reverse their rotation for a few degrees after stopping.

c) Operation of the contacts. There shall be no excessive sparking or arcing.

8.3 Check the machine for foreign bodies.

8.4 Close and secure the lid. Lubricate the hinges and padlock.

8.5 Close and secure the crank handle cut-out cover. Lubricate the hinges and padlock (RKB222).

8.6 Replace the weatherproof covers.

8.7 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

8.8 The final check before you finish the work is to ask the Signaller to operate the points and reverse positions (twice if possible and watch for correct operation).

SERVICE B

Isolate as for service A if not already done so.

9. General

9.1 Clean the lid (inside, outside and casting).

10. Motor and drive mechanism

10.1 Clean and examine the motor commutator, where possible.
Rotate the commutator using the crank handle; the surface shall be a light brown coffee colour.

Clean by pressing a clean lint free cloth, slightly moistened with an approved cleaner onto the surface.

Brushes can soak up excess cleaner and stick in their holders. Alternatively, use a very fine emery cloth (grade 1000) to carefully remove carbon deposits.

10.2 Examine the motor brushes and spring retainers. The brushes shall slide freely in their holders and seat fully on the commutator. They shall also be replaced when worn down to the shoulder of their holder (or sooner depending on machine usage).

10.3 Lightly Lubricate the motor bearings (2 grease nipples) with one shot of lithium-based grease.

NOTE: *Too much grease will contaminate the clutch housing.*

10.4 Remove the crank handle cover plate. Clean and examine the crank handle cut-out contacts. Check the crank handle cut-out contacts break and re-make when the crank handle is inserted and then reset.

10.5 Check the gasket seal and refit the cover plate and fixings.

11. Circuit Controller

11.1 Snubbing and slow acting motor contacts.

a) Clean the contact segments with a surface cleaner.

b) Lubricate contact segment surfaces with an approved contact lubricant.

c) Operate by hand and check that the contacts lift 1-2mm when the contact segments engage and make contact with them.

11.2 Quick acting motor cut-off contacts

a) Manually operate the machine to mid-stroke position and check that both contact arms are held back by the latch.

b) Close and lock the points normal and Gauge the gap between the shorting strip and the shorting strip carrier, using gauge J12129/1. The gauge shall be a slide fit (Appendix B).

c) Repeat for reverse lie of points.

d) Make sure the moveable contact nuts are tight.

e) Check the contacts operate correctly both ways.

11.3 Examine the circuit controller camshaft drive rack on the drive slide (2 fixing screws).

11.4 Examine the circuit controller nylon gear wheel.

12. Diode Snubbing (non ac immune machines)

12.1 Examine the diodes and wiring.

12.2 Using a meter, check the diodes using the digital meters use the diode test function.

13. Centrifugal Snubbing

13.1 Closely examine the centrifugal snubbing switch and black motor end casing for metallic dust (gold coloured). If there is any dust, the leather washers are badly worn, and the steel tips are wearing the brass housing. You shall arrange to replace the motor before the snubbing switch fails.

It is possible to remove the centrifugal snubbing switch for a closer examination, but this is difficult on site without removing the motor.

13.2 Examine the hold on coil assembly, where fitted.

13.3 Examine the centrifugal snubbing contacts.

a) Check the ends of the inner springs are clear of the clutch housing.

b) Check the gap between each carbon contact (3mm).

c) The clearance between the back of the outer spring and its spring keeper shall be 3mm (0.5mm with magnetic hold-on).

d) Adjust the springs and keepers to suit.

14. Clutch

14.1 Reset the isolating contacts and restore the drive and detection fuses.

14.2 Check that when the points are operated on power, a pencil mark across the clutch housing moves no more than 10mm. When the points are moved to the original position, the pencil marks should roughly re-align.

14.3 Measure and record the motor operating current whilst operating the points to both positions (ignore the initial surge current).

14.4 Measure and record the motor operating current whilst operating the points to both positions with the points obstructed. The clutch slip current shall be set to 12A ±2A.

Check that overload protection operates between 6 and 9 seconds.

If any adjustments are required, you shall isolate the machine first.

15. Disconnection Boxes (if Provided)

15.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

15.2 Refit the lid and (if provided) padlock, check they are fitted securely.

16. Tests and Final Checks

16.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

16.2 Carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

16.3 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

16.4 Reset the crank handle cut-out contacts and observe by operation in both directions from the signal box:

a) Motor drives.

b) Snubbing is effective.

c) Operation of the contacts. There shall be no excessive sparking or arcing.

16.5 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test)

It is recommended that this test be carried out from the location case or equipment room if possible.

16.6 Check for foreign bodies in the machine.

16.7 Close and secure the lid. Lubricate the hinges and padlock with mineral oil.

16.8 Close and secure the crank-handle cut-out cover. Lubricate the hinges and padlock (RKB 222) with mineral oil.

16.9 Replace the weatherproof covers (if removed).

16.10 The final check when you have finished the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible) and watch for correct operation.

SERVICE V1

When Requesting permission to from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

17. Visual Checks

17.1 Check for potential fire risks and obstructions around the S&C and within close proximity of the POE mechanism and fittings.

17.2 Check sleeper beds are clear of any obstructions.

17.3 Check cables and cable routes for any visible damage and are clear from any rodding runs.

17.4 Check the correct padlock is fitted.

17.5 Check the covers are fitted and not damaged.

17.6 Check while the points are operating that there is no movement relative to the bearers.

17.7 Report any significant wheel burns, rail defects and poor permanent way.

17.8 Report any adjustment, replacement or further work being carried out to remove the defective condition within the POE.

17.9 Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection has been obtained.

17.10 Observe the operation of the points and investigate any issues found.

SERVICE R1

Remote Condition Monitoring

If the points that you have requested to work on are fitted with remote condition monitoring check that the asset has been placed into maintenance mode prior to commencing work.

Prior to commencing work, it is recommended that the previous current traces are made available from the remote condition monitoring system to check for abnormalities.

Also, on completion of the work it is recommended that the new traces are recorded and viewed so they can be compared with the traces produced before the maintenance activity.

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

18. Observations

18.1 While the Signaller is operating the points, look for signs of resistance to movement which could be caused by:

a) Stretcher bars bowing.

b) Roller set-up.

c) Supplementary Drive set-up.

d) Overdriving.

e) Contaminated base plates.

f) Binding kicking strap.

At this point, the machine is not electrically isolated from the operation supply.

19. Machine Isolation Check

19.1 Once the Signaller has confirmed you have possession of the points, insert the point handle.

19.2 Test the operation of the handle cut-out.

19.3 With the handle cut-out reset, connect a meter across terminal C & 38 in ohms and confirm near short circuit.

19.4 With the handle cut-out reset, connect a meter across terminals D & 42 in ohms and confirm near short circuit.

19.5 Insert the crank handle.

19.6 Check that the isolation is effective by connecting the meter across C & 38 in ohms and confirm open circuit.

19.7 Check that the isolation is effective by connecting a meter across terminals D & 42 in ohms and confirm open circuit.

19.8 Clean the exterior and remove weather proof covers.

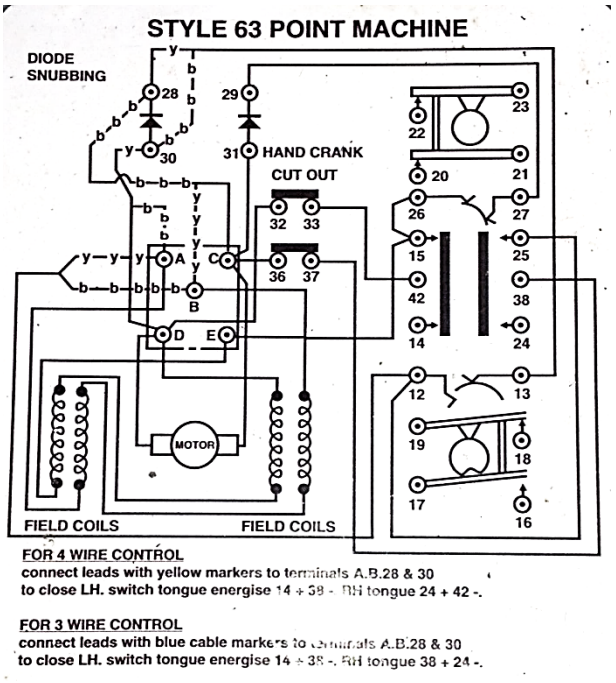


Figure 1 – Internal Wiring

19.9 Clean the lock and detector blades and the throw-bar.

19.10 Check the tightness of all point fittings

19.11 Check all contacts, checking for signs of deformation, wear or arcing.

19.12 Examine lock blade notches for signs of swarf or impact damage.

19.13 Examine detector blades for wear, arrange replacement if necessary, via a WAIF.

19.14 Check the security of wiring to prevent it being damaged.

19.15 Check for loose wires on terminations, BEWARE this could cause a loss of detection.

19.16 Check the heater is working correctly.

19.17 Check cable glands and plug couplers securely hold the cables and are preventing water ingress.

19.18 Check drain holes are not blocked.

19.19 Check condition of the drive belt.

19.20 Check the drive belt vertical play is between 2mm & 5mm, adjust when necessary.

19.21 Measure the two detection contacts in both the normal and reverse positions of the points using a 2mm non-metallic gauge J13523/2.

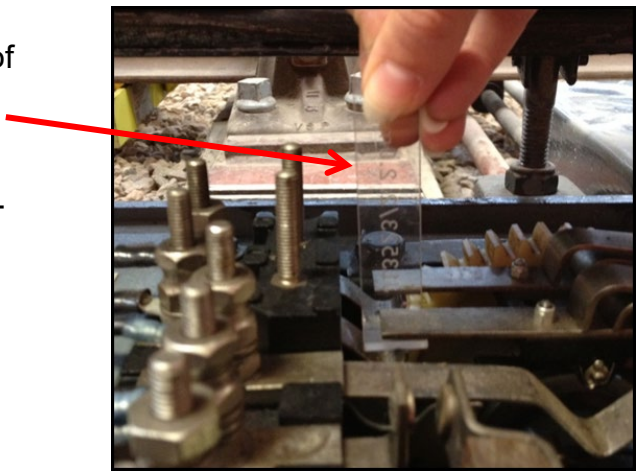


Figure 2 – 2mm Non-metallic Gauge

19.22 Lubricate lock & detector blades, throw-bar, ball screw, thrush bearing, all grease nipples and padlocks.

19.23 Lightly lubricate the detection rollers.

20. Tests

20.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

20.2 Carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

The following is not applicable if continuing to carry out service R2.

20.3 Replace weatherproof covers.

20.4 Remove Chog from open switch.

20.5 Remove crank handle & operate the cut-out reset.

20.6 Confirm point operation by asking the Signaller to operate the points in both directions and confirm the Signaller obtains both normal and reverse detection.

20.7 Where local Remote condition monitoring is fitted and work on the set of points has been completed, check with the local RCM team to confirm the asset trace has not deteriorated. If there are no issues take out of maintenance mode.

SERVICE R2

21. Checks

21.1 Check when the Signaller is moving the points, that snubbing stops the motor/ drive slide rapidly and cleanly. If the snubbing is not working correctly then the worm drive cradle comes to a halt with noticeable “clunk” and eventually the holding bolts shear.

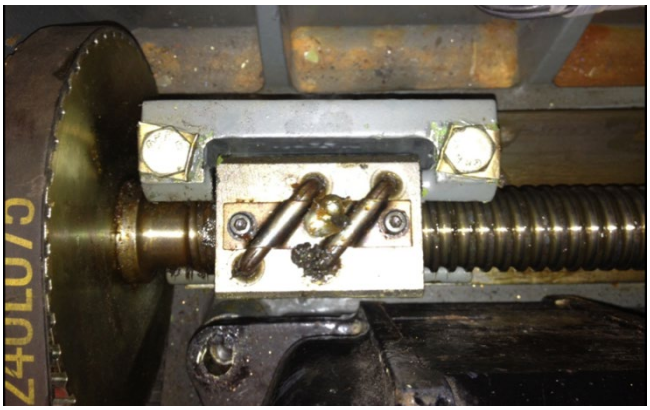


Figure 3 – Worm Drive Cradle

21.2 Check motor brushes are the correct type, free to move in their holder and not worn to the shoulder of their holder, if so replace.

21.3 Check the motor commutator is a light brown / coffee colour – clean as necessary.

21.4 Examine the base of the machine near the centrifugal snubbing switch, as pictured, for build-up of brass dust. If evident arrange replacement of motor within 48 hrs.

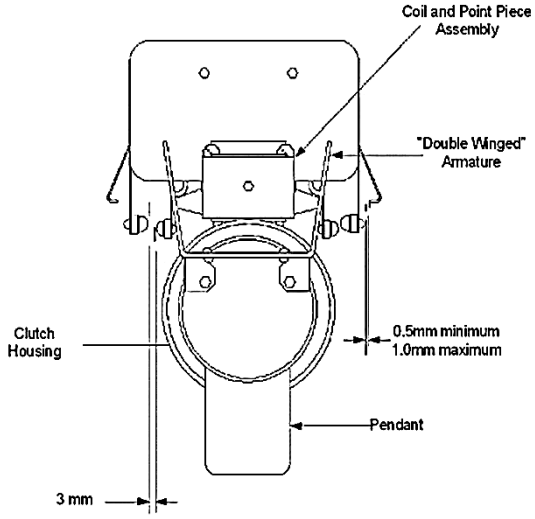


Figure 4 - Centrifugal Snubbing

22. Tests

22.1 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

22.2 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Test).

It is recommended that this test be carried out from the location case or equipment room if possible.

22.3 Replace the main cover.

22.4 Remove the point handle.

22.5 Remove chog from open switch and rest the cut-out.

22.6 Before leaving site arrange for the Signaller to operate the points in both directions and confirm with the Signaller that detection has be obtained.

22.7 Observe the operation of the points and investigate any issues found.

22.8 Where Remote condition monitoring is fitted and work on this set of points has been completed check with the local RCM team to confirm asset trace has not deteriorated. If there are no issues take out of maintenance mode.

APPENDIX A - How to Gauge the Detection Contacts

When open, the gap between the fixed and moving contacts shall be at least 2mm. Use gauge J13523/2. If the gap is less than 2mm, the points shall be booked off.

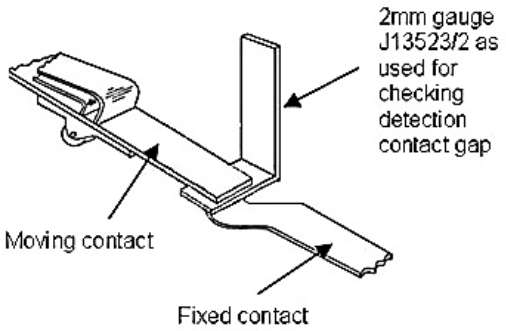


Figure 5 – Gauge Position

The gauge shall enter the gap freely. If it does not enter freely the circuit controller shall be replaced.

APPENDIX B - How to Set the Quick-Acting Cut-Off Contacts

The shorting strip between contacts 14-15 and 24-25 shall have a nominal 1mm gap between the strip and the carrier.

If the spring tension is correct, a gap of that size gives the correct contact force.

The 1mm gap shall be checked using gauge J12129/1.

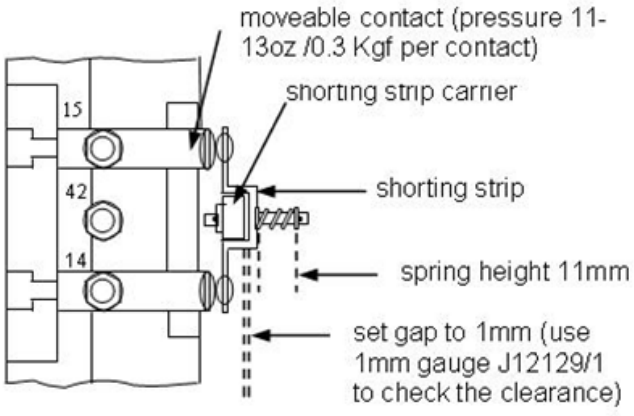


Figure 6 - Quick Acting Contacts

To adjust the contact, you shall first crank the machine to the mid-stroke position. This makes sure that the camshaft striker is not bearing on the reset roller, which would cause excessive pressure on the shorting strip carrier and prevent you from correctly adjusting the contact. Loosen the 0BA nuts of the stud terminals and slide the moveable contacts as necessary.

APPENDIX C - Internal Layout

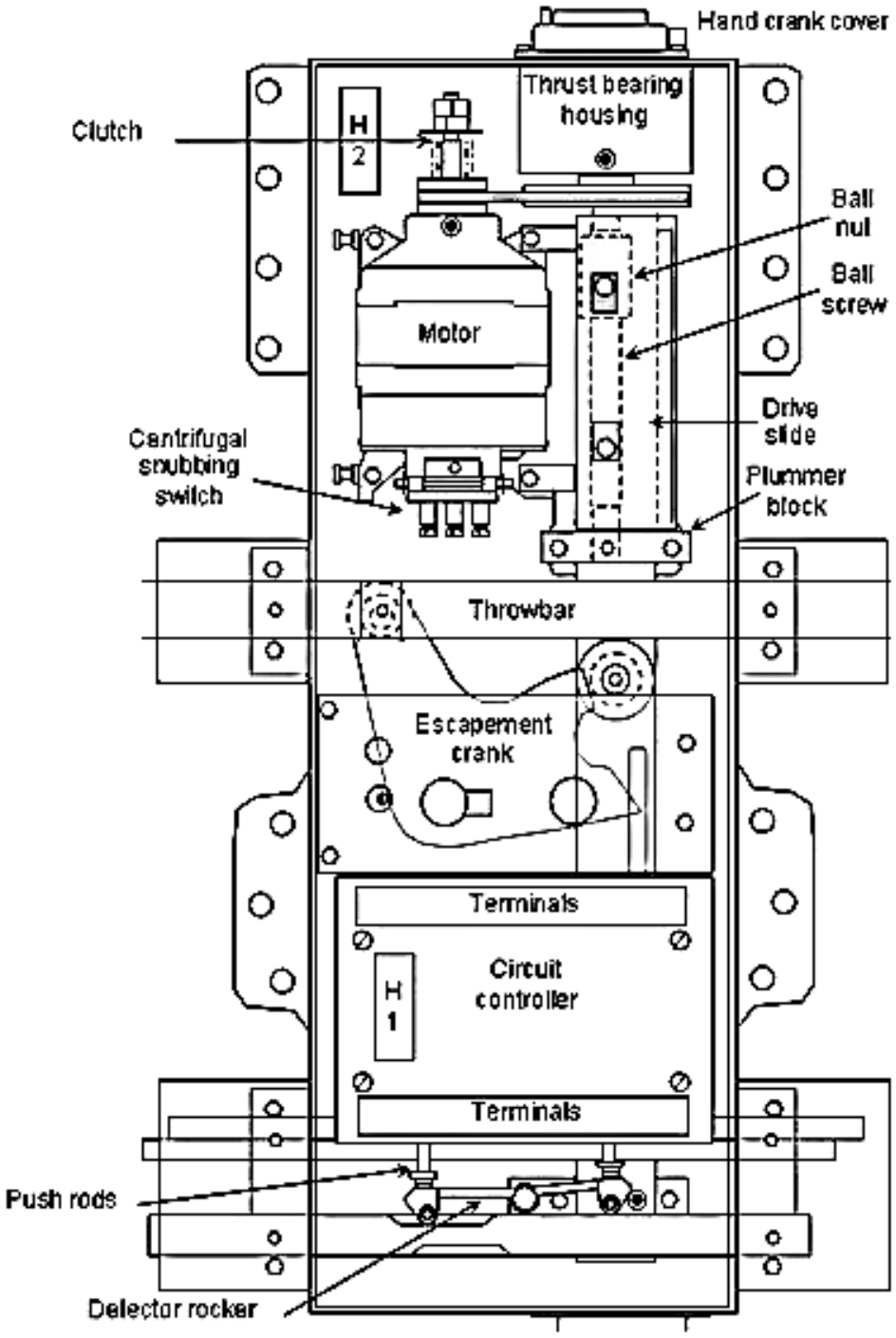


Figure 7 – Internal Layout

APPENDIX D - Typical Drawing: 63 Point Layout – Right Hand Machine (Not to Scale)

(Sole-plate & sleepers omitted for clarity)

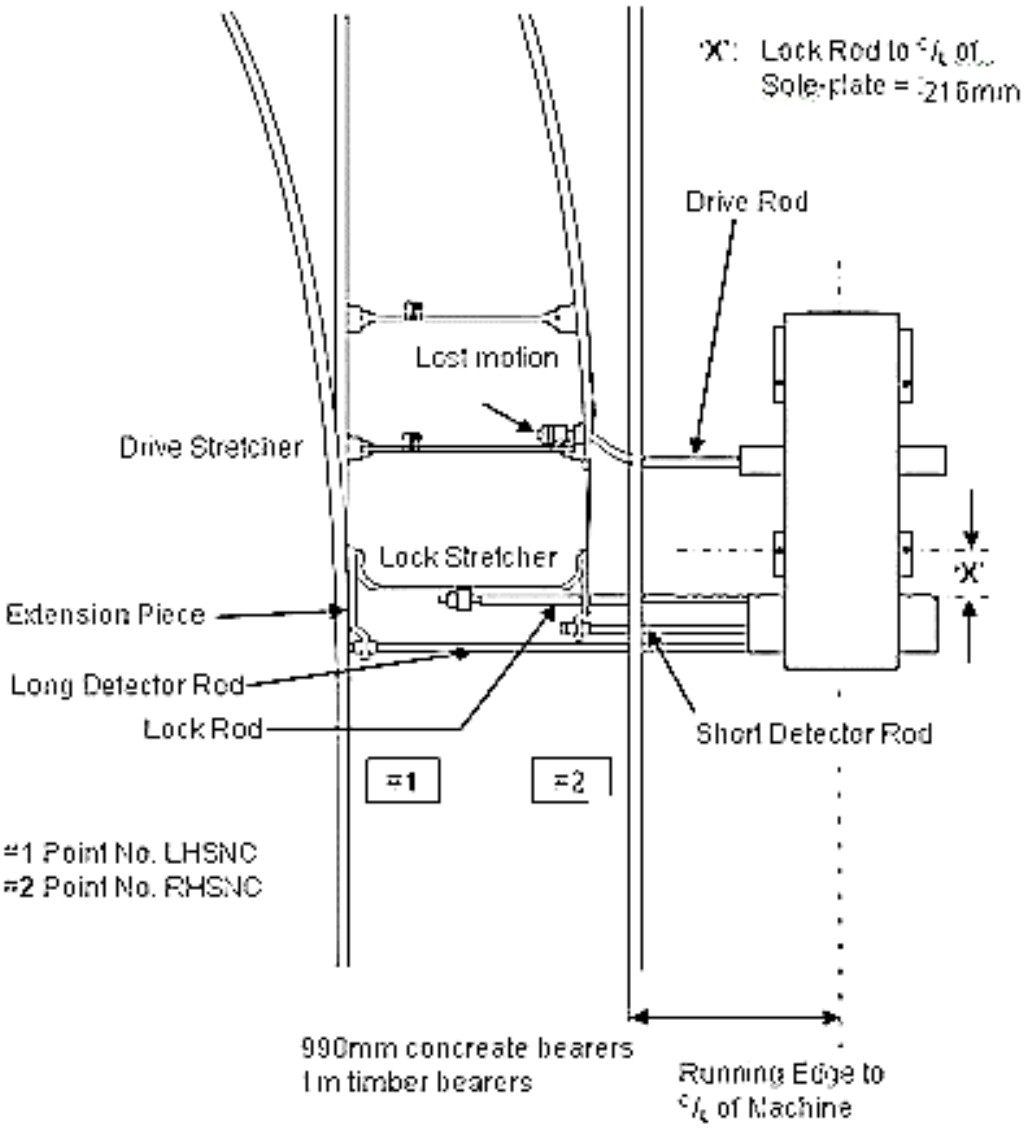


Figure 8 - 63 Point Layout

END

Includes:	Point Machine WRSL Styles M3 & M3A
Excludes:	Point inspections, Point fittings and Supplementary drives

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Nuts that are tight shall not move by the application of a short-handled spanner.

Any tightening of nuts or adjustments shall be reported as corrective maintenance.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine)).

SERVICE A

2. Exterior

2.1 Check and tighten point machine fixings. Operate machine under power. If any movement is observed, relative to the bearers, tighten fixing bolts to 100 – 120Nm and recheck at the next visit.

2.2 Remove and examine throw bar and detector rod covers.

2.3 Clean and examine connections to throw bar, lock blades and detector rods. Protect with adhesive grease.

Do not allow too much grease to enter the machine.

2.4 Examine machine covers and base casting for cracks.

2.5 Remove potential obstructions and fire risks.

2.6 Check visible tail cable and route.

2.7 Lubricate throw bar and detector rod cover fixing bolts and refit covers.

3. Machine Interior (General)

Before you start any work, isolate the machine by operating the motor cut out.

NOTE: *The machine is isolated by removal of the pin when the crank handle cover is taken off.*

3.1 Remove and examine point machine covers.

M3A Machines Only

3.2 Examine crank handle screw access and lid clamp arrangement.

All Types

3.3 Clean the interior of the machine; remove accumulated moisture and debris.

3.4 Check that all drain holes and ventilators are clear.

The drain hole in the gear wheel compartment is located under the gear wheels, if this gets blocked the compartment can fill with water and freeze in cold conditions causing the machine to fail. See Appendix B.

4. Motor Assembly (See Figure 1.)

4.1 Examine the following:

a) Tail cable, cable entry and gland.

b) Cable cores, wires and ducting.

c) Terminal block, terminals and terminations.

d) Snubbing resistor and fixings (where fitted).

e) Motor assembly and fixings.

f) Clutch assembly and fixings. Including castellated nut and split pin.

g) Centrifugal snubbing switch and contact assembly.

4.2 Where fitted, check the heater is working.

Machines Fitted with a Friction Clutch

4.3 Check the clutch housing and clutch shaft seal retaining plate for any sign of oil leakage from the gear wheel compartment.

5. Drive Assembly (See Figure 1.)

5.1 Examine the lid gasket. Check it provides a good seal, if the seal requires replacing this shall be reported to your SM(S).

5.2 Clean and examine:

a) Gear train.

b) Worm drive and worm wheel.

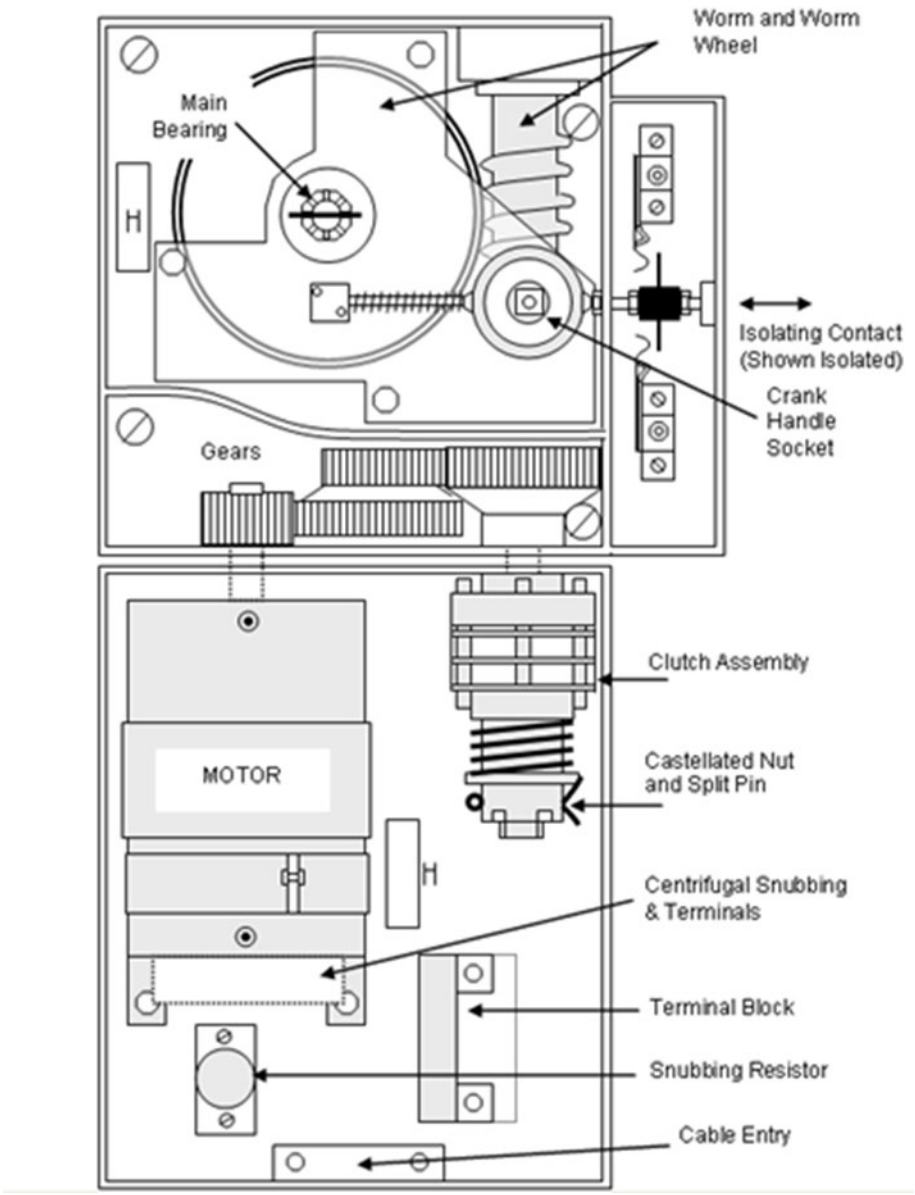


Figure 1 – Motor and Drive Assemblies

5.3 Manually operate the machine to examine all parts, including.

a) Examine the main bearing, castellated nut and split pin.

b) Examine all fixing bolts and set screws.

c) Examine crank handle assembly, spring stop and fixings.

d) Isolating mechanism, insulation and lock nuts.

5.4 Check the open contact gap is a minimum of 2mm.

5.5 Check the contact bridging piece forms a proper contact with the springs, when closed.

5.6 Check the cut-out contacts. Clean contact faces as necessary using a lint free cloth. Replace as necessary.

5.7 Check the terminal blocks, wiring & terminations are clean, and any protection required has been applied.

5.8 Check heater is working.

6. Detector & Lock Assembly (See Figure 2)

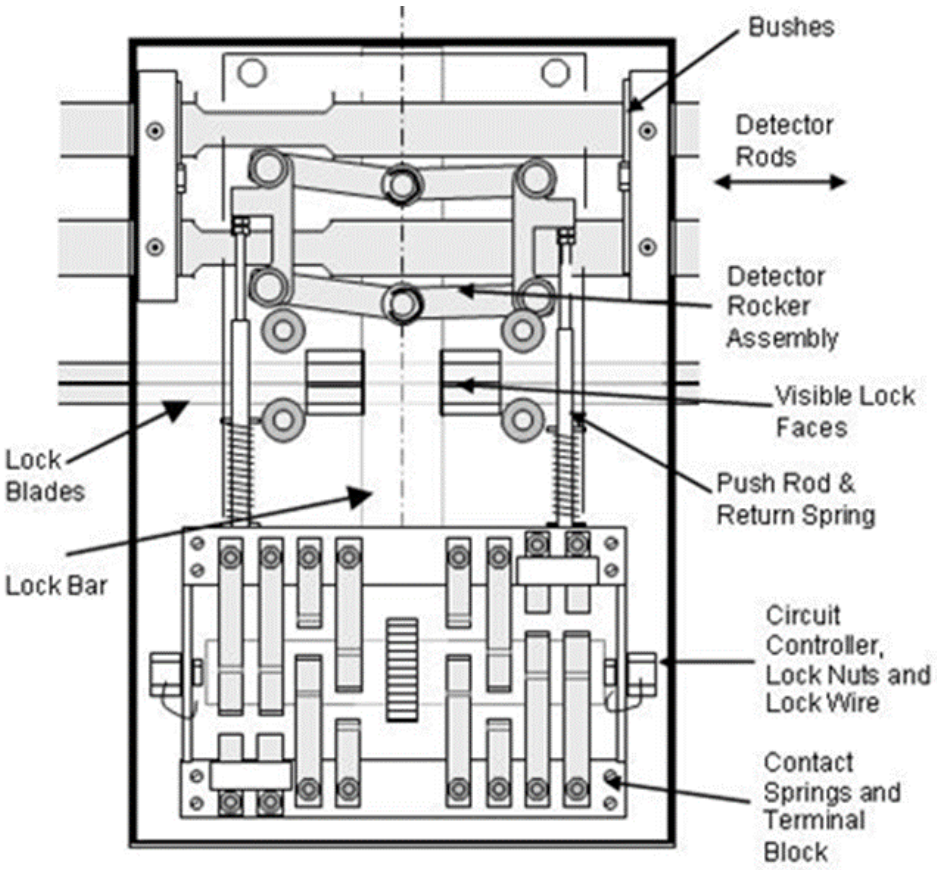


Figure 2 - Lock and Detection Assembly

Detector Assembly

6.1 Examine internal chassis and check all fixing bolts.

6.2 Clean and examine detector rods, bushes and fixing bolts.

6.3 Clean and examine detector rockers, rollers, and pins.

A small-insulated mirror is useful.

6.4 Check the connections to the push rods are secure (when not under tension) and the lock nuts are tight.

6.5 Check the rollers fully engage in the detector rod depressions and freely rotate.

6.6 Check the 'E' Clips are fitted to the rocker pivots and hold the rockers securely.

6.7 Clean and examine push rods, springs and stops.

6.8 Check the heater is working.

Lock Assembly

Operate the machine by hand and examine the visible parts of the lock blades, lock faces, & lock bar. Look particularly for shiny corners and swarf.

6.9 Check the lock blade rollers. The rollers shall freely rotate with movement of the blades.

Circuit Controller

6.10 Examine securing screws, lock nuts and locking wires.

The circuit controller shall be held securely.

If the circuit controller shaft has not been lock wired to the chassis, it shall be secured using a steel shim (or block of wood) between the end of the shaft and the machine casting (See figure 3).

Report any machine found with these items fitted to your SM(S).

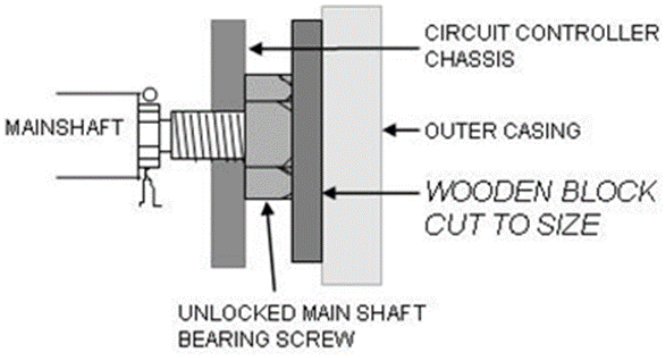


Figure 3 - Circuit Controller: Shaft Security

6.11 Clean and examine the circuit controller assembly including:

a) Gear drive

b) Contact faces and segments. Each open detection contact shall permit a 2.5mm non-metallic gauge to be inserted when the lock bar is withdrawn just clear of the lock notch. The contacts shall remain broken during travel until detection is achieved.

c) Contact springs and contact faces. Clean contact surfaces using a lint free cloth moistened with switch cleaner.

d) Terminal blocks, terminations and wiring.

6.12 Check that each circuit controller contact is fully engaged with the respective cam.

6.13 Check each bearing in which the circuit controller main shaft rotates. There shall be no significant longitudinal movement.

7. Lubrication

7.1 Lubricate, using adhesive grease:

a) Clutch spring and castellated nut.

b) Main bearing castellated nut.

7.2 Lubricate, using lithium grease:

a) Grease nipples on throw bar.

b) Grease nipples on detector rod bushes.

c) Surfaces of detector rods, and accessible parts of lock blades and lock plunger.

d) Main gear teeth (unless an oil bath is provided).

e) Worm gear and wheel.

f) Crank handle connection.

g) Crank handle cover screw thread.

7.3 Lubricate, using mineral oil:

a) Oil cups (where provided).

b) Detector rocker pivots.

c) Lock and detector rollers.

d) Crank handle plunger mechanism and gear bearing.

e) Push rod springs.

f) Circuit controller operating rack.

g) Fixing bolts.

7.4 Top up the oil bath with gearbox oil, where an oil bath is provided.

8. Tests & Final Checks

8.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests (Machine))

8.2 Check for foreign bodies in the machine, replace machine centre cover, and check that a RKB222 padlock is fitted to crank handle latch.

8.3 Reset the crank handle cut-out. Observe correct operation of the machine. There shall not be any excessive ‘kick-back’ on the motor.

8.4 Observe that the snubbing is effective.

8.5 Replace and secure the remaining machine covers. Lubricate the padlocks.

8.6 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

8.7 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

9. General

9.1 Clean the covers (inside and out) and casting.

9.2 Drain the oil from the gear box, where provided, and refill to the indicated level.

10. Motor

10.1 Examine the motor commutator (it shall be a light brown / coffee colour). Rotate using the crank handle and clean by pressing a clean, lint free cloth moistened with a cleaning agent onto the surface of the commutator.

10.2 Examine the motor brushes. Brushes shall slide freely in the holders and seat fully on the commutator. The end of each brush shall protrude from its holder.

10.3 Lubricate the motor grease nipples with a little lithium grease.

11. Contacts

11.1 Clean using lint free cloth moistened with a cleaning agent:

a) Circuit controller contact segments.

b) Normal and reverse detection contacts.

c) Motor control contacts.

d) Crank handle cut-out contacts.

e) Centrifugal snubbing contacts.

11.2 Examine the circuit controller plug coupler (where fitted). Brush the top; separate the two halves and clean the joint faces. Check that the two halves are screwed tightly back together again.

12. Centrifugal Clutch (where provided)

12.1 Remove centrifugal clutch housing cover plate and underlying circlip. Carefully pull off the clutch housing and remove the plunger cage and plungers.

12.2 Clean and examine all parts using a lint free cloth moistened with a cleaning agent. Replace the leathers where the tip of a plunger has been rubbing on the clutch housing.

12.3 Replace the clutch housing if it has become scored.

12.4 Apply a small amount of lithium-based grease to the ball race and reassemble the unit.

13. Friction Clutch (where provided)

Friction Clutches are no-longer a serviceable item and therefore shall not be disturbed, any failure shall be reported to your SM(S).

14. Centrifugal Snubbing

14.1 Examine the centrifugal snubbing switch, adjust as necessary. The ends of the inner springs shall be clear of the clutch housing.

The ends of the plastic striker arm shall be just clear of the backs of the inner springs. The gap between each pair of carbon contacts shall be 3mm.

The clearance between the back of the outer spring and its spring keeper shall be 3mm.

15. Disconnection Boxes (if Provided)

15.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

15.2 Refit the lid and (if provided) padlock, check they are fitted securely.

16. Local Policy Requirement

16.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and Carry out NR/SMS/PartB/Test/019 (Loop Detection Test) as directed

17. Tests and Final Checks

17.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Test (Machine)).

17.2 Carry out NR/SMS/PartB/Test/011 (Detector Tests (Electrical Detectors).

17.3 Return the point machine to power operation.

17.4 Clutch test: record the operating current whilst operating the points N-R and R-N (max 10A).

Repeat this test after inserting an obstruction between switch and stock rail. Observe correct operation of the overload cut-out protection (6 - 9s), i.e. WJR.

This test shall be undertaken using a meter or a current clamp meter.

The clutch slip current shall be set to 12A ±2A.

The dry plate clutch is adjusted mechanically by increasing or decreasing the clutch spring pressure by adjusting the castellated nut.

17.5 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

It is recommended that this test be carried out from the location case or equipment room if possible.

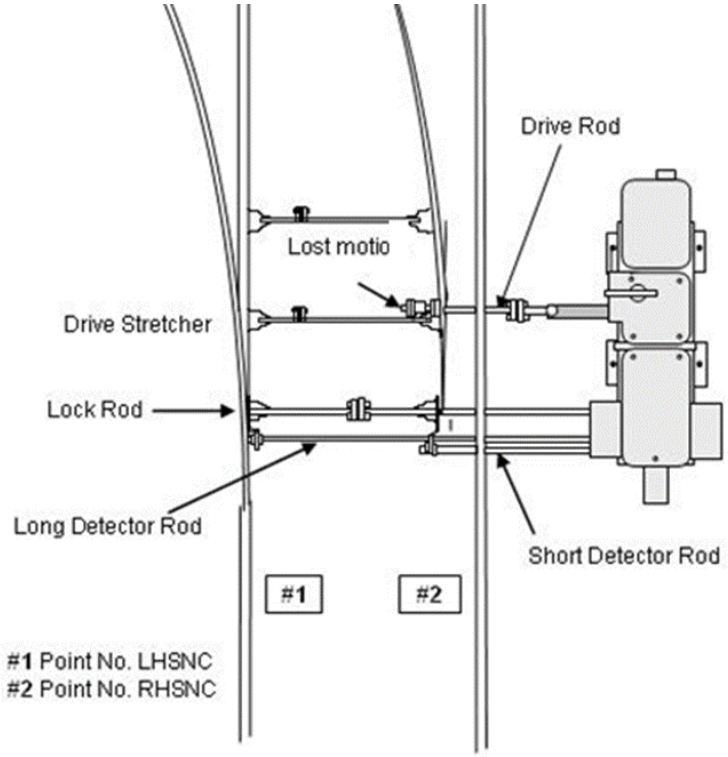
17.6 Observe correct operation of the machine. There shall be no ‘’kick-back’ on the motor.

17.7 Check for foreign bodies in the machine, replace cover, and check that RKB222 padlock is fitted to crank handle cover. Lubricate the padlocks.

17.8 The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation

APPENDIX A - Typical Drawing: M3 Point Layout – Right Hand Machine

(Not to scale, soleplate & sleepers omitted for clarity)



APPENDIX B - Location of drain hole

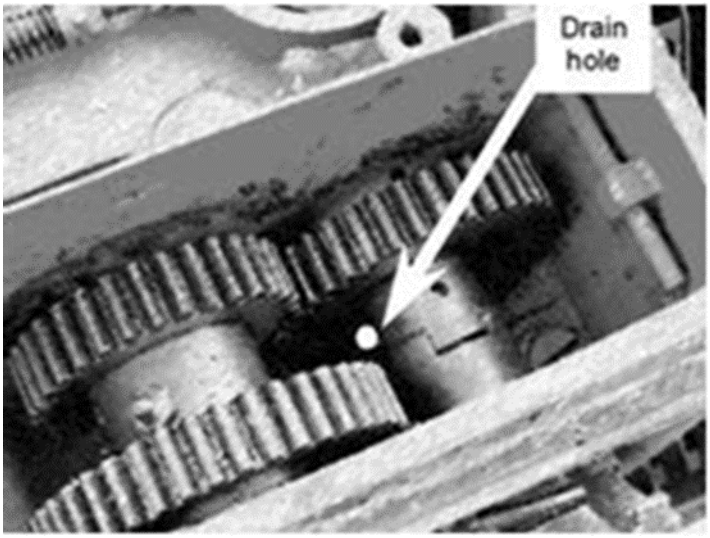


Figure 4 - Location of drain hole in gear wheel compartment

END

General

The WBS AC point controller is a predecessor of the of the modern point contactor relay used to drive point machines.

They are normally found on older installations of WBS point machines

SERVICE A

1. External

1.1 Remove all fire risks from around and near to the controller. Paper, oily waste etc.

1.2 Check the following items:

a) Condition of the casting and cover.

b) Security of the fixing bolts.

c) Cable entry glands.

2. Internal

2.1 Remove the cover and check the general condition of the interior. Clean and wipe as required. Remove any moisture.

2.2 Visually examine all wiring.

2.3 Check the capacitor for any signs of leakage and the resistor(s) for signs of overheating.

2.4 Check that insulating shrouds are fitted to all terminals. Replace any that are damaged or missing.

2.5 Visually examine the motor and cam assembly.

2.6 Lubricate the following with mineral oil:

a) All oil cups/dash pots.

b) Pivots and cam roller.

One drop from a can with a 150mm thin non-conductive tube is required for this item.

2.7 Check the condition and security of the contact fingers, springs, and terminals. Clean (if required) the contacts using a lint free cloth and cleaner.

Take care not to bend or distort the contacts.

Do not attempt to adjust or change the contacts, if any are found to be defective, the complete mechanism shall be changed.

2.8 Check that when the points are normal the reverse contacts are broken, and when the points are reverse the normal contacts are broken.

Measure the gap on the open contacts in both positions, check that it at least 5/16" (7mm).

3. Final

3.1 Check that the plug coupler, flexible hose, and tail cable to the point machine are secure and undamaged.

3.2 Check for correct operation of the points before and after securing the cover.

3.3 Check that a RKB221 padlock is fitted to the unit locking device. Lubricate with mineral oil the hinges and securing device threads.

3.4 Check that the point controller is correctly numbered.

END

General

The High Performance Switch System (HPSS) comprises the High Performance Switch Actuator (HPSA) and the PowerLink Supplementary Drive, plus toe and supplementary rail position sensors (LVDTs).

Further information and details can be found in the HPSS handbook (NR/L2/SIG/11400)

Remote Condition Monitoring (RCM)

If the points that you have requested to work on are fitted with RCM check that the asset has been placed into maintenance mode prior to commencing work.

Prior to commencing work it is recommended that the previous current traces are made available from the RCM system and checked for any abnormalities.

On completion of maintenance, it is recommended that new traces are recorded and viewed so they can be compared with the traces produced before the maintenance activity.

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/004 (Facing Point Lock Test).

SERVICE B

2. HPSS External Checks

2.1 Check all the lids, gaiters, covers and retaining fasteners are present.

2.2 Examine the base plate / slide chair assembilies and ensure they are clean and free from excessive wear and damage.

2.3 Examine switch rails for hogging/dipping. Report any significant wheel burns, rail defects and poor permanent way.

3. HPSS Set-up Checks

3.1 Remove the end lid of HPSA (2x padlocks RKB221).

3.2 Disconnect the RCM cable (if fitted) from J5 on the ECU and connect the HPSS handset cable.

3.3 Check visually that the cut-out flag in the powered position and prevents accidental insertion of the cranking handle into the winding mechanism.

3.4 Isolate the motor power to the HPSA by operating the crank handle cut-out mechanism.

3.5 Check when operating the cut-out mechanism,that the indicator flag moves fully to the 'Power-off' position and is retained by the spring loaded locking pin. Confirm that the power is isolated using the handset, the status screen shall indicate 'Manual'.

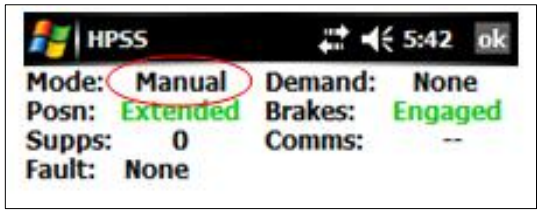


Figure 1

3.6 Remove the remaining covers from:

a) HPSA point machine - centre cover (requires release of 2 rubber gaiters).

b) All centre covers of PowerLink backdrive.

c) Covers (extend and retract side), protecting the toe and supplementary sensors.

NOTE: *Take care when lifting any of the centre covers that are equipped with winter covers.*

4. Switch set up checks

4.1 Check the following measurements for the open switch as stated in NR/SMS/PartZ/Z02 (Point Reference Values):

a) Switch opening at the toe.

b) Minimum Free Wheel Clearance at the Headcut.

4.2 Check the following on the closed switch:

a) That there is 2.5mm to 3mm gap between the switch and stock rail at the end of the switch rail planing (head cut).

NOTE: *If this gap is not achieved, the heel of the switch might close up before the toe, preventing the switch tips closing correctly.*

b) There is a gap of 2mm or less between the stock and switch rail inline with any supplementary sensor, except for CEN54 'C' switches which can be 2mm to 3mm.

c) Check that lost motion is present at all supplementary drive locations. See Figure 2.

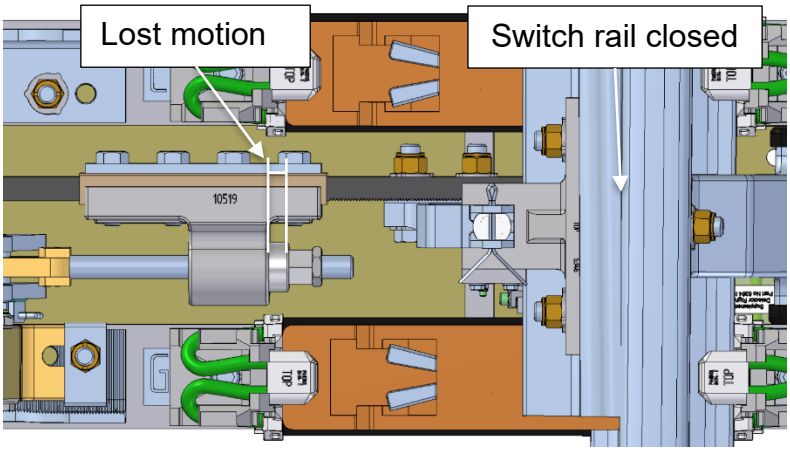


Figure 2

4.3 Return the HPSS to 'Powered' operation and power operate the points to the opposite side.

4.4 Return the HPSS to "Manual" operation.

4.5 Repeat steps 4.1 and 4.2 for the opposite side.

4.6 Return the HPSS to 'Powered' operation.

4.7 Visually check under powered operation that:

a) Operation is smooth and completes within 2.5 – 4 seconds.

b) All fittings are secure.

c) The switch rail rollers are free to rotate and are in contact with the switch rail during operation.

5. Checks within HPSA hollow bearer

5.1 Operate the points under power to the ‘retract’ position (with the closed switch rail nearest to the gearbox).

5.2 Return the points to “Manual” operation and check that there is a 2mm minimum gap between the white anti-rotation bush and the gearbox casting, See Figure 3. If no gap is visible, add switch rail packer(s) as required on the retract side to obtain a ‘set-up’ gap of minimum 3.5mm.

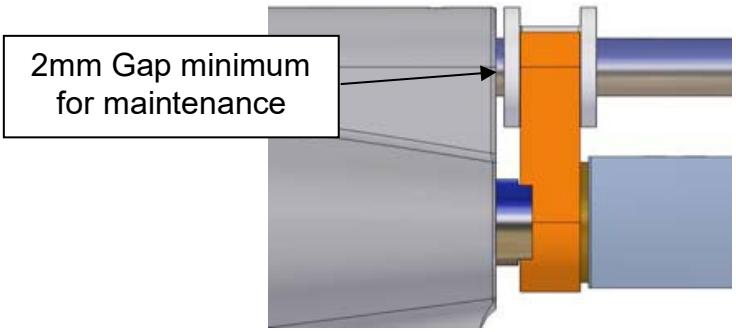


Figure 3

5.3 Remove all debris from around and within the HPSA point machine.

5.4 Check that the HPSA electric motor, brake, power isolation switch, and ECU shock mounts are secure and undamaged.

5.5 Check, that all plug couplers are securely connected to the ECU by attempting to gently rotate the bezel clockwise, use Figure 4 to assist.

a) 4x sensor plug couplers.

b) 2x motor power / sensor, plug couplers.

c) 2x brake plug couplers

d) 2x ECU power and detection plug couplers.

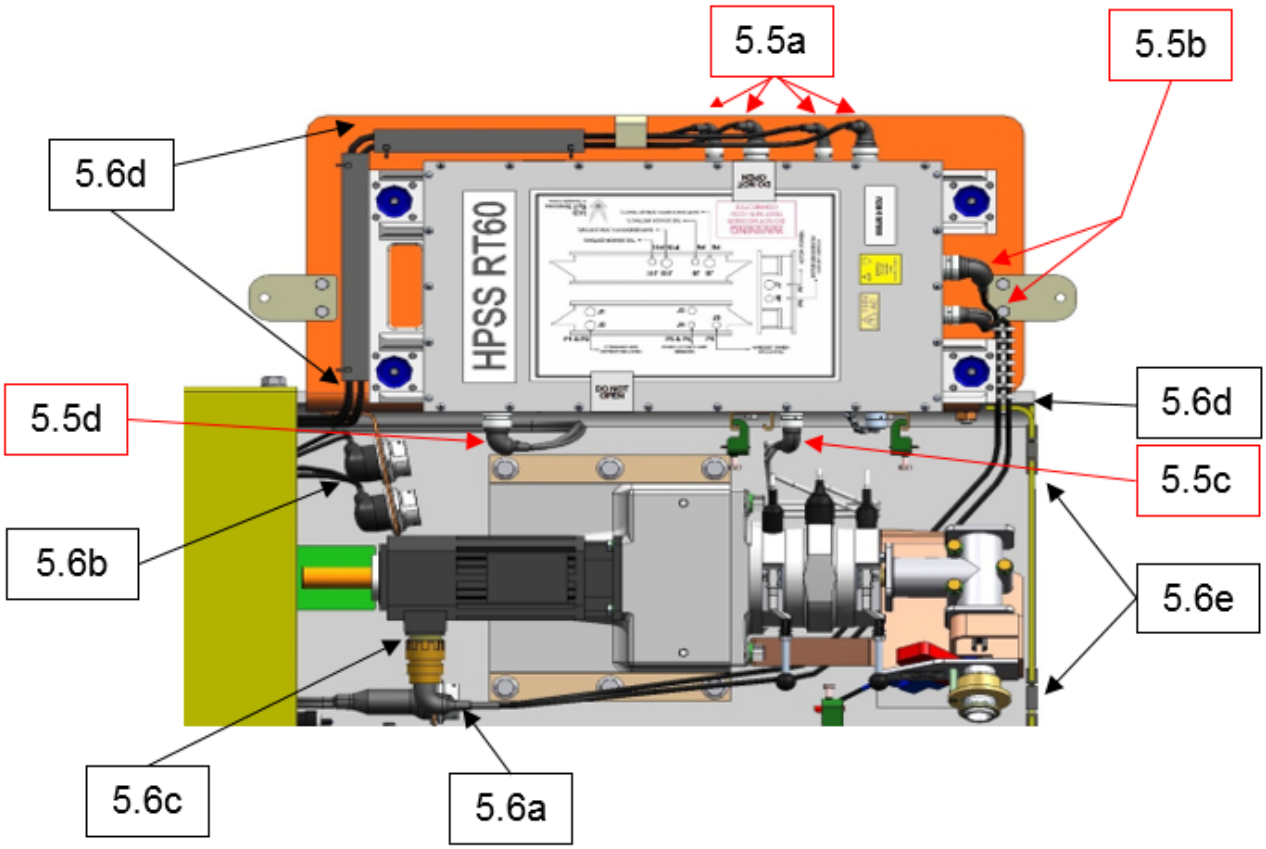


Figure 4

5.6 Check the following within in the HPSA, use Figure 4 to assist.

a) Command (10core), detection (4core) plug couplers.

b) 2x (or 4x) supplementary plug couplers.

c) 2x motor connectors are fully installed and correctly cable tied.

d) Cables are clear of the potential trapping points by the end lid, (3 places).

e) Tail cables are free from damage at cable entry points.

5.7 Check all cables are secured away from the HPSA bearer heater element and any moving parts.

5.8 Using a 'Check torque' (refer to NR/SMS/PartZ/Z02 - Point Reference Values) check all self-locking nuts and bolts are present and secure. Use Figure 5 to assist.

a) 2x (per bracket), toe sensor mounting bolts.

b) 6x gearbox mounting bolts.

c) Where a packing plate is installed under gearbox, 4x packing plate bolts.

5.9 Visually check the condition of the HPSA Drive and Lock Mechanism, use Figure 5 to assist.

a) 4x carriage shaft bolts.

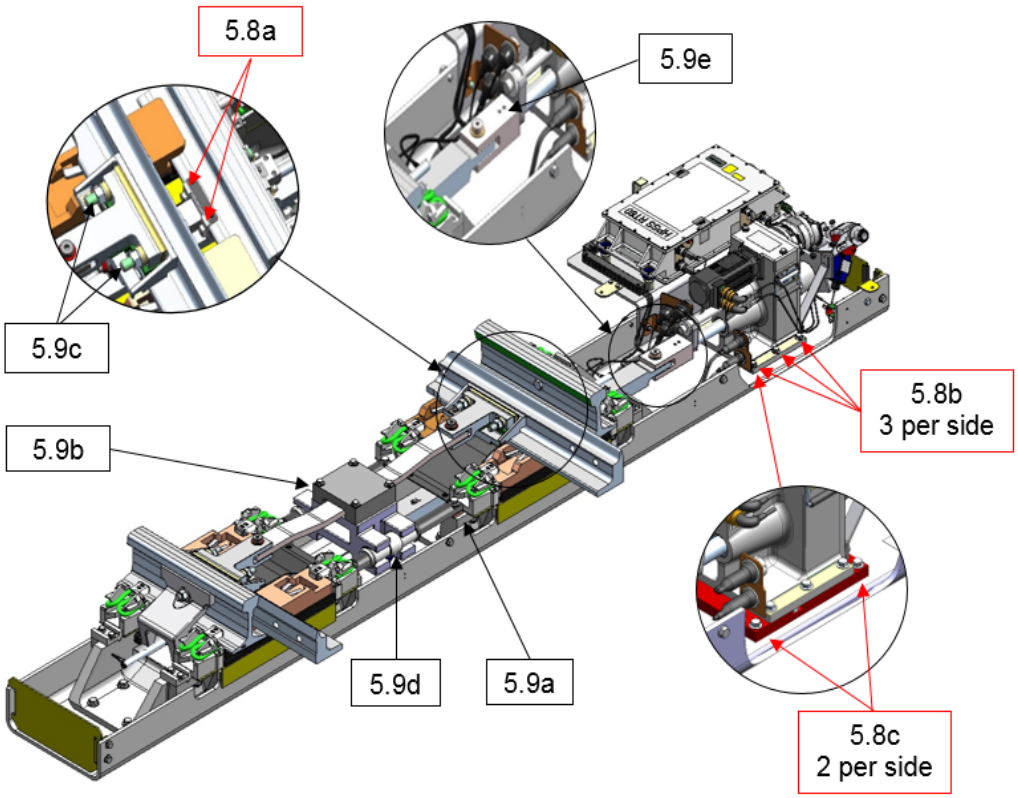
b) 4x carriage top cap bolts.

c) 2x switch rail drive bracket fasteners per bracket.

d) Check the carriage bushes for damage, and clean the carriage shafts using soapy water.

e) Inspect the gearbox to check that the clevis is pinned to the lead-screw.

Any bolts / fasteners / toe sensor brackets that are found to be loose or damaged shall be classed as corrective maintenance and replaced.



6. Manual Cranking Operation

Manually operating the HPSS, check the security of the cranking mechanism and smooth operation.

7. PowerLink Supplementary Hollow Bearers

7.1 Remove any debris/ballast from around and in the supplementary hollow bearers.

7.2 Check the following, at each Backdrive hollow bearer, using a 'check torque' (NR/SMS/PartZ/Z02 Point Reference Values), use Figure 6 to assist:

a) 2x bearing blocks mounting fasteners.

b) 4x dropper bracket to stretcher bar fasteners.

c) Supplementary drive bearers only: 2x locknuts are tight against the lost motion thimbles.

d) Supplementary detection bearers only: 2x supplementary sensor drive brackets. If tabbed washers are installed then visually check tabs.

Figure 5

Any bolts / fasteners / supplementary sensor brackets that are loose or damaged shall be classed as corrective maintenance and replaced.

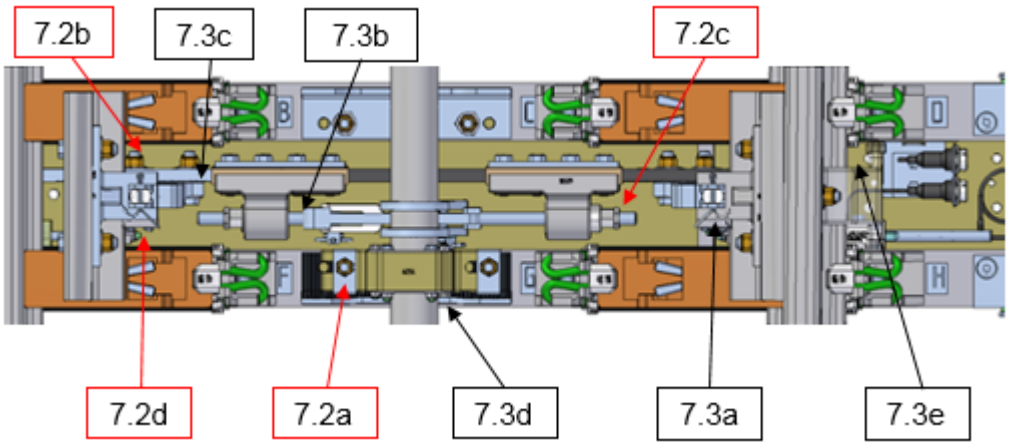


Figure 5

7.3 Visually inspect the following, use Figure 6 to assist:

a) The split pin on the web drive brackets have been correctly formed. One leg should be curled out, the other bent and straight.

b) Check that the 'D' links of the mid (where fitted) and rear supplementary drive stretcher bars are not touching the drive basket when the points are retracted.

c) The serrations between the dropper bracket to stretcher bars are fully engaged.

d) 6x bearing block clamping and bearing journal fasteners.

e) Supplementary detector bearers only: Check all cables are secured away from the bearer heater elements and any moving parts.

8. Torque Tube

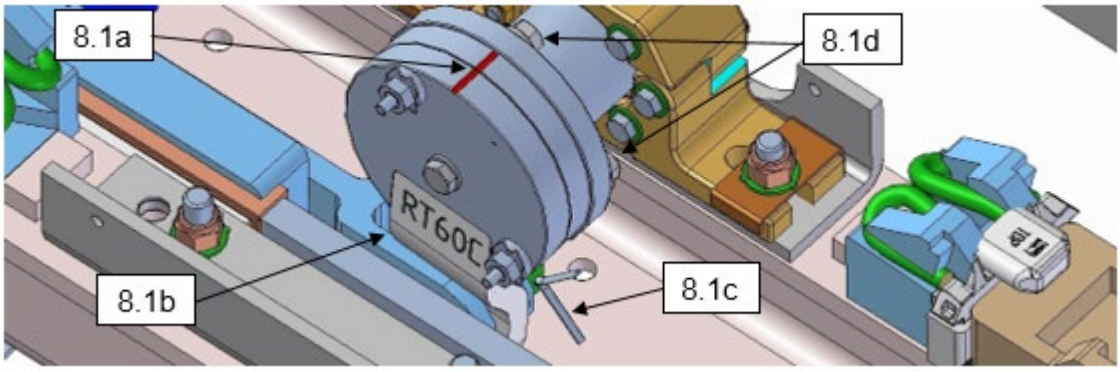


Figure 6

8.1 Check visually the following:

a) That the red lines of the shear pin module align.

b) The shear pin module does not foul on the drive take-off fork (this will be indicated by contact marks on the take-off fork).

c) The retaining split pin legs are present and bent out, at the torque tube drive lug positions.

d) The shear pin module is securely mounted to the torque tube.

e) F and SG torque tubes only: the serrated joint is secure.

f) That no ballast is trapped, or likely to become trapped, between the torque tube and any bearers.

9. Heater check

9.1 With the point end heating system activated (this might require manual activation of the points heating supply), check that the HPSA, supplementary detector(s) and rail heaters are operational.

10. Disconnection Boxes (If provided)

10.1 Remove the lid and Check the following:

a) Disconnection boxes are stable, securely fixed.

b) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

c) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

d) Cable glands are fitted and effective.

10.2 Refit the lid.

10.3 Check the condition and lubricate the RKB221 padlock.

11. Final Checks

11.1 Check the following before returning the HPSS to service:

a) there are no physical obstructions to prevent movement.

b) that the correct number of supplementary detector pairs are recognised by the ECU (via the HPSS Handset).

c) the crank handle is correctly stored.

11.2 Replace all covers and gaiters, except for the ECU end lid. Torque tighten as stated in NR/SMS/PartZ/Z02 (Point Reference Values).

11.3 Return the HPSS to ‘Powered’ operation.

11.4 Carry out NR/SMS/PartB/Test/008 (HPSS Tests).

11.5 Carry out NR/SMS/PartB/Test/004 (Facing Point Lock Tests - HPSS).

11.6 Remove the HPSS handset and reconnect the RCM communication cable. Check that comms is achieved. If RCM is not installed, re-connect the bayonet blanking cap to the handset port of the ECU (J5).

11.7 Replace the ECU end lid.

11.8 Check and lubricate the RKB221 and RKB222 padlocks and re-secure.

11.9 Check that the HPSS operates correctly under power to both normal & reverse positions, (twice if possible).

11.10 If fitted with remote condition monitoring, contact the local RCM team to review the asset trace and to confirm whether the asset can be taken out of maintenance mode.

APPENDIX A - Datum Reset

If any components are changed, any adjustments made to the HPSA point machine, PowerLink supplementary back drive, or tamping has taken place through the points then a Facing Point Lock Test (NR/SMS/PartB/Test/004) should be undertaken which includes the datum reset procedure, after which, a facing point lock and detection test should be carried out and completed successfully prior to a return to service.

The HPSA handset is used to carry out the HPSS datum reset procedure. This updates the fully open and fully closed 'reference positions' of all rail position sensors (LVDTs) that are stored within the ECU (but does not change detection limits.)

Before commencing with the datum reset procedure, check the following:

a) HPSS handset is connected to the ECU and comms is established between the two.

b) check that the HPSS is able to operate correctly to the extend and retract positions.

Each switch rail must be fully closed against the stock rail in line with the first slide chair bolt, before confirming a good extend or a good retract position during the Datum Reset procedure. Failure to do so (e.g. due to switch rail lipping) can result in the points being set up with a gap at the toe between the stock and switch rails.

Using the touch screen of the HPSS handset carry out the following steps:

1. Select Main Menu then Set HPSS Datums.
2. Do You Wish To Proceed? Enter Yes.
3. Are You Able To Complete The Entire Process? Enter Yes.
4. Select number of sensors installed on the layout.
5. HPSS Handset prompts to confirm the number of sensors selected, enter Yes or No, to return to the previous screen.
6. Following the erasure of existing data in ECU, handset prompts Position Rail For Good Extend.
7. Operate HPSA to move to Extend position. Wait for brakes to re-engage.

8. Press Done when switch rail is in the fully extended position and is hard up to stock rail at the toe of the points (i.e. zero gap exists).
9. Writing Extend References data appears on the screen and then prompts Position Rail For Good Retract.

10. Operate HPSA to move to Retract position. Wait for brakes to re-engage.

11. Press Done when switch rail is in the fully retracted position and is hard up to stock rail at the toe of the points (i.e. zero gap exists).

12. Writing Retract References data appears on the screen and then prompts Handset Process Complete.

13. Press OK.

APPENDIX B - Run-Through

The gearbox shall be replaced following a run-through.

All components listed below shall also be replaced before the HPSA is returned to service, together with their associated fasteners, pins, and bearings. Guidance on HPSA component replacement is found in the HPSS Manual (NR/L2/SIG/11400).
The shear pin module (which is a run-through detection feature that forms part of the PowerLink supplementary drive torque tube) shall be replaced following a run-through.

All other supplementary drive components shall be inspected for damage and replaced as necessary. An assessment of any other components shall be made then escalated to the SM(S)

Guidance on component replacement is found in the PowerLink supplementary drive manual.

Ordering the ‘run through kit’ will provide you with all the components for each rail type detailed in Table 1:

Description	Part Number			Qty
	CEN54	RT60	NR60	
Run-Through Kit	4080	4079	4108	1
Gearbox Kit	4001	4001	4001	1
Switch Rail Drive Brkt Kit	4009	4009	4109	2
Switch Rail Drive Arm Kit	4012	4012	4110	2
Drive Shaft Assembly	6035	6026	6225	1
Shear Pin Module CEN54	4052	-	-	1
Shear Pin Module RT60C	-	4047	-	1
Shear Pin Module RT60D	-	4048	-	1
Shear Pin Module RT60E	-	4049	-	1
Shear Pin Module RT60F	-	4050	-	1
Shear Pin Module RT60SG	-	4051	-	1
Shear Pin Module NR60	-	-	4111	1

Table 1 – Run-through: Component Replacement List

1. The above kits contain all the relevant fasteners, pins etc. to enable all HPSA components to be replaced.

2. This list is limited to HPSA components and the shear pin module only. Other PowerLink supplementary drive components shall be inspected and replaced if damaged.

3. CEN54 and NR60 shear pin module: Each design is common to all switch sizes.

4. The gearbox and drive shaft assemblies are extremely heavy and require more than one person to lift them.

APPENDIX C - Basic terminology and information

Extend & Retract

The HPSA uses the above terms to refer to the movement and position of the leadscrew in relation to the gearbox:

a) ‘Extend’ = leadscrew protrudes from the gearbox.

b) ‘Retract’= leadscrew is withdrawn into the gearbox.

These terms do not relate to the Normal or Reverse positions of the points, since the HPSA can be installed with the gearbox at either side of the rails.

HPSA Adjustment

If any adjustment is made to the HPSA such as:

a) Toe opening adjusted.

b) A component within the drive chain replaced (gearbox, drive arm etc).

c) Toe / supplementary sensor replacement

Then a Datum Reset procedure shall be completed (Appendix A) and a facing point lock test shall be carried out.

Electronic Control Unit (ECU)

There are 2 types of ECU, for the following rail types:

- NR60/RT60 rail.
- CEN54 rail (previously known as UIC 54).

Different plug connector keyways are provided for command cable (J1) and detection cable (J2) to prevent the wrong ECU being installed.

The NR60/RT60 and CEN54 ECUs differ due to the 15mm and 12mm obstruction detection requirements respectively.

Toe Sensors Overview

A pair of toe sensors (Extend and Retract) are always fitted at the toe of each switch rail.

Toe sensors are clamped to the foot of each stock rail and are driven to position by the motion of the switch rail drive brackets.

Toe sensor detection windows

The toe sensors are used to detect that the closed switch rail is within 3.5mm of the stock rail, in order for the ECU to give detection.

Supplementary sensor overview

Supplementary sensors are mounted within the backdrive hollow bearers and are driven via a supplementary sensor drive bracket via the switch rail interface bracket.

Pairs of supplementary sensors are fitted along the length of the switch to meet obstruction detection requirements (the quantity of supplementary sensors is determined by switch size length).

Supplementary sensor detection window

Supplementary sensor detection requirements are as follows:

a) CEN54, each supplementary sensor detects that the closed switch rail is less than 8mm from the stock rail, for the ECU to give detection.

b) NR60/RT60, each supplementary sensor detects that the closed switch rail is less than 10mm from the stock rail, for the ECU to give detection.

Insulated and non-insulated sensors

There are two types of drive pegs fitted to the toe and supplementary Sensor(s), insulated and non-insulated.

Do not install a non-insulated sensor (toe or supplementary) with an 'insulated' drive bracket.

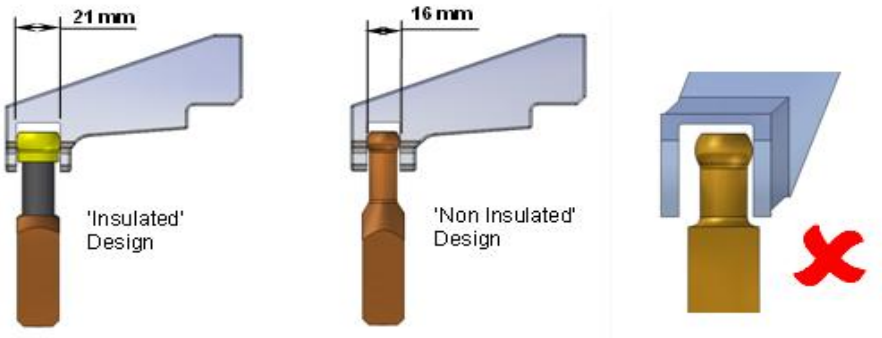


Figure 7

Supplementary Sensor Mounting Bracket

There are three types of bracket:

1. Standard non-handed, (See Figure 9) secured using 4no. M12 screws to bearer wall, made from 5mm thick steel plate. Installed at all RT60 layouts and specific locations on UIC54B layouts. See table Table 2.

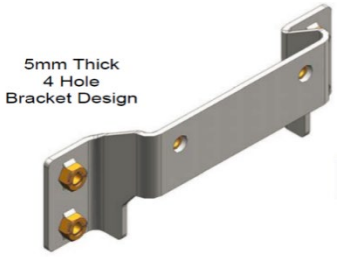


Figure 8 – Standard mounting bracket

2. Non-handed, (See Figure 10) secured using 2no. M12 bolts to bearer wall, made from 3mm think steel plate. Installed on RT60 layouts and specific locations on UIC54B layouts. **This style has been superseded and should not be installed.** If this type of bracket is being replaced due to failure, inspect the other supplementary sensor mounting bracket and, if of the same 3mm type, replace with a 5mm thick bracket when possible.

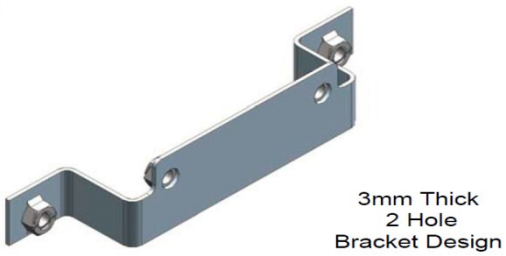


Figure 9 – Superseded mounting bracket

3. Offset mounting bracket (L/H or R/H), (See Figure 11) secured using 4no. M12 screws to bearer wall, made from 5mm thick steel plate. Situated at specific locations on UIC54B layouts only, see Table 2.

Figure 10 – Offset (handed) mounting brackets

Table showing location of offset and standard supplementary sensor mounting brackets UIC54B only.

Switch Size	Supplementary 1 Bracket type (Bearer No.)	Supplementary 2 Bracket type (Bearer No.)
BVs	Not present	Not present
CVs	Offset Brackets (Bearer No 7)	Not present
DVs	Standard Brackets (Bearer No. 5)	Not present
EVs	Standard Brackets (Bearer No. 6)	Not present
FVs	Standard Brackets (Bearer No. 4)	Offset Brackets (Bearer No. 10)
SGVs	Standard Brackets (Bearer No. 5)	Offset Brackets (Bearer No. 11)

Table 2 - Bracket Type / Supplementary Bearer No. (UIC54B only)

HPSA Handset

The HPSA Handset is a pre-programmed portable computer that is used to set up the HPSS system (setting ECU Datum's / Datum Reset) and for faulting and maintenance (LogDump).

It is permissible to have the HPSA Handset connected to the ECU whilst attended, during the passage of rail traffic for on-site points monitoring.

The Datum Reset procedure shall only be carried out when the points (all ends) are in your possession.

Self-Locking Nuts & Bolts

If a self-locking fastener is removed it shall be replaced. Regular re-use will reduce the locking effectiveness. Any self-locking fastener that is found to be loose shall be immediately replaced.

PowerLink Supplementary Drive Adjustment

If any adjustment to the PowerLink Supplementary Drive is made, a Datum Reset procedure shall be completed (Appendix A) and a facing point lock test shall be carried out.

Lubrication

Do not apply mineral oil to the low friction bushes (fitted to the carriage shaft), chair slides or any of the spherical bearings.

The use of Interflon is permitted on the sliding surfaces of the baseplates, carriage shafts and the guide shafts of the toe and supplementary sensors.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/PC61		
Point Machine T72 with VCC Lock & Detection		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	T72 Point Machines
Excludes:	All other Point Machines.

General

The machine shall not be operated electrically until all adjustments have been verified by crank handle operation.

Check that the point identification number corresponds with that shown on the lid and/or machine body.

Nuts that are tight should not move by the application of a short handled spanner.

More information about these machines along with set up and adjustment details is contained in NR/SMS/Appendix/02.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/005 (Facing Point Lock Tests T72 with VCC Lock).

SERVICE A

2. Exterior (T72)

2.1 Check point machine fixings and tighten (if required). Operate machine under power and observe that there is no movement relative to the bearers. If movement is observed, tighten fixing bolts to 100 – 120 Nm and arrange a re-check at the next visit.

Isolate the machine by moving the selector lever from 'MOTOR' to 'HAND'

2.2 Examine crank handle access mechanism MOTOR/HAND selector lever for damage and or wear.

2.3 With 'MOTOR' selected, check that the crank handle cannot be inserted.

2.4 Liaise with the Signaller and with 'HAND' selected, check that the points are isolated and cannot be moved under power, it might not be possible to carry out this task in all circumstances.

2.5 Remove fire risks and potential obstructions.

2.6 Check machine case, cover, fixing clips, hasp(s) and padlock(s) for damage and or wear.

2.7 Clean the drive arm and drive rod and examine for damage and or wear.

2.8 Examine the insulation bush and washers on drive rod.

2.9 Examine the drive arm screws and tab washers; confirm the tab is bent firmly against the side of each screw head. If drive arm clamp screws are found to be loose advise your SM(S).

2.10 Check and adjust the travel of drive rod and drive arm.

2.11 Examine the plug coupler for damage and or wear.

2.12 Check the cable from machine to junction box for damage and or signs of wear.

2.13 Check that the spiral sheath is intact and clamped securely.

2.14 Check that cables are not trapped or covered by P-Way materials.

3. Interior Mechanism (T72)

3.1 Examine plug coupler connections for damage and or wear.

3.2 Check the cable ties are secure.

3.3 Check wires are secured clear of moving parts.

3.4 Examine the following items for damage and or wear.

a) Wires and terminations.

b) All exposed gear wheels.

c) Lock cam and roller.

3.5 Check that the heater assembly mounting plate/gear cover is secure.

3.6 Check the heater and thermostat for damage and or wear, then carry out NR/SMS/PartB/Test/170 (Point Machine T72 Heater and Thermostat Test).

3.7 Examine the manual operation shaft, gear wheel, and return spring. If the spring is defective arrange corrective action.

3.8 Open the water drain device and examine the interior. Remove any debris and any moisture from inner face of cover and case. Close water drain device.

4. Motor Assembly

4.1 Check the motor and fixings for damage and wear.

4.2 Examine the commutator at each end of motor. It should be a light brown/coffee colour.

4.3 Clean the commutator by rotating it slowly and pressing a clean, lint free cloth moistened with an approved cleaner onto the surface.

4.4 Examine the motor brushes and holders.

Brushes shall to be renewed if any has worn down to the minimum permitted length (8 mm).

The brushes shall slide freely in their holders and seat fully on the commutator

5. Junction Box

5.1 Check the following items for damage or wear:

a) Case.

b) Door.

c) Lock.

d) Weather seal.

5.2 Examine the following items for damage or wear:

a) Interior.

b) Terminal blocks.

c) Cable glands.

d) Ties.

e) Wires and terminations.

5.3 Lubricate with mineral oil the door hinges and lock.

6. VCC Lock and Detector Assembly

6.1 Check the balance of the lock arm stroke. Details are in NR/SMS/Appendix/02. If incorrect, report this to your SM(S). Remedial action shall be instigated.

6.2 Check the tail cables, padlock, and the padlock bracket for damage or wear. Confirm that the cables are not trapped or covered by track materials.

6.3 Check the cover and spring retaining clips. If the cover is damaged or spring retaining clips are missing or faulty report it as a corrective maintenance.

6.4 Check the body and fixings, and the internal detector cover for damage or wear.

6.5 Check VCC Lock for signs of run through. If suspected, report it as a corrective maintenance.

6.6 Examine the cam (detector drum) for damage or wear.

6.7 Check the cable clamps and that the cables are secure. Check that any wires cannot be damaged and/or trapped or any terminations touch the cover when it is replaced.

6.8 Examine and clean the wires and terminations and contacts. Pay particular attention for bent contacts, light contacts or contacts with Verdigris on them.

6.9 Examine both ends of brass plunger (switch blade open). If damaged or deformed, report it as a corrective maintenance.

6.10 Check the brass plunger for freedom of operation (switch blade open).

6.11 Gauge the clearance between the cam shaft hexagonal nut and rear of the detector frame (switch blade closed and locked). The 6 mm slotted gauge should be a sliding fit. Adjust the tappet screw as necessary.

6.12 Measure the overall length of the tappet lock nut/tappet screw assembly. If the overall length exceeds 17 mm the brass plunger shall be replaced. See NR/SMS/Appendix/02 for details of these.

6.13 Examine the operating finger, nut and split pin. The finger should be free within the notches of the frame and crank head, If the finger is not free action shall be taken to rectify the issue.

6.14 Check the crank lock casting and the coupling rod insulation for damage or wear. Clean the insulation upper surface as necessary.

6.15 Check the coupling rod and the control arm connections and confirm that the coupling rod is not binding the lock-arms in the transfer channel.

6.16 Check the split pins securing the crank lock bracket nuts for damage or wear.

6.17 Measure (at the edge of their outer diameter) the gap between the spring washers on the hammer head bolts securing the lock crank bracket assembly to the switch blade. (0.5mm – 1mm).

If the gap is less than 0.5 mm the nuts have been over-tightened. Rail creep might result in misalignment and mal-operation. Inform your SM(S). See NR/SMS/Appendix/02 for details

6.18 Check that the lock crank bracket assembly is in contact with plastic sleeve on sliding plane.

6.19 Examine the plastic sleeve on sliding plane. If wear exceeds 1 mm, report it as corrective maintenance.

6.20 Check the plastic pad on crank head. If the pad projects less than 0.5 mm from the crank head, or the chamfered edge of support pad is no longer visible report it as a corrective maintenance.

If the crank head pad requires renewal, remove the lock crank bracket assembly and examine the plastic support pad.

6.21 Examine the crank arm and arm pivot for wear as follows:

a) Move and hold the switch in the mid stroke position.

b) Push the ‘C’ heel against the blade and measure the gap between the heel and the first adjusting shim.

c) Pull the ‘C’ heel away from the blade and measure the gap between the heel and the first adjusting shim.

If the difference between the two readings is more than 2 mm, the lock crank bracket assembly shall be renewed.

With the VCC locked:

6.22 Check that the crank head fully engages the locking piece. Record the amount of engagement / position of the crank head See NR/SMS/Appendix/02 for details.

6.23 Test the stabiliser by trying to push the roller into its housing. If the device is inoperative (spring broken), report it as corrective maintenance.

6.24 Examine the control arm insulating bush. If wear exceeds 1 mm, report it as corrective maintenance.

6.25 Repeat clauses 6.1 to 6.24 for the other VCC lock and detector assembly.

7. Lubrication

NOTE: *The lubricants named in this section are recommended by the equipment manufacturer. Equivalent type lubricants may be used.*

T72 Point Machine

7.1 Lubricate with 'SHELL' Retinax HD Grade 2 grease - Multipurpose grease (blue) the following:

a) Lubricators (1 x internal, 1 x external).

b) grease gun with hexagonal fitting required.

c) Roller assembly.

d) Inside of output shaft cam.

e) Bevel gears (if applicable).

f) Clutch fork and shaft (if applicable).

g) Manual lever pivot (if applicable).

h) Drive arm pivot.

i) Drive rod pivots.

7.2 Lubricate with 'SHELL' Rimula C oil for diesel engine Viscosity SAE 20W-40 via an oil can the following:

a) Gears.

b) Lower shafts.

7.3 Lubricate with adhesive type grease the driving rod thread.

7.4 Lubricate with mineral oil the following:

a) Pivots of crank handle access mechanism.

b) Pivot of manual operation lever housing.

c) Pivots of machine cover latches.

d) Padlocks.

e) Hasp pivot.

VCC Lock

7.5 Lubricate with BP Energrease LS EP grease the following:

a) Surfaces between lock arm and lock crank bracket (lock crank pivot).

b) Both sides of crank head.

c) Plastic sleeve.

d) Locking piece.

e) Roller stabilising device.

VCC Detector

7.6 Lubricate with mineral oil the following:

a) Cam shaft, smear exposed portions of shaft (lock blade closed).

b) Cam shaft bearings via hole at either end of support frame.

c) Padlock.

Junction Box

7.7 Clean and protect terminations.

7.8 Lubricate with mineral oil the door hinges and lock.

8. Contacts and Terminals T72

8.1 Remove the contacts protection cover and check the condition of the contacts.

8.2 Replace the contact cover.

VCC

8.3 Check lock detection contact blades are touching the cam plastic cover (switch blade open).

8.4 Check lock detection contact blades are clear of the cam plastic cover (switch blade closed and locked).

If the contacts are touching the cam plastic cover when the switch blade is closed and locked, then the cam is worn. The contacts shall not be bent. The detector shall be replaced.

Or

The locking is out of adjustment. Arrange remedial action.

8.5 Clean contacts using lint free cloth moistened with an approved cleaner. Contacts are easily damaged. If the contacts are bent/damaged then the detector shall be replaced and a detection test carried out.

8.6 Clean the insulation on the contact block.

8.7 Examine and protect contacts and terminals.

9. General

9.1 Clean the cover and case (T72) and body (VCC) inside and out.

10. Tests and Final Checks

10.1 Carry out NR/SMS/PartB/Test/005 (Facing Point Lock Tests (T72 with VCC Lock).

10.2 Carry out NR/SMS/PartB/Test/007 (Detection Test (T72 with VCC Detector).

10.3 Check all labelling is intact, secure and legible.

10.4 Check and remove any foreign bodies found on the sliding plane or within the detector body.

10.5 Replace the VCC cover and secure padlock. A RKB221 shall be fitted.

10.6 Check for foreign bodies in the point machine, re-fit the lid and secure padlock(s). RKB221 padlock(s) shall be fitted.

10.7 Reset the crank handle cut-out and restore the point machine to power operation.

10.8 Observe correct power operation of the machine. There should be no excessive ‘kick back’ on the motor. If excessive kick back is noted this shall be investigated and rectified

10.9 Place an obstruction between the switch and the stock rail. Operate the points under power and check that the motor stops within 6 to 9 seconds. Remove the obstruction and operate the points under power.

10.10 Check that a RKB222 padlock is fitted to the crank handle access lever bracket.

10.11 Check that with power restored, that crank handle access is prevented.

10.12 The final check before completion of the work is to ask the Signaller to operate the points to Normal and Reverse positions (twice if possible). Observe correct operation.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/PC81		
Unistar HR Points		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	Unistar HR
Excludes:	Any other type of hydraulic points

GENERAL

Do not use solvent based cleaner to remove grease from the internal components of the DLD (Drive, Locking, Detection) unit. Clean by wiping surfaces clean with a lint free cloth which is disposed of after use.

See NR/SMS/PartA/A04 (Method Statement Summary) for information on safe working on point systems.

See NR/SMS/PartZ/Z02 (Point Reference Values) for all torque values used in this document.

NOTE: *In wet or inclement weather the drying bags are to be removed and stored safely and the DLD body left open for the shortest possible time.*

On completion of the work, any moisture shall be carefully removed, and the drying bags replaced before the lid is replaced.

1. Remote Condition Monitoring

If the points that you have requested to work on are fitted with Remote Condition Monitoring, check that the asset has been placed into maintenance mode prior to commencing work.

Prior to commencing work, previous current traces should be made available from the Remote Condition Monitoring system and checked for any abnormalities.

Also, on completion of the work new traces should be recorded and viewed so they can be compared with the traces produced before the maintenance activity.

When requesting permission from the Signaller to work on a set of points, ask the Signaller to operate points in both directions to verify and prevent any confusion on the set of points you have requested to work on.

REGULAR TESTS

2. Facing Point Lock

2.1 Carry out NR/SMS/PartB/Test/270 (Facing Point Lock Tests – Unistar HR).

ANNUAL SERVICE

3. Check For External Damage

3.1 Check for any damage, wear, or corrosion.

4. Power Pack

4.1 Check the concrete base, power unit mountings and fixings for damage and that all fasteners are secure.

NOTE: *The pump unit should be reasonably level and secure.*

4.2 Check the plug coupler cable and route for damage, signs of wear and chafing, remove any objects that might cause damage.

4.3 Remove the power pack lid (unlocking the lid automatically cuts power to the machine).

4.4 Remove the drying bags and place aside for disposal.

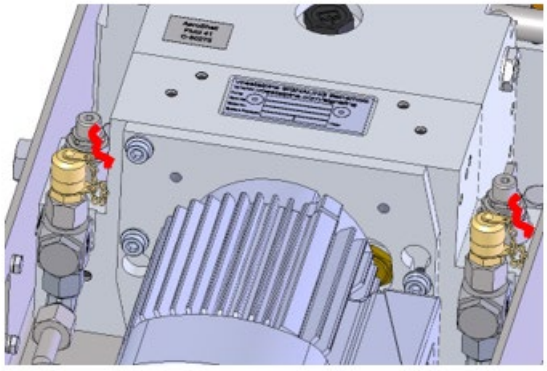
4.5 Check the lid latches are adjusted to give a secure fit, adjust as necessary.

4.6 Check the protective vents on the side of the case are clean and undamaged.

4.7 Check the safety paint marks on the overpressure valves – See Figure 1.

If the paint is damaged, then the unit is potentially operating above its recommended value.

If damage is seen, raise a work arising form to replace the power-pack as corrective maintenance within 6 weeks as a precautionary measure.



Check paint safety indicators of overpressure valves

Figure 1 – safety paint marks (highlighted) on overpressure valves

4.8 Check the advisory LEDs are illuminated.

4.9 Examine internal wiring.

NOTE: *Hydraulic fluid can cause degradation of insulation.*

4.10 Replace (with an approved product) the 3.6v battery that powers the LEDs – see Figure 2.

Figure 2 - Location of local indication battery within Unistar HR power pack

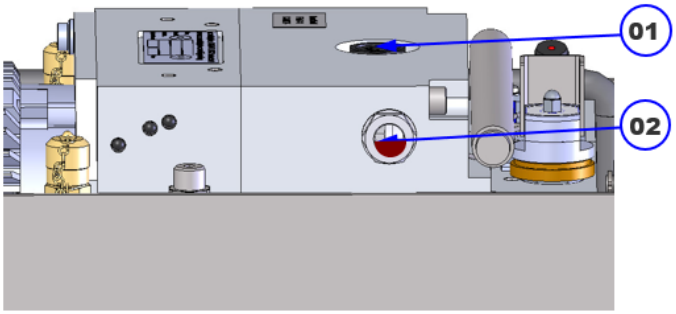
4.11 Clean and examine the pump unit, motor assembly and all fixings. Check for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

4.12 Turn the pump control to the intended direction of operation.

4.13 Manually operate the points to both normal and reverse, checking the LED's illuminate in correspondence.

4.14 Check the hydraulic fluid level. If a top up greater than 0.5 litres is required check for leaks in the hydraulic system, rectify as required. If a leak cannot be found, report as corrective maintenance before the end of the shift. If more than 1 litre is required, or notching is felt during manual operation then bleed the system.

The maximum fluid level is indicated by the fluid being halfway up the sight glass as shown in Figure 3. Fluid level beyond this point may leak out of the vent cap during hot weather. This is normal and will not impact the operation. Surplus fluid may accumulate in the base of the unit and should be removed.



01 Oil filling and ventilation plug

02 Maximum oil level (middle of oil sight glass)

Figure 3 – Maximum fluid level reached when oil is half-way up sight glass

4.15 Install new drying bags and close the main lid and fit the padlocks. The position of the drying bags is shown in Figure 4.

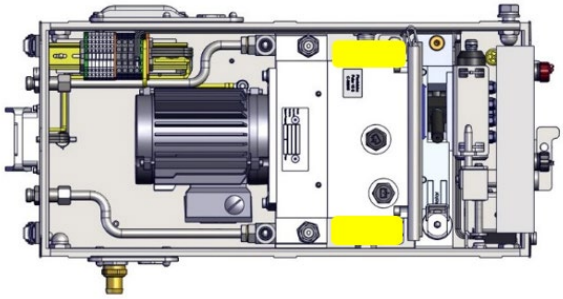


Figure 4 – Position of drying bags in Power-pack (shown in yellow)

5. Switch Rail Bracket and Rod Ends Assembly

5.1 Examine switch rail bracket assembly and fixing bolts. Check that the bolts are torqued in line with NR/SMS/PartZ/Z02 (Point Reference Values) and that the bolts protrude through the lock nuts. Philidas 4 threads, Hardlock 6 threads.

5.2 Schedule any corroded components for replacement.

5.3 Check that the Drive and Detector rod end threads are greased.

5.4 Check the Residual Switch Opening (RSO), if not within specification, check for an obstruction in the switch.

If there is no obstruction present, the lock rod end needs to be adjusted and the detection checked and adjusted as necessary. If the RSO cannot be brought into specification, then this indicates that the integrated pressure heads might be worn.

NOTE: *On switch diamonds, it may not be possible to achieve compliant RSO at the rear of the switch. This is due to the geometry of the switch diamond. Non-compliances shall be reported to the Section Manager for review.*

5.5 Check the integrated pressure heads visually for wear and correct function. If the pressure head does not automatically return to its uncompressed state when the switch is in the open position, then it shall be replaced.

This is indicated by the witness line (shown in Figure 5) failing to be seen when the switch is in the open position, and no resistance being felt when tightening the pressure head setting nut.

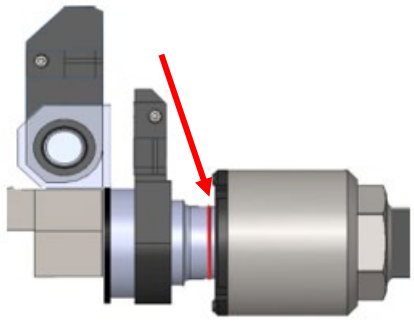


Figure 5 - Indicator mark on integrated pressure head highlighted in RED

5.6 Check the lock and detector bracket retaining plates. Schedule any lock and detector bracket retaining plates that show signs of wear or damage for renewal.

6. Drive Lock Detector Unit - DLD

6.1 Remove the DLD lid. Remove the drying bags and place aside for disposal.

6.2 Check the lid latches are adjusted to give a secure fit, adjust as necessary.

6.3 Check the protective vents (shown in Figure 6) on the side of the case are clean and undamaged.

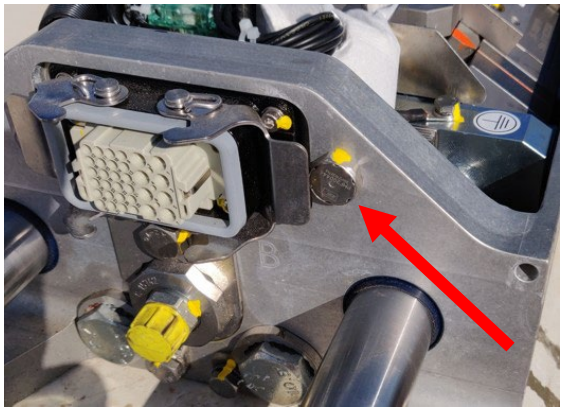


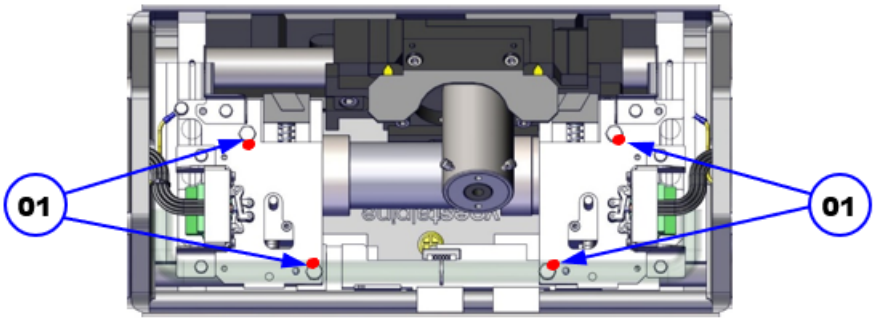
Figure 6 - Protective vent indicated by arrow one on each side of the DLD

6.4 Check the plug coupler cables, hoods and route.

6.5 Check the hydraulic connections on the DLD(s) are tight and there are no leaks. Installation torques and check torques are given in NR/SMS/PartZ/Z02 (Point Reference Values).

6.6 Check the DLD securing bolts, or the DLD to Buttress Plate fasteners for security and tighten to specification if movement is observed under manual operation. Locking plate bolts shall be tightened to specification.

6.7 Check the safety marked elements in the housing of the DLD unit (see Figure 7), if the paint marks show movement has occurred, tighten to specification and paint new marks.



Safety paint marked fasteners in the DLD-unit

01	Bolt with Nord-Lock washers

Figure 7 – Security pain marked fastenings within DLD unit

6.8 Manually operate to both normal and reverse positions, observe and verify the Lock Prism indicators overlap and align correctly and that Lock has been made.

6.9 Manually operate to both normal and reverse positions, when visual verification of the lock is made at the prisms, check the Detector Plate detection markings are visible and that Detection has been made (this will be verified by seeing the detection assembly engage).

6.10 Manually operate to both normal and reverse positions, observe the operation of the detector bar head and springs during manual operation. Check that the bolt head returns automatically.

6.11 Clean and lubricate the internal parts of the DLD as shown in Figure 8 with a manufacturer-approved grease (e.g. Renolit HT2).

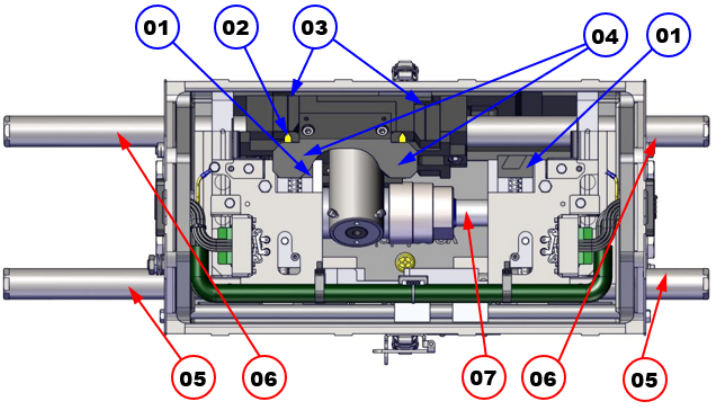


Figure 18: Greasing points DLD-unit

01	Head of the detector bar (Well visible grease film)	05	Detector rod **ex**ternal: *no lubrication* Detector rod **in**ternal: *thin grease film*
02	Locking plate (*thin grease film*)	06	Drive rod **ex**ternal: *no lubrication* Drive rod **in**ternal: *thin grease film*
03	Prisms (*thin grease film*)	07	Piston rod (***no lubrication***)
04	Guidance Bar (*thin grease film*)		

Figure 8 – greasing points within the DLD unit

.

6.12 Install new drying bags and close the main lid and refit padlock. Position drying bags as shown in Figure 9.

Drying bags should be positioned so that they cannot obstruct moving parts of the mechanism.

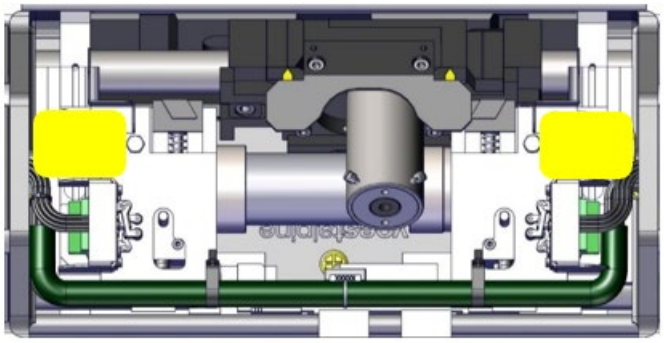


Figure 9 - Position of Drying Bags in DLD (shown in yellow)

7. Disconnection Boxes

7.1 Remove the lid and check:

a) Cables and cores are undamaged, correctly labelled, and free from degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

7.2 Refit the lid and (if provided) padlock.

8. Final Tests and Checks

8.1 Carry out NR/SMS/PartB/Test/270 (Facing Point Lock Tests – Unistar HR).

8.2 Carry out NR/SMS/PartB/Test/271 (Detection Test (Unistar HR).

8.3 Switch the power pack control to “Motor”, stow the manual operating handle and close the lid. Turn down the power cut-off latch to lock the lid and restore power.

8.4 Refit and lubricate padlocks (RKB 221 and 222 padlocks on the lock body, pump unit cover and local control lids). Check padlocks for condition and replace any showing signs of damage.

8.5 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/PC91		
Point Machine WRSL Style CP & D Pneumatic		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	WRSL Style CP & D Pneumatic
Excludes:	All other types of Pneumatic Point Machine

General

These machines operate on an air pressure of typically 50-60 psi. Care shall be taken when manipulating or regulating the air supply.

When required, the machine shall be isolated as follows:

- CP: Remove the de-energised N or R magnet valve armature depending on the lie of the points (e.g. points normal – remove the reverse armature).
- D: Disconnect the electrical feed to the magnet valve armature for the opposite lie of the points and maintain the lock valve energized. If you remove the plug coupler, point operation and detection shall be isolated.

Or

- CP or D: Insert a tapered block into the centre drive of the drive and lock movement

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

SERVICE A

2. Exterior

2.1 Examine machine covers, studs and padlocks.

2.2 Check visible tail cables and route.

2.3 Check air pipes and connections for leaks.

2.4 Check base-plate and castings for cracking. Operate machine under power and check the machine is secure. Tighten as necessary.

2.5 Remove fire risks and potential obstructions

2.6 Clean and apply adhesive grease to point drive and lock and detector movements.

2.7 Examine piston cylinder glands.

3. Interior

Before you start any work, isolate the machine.

Piston Assembly

3.1 Examine the following:

a) Piston cylinder; look for signs of swarf or corrosion.

b) Air connections. Break detection and listen for air leaks with the points in both positions. Tighten the piston ring as necessary using a 'C' spanner.

c) Piston connection to drive (mushroom and locknut).

Point Drive Assembly

3.2 Clean and examine base assembly and fixings.

3.3 Clean and examine point drive and lock movement, lock dogs, rollers and rivets.

3.4 Lubricate with lithium grease the following:

a) Point drive and lock movement.

b) Piston shaft.

c) Escapement.

d) Rollers (grease nipples x 9).

e) Lock blades and bearer plates. Chamfering and swarf indicates points are out of adjustment.

f) Lock dogs.

3.5 Check lock plunger connection and nut.

Contact Assembly

3.6 Remove accumulated dirt and moisture. Check for signs of cracking.

3.7 Examine the following:

a) Lock plunger and rollers.

b) Detector blades, slides and bolts.

c) Lock plunger retaining straps and bolts.

3.8 Examine yoke, pivot pin, slide bars, rollers, pins and fixing bolts.

3.9 Clean and lubricate with lithium grease the lock plunger and detector blades.

3.10 Clean and lubricate with oil the yoke slide bars, rollers, and pins.

3.11 Check the tension of yoke spring. The spring shall be tight with no loose motion. If the motion is loose, check the spring, pivot block and pivot pin; tighten or replace as necessary.

3.12 Examine the detector slide bar and centre pivot fastening.

3.13 Where fitted, check the heaters and mountings.

3.14 Examine the following:

a) Cable entries, blanking plates and water seals.

b) Internal wiring and terminations. Wiring on these machines tends to degrade due to contamination by oil and water.

c) Clean and protect as necessary.

3.15 Examine detection contact adjustment. Rollers shall rotate freely and sit in the bottom of notches for both N & R positions.

3.16 Examine terminal blocks, detection ('butterfly') contacts and mounting block. All fixings shall be tight.

3.17 Check contact springs and contact alignment in N & R positions; adjust as necessary.

a) Check fixings are tight.

b) Clean contacts with an approved cleaner.

c) Replace contacts that are worn or damaged.

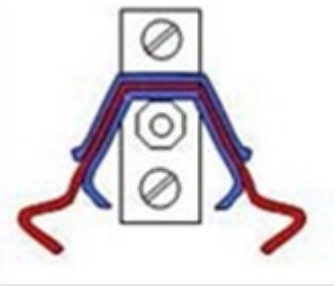


Figure 1 - Contacts

4. Valve Chest – Style CP

4.1 Wipe, clean and examine interior of case, where not treated with anti-condensation paint.

4.2 Examine the following:

a) Cable entry and terminations.

b) Circuit controller contacts. Clean or replace dirty, damaged or worn contacts.

c) Terminations and contact fingers. Clean and protect as necessary (excluding contact faces).

4.3 Examine and clean contact rocker arm. Lubricate with lithium grease.

4.4 Remove and clean both valve armatures using a lint free cloth. Lubricate (lightly oil) the bottom of each armature.

4.5 Check that magnet valve caps are screwed on tight.

4.6 Examine all air connections and joints.

4.7 Replace cover and padlock.

5. Valve Chest – Style D

5.1 Wipe, clean and examine interior of case, where not treated with anti-condensation paint.

5.2 Examine the following:

a) Air regulator lock nut, adjust regulation as necessary. A loose lock nut might cause the regulator to blow out.

b) Plug coupler terminations.

c) Cable entry.

d) Plug coupler fixing clips.

e) Valve seating bolts.

6. Tests & Final Checks

6.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests, Electrical Detectors).

6.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

Any adjustments shall be verified manually before operating under power.

6.3 Replace covers and secure using padlocks (Lubricate).

The final check before completion of the work is to ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

General

6.4 Thoroughly clean machine and cylinder covers.

6.5 Lubricate with oil or lithium grease the piston cylinder.

7. Valve Chest – Style CP

7.1 Clean the air filter gauze with cleaning fluid.

7.2 Lubricate with oil the valve piston leathers

8. Valve Chest – Style D

8.1 Clean the plug coupler, protect as necessary.

9. Tests & Final Checks

9.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests, Electrical Detectors).

9.2 Carry out, NR/SMS/PartB/Test/019 (Detection Loop Test).

9.3 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

Any adjustments shall be verified manually before operating under power.

9.4 Replace covers and secure using padlocks (Lubricate).

9.5 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

9.6 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

EP Drive and Lock Mechanism

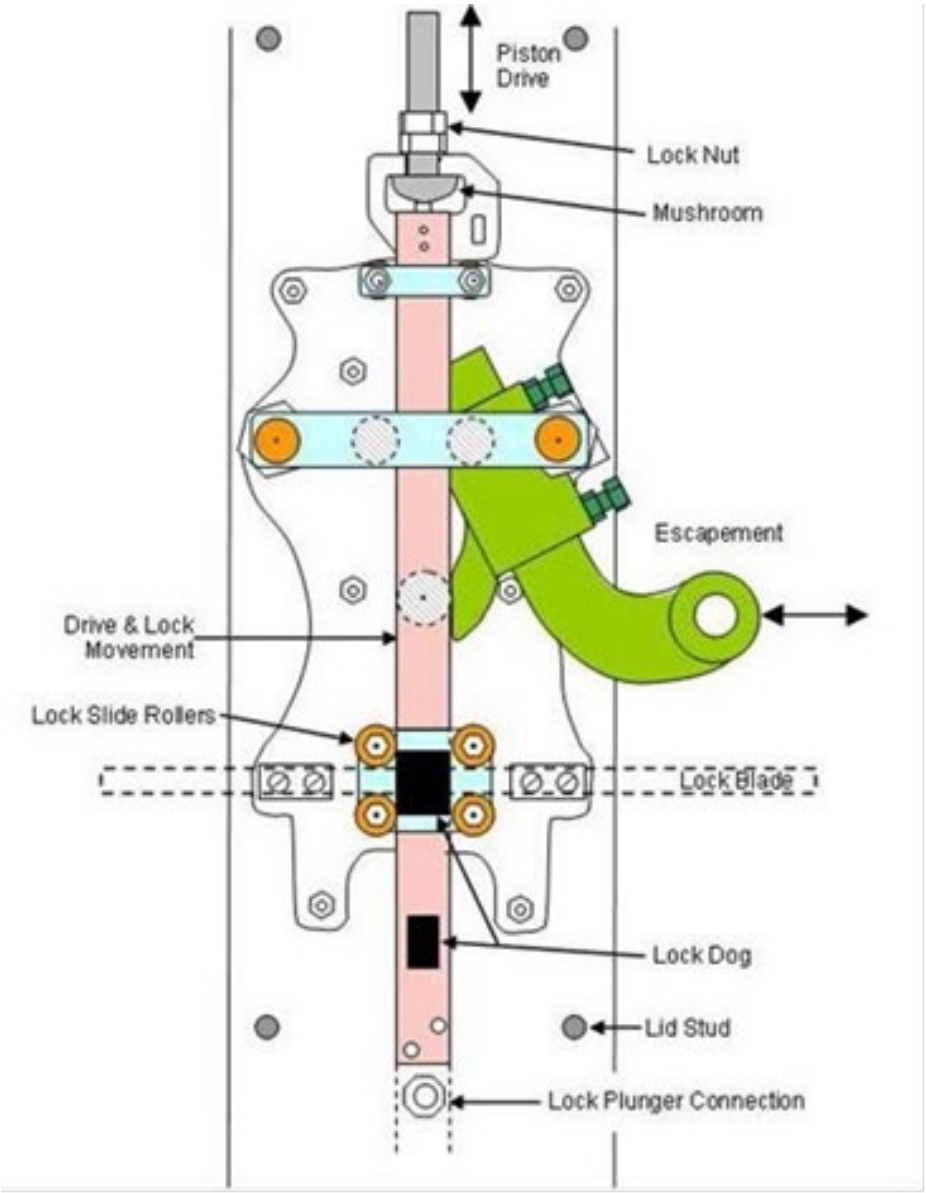


Figure 2 – EP Drive and Lock Mechanism

EP Detection Assembly

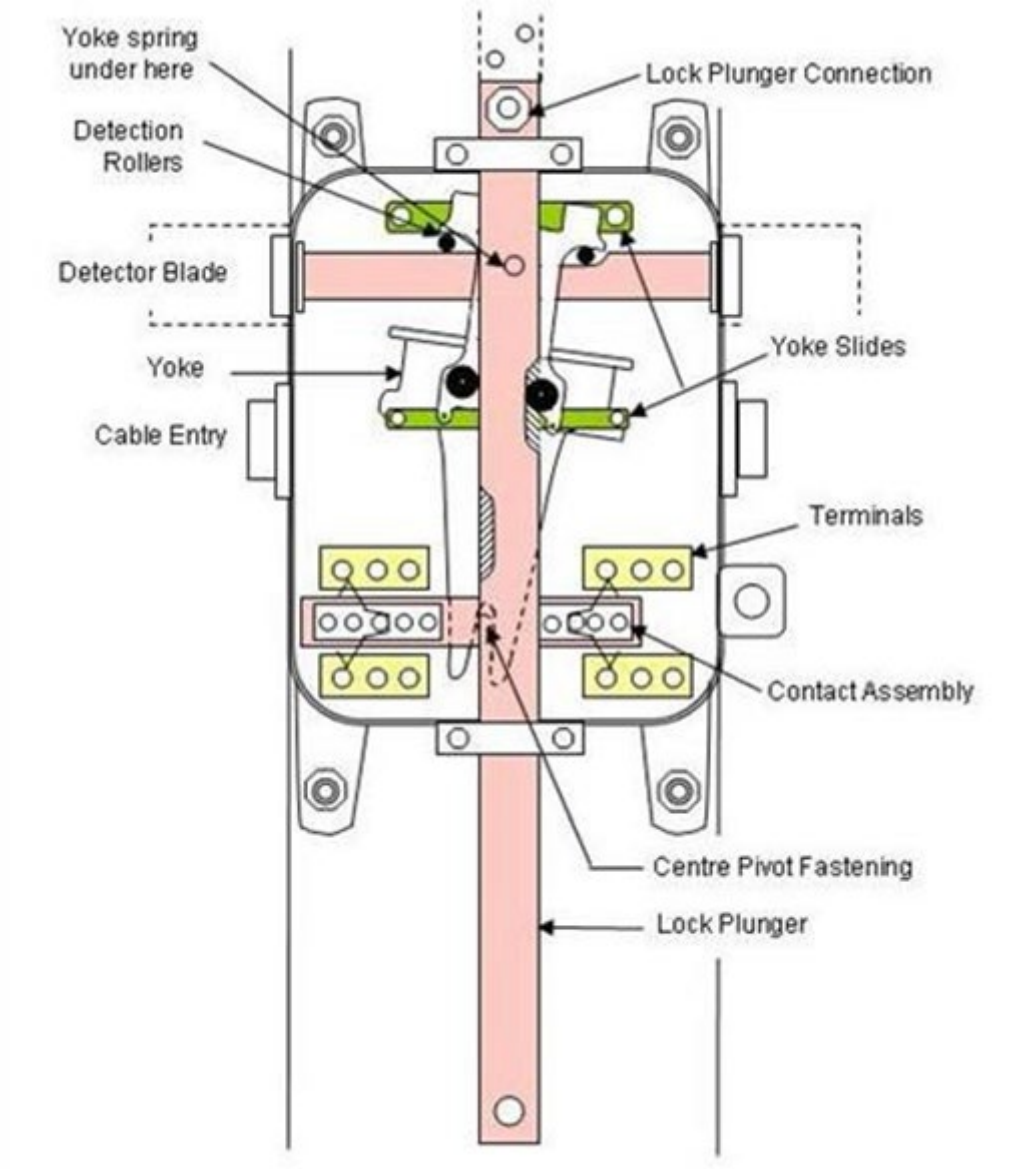


Figure 3 – EP Detection Assembly

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/PC92		
WRSL Hand and Air Points		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	WRSL Hand and Air Points
Excludes:	All other Hand and Air Points

SERVICE A

1.1 Examine all air pipes and connections.

1.2 Examine point operating cylinder.

1.3 Examine point operating ram and seal, check for excessive free play. Where this is found to be unacceptable it shall be reported as corrective maintenance so that the necessary remedial action can be arranged.

1.4 Clean and lubricate the point operating ram with an adhesive type grease.

1.5 Examine and lubricate all point and drive fittings.

1.6 Examine and lubricate (P-Way) hand point mechanism, spring, and fittings.

1.7 Remove all fire risks and potential obstructions from or near point equipment e.g. oily waste, paper and ballast.

1.8 Wipe all external housing parts and fittings.

1.9 Examine wiring, termination's and cable entry - Check the cable is not chaffing.

1.10 Remove any moisture from bottom of housing and case.

1.11 With the co-operation of the Signaller/Panel Operator:

a) Operate the points locally by depressing button on top of the valve, observe correct movement and that the points are fitting up correctly.

b) Repeat for opposite lie of points.

c) Depress isolation plunger in valve chest and by use of the P-Way hand lever (where fitted) or by barring the points off, check that the force exerted by the hand point spring is enough to return and hold the switch rails in position against the stock rails.

d) Repeat this operation for opposite lie of points.

NOTE: *Any discrepancies shall be immediately reported as corrective maintenance so that the necessary remedial action(s) can be arranged.*

1.12 Carry out NR/SMS/PartC/PD01 (BR998 Detector) - Service A and any associated tests called by the SMS.

1.13 Arrange for points to be operated from the control point and observe apparatus functions correctly.

SERVICE B

2. Detector Test

2.1 Carry out NR/SMS/PartC/PD01 (BR998 Detector) - Service B and any associated tests called by the SMS.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/PC95		
Point Machine SGE Style VB Pneumatic		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	SGE Style VB Pneumatic
Excludes:	All other types of Pneumatic Point Machine

General

These machines operate on an air pressure of typically 50-60 psi. Care shall be taken when manipulating or regulating the air supply.

When required, the machine shall be isolated as follows:

a) Remove the plug coupler: point operation and detection shall be isolated.

Or

b) Insert a block into the point switch to prevent the points from operating.

REGULAR TESTS

1. Facing Point Lock

1.1 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

SERVICE A

2. Exterior

2.1 Examine machine covers, studs and padlocks.

2.2 Check visible tail cables and route.

2.3 Check air pipes and connections for leaks.

2.4 Check base-plate and castings for cracking. Operate machine under power and check the machine is secure. Tighten as necessary.

2.5 Remove fire risks and potential obstructions

2.6 Clean and apply adhesive grease to point drive and lock and detector movements.

3. Interior

Before you start any work, isolate the machine.

3.1 Examine the following:

a) Piston cylinder; look for signs of swarf or corrosion.

b) Air connections. Break detection and listen for air leaks with the points in both positions. Arrange for 'O' ring seals on end of cylinder to be replaced as necessary.

c) Piston connection to drive (lug, split pin and locknut).

3.2 Clean and examine base assembly and fixings.

3.3 Clean and examine point drive, escapement and lock assembly:

a) Baseplate, castings, rivets and fixings.

b) Point drive bar and slider plates.

c) Escapement, pivots and bolts.

d) Throwbar, drive lug and split pin.

e) Rollers and grease nipples.

f) Lock blade, lock dogs, and notches.

g) Chamfering and swarf indicates points are out of adjustment.

3.4 Clean and examine connection to detector box (Lug, bolt and split pin).

3.5 Lubricate with lithium grease the following:

a) Point drive and lock movement grease nipples.

b) Piston cylinder grease nipple.

3.6 Lubricate with oil the following:

a) Piston surface.

b) Wearing surfaces of drive mechanism.

4. Contact Assembly (Style HV)

4.1 Remove the cover, check the seal and castings.

4.2 Check the drain holes and ventilators. Remove any accumulated moisture and debris.

4.3 Clean and examine the following:

a) Locking bar and dogs.

b) Lock slides and notches.

c) Look particularly for wear (swarf) and chamfering (bright corners).

d) Detector slides and notches.

e) Guides, rollers, and fixings.

f) Cover plate and fixings.

4.4 Lubricate the slides with lithium grease.

4.5 Fill the oil cups with mineral oil.

4.6 Examine the following:

a) Detector actuators.

b) Rollers, pivots and split pins, lubricate with mineral oil. Rollers shall fully engage in notches and rotate freely.

4.7 Examine ‘shuttle mechanism’:

a) Moving contact and return spring assemblies.

b) Terminal blocks & fixings tighten / protect as necessary.

c) Contacts and springs, clean and protect as necessary.

d) Protection shall not be applied to contact faces.

e) Cables, cable entries, wiring and terminations.

4.8 Check heaters, where fitted.

5. Valve Unit – Style VG

5.1 Check exterior of case, pedestal and fixings

5.2 Wipe, clean and examine interior of case, where not treated with anti-condensation paint.

5.3 Examine the following:

a) Air regulator lock nut adjust regulation as necessary. A loose lock nut might cause the regulator to blow out.

b) Cable entry.

c) Plug coupler fixing screws.

d) Valve seating bolts.

5.4 Clean and check the exhaust ports.

6. Tests & Final Checks

6.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests, Electrical Detectors).

6.2 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

Any adjustments shall be verified manually before operating under power.

6.3 Replace covers and secure using padlocks. An RKB222 shall be fitted.

6.4 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

7. General

7.1 Thoroughly clean machine and cylinder covers.

7.2 Lubricate with lithium grease the piston cylinder grease plugs.

Only remove these plugs after the air has been isolated. Check they are properly refitted afterwards.

8. Valve Unit – Style VG

8.1 Clean air filter gauze with cleaning fluid.

8.2 Clean plug coupler, protect as necessary.

9. Final Checks and Tests

9.1 Carry out NR/SMS/PartB/Test/011 (Detector Tests, Electrical Detectors).

9.2 Carry out NR/SMS/PartB/Test/019 (Detection Loop Test).

9.3 Carry out NR/SMS/PartB/Test/001 (Facing Point Lock Tests, Machine).

9.4 Check that any adjustments are verified manually before operating under power.

9.5 Replace covers and secure using padlocks. An RKB222 shall be fitted.

9.6 Carry out NR/SMS/PartB/Test/052 (Dynamic Earth Tests).

9.7 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

EP Drive and Lock Mechanism

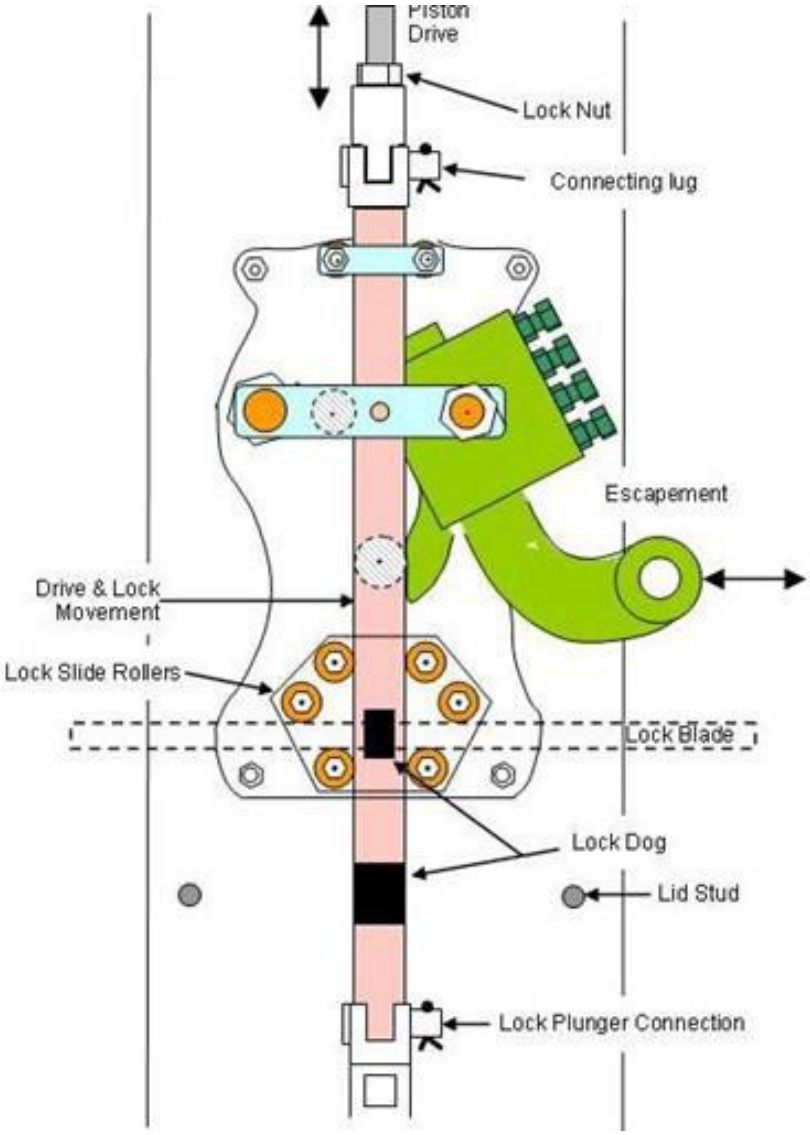


Figure 1 – EP Drive and Lock Mechanism

EP Detection Assembly

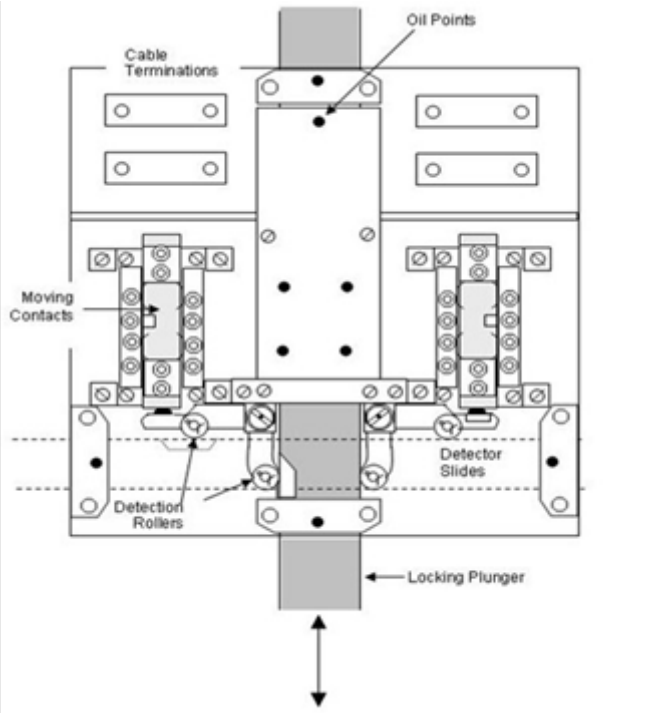


Figure 2 – EP Detection Assembly

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/PD01		
BR998 Detector		
Issue No: 06	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	BR998 detectors used for main or supplementary point detection
Excludes:	Other detector types, internal detectors in point machines

General

Liaise with the Signaller before carrying out work on detectors.

If any adjustments are made, the correct detection tests shall be carried out before the equipment is handed back to the Signaller.

Main point detectors are usually situated at the points toe, supplementary detectors towards the heel. At some installations (e.g. double slips) the supplementary detector can be located at the toe. If you are in any doubt, ask your SM(S).

SERVICE A

1. Exterior

1.1 Remove all fire risks and potential obstructions.

1.2 Check the security of the detector casting fixings and the condition of the lid. The detector assembly shall not move when the points are operated. The lid shall provide an effective weather seal.

1.3 Open the lid, remove and examine detector cover. Report damaged covers as corrective maintenance. Track vibration can cause terminal assembly bolts to gradually puncture through the cover.

1.4 Wipe and examine the detector rods, adjusters, connections, and fixings. Protect screw threads with adhesive grease. The detector rod shall not be able to short against the rail.

2. Detector Assembly

2.1 Clean, check and examine the detector assembly, particularly:

a) Base plate and fixings.

b) Detector base casting and fixings

c) Check the circlips are fitted in the correct position

d) Detector slides, notches, holding clamps, and fixings. The tappet slides shall be securely held and not bent or damaged.

e) Check the locknut on the adjustable tappet for tightness.

f) Rocker arm, pivot, return springs, and stops. The pivot shall be rigid, and the springs correctly return the rocker.

g) Rollers, pivots, and fixings. The rollers shall be fully engaged into the notches and freely rotate.

h) Microswitch assemblies and fixing bolts. The adjustable tappet screws and rocker interfaces shall not be clogged.

2.2 The rubber 'gaiters' shall be in good condition and undamaged. No part of the O-ring seal between the switch body and the box casting shall be visible

Any problems found with micro switches shall be reported as corrective maintenance.

3. Terminal Assembly

3.1 Remove the terminal box cover. Check that the water seal is undamaged and effective.

3.2 Remove accumulated moisture and debris. Excessive moisture or water ingress shall be reported as corrective maintenance immediately.

3.3 Examine cable entry, glands, visible tail cable and route. The glands shall form a tight seal around the cables, if not tighten or replace as necessary.

3.4 Clean and examine terminal block and set screws.

3.5 Examine cable cores, internal wiring, and terminations to micro-switches and terminal block. Protect terminations as necessary. Check that the terminations are tight, and that wire insulation is not degraded.

3.6 Replace the terminal box cover. Check that the securing nuts are tight

4. Lubrication & Final Checks

4.1 Lubricate, using lithium grease the following:

a) Rocker arm grease nipple.

b) Detector slide grease nipples.

c) Rocker springs.

4.2 Apply a minimum of mineral oil to roller spindles, tappets, and microswitch contact surfaces.

4.3 Smear a film of oil onto the surface of detector slides.

4.4 Observe the apparatus for correct operation. Lubricate padlock, replace and secure detector lid.

5. Local Policy Requirement

5.1 Where the detector is used for main point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.

5.2 Where the detector is used for supplementary point detection, check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.

5.3 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests). as directed.

For Detectors fitted to Train Operated Points Systems

5.4 If any adjustments are made, then carry out NR/SMS/PartB/Test/018 (Train Operated Points Detection Test).

SERVICE B

6. Detection Tests

6.1 Where the detector is used for main point detection, carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

6.2 Where the detector is used for supplementary point detection, carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test).

6.3 Carry out NR/SMS/PartB/Test/010 (BR998 Detector Electrical Tests).

APPENDIX A - BR 998 Detector

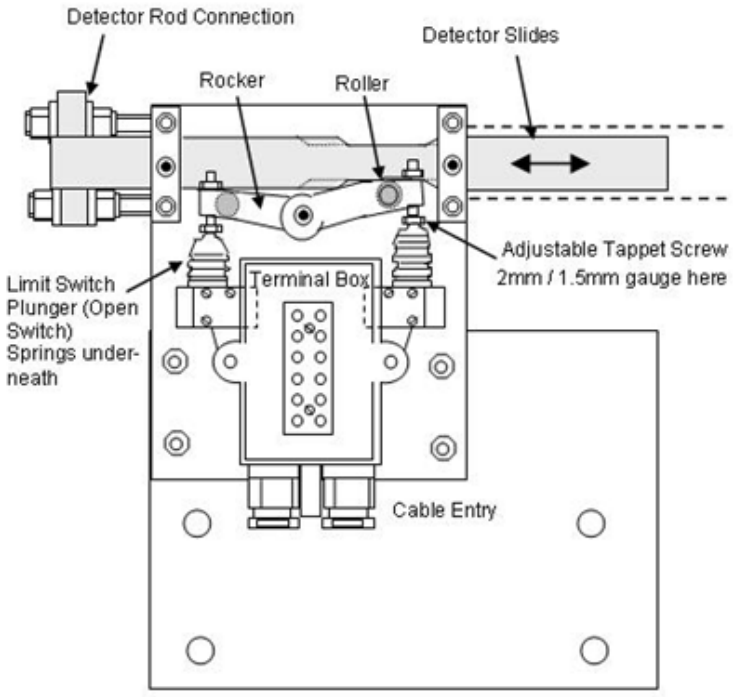


Figure 1 - BR 998 Detector Layout

END

Includes:	Crewe Type, LMS Type, SGE Type detectors used for main or supplementary point detection
Excludes:	BR 998 detectors, internal detectors in point machines

General

Liaise with the Signaller before carrying out work on detectors.

If any adjustments are made, the correct detection tests shall be carried out before the equipment is handed back to the Signaller.

Main point detectors are usually situated at the points toe, supplementary detectors towards the heel. At some installations (e.g. double slips) the supplementary detector can be located at the toe. If you are in any doubt, ask your SM(S).

SERVICE A

1. External

1.1 Remove all fire risks and potential obstructions.

1.2 Check the security of the detector casting fixings and the condition of the lid. The detector assembly shall not move when the points are operated. The lid shall provide an effective weather seal.

1.3 Clean and examine the following:

a) Detector rods, insulations, lug connections, screw threads nuts and lock nuts.

b) Detector slides.

c) Detector fixings.

1.4 Apply adhesive type grease to exposed surfaces of detector slides.

1.5 Examine visible tail cable and cable route. Tail cables shall be protected by cable ducting or orange pipe.

2. Internal – General

2.1 Check the interior of the detector casting, remove moisture and debris. Drain holes shall be unobstructed and effective. Detector slides and cable entries shall be fitted with seals.

2.2 Clean and examine detector slides, bushes and wear plates.

2.3 Lubricate (lithium grease) detector slides, bushes and wear plates (oil).

3. Rocker Assemblies

3.1 Clean and examine the following:

a) Rollers and notches.

b) Rollers shall rotate and fully engage in the notches.

c) Pivots.

d) Spindles.

e) Spring assemblies.

f) Spring-loaded operation shall be smooth and quick.

g) Stops.

h) Split Pins and Fixings.

3.2 Lubricate joints and wearing surfaces, including grease points and oil points, where provided.

4. Tappet & Slider Mechanisms

4.1 Clean and examine the following:

a) Tappets, notches and sliders.

b) Dogs and fixings. Dogs shall fully engage in notches. Shiny corners and swarf indicate an adjustment problem.

c) Packing pieces, guide ways, straps, rivets and fixings.

d) Adjusters. Adjustment facilities shall be secure.

e) Spring and end stop assemblies. Spring-loaded operation shall be smooth and quick.

f) Fixings.

4.2 Lubricate joints and wearing surfaces, including grease points and oil points, where provided.

5. Contact Assemblies

5.1 Clean and examine moving contact assemblies, rockers, pivots, spindles, springs, split pins and fixings.

5.2 Examine contact bands/segments and contact fingers.

a) Clean with a lint free cloth.

b) Apply a protection agent as required (except contact faces).

c) Apply an approved contact lubricant to the contact faces.

5.3 Check spring tension is satisfactory.

5.4 Observe contact movement during manual operation.

6. Wiring and Terminations

6.1 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

6.2 Examine terminations, clean and protect as necessary.

6.3 Where provided, check heaters.

7. Final

7.1 Check for any slackness or maladjustment and that the equipment operates correctly. If any defects are found, the equipment shall be treated as faulty and the Signaller informed.

7.2 Lubricate padlock, secure detector cover, and observe the apparatus for correct operation.

8. Local Policy Requirement

8.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/011 (Electrical Detection Test) as directed.

8.2 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test) as directed.

SERVICE B

9. Detection Tests

9.1 Where the detector is used for main point detection, carry out NR/SMS/PartB/Test/011 (Detector Test Electrical Detectors).

9.2 Where the detector is used for supplementary point detection, carry out NR/SMS/PartB/Test/016 (Supplementary Detection Test).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/PD03		
Mechanical Detectors		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Mechanical Detectors
Excludes:	All other types on Point Detection

General

Signal wires to/from mechanical detectors are covered in NR/SMS/PartC/SG12 (Semaphore Signals).

SERVICE A

1. Mechanical Detectors

1.1 Check that the detector slides are not obstructed and are clear of ballast. Rectify as necessary.

1.2 Check the installation is undamaged and securely fitted, look for:

a) Broken or cracked casting.

b) Loose fixings.

c) Worn slide(s).

d) Seized rollers.

Rectify as corrective maintenance as necessary.

1.3 Check that all shackles, cotter pins, and split pins are undamaged and secure.

1.4 On floating mechanical detectors, check the anchor rod is securely fitted.

1.5 Scrape, wipe, and clean the detector as necessary. Lubricate the slide(s) with adhesive grease.

Check that the cover is correctly fitted after maintenance.

1.6 Carry out NR/SMS/PartB/Test/012 (Detection Test (Mechanical)).

END

Includes:	Fixed Stretcher Bars; Adjustable Stretcher Bars; Tubular Stretcher Bars; Lock Stretcher Bars; Bracket Fasteners; Extension Pieces; Drive Rods; Lock Rods; Detector Rods; Connections; Lugs and Insulations
Excludes:	Nuts/ bolts not associated with point fittings; Adjustable tie bars fitted to some Clamplocks; and Hand Points

GENERAL

The safe running of trains is the top priority; actions taken shall reflect this at all times, if you are unsure block the line.

An FPL test shall be carried out and recorded on the relevant NR/SMS record card after any adjustments or nut tightening.

Security of Fastenings

The tightness and positioning of nuts and locking nuts on point fittings shall be checked by using a calibrated torque wrench as relative to the nuts in use.

Heads of bolts (if a bolt head retaining plate is not fitted) shall be prevented from turning by use of an approved spanner or other approved retaining device whilst torque is applied to its associated nut(s).

The tightness of nuts and locking nuts on **all** point fittings, **including TSB motion unit fastenings**, shall be checked by using a torque wrench, refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

Bolts shall be of a length to accommodate the relative locking function (at least two visible threads showing once the fastening is installed in its ‘service’ configuration).

A thread is defined as a continuous raised line which goes around the outside of the bolt.

Types of Fastenings

On fixed stretcher bar assemblies, various types of fastenings can be found depending on the age of the installation. If fastenings are replaced Hardlock nuts and grade 8.8 M20 bolts shall be used.

In some positions (e.g. the goose neck) it might not be possible to fit these fastenings, the process detailed in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars) shall be followed in these circumstances.

On 35mm adjustable stretcher bar assemblies fitted to point systems, Hardlock nuts and full/half nut locking nuts can be found on the adjustable bar. Depending on the age of the installation along with torque prevailing nuts on the bracket fastenings. The process detailed in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars) shall be followed for any replacements or adjustments.

For HPSS point systems adjustable stretcher bar preventative or corrective maintenance items can be found in NR/L2/SIG/11400.

Table 1 details the different types of fastenings that are associated with tubular stretcher bar assemblies.

Motion Unit Colour	Locking Technology	Bolt Type	Grade
Yellow (Full Depth)	Locking Helicoil fitted in Motion Unit	M20 x 80mm	8.8
White (Full Depth front Position Clamp Lock Only)	Locking Helicoil fitted in Motion Unit	M20 x 90mm	8.8
Red (Shallow Depth Web Mounted AND all positions for RT60)	Locking Helicoil fitted in Motion Unit	M20 x 110mm	8.8
Orange (Shallow Depth Foot Mounted)	Shakeproof Bolt & Nut retaining clip	M20 x 80mm Shak epro	8.8
Motion Unit to Tube Connection	Locking Helicoil fitted in End Post	M20 x 80mm	8.8

Table 1 – Fastenings

The process detailed in NR/L2/TRK/6100/Mod04 (Tubular Stretcher Bars) shall be followed for any replacement of any component or if there is an adjustment to the length of the tube assembly required.

The fastenings for the tubular stretcher bar shall only be used once.

Installation of Point Fittings

Details on the installation of fixed stretcher bar assemblies can be found in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars).

Details on the installation of adjustable stretcher bar on non HPSS Point Systems assemblies can be found in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

For HPSS Point Systems assemblies can be found in NR/L2/SIG/11400.

Details of before/after checks for fixed and adjustable stretcher bar assemblies can be found in NR/SMTH/Part04/PA02 (Replace or Adjust a Point Stretcher Bar).

Details on the installation of tubular stretcher bar assemblies can be found in NR/L2/TRK/6100/Mod04 (Tubular Stretcher Bars).
For Tubular Stretcher Bar assemblies, the before/after checks can be found in NR/SMTH/Part04/PA04 (Replace or Adjust a Tubular Stretcher Bar).

For other point system equipment in NR/SMTH/Part04/PA01 (Replace Rodding, Drives, Lock and Detector Equipment).

Root cause of deficiencies

If any component is found to be loose, broken or requires adjustment; the cause for it shall be investigated. Incorrect set-up of fittings and defects with the P Way can set up vibrations and stresses as trains pass over causing fractures and nuts to loosen on the point fittings. If you are in any doubt, ask your SM(S).

Hardlock Nuts

Hardlock nuts are an alternative vibration resistant nut to the conventional main nut/locking nut configuration (see Appendix D). They can be used on stretcher bars and drive rods.

On adjustable stretcher bars that have a metric M30 thread the nuts are finished in a bright zinc plate with a yellow finish.

On fixed stretcher bars that have a metric M20 thread the nuts are finished in a bright zinc plate.

On drive rods that have a one and a quarter inch imperial Whitworth thread they are finished in a bright zinc plate only.

These different thread types are not compatible, nuts and bolts of the same thread type shall only be used together. If you are in any doubt, ask your SM(S).

Torque Prevailing Nuts (self-locking)

Philidas turret nuts are no longer generally available. SNEP DAH class 8 double slotted self-locking nuts can be used as a direct equivalent. Further details on these nuts can be found in Appendix C.

Corrective Maintenance

Where corrective action is required as part of the maintenance activity due to component faults, these shall be classed as corrective maintenance and reported as detailed in NR/SMS/PartA/A02 (Preventative and Corrective Maintenance) and to your SM(S). This includes any adjustment or tightening of nuts, lock nuts, and bracket fasteners or replacement of complete stretcher bar assemblies.

Imperial/Metric

Older point system may use imperial nuts and bolts on certain fittings, newer or replaced fittings may use metric. Imperial bolts and metric nuts (or vice-versa) shall never be mixed as this can lead to damage and failure of the fastening.

Track Gauge (TG), Free Wheel Passage (FWP), Free Wheel Clearance (FWC), and Residual Switch Opening (RSO)

It is the responsibility of the Section Manager (Track) (SM(T))to measure and record the TG, FWP, FWC, & RSO on point systems during supervisory inspections. Additionally, it is also the responsibility of the Signal Technician to measure and record the FWP, FWC, and RSO on point systems during preventative maintenance.

To enable the installation of any fixed or adjustable stretcher bars, The SM(S) shall arrange for competent personnel to measure track gauge prior to the replacement of the stretcher bar assembly.

Reference Values

Refer to NR/SMS/PartZ/Z02 (Point – Reference Values) for reference values on point systems.

SERVICE A

1. Point Fittings (All types)

Not all the tasks in this section are applicable to all point installations (e.g. Clamp Lock & HPSS). If you are in doubt, ask your SM(S).

For point fittings that are part of a SO Hydraulic Supplementary Point Drive System refer also to NR/SMS/PartC/PF04 (SO Hydraulic Supplementary Point Drive System).

1.1 Check that the point number is correctly fitted and clearly visible.

Numbers are on the first bearer in front of the soleplate to the left or right of the centre line depending on the normal lie of the points.

1.2 Where power operated points have the number on the machine, power pack or other operating mechanism, check it is correct and legible.

1.3 Remove fire risks and potential obstructions. Orange pipes (etc) shall not cause any obstructions. Icy weather can cause ballast to expand.

1.4 Clear any excessive ballast which is within 30mm of point operating equipment or likely to obstruct slide chairs.

1.5 Check the insulations; remove any possible conductive material.

1.6 Scrape, wash, and wipe all components to allow examination for defects or cracks/breakages. Where necessary use a wire brush and a detergent based cleaner to remove dirt and grease.

1.7 Check stretcher bar kicking strap clearances. Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

1.8 Check there is the required clearance between the bottom of the rail and drive/lock/detection rods. Rods shall not bind on rails during operation. Plastic rail clips may be fitted as a temporary solution to protect from track circuit failure.

1.9 Check that when the points are in the normal or reverse position there is no excessive distortion of the stretcher bars or brackets.

Distortion of the stretcher bar or brackets when the switch rail fits up to the stock rail, indicates incorrect drive set up or incorrect installation of the stretcher bar or brackets. The cause shall be identified before rectification is undertaken. If you are in doubt, ask your SM(S).

1.10 If provided, check any point heating equipment for security and position.

NOTE: *During this check, be aware the point heating might be active.*

Report any defects to your SM(S).

2. Nuts and Bolts (All Types)

On fixed stretcher bar assemblies where loose nuts are found on bracket to rail fastenings that are not Hardlock nuts, they shall be replaced with Hardlock nuts and M20 bolts. See full details in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars).

Both Torque Prevailing nuts and Hardlock nuts and M20 bolts can be used on Lock Stretcher assemblies.

Details on the tightening of different types of nuts can be found in Appendix B.

Further tasks on nuts and bolts relative to the type of stretcher bar used are in sections 3 & 4.

2.1 Where torque prevailing nuts (such as Philidas or SNEP DEH) are used:

Check that the nut is tight by the application of a calibrated torque wrench set to 200Nm (the nut shall not move).
If the nut is loose, both the nut and bolt shall be replaced with new components and torqued to the values detailed in NR/SMS/PartZ/Z02 (Point – Reference Values).

See the note in the preamble of this section for fastenings on fixed stretcher bars.

Details of these nut types are shown in Appendix B. These nuts and bolts can be imperial or metric.

2.2 Where Hardlock nuts are used on fixed stretcher bars/Lock Stretcher Bars:

Check that the female nut is tight by the application of a torque spanner set to 200Nm.

If the female nut is loose, both female nuts associated with the connection shall be backed off and the process detailed in Appendix B (Hardlock Nuts on fixed stretcher bars) shall be followed.

Details of these nut types are shown in Appendix C. Hardlock nuts on adjustable stretcher bars fitted to non HPSS Point systems are covered in section 4 and NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars). These nuts and bolts are metric.

2.3 Where square nuts (and occasionally hex nuts) are used on fixed stretcher bars:

Check that the nut is tight by the application of a calibrated torque wrench set to 200Nm (the nut shall not move).

If the nut is loose, it shall be replaced as detailed in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars).

See the note in the preamble of this section for fastenings on fixed stretcher bars. Historical fastenings are normally imperial.

Fastenings associated with Philidas / SNEP / Hardlock components are normally metric.

Details of these types of nuts on adjustable stretcher bars fitted to non HPSS Point Systems are in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

2.4 Check all nuts and lock nuts on detector and lock rods are secure and tight.

The nuts shall not move by application of a short spanner. See the details in NR/SMS/PartC/PA00 (Point Equipment General).

2.5 Check the drive rod is securely fitted to the throw bar of the point machine.

2.6 Following any adjustments (nut tightening or nut and bolt replacements) carry out NR/SMS/PartB/Index - FACING POINT LOCK TEST (001-055).

3. Fixed Stretcher Bars (Only)

The stretcher bar assembly (including all of the stretcher bar, the brackets, insulations, and nuts/bolts/washers) shall be considered as a line replacement unit which shall be replaced as a whole.

New line replacement units shall use Hardlock nuts and grade 8.8 M20 bolts only. Details can be found in drawing number RE/PW/721.

If any defects are found, other than a single loose nut and bolt, the whole assembly shall be replaced.

Where individual fastenings require replacement, the fastening may be replaced alone but the fastenings shall be replaced as a pair (see detail in NR/L2/TRK/6100/Mod08 (Action Tables).

Where corrective maintenance activities are required in this section, see NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars).

NOTE: *Detailed information on these items is contained in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars). For explanation of terminology see Appendix A.*

General

3.1 Examine the components of the Stretcher Bar.

a) Brackets - check for cracking.

b) Stretcher Bars - check for bent bars and cracking/breakages.

Brackets

3.2 Check that the Bracket Fasteners are in place and secure. Check there is no movement relative to the rail. Rectify as necessary.

Stretcher Bar

Tasks 3.3 to 3.13 shall be undertaken for both the Normal and Reverse position of the points.

3.3 Examine the back of the switch blades visually for flange back contact. If flange back contact is found or suspected, it shall be reported as corrective maintenance.

3.4 Check for theoretical flange back contact using the wheel profiles part of the S&C gauge.

If the gauge does not fit freely the defect shall be reported as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod08 (Action Tables).

3.5 Check that the toe opening is correct, record the measurements. Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

If the switch openings are compromised by track gauge, the defect shall be reported as corrective maintenance.

3.6 Examine the following on stretcher bars.

a) Insulations.

b) Nuts and bolts.

c) Lock nuts (if fitted) and screw thread.

With the exception of defective nuts and bolts, which may be replaced in isolation (as a pair), any other replacement shall require the whole stretcher bar assembly to be replaced.

3.7 Examine the Lock Stretcher Bar. Check for cracks around the bolt holes and damage/corrosion to the Lock Stretcher Bar.

Any defects found shall require the replacement of the Lock Stretcher Bar and fastenings. Both Torque Prevailing nuts and Hardlock nuts and M20 bolts can be used on Lock Stretcher assemblies.

3.8 Measure by use of the S&C gauge the Free Wheel Passage (FWP). Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

Insert the S&C gauge at the rear stretcher bar and move towards the heel of the switch. Identify the maximum FWP.

On slips measure the FWP one metre either side of the end of the switch planning.

3.9 Measure by use of the S&C gauge the Free Wheel Clearance (FWC). Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

Insert the S&C FWC gauge at the rear stretcher bar and move towards the heel of the switch. Identify the minimum FWC.

3.10 Measure that the Residual Switch Openings (RSO) are correct throughout the planed length, Record the measurements. Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

3.11 Record the FWP, FWC, & RSO values on record card NR/SMS/PartR/PF01/RC01 (Point Fittings).

3.12 If the FWP, FWC or RSO is incorrect it shall be classed as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod08 (Action Tables).

If the recorded value increased by more than 3mm on the previous two measurements but remains compliant to the values in NR/SMS/PartZ/Z02 (Point – Reference Values) it shall be reported as a trend requiring corrective maintenance to the Section Manager (Track).

3.13 Any defects or deficiencies that are found and are recorded as corrective maintenance shall be dealt with according to NR/L2/TRK/6100/Mod08 (Action Tables).

4. Adjustable Stretcher Bars (Only)

The Stretcher Bar Assembly (including the stretcher bar complete with bushes, lock nuts, and brackets) shall be considered as a line replacement unit, if any defects are found the whole assembly shall be replaced. Where individual nuts and bolts require replacement, the nut and bolt may be replaced alone.

Where corrective maintenance activities are required to these items on non HPSS Point systems see NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars) and Appendix B for details.

Detailed information on these items fitted to Non HPSS Point Systems are contained in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

Detailed information on these items fitted to HPSS Point systems are contained in NR/L2/SIG/11400 (HPSS Handbook). Where preventative and corrective Maintenance activities are required to these items on HPSS Point systems see NR/L2/SIG/11400.

For details of terminology see Appendix A.

4.1 Examine the components of the Stretcher Bar Assemblies

a) Brackets: Check for cracking particularly around drilled holes or at weld of the strengthening web.

b) Stretcher Bars: Check for bent bars and damaged threads.

c) Bushes: Check for distortion and deterioration.

Any defects found shall require the replacement of the Stretcher Bar Assembly.

4.2 Examine the Lock Stretcher Bar. Check for cracks around the bolt holes and damage/corrosion to the Lock Stretcher Bar.

Any defects found require the replacement of the Lock Stretcher Bar.

Both Torque Prevailing nuts and Hardlock nuts and M20 bolts can be used on Lock Stretcher assemblies.

Brackets

4.3 Check that the Bracket Fasteners are in place, secure and tight. Check there is no movement relative to the rail. Rectify as necessary.

Stretcher Bars

Tasks 4.4 to 4.14 shall be undertaken for both the Normal and Reverse position of the points.

4.4 Examine the back of the switch blades visually for flange back contact. If flange back contact is found or suspected, it shall be reported as corrective maintenance.

4.5 Check for theoretical flange back contact using the wheel profiles part of the S&C gauge.

If the gauge does not fit freely:

On 35mm square section adjustable stretcher bars the defect shall be recorded as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

On HPSS point systems the defect shall be recorded as corrective maintenance and dealt with according to ER/R/1/0224 (via NR/L2/SIG/11400).

4.6 Check that the toe opening is correct, Record the measurements. Refer to NR/SMS/PartZ/Z02 (Point – Reference Values). Id the switch openings are compromised by track gauge, the defect shall be reported as corrective maintenance.

4.7 Check that the adjustable stretcher bars are securely attached. Check that the lock nuts are in place with at least four threads (2 threads if Staytite Hardlock nuts are used) showing beyond the end of each locking nut.

The amount of exposed thread is normally symmetrical. Report any problems as corrective maintenance.

4.8 Check that the locknuts are properly adjusted to provide the locking function.

For 35mm adjustable stretcher bar assemblies on point systems details on this can be found in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

On HPSS Point Systems details on this can be found in ER/R/1/0224 (via NR/L2/SIG/11400).

4.9 If any of the following defects are found, then the Signaller shall be informed immediately, a 20-mph emergency speed restriction imposed, and the defect repaired within 36 hours:

a) A missing, broken, or detached stretcher bar, or

b) A cracked stretcher bar, or bracket that significantly reduces the integrity of the stretcher bar assembly or

c) Less than 4 threads (2 for Staytite Hardlock nuts) showing beyond the locking nut. All other point fitting components shall in place, secure, and all nuts are tight.

If these conditions cannot be met or if any other components in any of the other stretcher bar assemblies are missing, defective, broken, or detached, the line shall be blocked pending repair.

This action applies to both facing and trailing switches.

4.10 Measure by use of the S&C gauge the Free Wheel Passage (FWP). Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

Insert the S&C gauge at the rear stretcher bar and move towards the heel of the switch. Identify the maximum FWP.

On slips the maximum FWP is located one metre either side of the end of the switch planning.

4.11 Measure by use of the S&C gauge the Free Wheel Clearance (FWC). Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

Insert the S&C FWC gauge at the rear stretcher bar and move towards the heel of the switch. Identify the minimum FWC.

On slips the maximum FWC is located one metre either side of the end of the switch planning.

4.12 Measure that the Residual Switch Openings (RSO) are correct throughout the planed length, Record the measurements. Refer to NR/SMS/PartZ/Z02 (Point – Reference Values).

4.13 Record the FWP, FWC, & RSO values on record card NR/SMS/PartR/PF01/RC01 (Point Fittings).

4.14 If the FWP, FWC or RSO are incorrect it shall be classed as corrective maintenance and dealt with as corrective maintenance.

If the recorded value increased by more than 3mm on the previous two measurements but remains compliant to the values in NR/SMS/PartZ/Z02 (Point – Reference Values) it shall be reported to the Section Manager (Track) as a trend requiring corrective maintenance.

Bushes

4.15 Check the bushes for signs of surface deterioration. Bushes require to be replaced when they start to break up.

5. Tubular Stretcher Bar (Only)

The Tubular Stretcher Bar assembly consists of three main parts, a Tube Assembly and two 'Motion Units'.

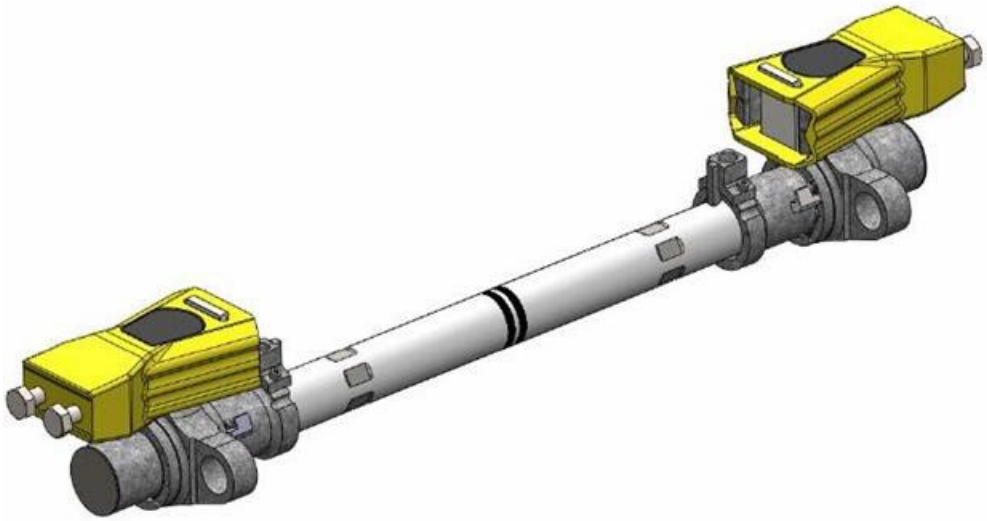


Figure 1 – A Tubular Stretcher Bar Assembly

Detailed information on these items is contained in NR/L2/TRK/6100/Mod04 - Tubular Stretcher Bars.

For explanation of terminology see Appendix A.

5.1 Examine the components of the tubular stretcher bar assembly

a) Drive Connections check condition.

b) Tube Assembly check for bent bars.

5.2 Check that the secondary locking washers are compressed.

5.3 Check the motion unit bolt head covers are fitted and are not damaged; remove any conductive material.

5.4 Check that nut retaining clips are fitted (foot mounted motion units only).

Switch Diamond Layouts

5.5 Check the security of each of the fastenings that secure the motion units to the switch rail through the application of a check torque to the fastening. Refer to NR/SMS/Part/Z02 (Point – Reference Values) for check torque values.

S&C Checks

Tasks 5.6 to 5.14 shall be undertaken for both the Normal and Reverse position of the points.

5.6 Examine the back of the switch blades visually for Flange Back Contact. If Flange Back Contact is found or suspected, it shall be reported as corrective maintenance.

If flange back contact is evident check the retaining plate in the motion unit for damage.

If there is any damage to the retaining plate, then this shall be reported as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod08 Action Tables.

5.7 Check for theoretical flange back contact using the wheel profiles part of the S&C gauge.

If the gauge does not fit freely, the defect shall be reported as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod08 Action Tables.

5.8 Check that the toe opening is correct, record the measurements. Refer to NR/SMS/Part/Z02 (Point – Reference Values) for values. Should the switch openings be compromised by track gauge, the defect shall be reported as corrective maintenance.

5.9 Measure by use of the S&C gauge the Free Wheel Passage (FWP). Refer to NR/SMS/Part/Z02 (Point – Reference Values) for values.

Insert the S&C gauge at the rear stretcher bar and move towards the heel of the switch. Identify the maximum FWP.

5.10 Measure by use of the S&C gauge the Free Wheel Clearance (FWC). Refer to NR/SMS/Part/Z02 (Point – Reference Values) for values.

Insert the S&C FWC gauge at the rear stretcher bar and move towards the heel of the switch. Identify the minimum FWC.

5.11 Measure that the Residual Switch Openings (RSO) are correct throughout the planed length, record the measurements. Refer to NR/SMS/Part/Z02 (Point – Reference Values) for values.

5.12 Record the FWP, FWC, & RSO values on record card NR/SMS/PF01/RC/01.

5.13 Should the FWP, FWC or RSO be incorrect it shall be classed as corrective maintenance and dealt with according to NR/L2/TRK/6100/Mod08 Action Tables.

If the recorded value has increased by more than 3mm on the previous two measurements but remains compliant to the values in NR/SMS/Part/Z02 (Point – Reference Values), it shall be reported as a trend requiring corrective maintenance to the Section Manager (Track).

5.14 Any defects or deficiencies that are found and are recorded as corrective maintenance shall be dealt with according to NR/L2/TRK/6100/Mod08 Action Tables.

APPENDIX A - Illustration of terminology used for maintenance of point fittings (not to scale).

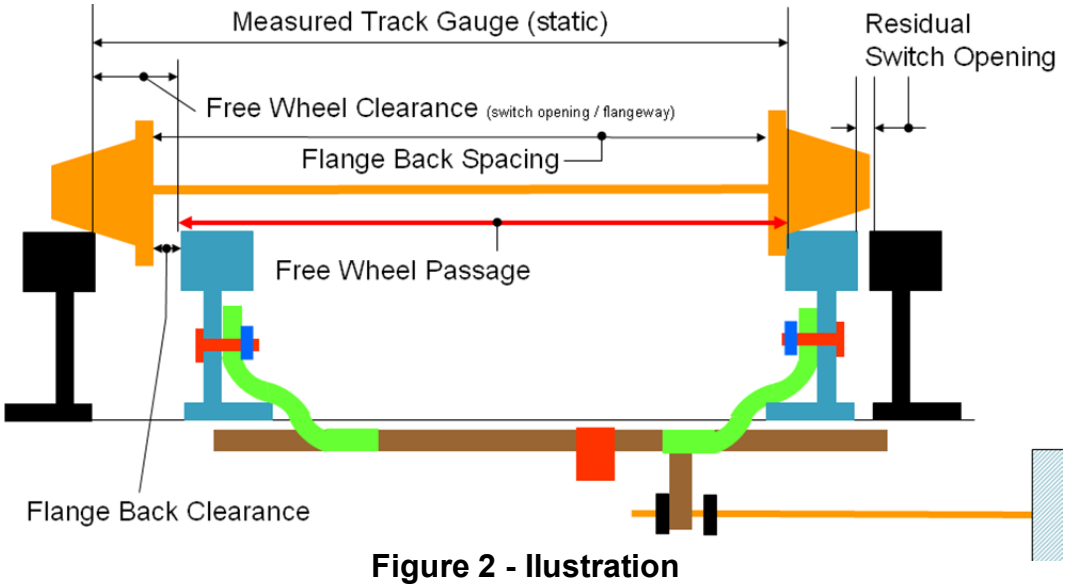


Figure 2 - Ilustration

APPENDIX B - Torque Prevailing Nuts

These can be used on adjustable stretcher bar assembles on non HPSS point systems to fit Mk.1 and Mk.2 brackets to the web of the rail (other type fastenings can also be used). For full details of components and assembly see NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars).

Screw the torque prevailing nuts on the bolts until resistance against the nut locking action is felt. Using an approved spanner to hold the bolt head against rotation, tighten the torque prevailing nut against the Vibrolock washer (if used, see NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars) using an approved ratchet with a 20mm deep socket.

When the prevailing torque nuts are ‘tight’, place the 20mm deep socket on an approved torque wrench (capable of applying 250Nm of torque) and using an approved spanner to hold each bolt head against rotation apply the torque detailed in NR/SMS/PartZ/Z02 (Point – Reference Values) to the nut.

Hardlock Nuts

On Adjustable Stretcher Bars on Non HPSS Point Systems:

The processes detailed in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars) shall be followed for installation and adjustment of Hardlock nuts.

On Fixed Stretcher Bars:

These are used with grade 8.8 M20 bolts on all fixings.

The male nut shall be sequentially tightened to 250Nm as detailed in NR/SMS/PartZ/Z02 (Point – Reference Values).

The female nuts shall then be finger tightened to engage the interlocking cones. Check there is a visible gap between the surfaces of the nuts - then tightened to 250Nm torque as detailed in NR/SMS/PartZ/Z02 (Point – Reference Values).

Check when applying torque to the female nut that it rotates at least half a turn between finger tightness (engagement of interlocking cones) and achievement of the torque detailed in NR/SMS/PartZ/Z02 (Point – Reference Values).

If a visible gap between the surfaces of the male and female nut does not exist when finger tightening the female nut to engage the interlocking cones or the female nut does not rotates at least half a turn between finger tightness and achievement of the torque detailed in NR/SMS/PartZ/Z02 (Point – Reference Values) the nut combination shall be scrapped and a new set of nut components installed in accordance with the process above.

Plain Square and Hexagonal Nuts

For adjustable stretcher bars on non HPSS point systems see the details in NR/L2/TRK/6100/Mod06 (Adjustable Stretcher Bars), for HPSS point systems see the details in NR/L2/SIG/11400.

On fixed stretcher bar assemblies these are usually found on older installations and mechanical point systems. They have no integral locking action.

They shall not be used on any new fixed stretcher bar installations. Any loose nuts shall be replaced with Hardlock nuts and M20 bolts as detailed in NR/L2/TRK/6100/Mod05 (Fixed Stretcher Bars).

APPENDIX C - Nut Types

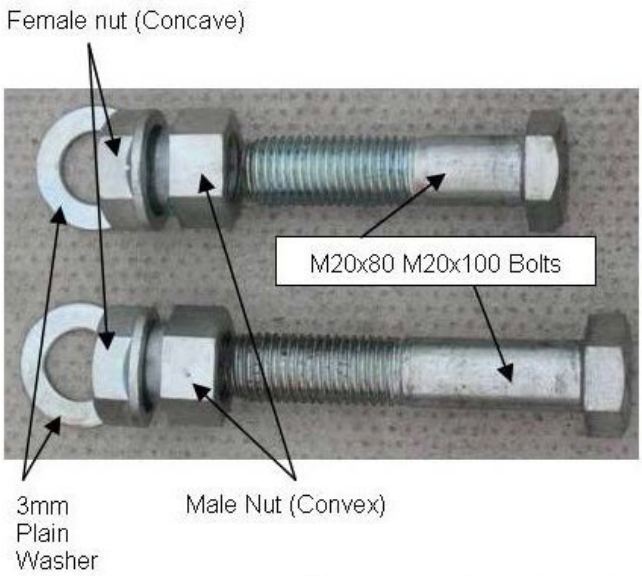
Identifiable by the ‘Б’ and ‘8’ marking stamped on the flat.

Figure 3 – Philidas Turret Nut

Identifiable by the ‘SN’ and ‘8’ marking on the top ring.

Figure 4 – SNEP DAH Nut

APPENDIX D - Hardlock Nuts & M20 Bolts



The male nut provides the fastening action; the female nut provides the locking action.

Figure 5 – Hardlock Nuts & M20 Bolts

APPENDIX E - Examples of Fixed Stretcher Bars

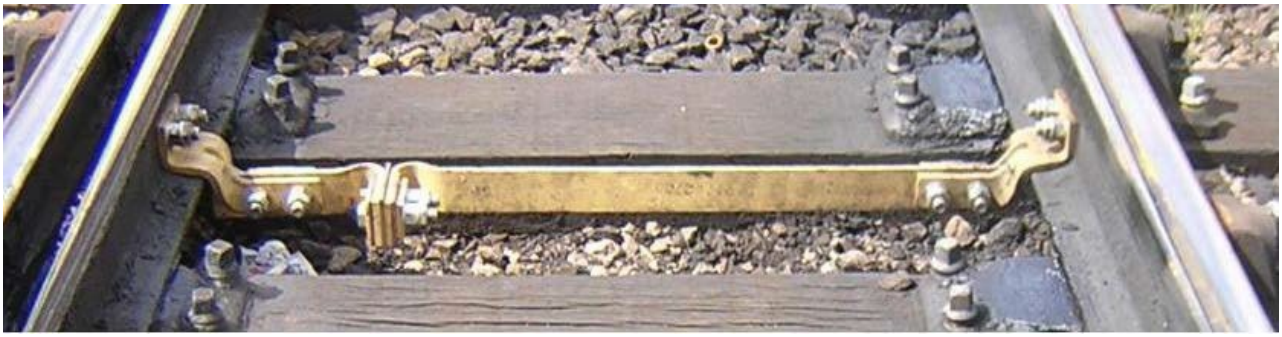


Figure 6 – Yellow fixed stretcher bar with hardlock fastenings

Figure 7 – Yellow stretcher bar bracket with hardlock fastenings

Figure 8 – Black stretcher bar bracket with square nut fastenings

Black stretcher bars and non-hardlock fastenings shall not be used on any new or replacement installations.

APPENDIX F - Examples of Adjustable Stretcher Bars

Figure 9 – Adjustable stretcher bar using hardlock nuts fixed to Shallow Depth Rail

Figure 10 – Adjustable stretchers bar using hardlock nuts fixed to Full Depth Rail.

Figure 11 - Adjustable stretcher bar Mk. 1 bracket using half/full nuts (supplementary drive also shown).

Figure 12 - Mk.2 bracket using Philidas type Turret Nut.

Figure 13 - Example of visible thread showing after installation of hardlock nuts. 11 threads showing.

Minimum of 2 threads visible for hardlock nuts and 4 threads visible for full/half nuts required.

APPENDIX G - Examples of HPSS Stretcher Bars

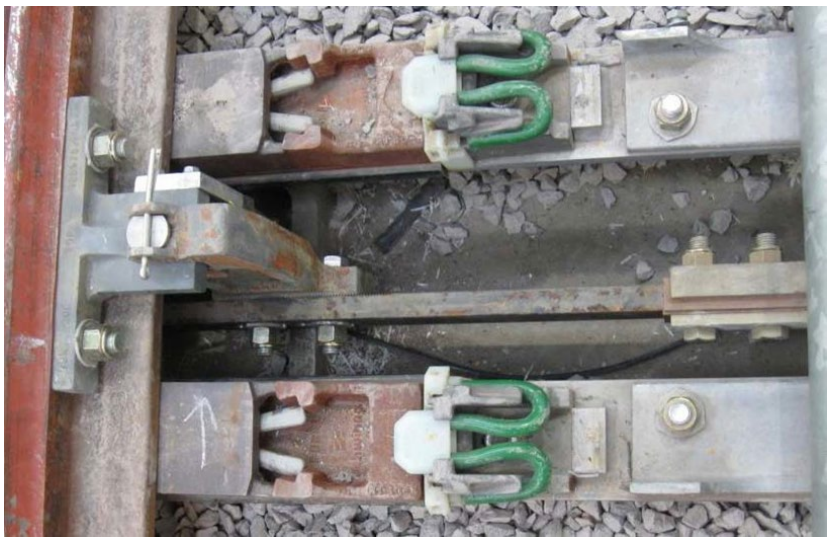


Figure 14 – HPSS Stretcher Bar

END

Includes:	Crank operated supplementary drive
Excludes:	Hydraulic operated supplementary drive and Torsion operated supplementary drive

Any adjustments, tightening, or replacement of components shall be classed as corrective maintenance and reported as detailed in NR/SMS/PartA/A02 (Preventative & Corrective Maintenance) and to your SM(S).

Incorrectly set up or adjusted supplementary drives can affect the operation of the points. If you are in any doubt about the set up or adjustment of a supplementary drive ask your SM(S).

On certain Hydro-Pneumatic points the escapement for the supplementary drive is on the front stretcher bar where the drive is taken off, not the rear stretcher bar where the drive is given. This system shall be set up according to the original design drawing. If in any doubt, ask your SM(S).

General

More information on supplementary drives can be found in NR/GN/SIG/11772.

SERVICE A

1. Crank Operated Supplementary Drive

Details on the set up and adjustment of crank operated supplementary drives can be found in NR/WI/SIG/00111.

1.1 Check that all moving parts are not obstructed and are clear of ballast. Rectify as necessary.

1.2 Check the installation is securely fitted, look for:

- Loose crank bases.
- Worn cranks.
- Seized cranks.
- Loose adjustable sleeve on cranks.
- Worn cotter pins.
- Bent rodding.
- Broken roller assemblies.

Rectify as necessary. Loose or worn fittings can impair the operation of the back drive. Tightening/replacement of any item of equipment requires the supplementary drive to be set up, see NR/WI/SIG/00111 for details.

1.3 Scrape, wipe, and clean the cranks as necessary. Lubricate bearings and cotter pins.

New grease should be pumped in at the grease nipple to expel the existing grease in the bearing/pin. Automatic lubrication can also be used in asssociation with Teflon based grease, see NR/SMS/PartA/A09 (Lubrication). Excess grease shall be wiped away.

1.4 Check the supplementary drive is correctly set up and operating correctly. Details are in NR/WI/SIG/00111.

1.5 Where fitted, carry out SUPPLEMENTARY DETECTION TEST (016).

1.6 Where any adjustments have been made, carry out FACING POINT LOCK TEST (001 or 003) as required.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/PF03		
Point Fittings: Switch Rollers		
Issue 04	Issue Date: 03/03/2018	Compliance Date: 31/05/2018

Includes:	Austro-roll, Schwihag and Vossloh types
Excludes:	All other types of roller

Switch rollers shall not be greased. Any such contamination shall be removed with the use of an approved metal cleaner.

SERVICE A

This service is a visual check of the switch rollers will require each roller to be checked in both the open and closed switch position.

On Hy-Drive mk2 installations, the rear rollers might need to be lowered to allow manual pumping of the points due to the back of the switch starting to move before the toe leading to the lock arm jamming.

1. Inspection

1.1 Remove all fire risks and potential obstructions.

1.2 Austro-rolls only: Check support brackets and spring plates for security and damage.

1.3 Check to make sure the switch is fitting up correctly, if not then the backdrive may need adjusting.

2 For the switch in the closed position:

2.1 Check that the roller barrel has a metallic silver band (see figure 1).

This will indicate the roller barrel is performing satisfactory.

Figure 1 – Metallic silver band check

2.2 Check that the sliding surface of the base plate does not show any wear (see figure 2).

This will indicate that the rollers are not lifting the rail.

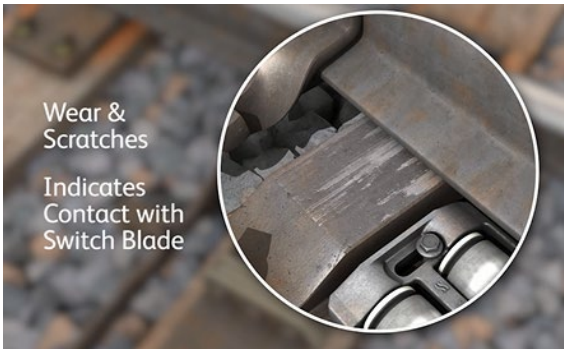


Figure 2 – Check for wear

2.3 Check that the rollers can move freely and that no flat spots are present on the roller barrels (see figure 3).

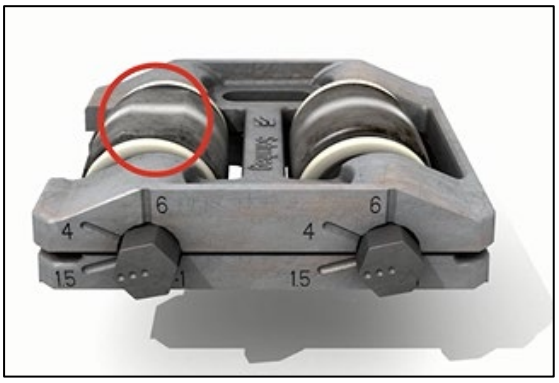


Figure 3 – Check for movement and flat spots

2.4 Check that there is a sufficient gap between the roller assembly and the closed switch rail to accommodate dynamic loading (see figure 4).

The clearence should be 1mm + the gap between the base of the switch and the slide chair to take in to account dynamic loading.

Figure 4 – Gap check

2.5 Check that the fixing bolts are in place.

2.6 Check for contamination (see figure 5). If required removed the roller package to clean underneath.

If it is not possible to do this at the time of inspection then it is importantant to report this to your supervisor for corrective maintenace.

Figure 5 – Contamination check

2.7 Check the roller height settings (see figure 6). If they are approacing their maximum height setting, this should be reported to your supervisor as corrective maintenance such as lifting and packing might be required.

Grey roller packages provide a lift upto 6mm whereas blue packages provide a lift upto 4mm.

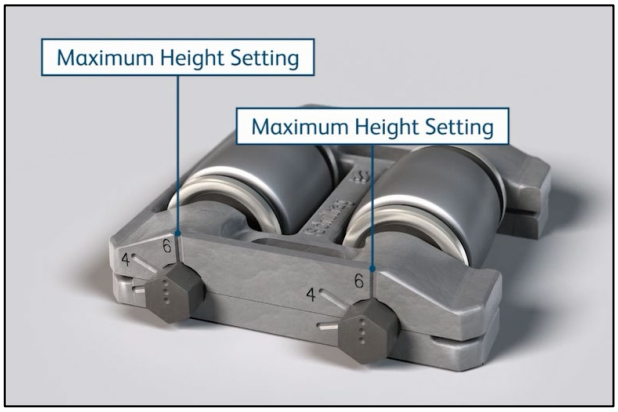


Figure 6 – Height setting

2.8 Check that the kicking strap has a clearence of 6-9mm from the stock rail.

3 For the switch in the open position:

3.1 Check that the open switch rail is resting on the roller and not on the sliding surface.

3.2 Check that the clearence between the switch rail and the sliding surface is 1-3mm.

3.3 Check the kicking strap for signs of binding.

Any issues identified during the inspection that could not be rectified should be reported to a supervisor.

Details of how to set up the rollers can be found in NR/SMS/Appendix/04.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PF04		
SO Hydraulic Supplementary Point Drive System		
Issue No: 02	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Alstom SO hydraulic supplementary drive system
Exclude:	Any other type of hydraulic supplementary drive

Disconnect the point detection from the KR lines or apply an alternative safe system of work (See NR/SMS/Part/ A04).

Isolate the mechanism by turning to the 'Manual' position on the hydraulic pack.

Nuts that are tight should not move by the application of a short handled spanner.

General
SO hydraulic supplementary drive systems are used in conjunction with an in-bearer clamp lock (IBCL) and NR60 layouts.
In this configuration the whole installation is called a Hy-Drive Point System.
Maintenance tasks & tests for the IBCL are contained in NR/SMS/PB11

SERVICE A

1. SO supplementary Drive Break-Out Device (BOD)

1.1 Check the Break-Out Devices have not been operated. See appendix A for further guidance.

Original Mk1 Design

The break-out device covers shall be 60mm-65mm from the end of the gauge adjusting lug when not operated.

Original Mk1 Design with modified cover

The modified cover shall align with the edge of the bracket when the device has not operated as per NR/L3/SIG/19808.

Mk2 Design

The red line on the side of the bracket is to be used to provide an indication of whether the device has operated.

1.2 Examine the BOD covers and insulations for damage.

1.3 Check that the BOD bolts are secure. Rectify as necessary.
If tightening is required, the torque shall be 250Nm.

1.4 Check that the gauge adjusting lug locking screws and associated tab washers are secure.

1.5 Check that the horizontal drive pins are secure and that the insulations and split pins are correctly in place and undamaged.

2. Pump Unit

2.1 Restore the points to power.

2.2 Disconnect one of the two motors at the plug connector.

2.3 Ask the Signaller to operate the points and Check that the remaining connected motor is operational.

Due to the requirement of the system for two motors, the points may not complete their movement within 6-9 seconds, this is not a failure. This test is only to check that each individual motor is operational.

2.4 Reconnect the first motor and disconnect the second motor to repeat step 2.3.

2.5 Reconnect the second motor.

3. Front Stretcher and Kicking Strap Brakets

3.1 Check that the stretcher bar bolts (4) are secure. Rectify as necessary.
If tightening is required, reffer to NR/SMS/Part/Z02.

3.2 Examine the front stretcher pivot pins, tabs and split pins and ensure that they are secure and undamaged.

3.3 Check that the M30 stretcher adjustment locking nut is secure. Rectify as necessary.

If tightening is required, the torque shall be 300Nm.

3.4 Check that the kicking strap brackets are secure. Rectify as necessary.
If tightening is required, refer to NR/SMS/Part/Z02.

4. Final Tests and Check

4.1 Carry out DETECTION TEST (HY-DRIVE POINTS) (009).

4.2 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

SERVICE B

5. SO Supplementary Drive Units

REMOVE the SO unit covers

5.1 Check that the SO unit plug couplers are properly secure and undamaged.

5.2 Check that the SO unit detector box lead seals are properly secure and undamaged.

5.3 Examine hydraulic hoses for security and signs of leakage or damage.

5.4 Examine the by-pass valve for signs of leakage or damage and check that it is closed and locked.

REPLACE the SO unit covers

5.5 Ask the Signaller to operate the points to normal and reverse positions (twice if possible). Observe correct operation.

APPENDIX A – Checking BOD's for Damage or Operation

It is important to check break-out for damage and/or operation. Mk1 break out devices are susceptible to damage and fracture around neck of the winged bracket (see figure 1 below). This was in part due to the screws that held the bracket cover in place being struck by the flange of train wheels. Subsequently a modified cover was then provided to prevent this failure mode (implemented via SIN118).

Following this a re-design of the BoD took place resulting in the Mk 2 BoD

Check for cracking on maintenance inspections.

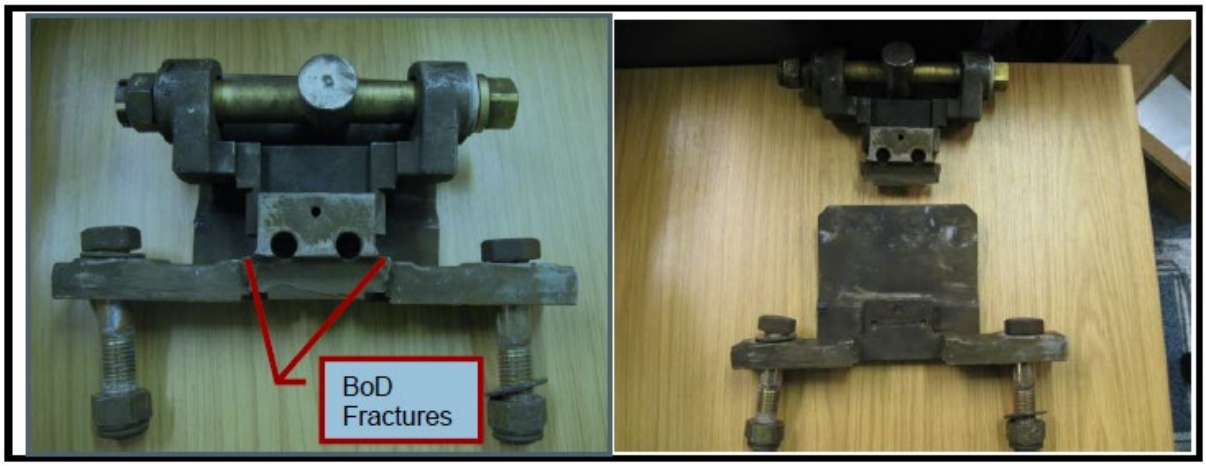


Figure 1 – Mk1 Break Out Device (BOD) fractures

Checking BOD's for Operation

Checking the BoD for operation depends on the cover installed (Mk1) or if it is a Mk2 BOD.

For the Mk1 BoD with the original cover the break out covers shall be 60mm – 65mm from the end of the gauge adjusting lug when not operated. The red line on the gauge adjusting lug provides a visual indication (see figures 2 and 3).

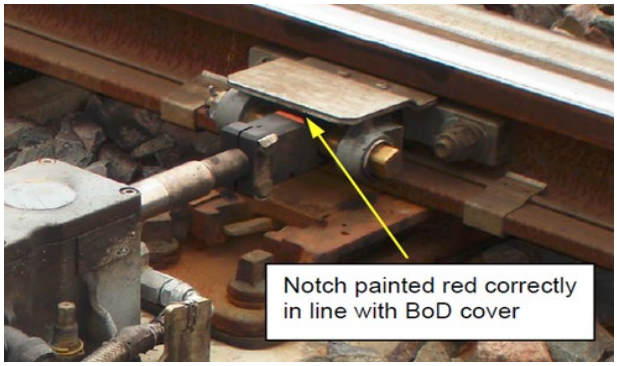


Figure 2 – Mk1 BOD

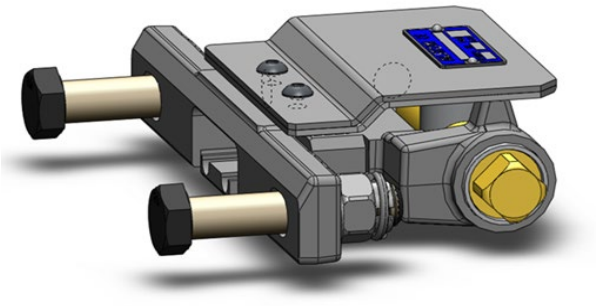


Figure 3 – Mk1 BOD Indication

For the Mk 1 BoD with the modified cover (NR/SIN/118), check that the cover aligns with the edge of the bracket. If it does not then the device has operated. If in doubt, remove the cover to check further (see figures 4 and 5 below).

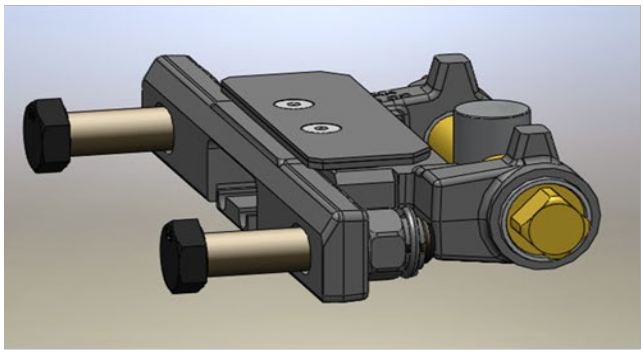


Figure 3 – Mk1 BOD

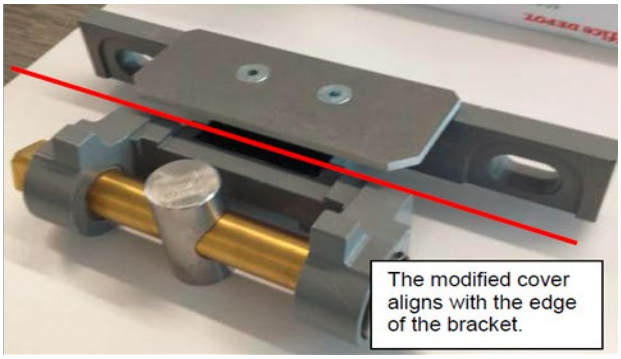


Figure 5 – Mk1 BOD Indication

For the Mk2 Design, run-through indication is provided by a red indication line on the side of the bracket as shown in figure 7.

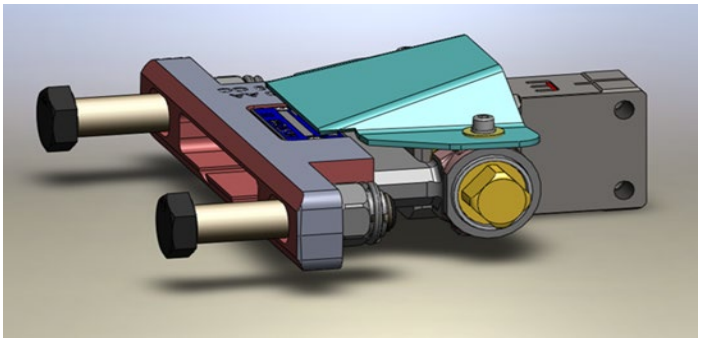


Figure 4 – Mk11 BOD

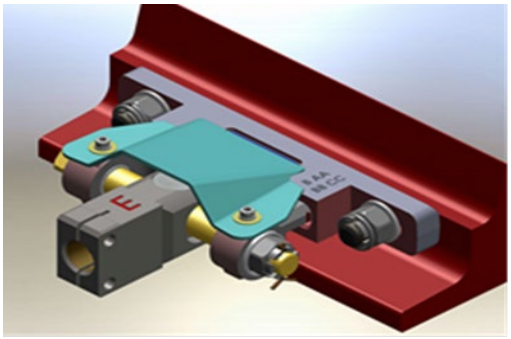


Figure 7 – Indication of BOD Operation

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PF05		
Hydraulic Assist Drives		
Issue No: 01	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Clamplock points fitted with Hydraulic Assist Drives
Exclude:	All other assist drives

SERVICE A

1. Maintenance Task

1.1 Check that hoses have no sharp bends and are not unduly raised, as this can allow air to be trapped in the system – Rectify as necessary.

1.2 Check hoses running up the four foot to the assist drive rams are secure and are not chaffing against any stretcher bar.

1.3 Visually inspect hydraulic hoses for signs of deterioration and/or corrosion, and in particular where the pipes run out of normal sight, i.e. in troughing.

1.4 Check the hydraulic fluid level and (where fitted) the level indicator. If the top up is greater than 0.5litres then check for leaks in the hydraulic system, rectify as required.

1.5 If a leak cannot be found, report as corrective maintenance before the end of the shift. If more than 1 litre is required, carry out TEST FOR AIR (015)
NOTE: When topping up the hydraulic fluid, avoid introducing contaminants into the system.

1.6 Check the locking wires on hose connectors are fitted and intact (Figure 1).

1.7 Clean and examine the hydraulic rams for leaks, in both normal and reverse positions. Look particularly at the spigots (where fitted) for any movement/abnormality (Figure 2).

1.8 Clean and examine the assist drive Ram fixing brackets and fixing bolts. Check the assist drive rams are secure to both the rail and the thrust plate at the assist drive position (Figure 3).

1.9 Check that the bolts are of sufficient length to accommodate the lock nut thread.

1.10 Check that there is no distortion of this pin.

APPENDIX A

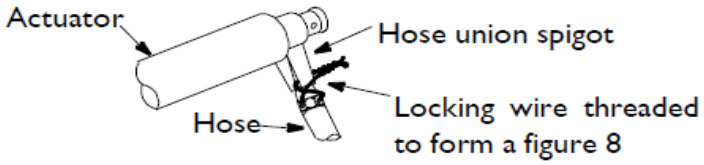
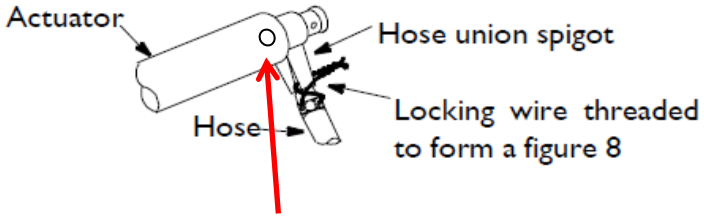
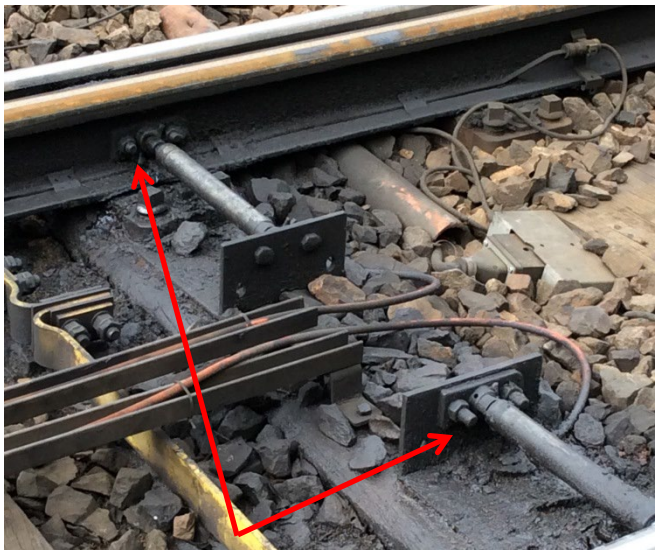


Figure 1 – Existing Type



On older versions of Hydraulic Actuators the spigot is joined to the main body and retained by a spirol pin.

Figure 2 – Old 'spiral' Type



Check Fastenings are secure on both 'N' & 'R' actuators at rear

Figure 3 – Fastenings

END

Includes:	Torsion Operated Supplementary Drive.
Excludes:	Hydraulic operated and crank operated supplementary drive

SERVICE B

1. Torsion Operated Supplementary Drive

1.1 Check that all moving parts are not obstructed and are clear of ballast. Rectify as necessary.

1.2 Check the installation is securely fitted.

1.3 Check the supplementary drive is correctly set up, Rectify as necessary. Details are in Appendix A

1.4 Check for wear on the drive pin fitted through the drive take-off arm on the drive take-off stretcher bar.

Arrange for replacement if excessively worn. Excessive wear is indicted by brass filings underneath the take-off arm and a ‘squaring’ of the round drive pin.

1.5 Check that the toe of the switch rail touches with the stock rail before the back driven portion.

1.6 Check that the lock nuts on the lost motion drive are tight.

APPENDIX A - Torsion Operated Back Drive Adjustment

If the torsion tube is not correctly aligned, excessive wear on components can be experienced and problems can be had driving the switch rails.

Alignment of the torsion tube can be checked by disconnecting the drive pin at the front drive take-off and the back-drive stretcher bars and then removing the top of the pillow block assembly.

The torsion tube can then be rotated in the pillow block assemble whilst observing the rollers within it. Any misalignment is apparent by the way the tube rotates within the rollers.

The front and back drive pillow blocks are mounted on a serrated edge surface, which can allow lateral adjustment to correct any errors.

Because of the design of the torsion back drive the amount of drive at the rear stretcher is the same as at the front therefore two lost motion escapements are provided at the rear stretcher to reduce the amount of drive on this part of the switch rail.

When setting up a torsion back drive the same basic principles in all mechanical signalling apply. With both switch rails equal distance from the stock rail at the toe, check the front stretcher torsion drive lug is vertical.

Connect the drive with drive pin at the front and rear stretchers and adjust via the lost motion escapements to give an equal distant from the stock rail to the switch heel tighten all nuts and locking nuts.

Check the open switch distance at the toe (108/110mm), at the heel check the open switch distance (113A & UIC54B - 50mm / RT60 & NR60 - 60mm) and the closed switch distance (1.5mm) in both the Normal and Reverse positions.

Check that the toe of the switch makes with the stock rail before the backdriven heel.

END

Includes:	Type R Reed FDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Under no circumstances shall the line amplifier gain straps, gain setting resistors or attenuator resistor values be adjusted. The need for any adjustment of these indicates a fault, inform your SM(S) immediately.

This system is for use on vital signalling functions. Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement. The R series of reed filters was manufactured by MV-GRS (later AEI-GS) in the late 1950's.

The plug boards used are of American GRS design and are unique to this equipment.

The system was also manufactured by GEC-GS (formally AEI-GS) for SGE and used their own style of plug board.

The type R system went out of production in 1964 therefore new build units are unavailable.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 As provided, check the fault logging system for any outstanding faults. Rectify or report.

1.2 As provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 As provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 As provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, Rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies (Tx and Rx)

7.1 Using an electronic meter measure the following voltages on all power supply units, see Table 1.

Type	Voltage	Limits	AC Ripple
Individual (Low Current)	AC input	105V to 120V	NA
	DC Output	12V to 13.5V	<75mV
Group (High Current)	AC input	105V to 120V	NA
	DC Output	12V to 13.5V	<75mV

Table 1 - Power supply limits

8. Transmitter (Tx) End

8.1 Using an electronic meter measure the transmitter output voltage across the line resistor, which is mounted between t3E and t1E.

a) Transmitting voltage: 0.7 - 1V AC

b) Not transmitting voltage: <200mV AC

9. Receiver (Rx) End

Using an electronic meter measure the receiver output voltage (across t12&t13) when receiving and not receiving a signal:

a) If receiving the voltage shall be between 10.5 – 15 V DC.

b) If it is not receiving voltage shall be <200 mV DC.

Due to operating conditions, it might not be possible to take receiving voltages on all receivers.

Not receiving voltages shall always be taken.

9.2 Measure using an electronic meter the DC voltage across R1 and R4 of the Reed Follower relay, check it is the same as in 3.1.

10. Line Amplifiers

10.1 Check by touch that the line amplifier transistors are not cold.

The transistors can become very hot in normal use. Cold transistors indicate the line amplifier is not working correctly.

10.2 Using an electronic meter measure the following voltages on the line amplifier, See Table 2.

Terminals	Tappings	Voltage (AC)
Input	NA	105V to 120V
t7 to t8	24V	22V to 26V
	28V	26V to 30V
	No transformer fitted	22V to 30V

Table 2 - Line amplifier voltages

11. Final

11.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

11.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

12. Equipment Cubicles

12.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

13. Control and Interface Equipment

13.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

13.2 As provided, disconnect and clean all keyboards as necessary.

13.3 As provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

13.4 As provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

13.5 As provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

13.6 As provided, check the Althorn (formally Rugby) clock for correct operation.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Type RR Reed FDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

A vital TX/RX can be used on a non-vital system, but a non-vital TX/RX shall never be used on a vital system.

Under no circumstances shall the line amplifier gain straps, gain setting resistors or attenuator resistor values be adjusted.

In some systems a vital TX/RX can be used with a non-vital TX/RX.

If you are unsure of the configuration of the system (series type or vital/non-vital) ask your SM(S) before carrying out any work.

General

This RR series of reed filters were first manufactured by AEI-GS. With mergers, the company was then GEC-GS, which was then GEC-Alstom.

All the RR types are compatible with the BR829 spec plug board.

Type RR2000 and RR4000 use double tuned reed filters and are approved for use on vital signalling functions.

Type RR3000 uses a single tuned reed filter and is used only on non-vital functions.

Type RR2000 systems are usually found on non-electrified traction areas.

Type RR4000 is used on electrified traction areas.

Type RR2000 and Type RR4000 series have separate ‘Reed Follower’ relays whilst RR3000 has an internal ‘Follower’ relay.

At PSB’s that have fixed test equipment provided, this can be used to test all the channels in place of individual transmitting and not transmitting tests at signal box/trackside locations.

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, Rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Sites without Fixed Test Equipment Transmitter (TX) End

7.1 Measure and record the transmitter output voltage across the line resistor, which is mounted directly behind the transmitter filter plug board (See Table 1).

RR Series	State	Voltage (AC)
RR1000	Transmitting	590mV to 750mV
	Not Transmitting	<100mV
RR3000	Transmitting	590mV to 750mV
	Not Transmitting	<200mV
RR4000	Transmitting (Normal O/P)	330mV to 430mV
	Transmitting (High O/P)	590mV to 750mV
	Not Transmitting	<100mV

Table 1 - Transmitter output voltages

Due to operating conditions it might not be possible to take TX/not-TX voltages on each function at every maintenance visit.

On vital systems all signal and point operating and indicating functions shall be measured within a 12 month period.

If you are unable to take TX/not-Tx voltages on functions other than signals and points (e.g. TC or GF indications) within a 12 month period, you shall inform your SM(S) and note it on your work order.

8. Sites without Fixed Test Equipment Receiver (RX) End

8.1 Measure and record the receiver output voltage when receiving and not receiving a signal (See Table 2).

On vital systems the voltage can alternatively be measured across R1 and R4 of the Reed Follower Relay.

RR Series	State	Terminals	Voltage (DC)
RR2000	Receiving	A1/D1	10.5V to 16V
	Not Receiving		<100mV
RR3000	Receiving	A1/D2	9V to 16V
	Not Receiving		<200mV
RR3001	Receiving	D1/D2	9V to 16V
	Not Receiving		<200mV
RR4000	Receiving	A1/D1	11V to 18V
	Not Receiving		<100mV

Table 2 - Receiver voltage

Due to operating conditions it might not be possible to take RX/Not-RX voltages on each function at every maintenance visit.

On vital systems all signal and point operating and indicating functions shall be measured within a 12 month period.

If you are unable to take the RX/not-RX voltages on functions other than signals and points (e.g. TC or GF indications) within a 12 month period, you shall inform your SM(S) and note it on your work order.

9. Sites with Fixed Test Equipment

9.1 Using the fixed test equipment provided, step through all channels in turn (including all unused or spare channels). Measure the system levels for each channel at that point in time:

a) When energised RMS voltage shall be between 100mV and 150mV.

b) When De-energised RMS voltage shall be less than 10mV.

10. Final

10.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

10.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

11. Equipment Cubicles

11.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth

12. Control and Interface Equipment

12.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

12.2 If provided, disconnect and clean all keyboards as necessary.

12.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

12.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

12.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

12.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

13. System

13.1 Check on vital type RR reed filter units that a silver data label is fitted. Any units without this label should be reported to your SM(S) immediately.

14. Power Supplies (Tx and Rx all locations)

14.1 Using an electronic meter measure the following voltages on all power supply units (See Table 3).

Unit	Voltage	Limits	AC Ripple
RR912X	AC input	105V to 120V	NA
	DC Output	11.5V to 13.5V	<75mV
RR913X	AC Input	105V to 120V	NA
	DC Output	11.5V to 13.5V	<175mV
RR9410	DC Input *	50V to 55V	NA
	DC Output	11.5V to 13.5V	NA

Table 3 - Power supply unit voltage limits

* At a line-side transmitter or receiver, the power supply voltage is sometimes fed from the 50V DC supply.

14.2 If an AC supply is being used check the AC ripple voltage by switching the meter to AC when measuring the DC output.

15. Line Amplifiers (All Sites)

15.1 Using an electronic meter measure and record the following voltages on the line amplifier (See Table 4).

Terminals	Tapping's	Voltage (AC)
Input	NA	105V to 120V
T10 to T11	24V	22V to 26V
	28V	26V to 30V
	No transformer fitted	22V to 30V

Table 4 – Line amplifier voltages

16. Line Levels (Vital Systems Only)

These require a possession of the system for all or part of the test.

There are different methods of performing these tests, either by replacement of the Rx amplifier with a dummy, a permanently modified Rx amplifier or by use of a spectrum analyser.

In all cases, the tests shall only be carried out by staff assessed as competent to work on Reed FDM systems and if necessary, holding a current instrumentation engineers' certificate.

16.1 Using the preferred method for the site (if none has been declared, ask your SM(S)), measure the line levels for a low frequency and a high frequency channel. (See Table 5).

16.2 Compare obtained readings with previously recorded readings, investigate any significant variations.

System	Location	Value (rms)
RR2000	Line	270mV to 350mV
	Dummy Amplifier or Receiver	110mV to 150mV
RR4000	Line	270mV to 350mV
	Dummy Amplifier or Receiver	105mV to 150mV

Table 5 - Line levels

Under no circumstances shall the level be greater than 500mV.

17. Line Protection and Route Selection

17.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

17.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

18. Spares

18.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

18.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S) Test the operation of the cards/units in the test rack.

19. Final

19.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

19.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Westone FDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

The gain of line amplifiers and gain setting resistors shall not be adjusted. The need for adjustment of these indicates a fault, inform your SM(S) immediately.

General

This system was the first FDM system developed by WBS. It uses a tuned circuit for frequency discrimination that has relatively poor selectivity therefore it can only be used on non-vital signalling functions.

There are some systems that are configured in a 'double cut' method; these are used to provide a remote emergency signal replacement function.

The transmitters and receivers are not particularly tolerant of varying installation conditions therefore the setting up of the system after equipment replacement can be difficult and time consuming to obtain the optimum performance.

Inform your SM(S) before replacing any transmitter or receiver.

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided should be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies

7.1 Measure the following voltages on all power supply units on Klippon block A:

a) Measuring across terminals 5 & 6, there should be an AC voltage between 95V to 120V.

b) Measuring across terminals 1 & 2, there should be a DC voltage between 17.1V to 18.9V with AC ripple of less than 75mV.

8. Transmitter and Receiver (TX & RX) End

8.1 Using a frequency selective meter, connected across the line pair, measure the received voltage at both ends of the system on one sample channel.

a) Voltages should be between 300 mV to 1000mV on both transmitter and receiver.

8.2 Measure the transmitters output and the receiver input:

a) Transmitter voltage should be 2V when transmitting and <10mV when not transmitting.

b) Receiver voltage should be 50mV when receiving and <10mV when not receiving.

Due to operating conditions, it might not be possible to take transmitting and receiving voltages on all functions.

9. Final

9.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

9.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

10. Equipment Cubicles

10.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

11. Control and Interface Equipment

11.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

11.2 If provided, disconnect and clean all keyboards as necessary.

11.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

11.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

11.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

11.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	FDM69-NV, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

The gain of line amplifiers and gain setting resistors should not be adjusted. The need for adjustment of these indicates a fault, inform your SM(S) immediately.

This system was devolved by WBS as the successor to Westone. It used a piezo-electric tuning fork for frequency discrimination that has an inferior bandwidth and poorer selectivity than reed systems therefore it can only be used on non-vital signalling functions. In other aspects, the FDM69-NV system has similar configurations (in principle) to those of the reed system.

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Power Supplies (TX and RX)

7.1 Measure the following voltages on all power supply units:

Voltage	Limits	AC Ripple
AC Input	105V to 120V	NA
DC Output	11.5V to 13.5V	<75mV

Table 1 – Power Supply Voltages

8. Transmitter (TX) End

8.1 Measure the transmitter output voltage across the line resistor.

State	Voltage (AC)
Transmitting	1V
Not Transmitting	<200mV

Table 2 – TX Output Voltage

Due to operating conditions, it might not be possible to obtain transmitting voltages on all channels.

9. Receiver (RX) End

9.1 Measure the receiver output voltage:

State	Voltage (DC)
Receiving	9V to 16V
Not Receiving	<200mV

Table 3 – RX Output Voltage

Due to operating conditions, it might not be possible to obtain transmitting voltages on all channels.

10. Final

10.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

10.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

11. Equipment Cubicles

11.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

12. Control and Interface Equipment

12.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

12.2 If provided, disconnect and clean all keyboards as necessary.

12.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

12.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

12.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

12.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

13. Line Amplifiers with battery standby power supply

This test shall only be carried out with the co-operation of the Signaller due to the possibility of the standby power equipment failing.

For CEGASA cells refer to NR/SMS/PartC/EL00 (Electrical Equipment – General).

For non CEGASA cells - NR/SMS/PartB/Test/058 (Primary Cell Test).

13.1 Check the system to be tested is working normally before any disconnections.

13.2 Remove the BX110 fuse for the PSU feeding the applicable line amplifier.

13.3 Check there is no failure to the FDM system the PSU feeds.

13.4 Replace BX110 fuse for the PSU and re-check power supply voltage is within limits.

13.5 Check the system is operating normally and re-store the system to the Signaller.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Westplex, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Westplex is a modern equivalent of Vital Reed remote control systems. It has been designed to facilitate pre-wiring and simple change over when replacing an existing Vital Reed system.

The line side cabling used by the Vital Reed can be re-used by this system as can the reed follower relays; however, it uses the two cable pairs as a ring and is thus tolerant of the first cable fault.

It is a digital system having the potential for use on open transmission networks such as FTN and does not share the susceptibility of the Vital Reed to interference in the modern traction environment.

Westplex systems also do not have the same channel number limitations that Vital Reed systems have permitting the future expansion of converted systems.

Westplex has a ring transmission system that connects HD Communicator modules to each other.

It is tolerant to any one single fault in this ring, but the fault will be recorded and some system response times can increase.

An Echelon LAN connects HD/LINK modules to an HD COMMUNICATOR, this LAN is not duplicated. Any fault on the LAN, including its EOL terminators, is likely to cause increased error rates and eventual loss of function.

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Ring Test

10.1 Check the status indications of the selected HD communicator module on the Westplex system to be tested using Appendix A.

10.2 Connect a laptop PC to the LAN port and using Microsoft Explorer, access the web pages for Line 1 and Line 2 and note the values for signal to noise and loop attenuation.

10.3 Compare with previous values recorded.

10.4 Download the event log and rectify any repeated ring faults (reductions in the signal to noise ratio or increases in loop attenuation).

11. Communications Test

Only one HD/LINKER download is permitted on one Westplex system at any one time.

11.1 Check the status indications of the selected HD/LINK module on the system to be tested using Appendix A.

11.2 Attach a laptop PC to the DIAGNOSTIC port and using HD/LINKER maintainers' facility (M53291.exe) check the communications statistics for every HD/LINK on the system for zero occurrences of missed messages and lost sessions.

11.3 If there are any missed messages, identify the location of the HD/LINK concerned and check for possible faults on its Echelon LAN.

11.4 If there are any lost sessions, carry out the ring test to look for ring faults.

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - Westplex Led Status Tables

HD/LINK (wait at least 90 seconds after power up before observing status).

LED	Correct Status
VRO	Correspond to current output status
VPI	Correspond to current input status
HEALTH	Flashing slowly, approximately once every 2 seconds
LAN TX	Flashing
LAN RX	Flashing
SERVICE	Both OFF
POWER	ON

Table 1 - HS/Link status

HD COMMUNICATOR (wait at least 30 seconds after power up before checking status).

LED	Correct Status
HEALTH	Flashing approximately once per second
LINE 1 & LINE 2	ON and steady *
LAN	ON (OFF or Flashing when computer connected to LAN port)
ALARM	OFF
POWER	ON

Table 2 - HD communicator status

* :- Flashing slowly indicates that the module is polling for a contact, flashing fast indicates that it is 'training up' (takes approximately 15 seconds).

END

Includes:	Type RM Systems, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems.

General

GEC Type RM equipment can also be referred to locally as SDT and SIGNET.

This system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

The system was developed in the late 1970's. It is a synchronous point to point system using simplex or duplex as a transmission mode. The system is based on microprocessor technology.

For older systems see the notes in NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems – General).

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies

10.1 In the order as listed in the following table, using a suitable meter and/or oscilloscope measure the microcomputer power supply and sub-rack PSU DC output voltages and the AC ripple voltages.

Compare the readings with the previously recorded results.

Card/Test	Terminals		DC Voltage Limits	AC Ripple
	+Ve	-Ve		
Microcomputer JM25XX +5V Supply Check	TP4	TP1 or TP6	+4.95V to +5.25V	<50mV
Single PSU +5v Output Check	TP2	TP1	+5.15V to +5.25V	
Triple PSU +5V Output Check	TP2	TP1	+5.15 to +5.45V	

Table 1 - Microcomputer power supply limits

If any of the voltages are found to be outside the limits, the relevant power unit shall be adjusted or changed and all units subsequently re-tested.

There is a test point located on back of PSU on some systems.

Some of the following tests do not require a possession of the system but it is recommended they are performed within a system possession unless the duration of occupation is limited and the Signaller is in agreement.

10.2 Measure the AC supply voltage to all the power supply units are between 105V and 120V.

11. System Changeover (Dual Systems Only)

The following test shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

11.1 Check that the processor indications are correct (Appendix A).

11.2 Check that SW1 on both Output Change-Over Unit cards are set at AUTO. Identify which Output Change-Over Unit card is in ONLINE by observing which one has LED 2 lit (Com Line Output indication).

11.3 Push SW1 on this card over to the OFF position. Observe that within 3 Seconds control passes over to the OFFLINE Output Change-Over Unit card.

This should be confirmed by LED2 illuminating on the card newly in control and extinguishing on the card previously in control.

11.4 Return SW1 on the OFFLINE card back to the AUTO position.

11.5 Observe the processor indications remain as listed in Appendix A.

12. Line Levels

The following test shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

12.1 At both the Office and Field ends of the system; measure using a meter, the transmitted controls/indications and the received indications/controls at the line connection points.

Function	Level	Limits
Tx	-13dBm	+3dBm to –7dBm
Rx	-13dBm	+3dBm to –20dBm

Table 2 - Line level limits

13. Monitor Card

13.1 Test the operation of the monitor card by checking a convenient signalling function whilst it is being operated.

14. Line Protection and Route Selection

14.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

14.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

15. Spares

15.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

15.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

16. Final

16.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

16.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

Systems can be made up of a variety of cards.

For older systems using computer cards of the JM10XX variety, the only visual indications are on the TX/RX/PP computer cards, modems, PSUs and the alarm unit. For systems with these cards installed ignore all other indication states listed below:

Card	Indication/Function	State
Alarm Unit	Sys OK Indication	Illuminated
	All other indications	Extinguished
Modem JD1080A (Field)	LED's 1, 2	Flashing
	LED's 3,4	Pulsing
	LED 5	Illuminated
Modem JD1080A(Office)	LED's 1,2 #1	Steady #1
	LED 3	Pulsing
	LED's 4,5	Flashing
PP Computer Card JM1036	LED	Illuminated

Card	Indication/Function	State
TX Computer Card JM1021	LED	Illuminated
RX Computer Card JM1020	LED	Illuminated
Microcomputer JM25XX	LED's 1-8	Extinguished
Memory Extension	N/A	N/A
Highway Buffer Unit	LED's A0-A10 #2	Pulsing
	LED's D0-D7	
	RD LED	
	WR LED	
	Reset LED	Extinguished
	Compare LED	Illuminated
Input Buffer Units (single)	LED1	Pulsing
Input Buffer units (Double)	LED1	Pulsing
	LED2	Pulsing
Transistor Output Buffer Units	LED1	Pulsing
Single PSU (JD1076)	+5v LED	Illuminated
Triple PSU (JD1077)	+12v LED	Illuminated
	+5v LED	
	-12v LED	
Battery Backed Triple PSU (JD1077)	+5v LED	Illuminated
	+12v LED	
	-12v LED	
	Batt OK LED	
Output Changeover Unit (Dual Systems only)	LED 1	Pulsing
	LED 2	Illuminated (online unit only)
	LED's 3, 4, 7, 8	Extinguished
	LED's 5, 6	Illuminated
Triac Output Buffer Unit	LED 1	Pulsing

Table 3 - System Indications

#1: LED's 1 and 2 are Flashing on 4 wire (full duplex) circuits but steady on 2 wire circuits (half duplex).

#2: LED's A7-A10 might be extinguished for smaller systems of less than 4 sub racks (refer to manufacturers' manuals).

END

Includes:	WRSL Type TDM69, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

Plugging and un-plugging of cards shall be kept to a minimum and undertaken with great care for the remaining life of the equipment.

Edge connectors in this system cannot be repaired or replaced and the failure of an edge connector can permanently render the card or motherboard involved unusable.

See the notes in NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General) on older systems.

General

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

This system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications (See Appendix A for indications).

This system was developed in the late 1960's. It is an asynchronous point to point system using simplex as a transmission mode. The system is IC based using TTL technology.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. High / Low Voltage Tests

The following checks are to be carried out in close liaison with the Signaller at times when no traffic is signalled at both the field and office ends of the system.

10.1 Operate the power supply unit high / low voltage switches as detailed below.

Each step shall be one-minute duration.

Observe the alarm indications remain normal:

a) 24V - High.

b) 24V - Low.

c) 7V - High.

d) 7V - Low.

e) 24V and 7V - High (simultaneously).

f) 24V and 7V - Low (simultaneously).

g) 24V - High and 7V - Low (simultaneously).

h) 24V - Low and 7V - High (simultaneously).

The following tests are best carried out under a system possession.

They can be carried out in conjunction with a test of the local panel. If so, the local panel shall be switched into use and the operator shall verify that they have control of the signalling functions before any testing is started.

Where there is no local panel, the interlocking involved can be put into override.

Testing can start once confirmation is received that override is operating correctly. Liaise with the Signaller before switching any local panels or putting the system into override.

11. Received Signal Level Test (TDM 69 Non-VF Only)

11.1 Using a meter, measure the signal level at the receiver line connection unit (plus A1 and A2 on the line connection unit plugboard). Compare the reading with those taken at the time of installation.

12. Line Level Test (TDM 69 Non-VF Only)

Using a meter capable of measuring decibels, measure the TX and Rx level at the appropriate transmitter or receiver module/modem/line termination (equipment side of any line connection unit). Compare the readings with the previously recorded results.

13. Voltage Tests

13.1 Using an electronic meter (or oscilloscope for the ripple voltage) measure the following voltages on the monitor card. Compare the readings with the previously recorded results.

Test Point	Limits	Ripple
TX +24V	+23.5V to 24.5V	N/A
TX +12V	+10V to 13V	N/A
TX -12V	-10V to -13V	<100mV P/P
TX +7V	+6.8V to +7.2V	<100mV P/P
TX +5V	+4.75V to +5.25V	N/A

Test Point	Limits	Ripple
Rx +24V	+23.5V to 24.5V	N/A
Rx +12V	+10V to 13V	N/A
Rx -12V	-10V to –13V	<100mV P/P
Rx +7V	+6.8V to +7.2V	<100mV P/P
Rx +5V	+4.75V to +5.25V	N/A

Table 1 - Voltage test limits

14. Insulation / Noise Tests

14.1 Using a meter, measure the insulation resistance between the 0v rail (inner PC card housing) and earth it shall be:

- One Rx/Rx Housing <20MΩ.

Where extension modules are used the readings can be reduced as below:

- One extension Module <10MΩ.
- Two extension Modules <7MΩ.

If the insulation resistances are below these stated in 14.1, connect an oscilloscope to the test points on a DIP or DOP card.

The voltages obtained under worse case conditions (when two or more routes are cancelled simultaneously) shall not exceed 400mV.

If this voltage is exceeded, then TX and RX extension modules shall be examined for faulty suppression capacitors.

15. Final Checks

Before booking the Remote Control system back into use check all the functions are present at the controlling signal box and there are no fault indications.

16. Line Protection and Route Selection

16.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

16.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

17. Spares

17.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

17.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

18. Final

18.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

18.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

These indications are at both the office and field ends of the system.

System	Indication
Dual Alarm Monitor	Green light
Highway Filter	Illuminated Steady LEDs
Alarm Card	

Table 2 - System Indications

END

Includes:	WRSL Type S2, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

The remote-control system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

At the office end a processor can be part of the S2 remote control system; this is a separate housing to the S2 card housing and will be STD bus or WRSL VME bus based. PLC's (Programmable Logic Controllers) can also be provided.

This system was developed in the late 1970's. It is an asynchronous multi station system using simplex or duplex as a transmission mode. The system is based on Microprocessor technology.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

System Tests

On duplicated systems invasive tests shall be conducted on the off-line system.

To test the current on-line system, a change-over shall be forced to change the on-line systems over.

On non-duplicated systems the tests shall be conducted under a system occupation.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies (non-Manchester systems)

10.1 Measure the DC voltages of the power supplies associated with the system. On the regulated supplies measure using a Digital voltmeter or an oscilloscope the AC ripple on the DC output.

Check they are within the limits as shown in Table 1:

Type	Supply Voltage	Limits	Ripple
Regulated	12V	11.5V to 12.5V	< 50mV
Regulated	24V	23.5V to 24.5V	< 70mV
Regulated	50V	48V to 51V	< 100mV
PSU	12V	11.5V to 12.5V	NA
PSU	24V	23V to 26V	NA
PSU	50V	49V to 55V	NA

Table 1 - Power Supply Limits (non-Manchester systems)

There is always a 12V supply and usually a 24V and/or 50V. If any of the voltages or ripples are found to be outside the limits the relevant power unit shall be changed and re-tested.

11. Power Supplies (Manchester systems only)

11.1 Processor (STD bus only) (If provided) measure the DC power supplied to the STD bus housing.

Using a Digital voltmeter or an oscilloscope measure the AC ripple on the DC output. Check they are within the limits as shown in table 2.

Between	Supply	Limits	Ripple
Black/Red	+5V	5V to 5.5V	<20mV
Black/Orange	+12V	11.5V to 12.5V	<50mV
Black/Purple	-12V	-11.5V to -12.5V	<50mV

Table 2 – Power Supply Limits (Manchester system)

11.2 Test at the connection between the housing and its associated PSU (no test points exist but the voltage can be measured by carefully inserting the test prods into the Molex connection block).

The +5V is critical to reliable operation of the processor. If any of the power supplies are outside of limits the power supply shall be changed. Adjustment of Style M281 power supplies +5V shall only be done for replacements.

TTL logic should operate between 5.0 and 5.25V, this is the voltage present on the cards. Due to the number of cards and current drawn, the voltage at the power supply can be slightly higher, hence the 5.5V upper limit.

12. Processor PLC Type EX40 (only)

12.1 Measure the internal unregulated 24V DC power supply between the DCO+ and the DCO– terminals.it should be between 12V and 30V DC.

The EX08 is an expansion unit.

13. Processor PLC Type S7-200 (Only)

13.1 Measure the external power supplies (Supplies and limits are as per the Table 2)

14. Duplicated Power Supply Units (PSU) Associated with S2 Housings (all systems)

The following tests shall be conducted under a system occupation or during a quite traffic period in liaison with the Signaller.

14.1 Disconnect the 110V AC feeds to one of the PSU's and check that an alarm is given and the S2 system continues to operate correctly.

14.2 Measure the DC output and using a digital voltmeter or an oscilloscope the AC ripple voltage of the remaining PSU. Check that the ripple voltage does not exceed 50mV.

If this voltage is exceeded the PSU shall be changed.

14.3 Observe that the DC output indicator lamp(s) of the un-powered PSU are extinguished. If any remain illuminated the PSU shall be replaced.

Repeat 14.1 to 14.3 for each PSU.

15. Line Levels (non- Manchester systems only)

15.1 Using the adaptor plug (Appendix A) set the office modem A to continually transmitting. Measure using a suitable meter the modems transmit level at a convenient point, they should be between 11.4dBm and –16dBm.

At the field(s) locations, measure using a suitable meter the received level at a convenient point they should be no lower than –40dBm.

15.2 Remove the adaptor plug from modem A and repeat 4.1 and 4.2 for modem B

Where Line Matching Units (LMU) is fitted the signal shall be measured on the modem side of the LMU.

15.3 Disable the office modems and set one of the fields modem to transmit (Appendix A).

Measure using a meter, the transmitted level at a convenient point, they should be between -11.4dBm and –16dBm.

At the office locations, measure using a suitable meter the received level at a convenient point they should be no lower than –40dBm.

15.4 Repeat 15.3 for each of the field modems.

Where Line Matching Units (LMU) is fitted the signal shall be measured on the modem side of the LMU.

Set all the modems back to normal operation and confirm using the office alarm panel that the system is operating correctly.

16. Line Levels (Manchester systems only)

The following tests shall be conducted under a system possession.

16.1 The modem line levels shall be measured with a constantly transmitting data signal. Use either the adaptor plug shown in Appendix A, modem test set, or the modems own test facilities (check the modem manual).

16.2 Set the office modem A to continually transmitting data. Measure using a suitable meter (VF meter) the modems transmit level at a convenient point; they should be between –11.4dBm and –16dBm.

At the field locations, measure using a suitable meter the received level at a convenient point, they should be no lower than –40dBm.

16.3 Check that the alarm fault indication panel for the processor housing is showing the relevant alarm, e.g. ‘link failure’.

Check the audible/visual LED indication alarms on Signallers desk and also on corresponding processor alarm panel (also ref section 6- System Changeover).

Not all processors are duplicated, check on drawings.

16.4 Set the field modem A to transmit data. Measure using a suitable meter the modems transmit level at a convenient point; they should be between –11.4dBm and –16dBm.

At the office locations, measure using a suitable meter the received level at a convenient point, they should be no lower than –40dBm.

16.5 Repeat 16.2 & 16.4 for modem B.

Where Line Matching Units are fitted the signal shall be measured on the modem side of the LMU.

16.6 Set all the modems back to normal operation and confirm using the office alarm panel that the system is operating correctly.

17. System Change Over (Dual systems and non-Manchester systems only)

The following tests shall be conducted under a system possession.

17.1 Operate the Signaller's change over control. Observe that the Signaller's system indications respond correctly and that each system operates correctly.

17.2 Operate (where fitted) the Technicians Auto/Manual change over switch. Switch from 'Auto' to system 'A' and check the system operates correctly. Return the switch to the 'Auto' position and repeat the test switching to system 'B'.

17.3 Check on completion of this test the switch is left in the 'Auto' position. Failure to do so results in the Signaller being unable to change systems in the event of a failure.

18. System Change Over (Manchester systems only)

The following tests shall be conducted under a system possession.

There are two different methods used to change over the systems, depending on the type of equipment present.

18.1 Carry out either Section 19. or Section 20 depending on the type of equipment in your area.

19. STD Bus & VME Bus CM2R systems only (control processors)

STD Bus systems and VME CM2R systems have a change-over switch located remotely from the equipment, on the Signaller's route setting desk.

19.1 Operate the Technicians Auto/Manual change over switch. Switch from "Auto" to system "A" and check that the system operates correctly.

19.2 Return the switch to the "Auto" position and repeat the test switching to system "B". Check the system is left in "Auto"

<u>CM2R system only:</u>

19.3 Check that the 'Auto Latch' LED is flashing. If the LED is extinguished press the 'Latch Reset' button.

20. VME Bus CM2 system only (Indication Processors)

VME CM2 type systems have a rotary switch in the processor housing to enable switching of the system by the Technician.

20.1 Set the rotary switch to the off-line system and observe that the systems switch over.

20.2 Set the rotary switch to the 'Auto' position.

20.3 Check the 'Auto Latch' LED is flashing. If the LED is extinguished press the 'Latch Reset' button.

21. Line Protection and Route Selection

21.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

21.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

22. Spares

22.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

22.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

23. Final

23.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

23.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - Modem Connections for Continuous Transmission

The configuration of the modem 9-way 'D' connector is as follows:

Pin	Signal
2	Tx Ready
3	Rx Data
4	RTS (Ready to Send)

Pin	Signal
5	CTS (Clear to Send)
6	DTR (Data Terminal Ready)
7	Ground (0V)

Table 3 - Modem configuration

A line pair can be tested by disconnecting the 'DTE' D- type connector at the rear of the 'end of the line' modem (this can be the office modem or the furthest away field modem) and replacing it with a D-type male plug with the internal connections configured Pin 4 connected to Pin 6.

This can set the modem to continually transmitting at 1300Hz (mark).

The modem launch level and receive levels along the line can now be measured at a convenient point in the S2 cabinet (refer to the site diagrams).

If there is a miniature switch fitted to the D-type plug (this is between Pin 2 and Pin 6) the modem can be set to transmit either 'mark' (1300Hz) or 'space' (2100Hz) to check the frequency attenuation of the line.

APPENDIX B - System indications

These indications are seen at both the office and field ends of the system.

Alarm Panel		
Location	**Indication**	**Status**
Office	Fault	Extinguished
	Call Technician	
	In Use	Illuminated (if System Selected)
	Available	Illuminated
Field	Fault	Extinguished
	In Use	Illuminated (if System Selected)

Table 4 - System indications

The 'In Use' indication does not appear on single systems

Power Supply	
Indication	**Status**
PSU	Illuminated
Power Failure	Extinguished

Table 5 - Power supply indications

Scanner Cards in the S2 Housings		
LED Position and Colour	**Indicating**	**State**
Top Red	Highway OK	Regular Flashing
Lower Red	Programme OK	On
Top Yellow (x2)	NA	Off (only active if alarms printer connected)
Lower Yellow (x2)	Data Tx or Rx	Continuous Flickering

Table 6 - Scanner Card Indications

Digital Input (DIP) & Digital Output (DOP) Cards in the S2 Housing		
LED Position and Colour	**Indicating**	**State**
DIP Card Top Red	Highway A	Regular Flashing
DIP Card Lower Red	Highway C	
DOP Card Top Red	Highway A	
DOP Card Lower Red	Highway C	

Table 7 - DIP&DOP indications

If the system is not dual only the top LED's flash

Modems		
LED	**Indicating**	**State**
PWR	Power	Illuminated
DTE	Data Terminal Equipment	
RXD	Receive Data	Flashing
TXD	Transmit Data	

Table 8 – Modem Indications

If the system is not dual only the top LED's flash

Processor (Type WRSL VME only) if provided	
LED	**State**
Online	Illuminated (SYS 1 or 2)
Watchdog	Flashing
Available	Illuminated
Autolatch	Flashing
Fault	Extinguished

Table 9 - Processor Indications

Toshiba PLC		
LED	**Status**	
	IP PLC	**CP PLC**
Power	Illuminated	NA
Run	Illuminated	Illuminated
Error	Extinguished	Extinguished
Alarm	Extinguished	Extinguished
PROM	Illuminated	Illuminated

Table 10 - Toshiba PLC indications

Siemens PLC	
LED	**Status**
SF	Extinguished
Run	Illuminated
Stop	Extinguished

Table 11 - Siemens PLC indications

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/RC10		
Remote Control System - Westronic F1 TDM		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Westronic F1 TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

A remote control system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

This system was developed in the mid 1960's. It is a synchronous multi-station system using half duplex as a transmission mode. The system is built on discrete components (cards).

See the notes in NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General) on older systems.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary, locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies (Office & Field)

10.1 Measure using a meter the DC voltage and AC ripple on the ‘A’ & ‘B’ supply lines at the appropriate fuse terminals on the supervisory and monitoring panel.

For 18V the limits are between 17.25 to 18 VDC, with a ripple voltage of <50mV.

10.2 In turn, operate and then return to the normal (up) positions the ‘A’ & ‘B’ marginal voltage switches. Measure using a meter the DC voltage and AC ripple at the same test points as 10.1.

For 16.5 V the limits are between 15. To 16.5 VDC, with a ripple voltage of <50mV.

11. Line Changeover (Office) (If Provided)

This test shall be performed in liaison with the Signaller.

11.1 By use of the line selection switch, change lines and check that the system returns to normal operation within 5 to 7 seconds. Return to the line originally selected and check that the system returns to normal operation within 5 to 7 seconds.

11.2 Observe that the ‘Line Selected’ indication corresponds with the position of the switch and no faults are indicated during the changeover test.

12. Fault Alarm and Alarm Resets (Office & Field)

Because of the disruptive nature of the following tests it is advised they are carried out under a system possession unless the duration of the occupation is limited and the Signaller is in agreement.

12.1 Because of the interaction between office and field, alarm tests shall be performed at one location at a time, with all others set for normal operation.

During these tests a secondary alarm can be given along with the one being tested; these should be ignored for the purposes of these tests.

13. Fuse Alarm

13.1 Turn the alarm reset switch to manual.

The door indication should show manual alarm reset.

13.2 Briefly connect the feed side of a fuse to the centre stud. Check that the red fuse alarm lamp illuminates.

13.3 On the monitoring panel check that after approximately six seconds the ‘System Normal’ lamp extinguishes and the ‘System Failed’ lamp illuminates.

13.4 Press the alarm reset button and check the alarms clear.

14. All Cards Present / Card Out (If provided) (Including registry relay cards)

14.1 Turn the alarm reset switch to auto.

14.2 Remove a principal card (e.g. OMT3). Check that the ‘All Cards Present’ lamp extinguishes and the ‘Card Out’ lamp illuminates.

14.3 On the monitoring panel check that after approximately six seconds the ‘System Normal’ lamp extinguishes and the ‘System Failed’ lamp illuminates.

14.4 Replace the card and check that the ‘Card Out’ lamp extinguishes and the ‘All Cards Present’ lamp illuminates on the monitoring panel, check that after approximately six seconds the ‘System Normal’ lamp illuminates and the ‘System Failed’ lamp extinguishes.

This test’s the auto reset of the ‘Card Out’ alarm.

14.5 Turn the alarm reset switch to manual.

14.6 Remove a principal card (e.g. OMT3). Check that the ‘All Cards Present’ lamp extinguishes and the ‘Card Out’ lamp illuminates.

14.7 On the monitoring panel check that after approximately six seconds the ‘System Normal’ lamp extinguishes and the ‘System Failed’ lamp illuminates.

14.8 Replace the card and press the alarm reset button, check the alarms clear.

15. Scan Fail

15.1 Turn the alarm reset switch to auto.

15.2 Connect together the P79 (80 stage stepping chain) or P63 (64 stage stepping chain) and the common sockets on the matrix board (located on the system monitoring panel).

15.3 Check that the 'Scan Fail' lamp illuminates. On the monitoring panel, check that after approximately six seconds the 'System Normal' lamp extinguishes and the 'System Failed' lamp illuminates.

15.4 Remove the strap and check that after approximately five to seven seconds the automatic fault reset operates and the system normalises.

16. Two Delivery Relays Up (Not fitted at single address fields)

16.1 Turn the alarm reset switch to auto.

16.2 Strap together the D2U and 2.2K sockets on the matrix board. Check that the 'D2U lamp illuminates. On the monitoring panel, check that after approximately six seconds the 'System Normal' lamp extinguishes and the 'System Failed' lamp illuminates.

16.3 Remove the strap and check that after approximately five to seven seconds the automatic fault reset operates and the system normalises.

17. Two Entry Relays Up (Not fitted at single address fields)

17.1 Turn the alarm reset switch to auto.

Strap together the E2U and 2.2K sockets on the matrix board. Check that the 'E2U lamp illuminates. On the monitoring panel, check that after approximately six seconds the 'System Normal' lamp extinguishes and the 'System Failed' lamp illuminates.

17.2 Remove the strap and check that after approximately five to seven seconds the automatic fault reset operates and the system normalises.

18. Delivery Fail

18.1 For each address in turn, remove the relevant RD1 card (refer to the WRSL diagrams for the system). Check that after a few seconds the 'Delivery Fail' lamp for that address illuminates.

18.2 Replace the card and check that after a few seconds the 'Delivery Fail' lamp extinguishes and all other alarms show normal.

19. Office Location Only

19.1 Remove the RD1 cards for all address. Check that the 'Common Delivery Fail' lamp illuminates.

19.2 Replace all the cards and check that after a few seconds the system normalises and no other alarms are indicated.

20. Final

20.1 At all locations check that all indications show normal, there are no alarms showing and the alarm reset switch is in the auto position.

21. Marginal Voltage Test (Office & Field)

21.1 Select the marginal voltage operation by using the two toggle switches. Check that the 'Marginal Voltage' warning lamp illuminates when either or both switches are operated.

21.2 Leave the switches in this position for at least 30 minutes. If any other alarms are indicated in this period rectify as necessary.

21.3 After the 30 minutes period return the switches to their normal position (Up) and check that the 'Marginal Voltage' warning lamp extinguishes.

22. DC Line Proving (If Provided)

22.1 Check that the Normal line is selected at all locations. Check that the 'Line Proving OK' lamp is illuminated.

22.2 At the terminal field location, disable the DC line proving supply by removing the two small plug-in relays whose coils are used as carrier signal blocking chokes.

22.3 At the office location check that the 'Line Proving OK' lamp extinguishes and the 'Line Fault' lamp illuminates. Replace the relays at the field location and check that the 'line Fault' lamp extinguishes and the 'Line Proving OK' lamp illuminates.

22.4 Switch to the Standby line.

22.5 At the terminal field location, disable the DC line proving supply by removing the two small plug-in relays whose coils are used as carrier signal blocking chokes.

22.6 At the office location check that the 'Line Proving OK' lamp extinguishes and the 'Line Fault' lamp illuminates. Replace the relays at the field location and check that the 'line Fault' lamp extinguishes and the 'Line Proving OK' lamp illuminates.

23. AC Line Proving (If Provided)

23.1 Check that the Normal line is selected at all locations. Check that the 'Line Proving OK' lamp is illuminated.

23.2 At the office location remove the line proving card check that the Normal line is selected at all locations. Check that the 'Line Proving OK' lamp is illuminated. Replace the card and check the indications normalise.

23.3 At the terminal field location remove the line proving card and check at the office location that the 'Line Proving OK' lamp is illuminated. Replace the card and check the indications normalise.

23.4 Switch to the Standby line.

23.5 At the office location remove the line proving card check that the Normal line is selected at all locations. Check that the 'Line Proving OK' lamp is illuminated. Replace the card and check the indications normalise.

23.6 At the terminal field location remove the line proving card and check at the office location that the 'Line Proving OK' lamp is illuminated. Replace the card and check the indications normalise.

24. Line Protection and Route Selection

24.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

24.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

25. Spares

25.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

25.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

26. Final

26.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

26.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Adjustments and Set Up

These procedures require the use of specialised equipment and can affect the operation of the system.

They shall only be carried out by persons competent in using this equipment and with the F1 system. (E.g. Technical Support).

APPENDIX B - System Indications

These indications are at both the office and field ends of the system. Note that not all the indications are present in systems at different locations. Check only the indications present on the system you are maintaining.

Indication	Colour	State
System Normal	Green	Illuminated
All Cards Present		
Door		
Line Proving OK		
Line Fault	Red	Extinguished
System Failed		
Card Out		
Scan Fail		
D2U		
E2U		
2DRU		
2ERU		
Fuse Alarm		
Delivery Fail		

Table 1 - System Indications

END

Includes:	Vaughan Harmon DM11, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Tell your SM(S) if any of these tests fail to meet the requirement.

The remote control system involves the transmission of data between locations called office and field.

An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

See the notes in NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General) on older systems.

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary, locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. DC Power Supplies

10.1 Measure using a meter the DC output voltages from all the power supply units on the ‘A’ and ‘B’ systems.

10.2 Measure using a digital voltmeter or an oscilloscope the AC ripple on the DC output. Check they are within the stated limits:

PSU	Test Point	Volts	Limits	Ripple
A&B +5VDC Logic	PSU Front Panel Sockets	+5V	+4.9V to +5.25V	< 50mV
A&B +7VDC Logic		+7V	+6.5V to +7.5V	< 50mV
A&B Interface		-12V	-11.5V to -12.5V	< 100mV
A&B Supply to regulated PSU	AP-H Test Points #	+48V	+45V to +52V < 5V	< 5V

Table 1 - Powers Supply Limits

If any of the voltages or ripples are found to be outside the limits the relevant power unit shall be changed and re-tested.

#: On Gresham-Powerdyne PSUs test voltage where accessible.

11. AC Power Supplies

11.1 Measure the AC supply voltage to all the power supply units this should be 105V to 120V.

12. System Change Over

The following tests shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

12.1 Check that the processor indications are as listed in Appendix A.

With the co-operation of the Signaller, force a changeover of the system and observe the processor indications remain as listed in Appendix A (on line and off line are now reversed).

12.2 Return the changeover switch to its original position and observe the processor indications remain as listed in Appendix A.

13. Line Levels

The following tests shall be conducted under a system occupation or during a quite traffic period in liaison with the Signaller.

On Line System

13.1 At the office end of the system measure using a meter, the transmitted level of the controls and the received level of the indications at the line connection points:

a) Tx Control Levels: -13dBm to -16dBm.

b) Rx Indication Levels: No lower than -40dBm.

13.2 At the field end of the system measure using a meter, the received level of the controls and the transmitted level of the indications at the line connection points.

a) Tx Indication Levels: -13dBm to -16dBm.

b) Rx Control Levels: No lower than -40dBm.

Off Line System

13.3 At the office end of the system measure using a meter, the transmitted level of the controls and the received level of the indications at the line connection points:

a) Tx Control Levels: -13dBm to -16dBm.

b) Rx Indication Levels: No lower than -40dBm.

13.4 At the field end of the system measure using a meter, the received level of the controls and the transmitted level of the indications at the line connection points.

a) Tx Indication Levels: -13dBm to -16dBm.

b) Rx Control Levels: No lower than -40dBm.

14. Monitor Card

14.1 Test the operation of the monitor card by checking a convenient signalling function whilst it is being operated for both the 'A' and 'B' systems.

15. Line Protection and Route Selection

15.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

15.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

16. Spares

16.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

16.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S) Test the operation of the cards/units in the test rack.

17. Final

17.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

17.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

Signaller's Alarm Panel	
LED	**State**
On Line	On (if system selected)
Fault	Off
Available	On

Table 2 - Alarm Panel Indications

System Cards		
LED	**Card**	**State**
Watchdog	68P Processor (A&B)	Flashing
Available		On
Selected		On (if selected)
Fault		Off
Tx		Flickering
Rx		Flickering
Halt	68P Processor (A&B)	Off
A&B Scan	6SI Input	Both Flickering
	6SO Output	One Flashing

Table 3 - System Cards Indications

END

Includes:	Telecode TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

The remote control system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

If a half system fails, then recovers or is switched out of maintenance there is an automatic two-minute ‘recovery’ period during which the affected half system cannot be brought ‘on line’.

Some systems are non-duplicated, and some are ‘one way’ (simplex) only. If you are unsure ask your SM(S).

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians’ terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Watchdog Unit

10.1 Check the alarm status displays on the Watchdog card. Investigate any alarms showing then press the Watchdog alarm re-set button.

11. Power Supplies

11.1 Measure the AC supply voltage to all the power supply units and confirm it is between 105V to 120V

11.2 Measure using a meter the DC output voltages from all the power supply units on the ‘A’ and ‘B’ systems.

11.3 Measure using a digital voltmeter or an oscilloscope the AC ripple on the DC output. Check they are within the stated limits:

PSU	Test Point	Volts	Limits	Ripple
Logic (without standby battery)	PSU Front Panel Sockets	+12V	+11.4V to +12.6V	< 50mV
Logic (with standby battery)	PSU Front Panel Sockets	+12V	+13.2V to +14.4V	< 50mV
Plant Supply	Melcher PSU 2mm Test Points #	+50V	+48V to +52V	< 100mV
Modem	5V Test Point	+5V	+4.9V to +5.25V	<100mV

If any of the voltages or ripples are found to be outside the limits the relevant power unit shall be changed and re- tested.

#: On this unit multiply the reading by two to obtain the correct voltage.

12. Standby Battery Test (where provided)

The following test shall be conducted in liaison with the Signaller.

12.1 Switch off the 'A' 12V logic PSU. Observe that the 'A' system continues to operate normally (although it shows as a fault on the maintainer's panel).

12.2 Measure the output voltage over a period of 5 minutes and check that it does not drop below 11.8V. Switch the unit back on and observe that the voltage increases slightly.

12.3 Switch off the 'B' 12V logic PSU. Observe that the 'B' system continues to operate normally (although it shows as a fault on the maintainer's panel).

13. Line Levels (VF Modems only, where fitted)

The following tests shall be conducted under a system possession.

13.1 Confirm which of the systems is currently in use (A or B) and check the correct indications are showing on the monitoring panels and the system cards.

13.2 At the field end of the system set the upper switch on the 'A' modem to the 'Test MK' position and measure using a meter the transmit level at the 'SEND' test points and confirm it is between -11dBm to –13dBm

Do not alter the setting of the 'LOOPBACK' switch.

13.3 At the office end of the system measure using a meter the 'A' modem received level at the 'REC' test points and confirm it is no lower than –30dBm.

13.4 At the field end of the system move the upper switch on the 'A' to the 'TEST BIAS' position.

13.5 At the office end of the system measure using an oscilloscope on the 'A' modem the received signal at the 'RD' test points is a square wave with a 1:1 mark/space ratio.

13.6 Replace the switch on the 'A' transmitter modem at the field end of the system to the 'NORMAL' position and repeat 4.2 to 4.5 for the field and office 'B' modems.

14. Line Levels (Fibre Modems only, where fitted)

When handing a disconnected fibre do not look into its end.

The following tests should be conducted under a system possession using a light meter accepted for this system.

14.1 At the office end, ascertain which of the systems is currently in use (A or B), checking that the correct indications are showing on the monitoring panels and the system cards.

On the system not currently in use establish where the Tx and Rx channels are.

On cards with two fibres connected, one is the Tx and the other the Rx. On cards with one fibre connected, the Tx and Rx use the one fibre with one operating at 1310nm and the other at 1550nm.

14.2 Measure using a light meter the Rx light level at the end of the fibre:

- No lower than -20dBm.

14.3 Measure using a light meter the Tx light level at the end of the fibre:

- No lower than -8dBm.

14.4 Reconnect the fibre(s) and repeat section 5 at the field end.

15. Alarms (VF Modems only, where fitted)

The following tests shall be conducted under a system possession.

15.1 At the office end of the system open the ‘transmit’ line pair by using the upper two isolating links fitted in the TBVFA terminal block (at the rear of the Telecode 80 cabinet).

15.2 At the field end of the system observe that the ‘A’ modem indicates a ‘CA’ alarm and that the ‘DCD’ indication extinguishes. Reinstate the links and observe that the alarms cancel.

15.3 Repeat 15.1 using the isolating links on the TBVFB terminal block and alarm indications on the ‘B’ modem.

15.4 At the field end of the system open the ‘transmit’ line pair by using the upper two isolating links fitted in the TBVFA terminal block (at the rear of the Telecode 80 cabinet).

15.5 At the office end of the system observe that the 'A' modem indicates a 'CA' alarm and that the 'DCD' indication extinguishes.

15.6 Reinstate the links and observe that the alarms cancel.

15.7 Repeat 15.3 using the isolating links on the TBVFB terminal block and alarm indications on the 'B' modem.

16. Transmission Test

The following tests shall be conducted under a system possession.

16.1 At the office end of the system using the maintainers panel, check that the test bit can be sent on both the 'A'&'B' systems.

16.2 Repeat 16.1 at the field end of the system using the test bit pushbuttons on the remote change over panel.

17. System Change Over (duplicated systems only)

The following tests shall be conducted under a system possession.

17.1 On the office Maintainer's Panel operate the switch on the system that is in use to 'Maintenance' and observe that the 'OK' light has commenced to flash, its 'In Use' indications are extinguished, and the other systems 'In Use' indications are illuminated.

17.2 Observe on the Signaller's TDM Status Panel that the 'In Use' indication has changed to the other system and the 'Semi Urgent Alarm' shows.

17.3 Switch the system back to 'Available' and after the two- minute recovery check that the Semi Urgent Alarm' has extinguished. Repeat 8.1 & 8.2 for the other system.

17.4 Check that during these tests all system indications display the correct information and that the audible alarm sounds when the system indicates a fault. When the system has recovered from a fault and can be silenced by the acknowledge pushbutton.

18. Line Protection and Route Selection

18.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

18.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

19. Spares

19.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

19.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S) Test the operation of the cards/units in the test rack.

20. Final

20.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

20.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications

Signaller's TDM Status Panel		
LED	**State**	**Meaning**
System OK	Normally Illuminated	At least one half of system available
System Failed	Normally Extinguished	If Illuminated, both systems failed or switched to maintenance
Semi Urgent Alarm	Normally Extinguished	If Illuminated, one half of system failed or one system switched to maintenance
System 1 in use	Illuminated or Extinguished	Only Illuminated if system in use
System 2 in use	Illuminated or Extinguished	Only Illuminated if system in use

Table 1 - Signaller's TDM Status Panel Indications

Maintainer's Panel (office end only)		
LED	**Colour**	**State**
OK (System A&B)	Green	Illuminated
Failed (System A&B)	Red	Extinguished
In Use Send (System A&B)	Green	Illuminated (only if in use)
In Use Receive (System A&B)		
Test (Systems A&B)	Yellow	Extinguished
50v Power Fail - Local	Red	Extinguished
50v Power Fail - Remote		

Table 2 - Maintainer's Panel (office end only) Indications

NOTE: *Not all Telecode 80 systems have a maintainer's panel.*

Remote Change Over Panel (field end only)		
LED	**Colour**	**State**
OK (Systems A&B)	Green	Illuminated
Failed (System A&B)	Red	Extinguished
In Use (Systems A&B)	Green	Illuminated (only if in use)
Test (Systems A&B)	Yellow	Extinguished
50v Power Fail	Red	Extinguished

Table 3 - Remote Change Over Panel (field end only) Indications

Power Supply Modules	
LED	**State**
PSU 1 - OK	Illuminated Green
PSU 1 - Failed	Extinguished
PSU 2 - OK	Illuminated Green
PSU 2 - Failed	Extinguished

Table 4 - Power Supply Modules Indications

System Cabinets		
Card	**Function**	**State**
Transmitter	Wait	Extinguished
	Start	Regular Flashing Yellow
	Parity	Regular Flashing Yellow
	Clear	Regular Flashing Yellow
TX Digital Extender	Scan	Illuminated Yellow
Receiver	Viol	Regular Flashing Yellow
	Parity	Regular Flashing Yellow
	D.Fail	Extinguished
Master Receiver	M.Fail	Extinguished
	C.Fail	Extinguished
	Scan	Regular Flashing Yellow
VF Modem	Test	Extinguished
	RTS	Illuminated Yellow

System Cabinets		
Card	**Function**	**State**
	SD	Flashing Orange
	RD	Flashing Pink/Orange
	DCD	Illuminated Orange
	CA	Extinguished
Fibre Modem	DC	Illuminated Green
	Sync	Illuminated Green
Mains Power Supply & Battery Charger	+12V	Illuminated Green
	+12V Battery	Extinguished

Table 5 - System Cabinet Indications

Assembly, Card, and LED names are as printed on the faceplate. Illuminated means non flashing. Not all the cards are present in all systems.

END

Includes:	AP Datalink TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

Before removing or replacing any card or module you shall power down the system cubicle by removing the fuses (AC & DC) on the front panel of the PSU and BSU.

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

This system involves the transmission of data between locations called office and field. An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

A list of system abbreviations can be found in Appendix A. This system was developed in the late 1970's.

It is point to point system using simplex as a transmission mode. The system is based on CMOS technology.

If the system is duplicated, the services shall be carried out on each system.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies

The tests in this section shall be conducted under a system occupation or during a quite traffic period in liaison with the Signaller.

They shall be performed for both the controls and indication systems.

10.1 Measure the power supply to the equipment cubicle it should be between 105V and 120V AC.

10.2 Remove the BSU fuse and measure the output of the PSU it should be between14.3V and 14.7V DC.

10.3 Measure the voltage across the BSU test points; this should be between 0.6V and 0.9V less than the PSU reading. Replace the BSU fuse.

10.4 Measure using an oscilloscope the ripple voltage on the DC supply from the PSU it should be < 10mV Peak to Peak.

10.5 Measure (where fitted) the supply for the output buffer relays it should be between 11V and 13V DC (Ripple <100mV PP).

11. Carrier Transmission Levels (spot frequencies)

The following tests shall be conducted under a system possession. The following tests are to be carried out for each Tx(M) card.

Remember to power down the cubicle before removing or replacing any card.

11.1 Remove the Tx(C) cards at both the office and field ends of the system then switch all the LAU's in the system to Tx line operation.

11.2 Connect an oscilloscope and a frequency / power level meter to the output test points on the Tx(M) card. Measure the carrier frequency. In turn strap the common test point to the Mark and Space test points and measure these.

For each of these, check the displayed waveforms are not distorted and the signal level frequency is as below -1dBm to –3dBm

11.3 Repeat 11.2 with the test equipment connected to the Tx line test socket on the LAU card.

11.4 Switch all the LAU's in the system to Rx line operation. Repeat 11.2 and 11.3 using the Rx line test socket on the LAU card.

11.5 When all the measurements have been obtained return the switches on the LAU cards to 'Auto' line selection and replace the Tx(C) cards.

12. Carrier Reception Levels (spot frequencies)

The following tests are to be carried out for each Rx(M) card.

Remember to power down the cubicle before removing or replacing any card.

12.1 Remove the Tx(C) cards at both the office and field ends of the system then switch all the LAU's in the system to Tx line operation.

12.2 Connect an oscilloscope and a frequency / power level meter to the input test points on the Rx(M) card. Measure the carrier frequency. In turn strap the common test point to the Mark and Space test points and measure these.

For each of these, check the displayed waveforms are not distorted and measure the signal level frequency -35dBm.

If this measurement is more than 6dB lower than the last recorded, inform your SM(S).

12.3 Repeat 12.2 with the test equipment connected to the Tx line test socket on the LAU card.

12.4 Switch all the LAU's in the system to Rx line operation. Repeat 3.2 and 3.3 using the input test point on the Rx(M) card and then the Rx line test point on the LAU card.

12.5 When all the measurements have been obtained return the switches on the LAU cards to 'Auto' line selection and replace the Tx(C) cards.

13. Mark-Space Ratio

13.1 With the system in normal operation, measure using an oscilloscope the mark-space ratio and the pulse width at the test points on the Tx(M) card. The Mark-Space Ratio should be equal and the Pulse Width 5ms (±0.2ms).

14. Line Change Over

14.1 Using the switch on the LAU cards, select Rx line operation at both the office and field ends of the system. Observe that the system operates normally and no alarms are indicated.

14.2 Repeat 14.1 for the switch on the LAU cards in the Tx line operation position. Check that the switches are returned to the 'Auto' position at the completion of this test.

15. Alarms

15.1 On each of the alarm tests check that the cabinet door indication changes from green to red.

Power

15.2 Remove in turn the 110V AC and the 12V DC fuses from the PSU. Observe that the power supply alarm (PWR) is indicated on the LAU.

Receiver

Remember to power down the cubicle before removing or replacing any module.

15.3 At the office end of the system, remove in turn the Rx(C), Rx(M) and the last Rx(E) unit. Observe that a local Rx alarm is indicated on the local LAU and a remote Rx alarm is indicated on the LAU at the field location.

15.4 Repeat 15.3 at the field end of the system.

Transmitter

Remember to power down the cubicle before removing or replacing any module.

15.5 At the office end of the system, remove in turn the Tx(C), Tx(M) and the last Tx(E) unit. Observe that a local Tx alarm is indicated on the local LAU and a remote Tx alarm is indicated on the LAU at the field location.

15.6 Repeat 15.5 at the field end of the system.

Line

15.7 At each location in turn disconnect the Tx line and observe that the system automatically switches to operation on the Rx line.

15.8 Check that a Tx line alarm is indicated on the local LAU and a Rx line alarm is indicated at the remote LAU. Re-connect the line.

15.9 At each location in turn disconnect the Rx line and observe that the system automatically switches to operation on the Tx line.

15.10 Check that a Rx line alarm is indicated on the local LAU and a Tx line alarm is indicated at the remote LAU. Re-connect the line.

16. Battery Supply Units

16.1 Remove the 110V AC supply fuse to the PSU and allow the equipment to operate on the internal battery for 30 minutes. At the end of this period measure the battery supply unit voltage it should be 11.5V DC.

If the voltage is less than this the battery might be suspect and a replacement shall be fitted.

17. Line Protection and Route Selection

17.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

17.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

18. Spares

18.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

18.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

19. Final

19.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

19.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - – Abbreviation Meanings

Abbreviation	Meaning
PSU	Power Supply Unit
BSU	Battery Supply Unit
LAU	Line & Alarm Unit
Tx(M)	Transmitter Modem Card
Tx(C)	Transmitter Control Card
Tx(E)	Transmitter Extender Card
Rx(M)	Receiver Modem Card
Rx(C)	Receiver Control Card
Rx(E)	Receiver Extender Card

Table 1 - System Abbreviations

END

Includes:	Transmitton TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

This system involves the transmission of data between locations called office and field.

An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies

Some of the following tests do not require a possession of the system but it is recommended they are performed within a system possession unless the duration of occupation is limited, and the Signaller is in agreement.

10.1 Measure the AC supply voltage to the power supply unit - 105V to 120V.

10.2 Measure the DC output voltages from the power supply at the bus bars on the back of the rack.

NOTE: *The bus bars are identifiable as hard wire straps, soldered across the card sockets on the pin positions listed in Table 1 below:*

Plane Position	Pin Position +Ve	Pin Position 0V	Voltage	Limits
Top	1 & 2	31 & 32	+5V	4.8V to 5.2V
Bottom	27	32	+12V	11V to 13V
Bottom	29	32	-12V	-11V to-13V

Table 1 - DC Output Voltages

11. Line Levels

The following tests shall be conducted under a system possession or during a quiet traffic period in liaison with the Signaller.

11.1 At the office end of the system measure the transmitted level of the controls and the received level of the indications at the line connection points:

System	Level	Limits
Tx Controls	-13dBm	+3dBm/-7dBm
Rx Indications	-13dBm	+3dBm/-20dBm

Table 2 - Office Line Levels

11.2 At the field end of the system measure the transmitted level of the indications the received level of the controls at the line connection points:

System	Level	Limits
Tx Indications	-13dBm	+3dBm/-7dBm
Rx Controls	-13dBm	+3dBm/-20dBm

Table 3 - Field Line Levels

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

APPENDIX A - System Indications:

Card	LED Function	State
Status Display Panel	System Healthy	Illuminated
	System Fail	Extinguished
	PSU Healthy	Illuminated
	Comms Fail	Extinguished
MT50 System Controller	Watchdog	Illuminated
CPU Board	Watchdog	Extinguished
MT 72 -16 Way Relay Input Board	Input Status	Flickering
MT 85 -16 Way Relay Output Board	Output Status	Flickering

Table 4 - TDM System Indication

Card	LED Function	State
PSU	+5v	Illuminated
	-12v	Illuminated
	+12v	Illuminated
	+24v	Illuminated
Memory Extension	N/A	N/A

Table 5 - Power Supply Unit

END

Includes:	DAM TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems.

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

This system involves the transmission of data between locations called office and field.

An office is a location that transmits controls and receives indications, a field station is one that receives controls and transmits indications.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary, locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Power Supplies

10.1 Measure the power supplies (logic, isolation, relay, transmission etc). Check they are within ±0.25V of their nominal value, if not rectify and/or report as corrective maintenance.

11. Line Levels

11.1 At the office end of the system measure the transmitted level of the controls and the received level of the indications.

Transmission Level	Maximum Permissible Line loss
-13dBm	30dB

Table 1 - Office Line Levels

11.2 At the field end of the system measure the transmitted level of the indications and the received level of the controls.

Transmission Level	Maximum Permissible Line loss
-13dBm	30dB

Table 2 - Field Line Levels

12. Line Protection and Route Selection

12.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

12.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

13. Spares

13.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

13.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

14. Final

14.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

14.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

Includes:	Westronic 1024 TDM, Interface equipment, and associated cubicles contained in equipment or relay rooms
Excludes:	All other Remote Control Systems, Equipment/Relay rooms (associated equipment), SSI, IECC or other complete control systems

System Configurations

The Westronic 1024 is provided in one of two configurations.

The field TDM is provided with duplicated processor cards (CPU-2) and a system arbiter card (SA-1) and duplicated power supplies.

The field TDM is equipped with a combination of up to 16 digital input (DIP-64) and Digital Output (DOP-64) cards.

The alarm monitor is fitted with a single processor card, a single power supply, and digital inputs only.

General

Record all results on the system test record sheet.

Advise your SM(S) if any of these tests fail to meet the requirement.

In some cases, not all of the equipment detailed in this SMS is installed for each system configuration, therefore only the tasks relevant to equipment provided shall be undertaken. If you are in doubt, ask your SM(S).

DAILY SERVICES

1. Fault Logging Systems

This can include the Technicians' terminal.

1.1 If provided, check the fault logging system for any outstanding faults. Rectify or report. This can be a screen display and/or a printout depending on the system.

1.2 If provided, check any associated printer(s) have enough paper and ink/toner. Rectify or report.

REGULAR SERVICE

2. Data Logger Systems

2.1 If provided, check that data logging is being undertaken correctly by analysis of a sample of information. Transfer archive data from the HD to removable recording media (floppy, CD-R or flash memory).

SERVICE A

3. Technicians' Terminal

These are not provided on all systems.

3.1 Check the correct time and date are displayed. Rectify as necessary.

4. Indications and Alarms

4.1 If provided, check that system status indications on the Signallers' alarm/status panel and any system indications on the control/interface or modem equipment are not showing any alarms or faults. If any are found, rectify or report.

If you are unsure about any indications or alarms, ask your SM(S).

Any corrective actions shall be logged with ICC/NRIFC.

Details of the indications can be found in the NR/SMS system tests appendixes.

On control and interface systems depending on the system configuration, indications can be at both office and field ends.

5. Equipment Cubicles

5.1 Check (if provided) cubicle cooling fans are working and any filters are clean. Rectify as necessary.

6. Control and Interface Equipment

6.1 Visually check that all leads, panels, cards, units, fastenings, and connectors are secure.

7. Final

7.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary locked.

7.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

SERVICE B

8. Equipment Cubicles

8.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

9. Control and Interface Equipment

9.1 Dust the equipment casings and panels using a dry lint free cloth. Check that leads and connectors are not disturbed during cleaning.

9.2 If provided, disconnect and clean all keyboards as necessary.

9.3 If provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

9.4 If provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

9.5 If provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

9.6 If provided, check the Althorn (formally Rugby) clock for correct operation.

10. Dual Processor Systems Only

This is to check that the off-line systems and the changeover units are serviceable.

10.1 At the System Arbiter module, check the LEDs indicate as follows:

a) Either ‘SYS 1’ or ‘SYS 2’ On-Line LED is illuminated to indicate which system is on-line.

b) Both the on-line and off-line system’s ‘Watchdog’ LEDs are flashing.

c) ‘Power’ LED is illuminated.

d) ‘Fault’ LED is not illuminated.

e) ‘PSU1’ and ‘PSU2’ LEDs are illuminated Green.

NOTE: *If either ‘PSU1’ or ‘PSU2’ LED is red then press the ‘reset’ button to clear. Investigate and rectify any defects as corrective maintenance.*

10.2 Set the rotary switch to manually select the off-line system and observe that the systems switch over.

10.3 Check the LED indications for correct system operation.

10.4 Set the rotary switch to the ‘AUTO’ position.

11. Power Supplies

11.1 For systems fitted with a battery back-up unit, check the 'Battery OK' LEDs are illuminated.

NOTE: *If either of these LEDs is extinguished the battery has failed or is discharged.*

NOTE: *If a mains failure occurred recently, allow time for the battery to re-charge. If the Battery OK LED remains extinguished, replace the battery as per manufacturer's instructions.*

11.2 Where fitted, switch battery back-up output to 'disable'.

11.3 Check the '5V Power' LED is lit on the front of each PSU.

11.4 Using a multi-meter, check the output voltage from each PSU within the limits stated below.

Adjust if necessary, by rotating the trim control on the PSU front panel.

Supply Voltage	Limits	Ripple
PSU 5.0V	4.9 to 5.1V	<50mV

Table 1 - PSU Output Voltages

11.5 Switch the battery back-up output to 'enable'.

12. Battery Back-up Unit

The internal sealed lead acid battery has a quoted typical service life of five years. It is recommended that the battery should be replaced after four years.

12.1 Check the length of time the battery has been in service.

12.2 If the battery has been in service for four years or longer, replace it as detailed in the manufacturer's instructions.

13. Line Protection and Route Selection

13.1 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

13.2 If provided, carry out NR/SMS/PartB/Test/149 (Electronic Route Selection Equipment (ERSE) Test).

14. Spares

14.1 Where no test rack facility for the system exists, check any system spares are correctly stored in anti-static bags or boxes.

14.2 Where a test rack or other functional spares assembly for the system exists, check that all the spare cards/units are correctly fitted into the rack. If requested to by your SM(S), test the operation of the cards/units in the test rack.

15. Final

15.1 On completion of tasks, check that any equipment cubicle doors are securely closed and as necessary, locked.

15.2 Record details of your maintenance visit and any other work undertaken in the site logbook or record card.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/RE01		
Off Grid Power Supply – Photovoltaic (PV) Cells (Solar Panels)		
Issue No: 01	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Solar systems used with Vamos Crossing Systems
Excludes:	All other types of Solar Powered Systems

General

An agreement with the Signaller shall be reached before any tasks are undertaken that affect the normal operation of the crossing equipment.

SERVICE B

1. Batteries

1.1 Check batteries for signs of damage, rectify if damaged.

1.2 Check all battery terminations are secure and clean.

1.3 Carry out NR/SMS/PartB/Test/055 (Secondary Cell Test) Section 1.

2. Solar Panels

2.1 Check all mounting bolts are secure.

2.2 Examine the solar panels for damage. Advise your SM(S) if the damage is noted.

Never use abrasive detergent, strong alkaline detergent and strong acid detergent

Clean the surface of the solar panel with water and a soft cloth or sponge. A mild detergent can be used on persistent dirt.

2.3 Verify that the Solar Panels have not moved due to vandalism or vibration and are still aligned correctly, by checking the witness marks on the post and lower bracket.

3. TriStar Battery Controller (Solar)

It should be noted that the solar version of this controller is used in both solar and wind turbine systems on the network.

3.1 Check the controller is secure and undamaged.

3.2 Verify that the bottom right of the LED screen indicates one of the following:

a) Absorb - (During daylight) Charging.

b) Float - (During daylight) Trickle Charging.

c) Night - (During darkness or when the solar panel connection is broken) Not Charging.

NOTE: *Any fault or error indications and take corrective action if necessary.*

3.3 Check that the airflow around the controller is not blocked, clear any dirt or debris from the heat sink, clean if required.

4. Metron Unit

4.1 Verify the Metron unit is working by pressing any of the buttons on the front panel. The LED panel illuminates showing the Menu. If the unit fails to respond advise your SM(S).

The LED panel returns to sleep mode after 2 minutes.

5. PowerTector Unit

5.1 Confirm that the green LED is lit and the alarm is not sounding.

PERIODIC TASK

6. Solar Panels

6.1 Replace the Solar Panel(s).

Solar panels degrade slowly and therefore require a routine replacement program.

END

Includes:	Miniature Wind Turbine Generator Systems used with Vamos Crossing Systems
Excludes:	All other types of Wind Turbine Generator Systems

General

An agreement with the Signaller shall be reached before any tasks are undertaken that affect the normal operation of the crossing equipment.

SERVICE B

1. Batteries

1.1 Check batteries for signs of damage, rectify if damaged.

1.2 Check all battery terminations are secure and clean.

1.3 Carry out NR/SMS/PartB/Test/055 (Secondary Cell Test) Section 1.

2. Wind Turbine

2.1 Switch the turbine brake to the on position and wait for the turbine to stop rotating.

If the turbine fails to stop turning within one minute the brake should be released. This shall be reported to your SM(S).

NOTE: *There are two reasons the brake fails to stop the turbine spinning, either the wind is too strong and is overcoming the brake or the brake has failed.*

If the wind is blowing too hard to complete the task this is to be recorded on the record card.

2.2 When the turbine has stopped moving, lower the tower using the approved method.

Under no circumstances shall the turbine be lowered if the blades are still turning.

2.3 Examine the turbine blades and the nacelle for damaged, worn/loose parts or cracks.

Particular attention shall be paid the blades and their leading edges, as damage to these causes an imbalance when the turbine is spinning. This imbalance leads to additional stress and might result in failure of the nacelle.

2.4 Raise the turbine using the approved method and secure it in place.

2.5 Release the turbine brake and confirm that the blades turn.

3. TriStar Battery Controller (Solar)

It should be noted that the solar version of this controller is used in both solar and wind turbine systems on the network.

3.1 Check the controller is secure and undamaged.

3.2 Verify that the bottom right of the LED screen indicates one of the following:

a) Absorb - (During daylight) Charging.

b) Float - (During daylight) Trickle charging.

c) Night - (During darkness or when the solar panel connection is broken) Not Charging.

NOTE: *Any fault or error indications and take corrective action if necessary.*

3.3 Check that the airflow around the controller is not blocked, clear any dirt or debris from the heat sink, clean if required.

4. Metron Unit

4.1 Verify the Metron unit is working by pressing any of the buttons on the front panel. The LED panel illuminates showing the Menu. If the unit fails to respond advise your SM(S)

The LED panel returns to sleep mode after 2 minutes.

5. PowerTector Unit

5.1 Confirm that the green LED is lit and the alarm is not sounding.

PERIODIC TASK

6. Turbine Nacelle

6.1 Remove and send the Turbine Nacelle for servicing.

Turbine Nacelle bearings degrade slowly and therefore require a routine replacement program

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/RE20		
Off Grid Power Supply – Direct Methanol Fuel Cell System		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	EFOY Fuel Cell Systems
Excludes:	All other types and makes of Fuel Cell

General

Do not smoke in the vicinity of the Pro fuel cell or fuel cartridge.

Protect from heat and ignition sources. Methanol is highly flammable!

Do not touch leaked methanol.

The EFOY Pro fuel cell shall not be opened.

Gloves and eye protection shall be worn during this task.

Leakage of a small quantity of methanol evaporates, leaving no residue.

For further information See NR/SMS/Appendix/26 (General Information on the Direct Methanol Fuel Cell System).

SERVICE B

1. Fuel Cartridge

1.1 Carry out NR/SMTH/Part04/RE21 (Replace a Direct Methanol Fuel Cell Cartridge).

2. General Maintenance

2.1 Switch the device off and disconnect the charge line before cleaning.

2.2 Visually check that there are no signs of water ingress.

2.3 Clean only with a soft cloth dampened with water.

2.4 Reconnect the battery charge line after cleaning.

If the battery charge line is not connected then the automatic antifreeze feature remains inactivated causing premature failure of the system.

PERIODIC TASK

3. Fuel Cell Unit

3.1 Replace the Fuel Cell Unit.

Fuel Cells degrade slowly and therefore require a routine replacement program.

END

PANELS, INTERFACES & ASSOCIATED EQUIPMENT

1. Switch Panels

Switch Panels are for control of a small area and are usually found in signals boxes that have been converted from a mechanical frame.

Operation of the signals, points etc is achieved by the operation of a switch that is adjacent to the item it controls (on some panels the switches may be grouped at the bottom of the panel).

The interlocking is achieved electrically by a free wired system usually in an adjacent equipment room connected to the panel by multi-core cables.

An indication by the switch shows if the requested operation has been allowed by the interlocking. Basically, the operation of these panels is similar to operation of a lever frame (one switch for each controlled item).

2. One Control Switch (OCS) Panels

One Control Switch panels are usually found in signal boxes controlling small interlockings. Each route on the panel is controlled by a switch at the entrance to each route (on some panels the switches may be grouped at the bottom of the panel).

Operation of the route switch sets all required points and signals (if allowed) to the exit of that route (usually another signal) where the next route switch is located.

Where main and shunt routes are provided to the same exit, a separate switch are provided (although some systems do use a three-position switch for this task).

Points have their own individual switches that are normally set in the ‘free to be called’ position (switch in centre position).

They can be called N or R by operation of the switch (providing this is allowed by the interlocking). The switch is left in the centre position for the route setting to work.

A variation of the OCS panel in complex areas is to provide one signal key and a multi-position route key. The Signaller first selects the required route and then operates the signal key to call the required points and signals for the selected route.

3. Entrance-Exit (NX) Panels

Push button entrance-exit (NX) panels are usually found in purpose built power signal boxes. They operate by selecting an entrance followed by an exit that (if allowed) sets a route between the two points.

This is indicated by a series of white lights on the diagram calling signals and points required in the selected route. The basic types of these panels are the entrance key/exit button and the entrance button/exit button

NX panels do not provide safety interlocking, this is carried out in the geographical, route relay, or computer based interlocking.

4. Entrance key/Exit button

This system requires the Signaller to turn a key to select the entrance signal and then press a button at valid exit signal or location (e.g. buffer stops).

5. Entrance button/Exit button

This system requires the Signaller to press a button at the entrance signal and then press a button at the valid exit signal. This system is the most commonly used method and the following notes apply to this system of operation.

Route buttons can be Entrance, Exit or combined Entrance/Exit. They are indicated by Red/Yellow bezel. An arrowhead on the button points in the direction of the route. They are black for entrance and clear for exit.

Combined buttons have two arrowheads to indicate their dual purpose. The set route is cancelled by pulling the entrance button.

Other buttons on the panel are for signal emergency replacement (red bezel with an ‘E’ on the button), controlled signal to automatic working (blue bezel with an ‘A’ on the button, ground frame release (brown bezel with an ‘F’ on the button) and track circuit override (black bezel only).

Points have their own individual switches that are normally set in the ‘free to be called’ position (switch in centre position). They can be called N or R by operation of the switch (providing this is allowed by the interlocking) the switch is left in the centre position for the route setting to work.

6. Push Button Interlocking (PBI)

These based on a NX panel, the non-safety push button interlocking is achieved by relays and allows only certain combination of buttons to set a route. If an entrance button is pressed, a route is set only if a valid exit button is then pressed; if the exit is not valid a route is not set.

If a valid route is set, the PBI sends this instruction to the interlocking. The interlocking then calls the signals and points for the selected route if they are available.

The PBI NX panel is connected to the interlocking either by multi-core cables if it is adjacent or by a TDM control system if the interlocking is remote.

7. Electronic Route Setting Equipment (ERSE)

These are also based on NX panels but the non-safety relay based PBI functions are performed electronically by the ERSE. The system consists of one printed circuit for each route in the interlocking.

These generate route calls to an associated relay interlocking depending on the buttons operated on the NX panel.

In addition to the route cards there are also input cards (to receive the push button and route availability information from the interlocking), output cards (to operate the point and signal NLR/RLR's) and power supplies.

In addition to the ERSE itself, the interlocking requires relays that can be fed from the electronic outputs; these are called Buffer Output Relay Units (BORU).

The ERSE is usually situated in or near the relay room where the interlocking it feeds is situated The NX panel is connected to the ERSE either by multi-core cables if it is adjacent or by a TDM control system if the interlocking is remote.

Later systems of ERSE are computer based, called a button processor. In these the interlocking circuits are fed directly from the computer outputs without the need for buffer output relays.

8. SSI Panel Multiplexers (PMUX)

These form the link between an NX panel and a SSI interlocking. The PMUX consists of a microcomputer system that scans all the buttons and other controls on the panel.

It then generates a serial data stream that it sends to the panel processor modules in serial form. Conversely it receives a data stream from the SSI that it uses to drive the panel lamps and other indications on the panel.

Transmission to and from the panel processor modules is continuous over separate pairs of wires. For high availability, the PMUX might be duplicated with manual or automatic changeover. Both PMUX then receive all inputs, one or the other driving the outputs at any given time.

9. TD Multiplexers (TDMUX)

These are basically the same as a PMUX but in this format they form the link between a relay interlocking and a train describer. The TDMUX reads the state of the relay interlocking via a number of digital inputs.

The data is then sent to the train describer as a serial message where it is used to generate the train movements.

10. Data Logging (Archive) PCs

Some new systems are provided with data logging personal computers (PCs) whilst in some other cases they are being retro fitted to existing systems. They can be fitted to TDM, PMUX or TDMUX equipment.

They record and store on their Hard Drive (HD) all activity of the equipment they are monitoring and provide an instant record of events or enable the information to be downloaded for analysis.

Reference to the manual for the analysis software is recommended to correctly transfer and analyse the data.

Information on the HD is overwritten with new data when it reaches full capacity. The time this takes depends on the capacity of the HD and the amount of activity in the monitored equipment.

Transfer of archive data to disk should be carried out at a frequency advised by your SM(S)

REMOTE CONTROL SYSTEMS

11. General

Remote control systems are a means of operating signalling equipment that is remote from the signal box.

They fall into three basic types:

a) Direct Wire that uses a different wire for each function

b) Frequency Division Multiplex (FDM) that uses a different frequency for each function

c) Time Division Multiplex (TDM) that uses a different time slot for each function.

Direct wire and TDM remote control systems are not fail safe; in these systems, the integrity of the signalling system is provided by the interlocking.

Vital FDM systems are designed to be fail safe as these systems directly operate signalling equipment.

Non vital FDM systems are used for systems that donot directly operate signalling equipment (see notes in the FDM section).

12. Direct Wire

This is the simplest system where the controls out and the indications back are fed over Micro-core or Telecoms paired cables. Due to losses in the cable and interference from traction supplies, these systems cannot be used over long distances.

They can be used for activating over-ride systems at remote interlockings.

Direct wire systems are usually cost effective for control over small distances with a limited number of functions

13. FDM Systems

This is a multiplexing system where more than one function can operate over the communication circuit (a line pair) by means of giving each function a frequency that is independent of any other used. By the use of filters (tuned reed, tuned circuit or tuning fork) at the Tx and Rx end total independent operation of each function is allowed.

In these systems, the interlocking for controlled area is at the signal box. Output from the interlocking drives a transmitter that generates a signal at a particular frequency.

This frequency is transmitted along a line pair and activates a receiver at a trackside location tuned to that particular frequency.

The receiver output drives either a reed follower relay that in turn operates the signalling function or directly drives the signalling function.

Indications from the locations are transmitted back to the signal box in a similar way on another line pair.

Line isolation transformers and line amplifiers are used to split the line pair into sections to minimise induced interference and to boost the line voltage over long distances.

Control and indication systems run on different line pairs (two way simplex). On the control system the transmitters in the PSB are wired in series with the receivers in the trackside locations wired in parallel.

On the indication system the transmitters in the trackside locations are wired in series and the receivers in the PSB wired in parallel The FDM system is limited to the amount of functions it can perform by the number of channels and therefore frequencies available in each system.

Vital Reed systems operate signalling functions from the interlocking, Non-vital Reed systems operate systems not controlled from an interlocking (overide, indication etc).

There are various vital FDM system that can be used for the control of vital signalling circuits, these include Type R, Type RR1000/2000, RR4000, RR5000, RR6000 etc as these use a double tuned reed filter.

Non-vital systems include Westone, FDM69-Nv and Type RR3000 can only be used for non-vital functions.

There are some installations were these non-vital systems have been ‘double cut’ and used for applications such as remote emergency signal replacement, but because of their design they cannot be used to directly operate a vital signal function (e.g. call a proceed aspect in a signal or call points)

Any Type RR system that uses RR3000 units in any part of the system are classed as non-vital. If you are in any doubt, ask your SM(S).

FDM systems are cost effective for distributed system over long distances with a limited number of functions.

If you are in doubt about anything on the system, ask your SM(S).

14. General FDM System

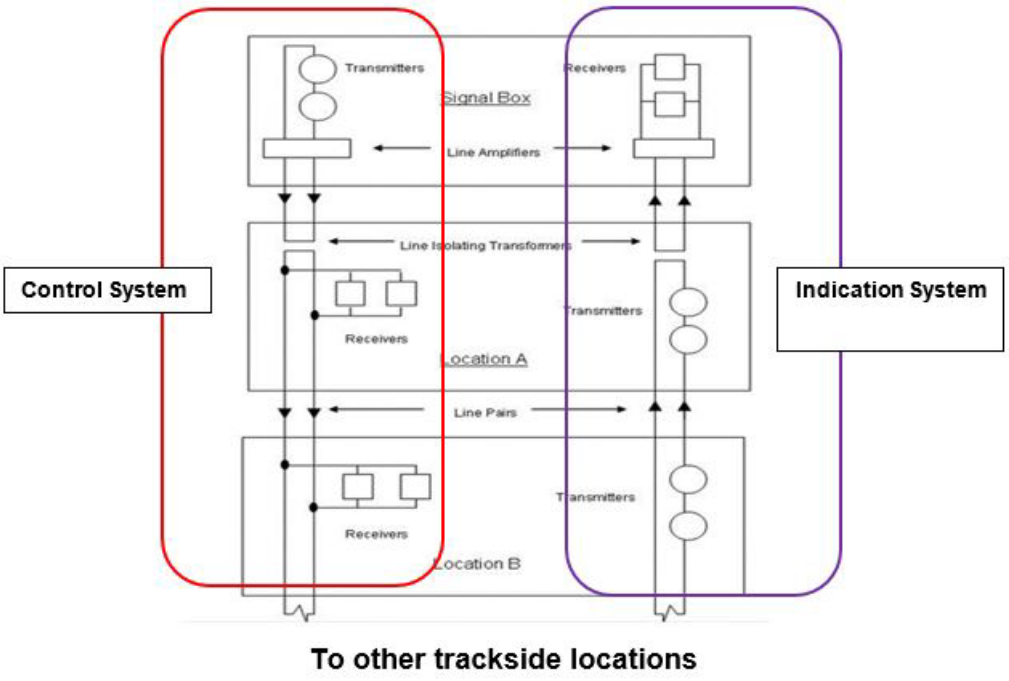


Figure 1 – General FDM System Schematic

TDM Systems

This system works by connecting circuits at each end of the system in turn, each circuit connection is separated by an interval of time.

This principle can be explained by comparing it to two uniselectors (rotary switches), one at each end of the system connected by a cable that rotate in synchronism.

This connects each output with its respective input (because of the synchronism) during one step of each cycle. In the TDM system, this action is carried out electronically.

TDM systems are used to transmit a large number of functions between two fixed points, these usually being a power signal box (office) and a remote interlocking (field).

An office transmits controls and receives indications; field locations transmit indications and receive controls.

TDM systems do not have to be ‘fail safe’ as safety (operation of vital signalling functions) is provided by the interlocking at the field end of the system.

Generally, TDM systems consist of a digital transmitter (multiplexer) that scans information inputted from a NX panel, push button interlocking or ERSE.

This information is then arranged for transmission (the information is put into a digital pulse train (serial) form where a 1 bit could indicate a closed input contact and a 0 bit an open input contact).

This digital information is then fed to a Frequency Shift Carrier Transmitter (modulator) that converts the digital information to a HF frequency modulated signal.

At the other end of the system the HF FM signal is demodulated to reproduce the digital information. This is then fed to a digital receiver (demultiplexer) that converts the digital information to drive the signalling output relays.

Control information from office to field and indication information from field to office can be sent Duplex, Half duplex, Simplex or Two way simplex depending on the system type.

The system can also be point to point (office to one field) or multi-station (office to two or more fields) again depending on the type.

TDM systems are cost effective for point to point working over long distances with a large number of functions

General TDM System

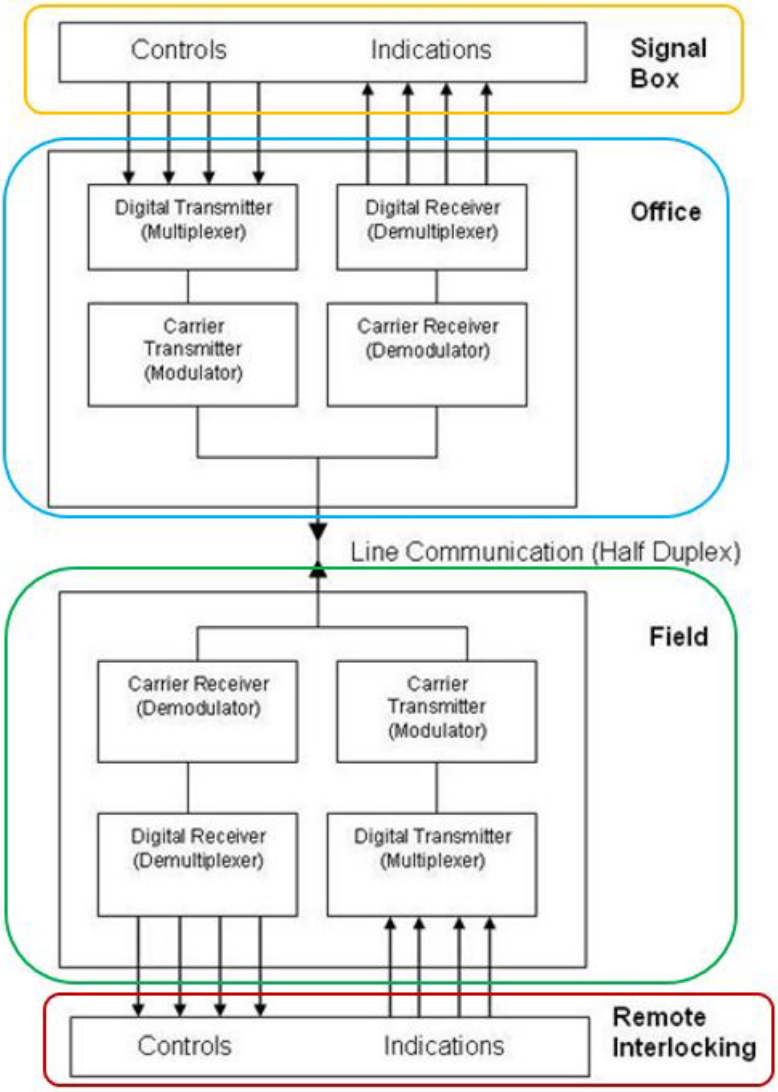


Figure 2 - General TDM System Schematic

The failure of a TDM system disables the remote interlocking, stopping the running of trains.

To avoid this three systems are available to minimise the effects of the failure of a TDM system (FDM systems because of their design and mode of operation do not cause the same problems as the failure of a TDM system)

15. Local Panel

A local panel might be located at the remote interlocking, this allows the interlocking to be worked locally without being linked by the remote system to the signal box.

When switched to the local panel the controls at the signal box are disabled, therefore the system should only be operated by authorised staff.

16. Overide Systems

Overide systems are provided to allow the Signaller limited control of an interlocking in the event of the failure of the TDM system.

The controls might be carried by a direct wire or a FDM system that enables the Signaller to set up a limited number of pre-set routes at the interlocking.

No indications are available to the Signaller from the interlocking whilst it is in overide.

17. Duplicated System

This method duplicates both the control and indication systems along with the line. The Signaller is able to switch individually between both the control and indication systems to provide the maximum system flexibility.

At the transmitting end, data is made available to each system independently using a relay to provide the isolation necessary. At the receiving end, the output is selected.

In some systems/locations, back contacts of the system selection relays are used so that any failure of the selection circuits connects both systems (which normally agree with each other) rather than leave no control at all.

Newer systems usually have automatic changeover facilities that are controlled by the system computers.

Technicians have the facility to force a changeover via the Technicians' terminal for maintenance but the Signaller usually does not. If you are in doubt about anything on the system, ask your SM(S).

18. Typical Applications of Remote-Control Systems

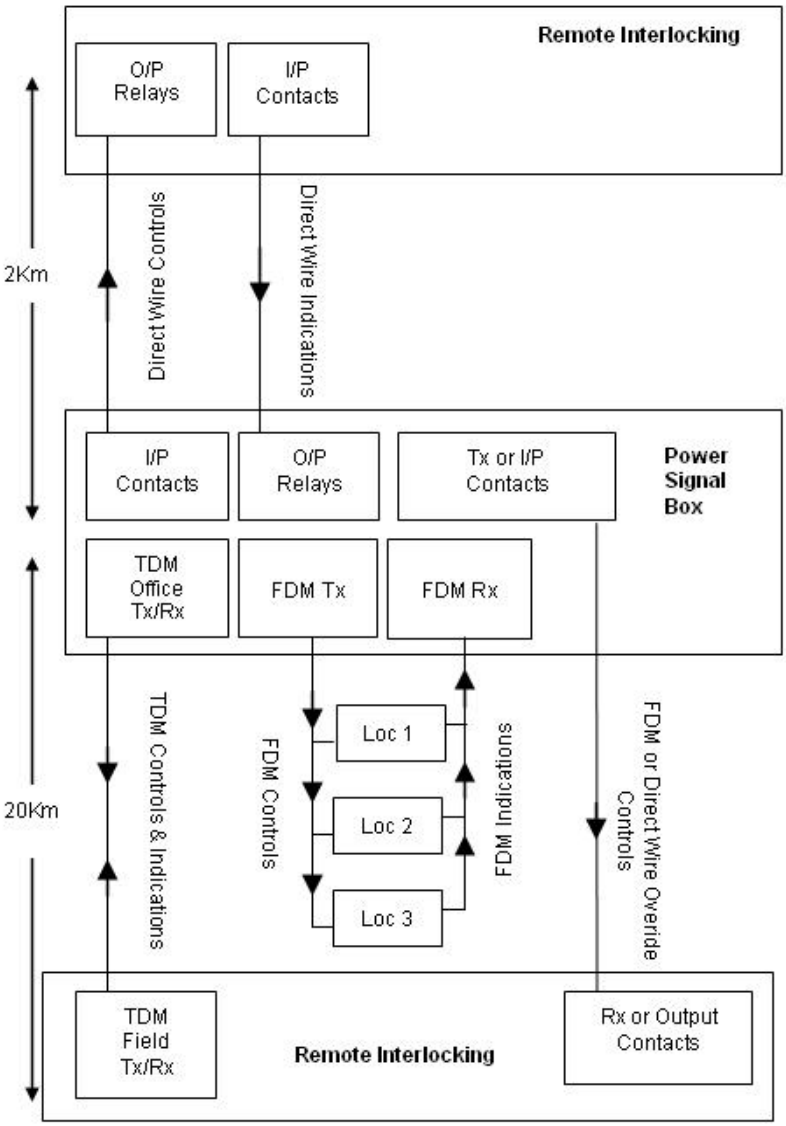


Figure 3 – Remote Control Typical Schematic

19. Older Systems

With the ongoing developments of TDM systems during the 60's & 70's, some systems of the same make installed at different times might not contain the same equipment (cards, indications etc).

Only the relevant sections of any applicable test should be applied to the system. If you are in any doubt ask your SM(S).

The NR/SMS tests for these systems are based on the manufactures manuals that were written when the systems were new.

As components age in older systems, tolerances and levels can vary. If the office and field ends of the system 'drift' together, tolerances and values might be at

different levels to that in the test but are working correctly for present system configuration.

This condition might also lead to certain tests and measurements in the NR/SMS to be unobtainable. Local instructions on certain systems might ask for certain tests not to be undertaken for this reason.

If you think a test is likely to severely disrupt the operation or reliability of the TDM system you are testing, ask your SM(S) before proceeding.

20. Newer Systems

Most modern systems are computer based and housed in similar looking cubicles. They can perform multiple tasks PMUX, TDMUX, TDM) depending on the cards and units they contain and the software loaded on them.

Special attention should be taken when exchanging components that the correct item is used for the system you are working on.

Cards might look the same but can perform different functions. If you are in any doubt, ask your supervisor.

Glossary of Terms Used in Remote Controls Systems

Term	Meaning
Address	A coded message in a specific pattern to identify the origin and destination of a package of information
Analogue Signals	Signals that can assume almost an infinite number of values during any specified time (e.g. the human voice)
Asynchronous	Transmission of data that is not in step. Timing signals are derived from special characters in the data stream itself (the opposite of synchronous)
Attenuation	A general term used to denote a decrease in magnitude of transmitted level from one point to another (e.g. line loss)
Bandwidth	The difference expressed in Hertz (Hz) between the highest and lowest frequencies handled by a system
Baud	Unit of transmission speed equal to the number of bits per second and inter-bit pauses
Bit	Unit of information content (contraction of ‘Binary Digit’), either a one (1) or zero (0). It might be equivalent to an ‘On’ or ‘Off’ condition
Carrier Frequency	The frequency of an alternating current used for conveying information along a line circuit (often in excess of 6KHz)
Carrier System	A means of obtaining a number of channels over a single path by modulating each channel on a different carrier frequency and demodulating at the receiver end to restore the signals to their original form. It also avoids the distortion of data over long lengths of copper cables

Term	Meaning
Channel	A unique path for the transmission of a single item of information (FDM systems)
Character	The actual or coded representation of a digit
CMOS	Complementary Metal Oxide Semiconductor (Transistor type device)
Code	A system of symbols or conditions which represent information
Crosstalk	Unwanted insertion of signal(s) from an adjacent communication channel
Data	Any representations such as digital characters or analogue quantities to which meaning is assigned
Decibel (dB)	A unit of power or voltage level difference, used as a measure of amplifier gain or attenuator loss
Demodulation	The process of retrieving an original signal from a modulated carrier wave
Digital Signals	Signals that can assume a limited number of discrete values usually related to some numerical or coded system
Duplex	Simultaneous two-way independent transmission of information over one communication system
Field (TDM Systems)	The end of a system receiving controls and transmitting indications
Frequency Division Multiplex (FDM)	A multiplex system where the available frequency spectrum is shared between channels
Half Duplex	Alternate two-way independent transmission of information over one communication system
Highway	Cables or wires used to carry data between a central control circuit and a number of other points (e.g. backplanes in PCB racks)
IC	Integrated Circuit
Line or Line Pair	A pair of electrical conductors
Modulation	The process by which some characteristic of one wave is varied in accordance with another wave
Multiplex	A means of combining several signals for transmission on a shared medium (e.g. line pair)
Noise	An undesired disturbance on a communication system
Office (TDM Systems)	The end of the system transmitting controls and receiving indications
Parity Checking	A means of checking that the number of logical 1’s received is the same as the number of logical 1’s transmitted, as an aid to error detection
Piezo Electric Effect	The generation of an electric charge when certain crystals are compressed or stretched in certain directions and the converse behavior of distortion when electric charges are applied to the crystals
Reed	A mechanically vibrating element used to provide frequency selectivity

Term	Meaning
Response Time	The time between inception and effective reception of a control or command
Scan	An electronic process of servicing all the inputs and outputs of a TDM system
Sectionalisation	Splitting of the line into isolated lengths connected together only by transformers or amplifiers (this reduces the level of induced voltages)
Sentence	A number of 'Words' joined together
Serviced	Response by a card to a correct address
Simplex	One-way transmission of information on a communication channel
Synchronous	The continuous transmission of data in order. A synchronizing signal is sent at the start of each scan to confirm that the counters at each end of the system are in step (the opposite of asynchronous)
System	All the channels carried on a line pair or all the equipment associated with a line pair
Time Division Multiplex (TDM)	A transmission system whereby unique time slots are assigned to individual inputs/outputs which are then multiplexed together
TTL	Transistor – Transistor Logic
Word	An ordered set of characters that is the normal unit in which information might be stored, transmitted or acted on

Table 1 - Glossary

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SB11		
Signallers Control & Indication Panels or Displays		
Issue No: 06	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Signal Boxes or Signal Control Centres with Switch Panels, NX Panels, VDU Based Control Equipment, or LC Control Units
Excludes:	Telephone Equipment, IECC, Westcad control system and Control & Interface equipment

General

Any intrusive work or tests shall be agreed with and carried out in liaison with the Signaller (e.g. replacing tiles or buttons, cleaning monitors screen, disconnecting keyboards etc).

Not all Signal Boxes or Signal Control Centres have all the equipment detailed in this SMS, therefore the relevant tasks for equipment shall be undertaken where provided. If you are in doubt, ask your SM(S).

It is good practice to ask the Signaller for known problems or faults before starting maintenance.

NR/SMS/PartC/SB00 (Signal Box Control & Operating Systems General) gives you details about the various panel types that can be found, generic details on VDU based control equipment can be found in NR/SMSPartC/IC00 (VDU Based Control Equipment - General).

The tasks in this section is for equipment contained within the Signal Box or Signal Control Centre. For equipment contained in equipment rooms the SMS tasks are included in the equipment specific SMS's

REGULAR SERVICE

1. Alarms

1.1 Check first filament failure alarms, system alarms, power supply alarms etc.

SERVICE A

2. Switch Panels and NX Panels (Exterior)

2.1 Check the panel structure and fixings.

2.2 Check the control/indication panel faceplate. In particular look for:

a) Worn or illegible artwork.

b) Damaged panel sections/tiles.

c) Faulty buttons/switches.

d) Faulty train describer displays.

e) Faulty indications/lamps.

Use the tools when changing Post Office type lamps to avoid damage to the panel. Check that the lamp is seated and operates correctly.

2.3 Dust and wipe the panel faceplate with a cloth moistened with detergent or non-abrasive cleaner.

2.4 Check and wipe associated diagrams (gradients etc).

2.5 Test audible alarms.

2.6 Check that CCTV crossing controls, indications and monitors operate correctly.

2.7 Check AHBC crossing indications and alarms.

2.8 Check HABD indications. Details can be found in the NR/SMS/HO series suite.

3. Switch Panels and NX Panels (Interior)

3.1 Examine the panel interior, look particularly for:

a) Damaged or incorrectly mounted components.

b) Signs of overheating.

c) Metallic debris.

3.2 Check the rear panel doors are correctly fitted.

3.3 Carefully examine internal cables, ducting, wiring, terminations, and insulation.

3.4 Examine switches, button fixings, armature assembles, springs and contacts. The armature shall seat correctly against the retaining screw. Adjust screw if required.

3.5 Examine plug couplers, power supplies, relays and bases.

3.6 As required, dust the interior.

3.7 As required, Lubricate hinges and locks.

4. Panel Block Equipment

NOTE: *Tasks 4.1 to 4.4 apply to panel block bells mounted in cases separate from the panel; the remaining tasks apply to all types of panel block equipment.*

4.1 Dust and examine the exterior.

4.2 Remove the cover and dust the interior.

4.3 Examine the interior; pay particular attention to:

a) The bell tapper/button assembly.

b) Springs and contacts.

c) Terminations, wires and insulation.

d) Fixings.

4.4 Check that wires cannot be trapped or damaged and replace the cover.

4.5 Check the correct operation of panel block bells and switches. This can be undertaken by observing the Signaller offering or accepting a train.

4.6 Check the emergency release seal is intact, correct and cannot be removed.

4.7 Check the emergency release cannot be operated without breaking the seal.

5. VDU Based Control Equipment

5.1 Clean all monitor screens and housings with a proprietary anti-static dry screen cleaner. Use cleaning products in accordance with the manufacturer's instructions.

5.2 Check that all monitors display a satisfactory picture. Rectify or report as required.

5.3 Visually check all leads and connectors are secure and undamaged. Rectify or report as required.

5.4 As necessary; disconnect and clean the keyboard(s). Hold the keyboard upside down when cleaning.

5.5 As necessary (if the operation has become intermittent or jerky) disconnect and clean the tracker ball and mouse. If necessary, remove and clean the ball and rollers.

5.6 Check there is a working spare keyboard and tracker ball or mouse available on site.

5.7 Check that the workstation areas are clean and tidy. Remove any rubbish and debris.

SERVICE B

6. Tests

6.1 Test 'All Signals On' feature. Not SSI Interlockings, see NR/SMS/PartC/IS11 (Solid State Interlocking (SSI) – section 13.1 Function Tests.

7. Emergency Release

7.1 Test for the correct operation of the emergency release.

7.2 If necessary, renew the seal and record the details. The Signaller shall not be able to operate the emergency release without breaking its seal.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/SB12		
Signal Box Operating Floor & Block Shelf		
Issue 04	Issue Date: 01/09/18	Compliance Date: 01/12/18

Includes:	Signal Box Operating Floor & Block Shelf Equipment
Excludes:	Lever Frames (RT/SMS/LVxx), Relay cabinets (NR/SMS/EL21), Lever Locks and Circuit Controllers (RT/SMS/LVxx), and Key Release Instruments (NR/SMS/LV51)

Any intrusive work or tests shall be agreed with and carried out in liaison with the Signaller (e.g. replacing indicators etc).

Not all Signal Boxes or Signal Control Centres will have all the equipment detailed in this SMS therefore the relevant tasks to equipment shall be undertaken where provided. If you are in doubt, ask your SM(S).

It is good practice to ask the signaller for known problems or faults before starting maintenance.

REGULAR CHECKS

1. Alarms

1.1 Check first filament failure alarms, system alarms, power supply alarms etc.

SERVICE A

2. General

2.1 Check signals and points are visible from the signal box. The signaller shall have an unobstructed view of signal arms and points, or is provided with indications.

2.2 Check all block shelf components and fittings are secure and seals are correctly fitted.

2.3 Check labelling. Indications, plungers (etc) should be labelled with the lever / function number to which they apply. The correct covers shall be are refitted after maintenance.

2.4 Check that mechanical locking cover plates and electric lock covers are secure. Padlocks shall be fitted to prevent unauthorised access to electric locks.

3. Signal Box Diagram

3.1 Check diagram is clean, legible, undamaged and securely supported. Clean using damp cloth moistened with dilute detergent.

3.2 Examine wiring, terminations and components.

3.3 Check the indication lamps (ask the signaller). Investigate any low output from the lamps and rectify where practicable.

4. Block Shelf Wiring

4.1 Check wiring and cables are supported and are not at risk of snagging.

4.2 Examine insulation for signs of wire degradation.

5. Block Instruments and Single Stroke Bells

5.1 Dust and Examine exterior.

5.2 Carefully remove cover.

5.3 Carefully Dust interior.

5.4 Examine interior mechanism, pay particular attention to:

a) Springs and contacts.

b) Bell tapper assembly.

c) Needle shaft for correct alignment

Warning: Do not clean or oil

d) Trigger mechanism.

e) Terminations and wires.

5.5 Check the commutator is clean.

5.6 Clean the glass.

5.7 Examine fixings.

5.8 Check wires cannot be trapped or damaged; carefully replace and secure (lock) cover.

5.9 Request signaller to operate each block instrument and Observe correct operation.

With the block ‘Normal’, the indicator should hang vertically.

You shall report to your supervisor, any bias towards ‘Train on Line’ or ‘Line Clear’.

5.10 Check that an additional line clear cannot be obtained by further movement of the commutator against its physical stop.

6. Southern Railway (SR) Standard 3 Position Block Instrument

These tasks are additional to section 5 for these types of block instruments.

Figure 1 shows the components of the block instrument as detailed in steps 6.1-6.4

6.1 Check that the locking pin and return spring assembly are clean and free from any lubricant or contamination.

6.2 Check that the return spring is not deformed. By use of a small non-metallic probe, (e.g. match stick) gently lift the commutator locking pin until it makes contact with the return spring mounted above the coil assembly.

6.3 When the pin is in its fully raised position (clear of the commutator ratchet teeth) carefully remove the non-metallic probe and Check that the pin drops away sharply.

6.4 If the pin remains in the raised position or is sluggish in dropping away inform your supervisor immediately. This is a sign that residual magnetism could be present that could affect the correct operation of the instrument

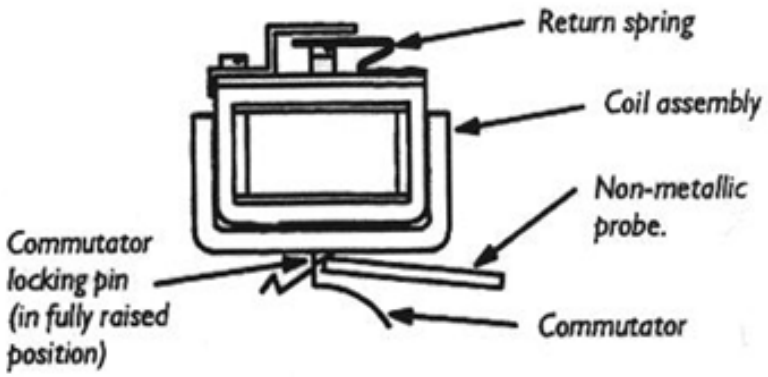


Figure 1 – Standard 3 Position Block Instrument

7. Emergency Release (Paper or Glass)

7.1 Dust and Examine exterior.

7.2 Check seal is intact, correct type and cannot be inadvertently removed.

8. Emergency Release (Welwyn Rotary)

8.1 Dust and Examine exterior.

8.2 Check seal is intact.

8.3 Check unit is correctly labelled.

8.4 Carry out a Function Test (NR/SMTH defined test B17 steps 4 to 14).

9. Plunger, Block Switch

9.1 Dust and Examine plunger/ switch mechanism, linkage, terminations, wires and fixings.

10. Needle Indicator (Spagnoletti)

10.1 Dust and Examine exterior.

10.2 Where provided, Check indication using test facility.

10.3 Check clarity of label/ artwork.

10.4 Examine interior mechanism, particularly for:

a) Any damage or misalignment to needles/ banners.

Warning: Do not attempt to clean or oil.

b) Degraded terminations or wires.

10.5 Clean the glass.

10.6 With no current applied, gently operate the needle by hand. Observe it returns smoothly and rapidly when released.

10.7 Apply current for each position and check the needle does not overdrive.

10.8 Check wires cannot be trapped or damaged; carefully replace and secure cover.

10.9 Request Signaller to operate and Observe correct operation.

11. Lamp Indicators

11.1 Dust and Examine exterior.

11.2 Where provided, Check indication using test facility.

11.3 Carefully remove cover

11.4 Examine interior, pay particular attention to:

a) Terminations and wires.

b) Lenses and lens engravings.

11.5 Check the lamps.

11.6 Clean the glass.

11.7 Examine fixings.

11.8 Carefully replace and secure cover.

11.9 Request signaller to operate and Observe correct operation.

12. Audible Alarms

12.1 Test audible alarms, where practicable to do so. Including: train running away, first filament failure, power supply, level crossing alarms etc.

Certain alarms are only identifiable by investigating the circuit records (e.g. Train Running Away audible alarm).

13. Control & Indication Panels

This includes level crossing pedestals and indicators

13.1 Check control / indication panel faceplate. In particular look for:

a) Worn or illegible artwork.

b) Damaged panel sections.

c) Faulty buttons/ switches.

d) Faulty indications / lamps.

13.2 Dust and Wipe clean with a cloth moistened with detergent or non-abrasive cleaner, as necessary.

14. Systems

14.1 Check and clean keyboards and VDUs. Including stand-alone train describers.

14.2 Check CCTV crossing controls and indications operate correctly.

14.3 Check HABD indications (See NR/SMS/HO** series)

14.4 As provided, Test other electronic systems.

SERVICE B

15. Emergency Release (Paper Type)

15.1 Check that the release cannot be obtained without breaking seal.

15.2 Break the seal and Test for correct operation.

15.3 Renew the seal and Record as appropriate.

16. Earth Test

16.1 If not monitored by ELD, carry out DYNAMIC EARTH TEST (052).

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SB21		
GraphXMaster CX50-100U Back Projection Unit		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	GraphXMaster CX50-100U Back Projection Unit
Excludes:	All other types of Back Projector Unit

General

High voltages are present in the projector.

Precautions for working on high voltage equipment shall be implemented and observed.

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

Never remove the lamp from its housing directly after use. The lamp is under great pressure when hot and might explode causing personal injury and/or property damage. Allow enough time for the lamp to cool completely.

Wear eye protection (UV goggles with side protection) and clean cotton gloves when handling the lamp.

More information on this equipment can be found in NR/SMS/Appendix/02

DAILY SERVICES

1. Projector Ventilation/Cooling

1.1 Check the projector ventilation apertures are clear. Rectify as necessary.

1.2 Check projector cooling fans are operating. Inform your SM(S) of any problems.

REGULAR CHECKS

2. Inspection

2.1 Check and confirm the operation of key pad. Replace the batteries as necessary. Details are in NR/SMS/Appendix/02.

SERVICE A

3. GraphXMaster Projector

3.1 Check that the warning labels and markings are secure and legible.

3.2 Switch off projector and check that the lamp cooling fans have stopped. Automatic fan control.

3.3 Isolate the power supply and unplug the projector AC power cable.

3.4 Dust the projector exterior.

3.5 Check the AC power cable and plug. Replace if damaged or has signs of overheating.

3.6 Carry out NR/SMS/PartB/Test/173 (GraphXMaster Protection AC Leakage Test).

3.7 Plug in projector AC power cable and connect back to the power supply.

3.8 Switch on projector and check that the internal cooling fans operate immediately.

If the cooling fans fail to start, switch off projector immediately and report to your SM(S). Allow enough time for the projector lamp to reach optimum temperature before proceeding.

3.9 Check projector operation and cube screen display. Adjust settings if necessary.

4. Control Room

4.1 Wipe the cube screens and the cube enclosures. More details are in NR/SMS/Appendix/02.

SERVICE B

5. Projector Lens

NOTE: *This task shall only be undertaken if there is degradation of the displayed image*

5.1 Dust the projector lens. More details are in NR/SMS/Appendix/02.

END

General

Liaise with the Signaller so that they are aware of your presence before any maintenance commences.

It is good practice to make an entry in the block / occurrence book on arrival at the signal box.

The back of a signal head shall not be opened when a train is approaching, as this can cause the driver to misread the signal.

Keep the door closed until the train has passed and check that there is no other train approaching.

Signal arms shall not be moved, unless it is certain that there is no possibility of the signal being misread by the driver of an approaching train.

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

SIGNAL LAMPS

1. Illumination of Auxiliary Filament

The preferred method of illuminating the auxiliary filament is by using the filament disconnection link in the signal head.

The link is disconnected by gripping the cover and pulling. Following the test, check that the connector is properly locked on the ‘faston’ tab by gently pulling the wire.

Where a link is not provided, the wire to the main filament is to be disconnected, you shall need to follow the SMTH.

2. Lamp Holder Spring Contact

To minimise a risk of high resistance or arcing, spring contacts should be adjusted correctly, so that any movement of the lamp in the holder will not cause the lamp to go out. The spring tension can be increased by gently bending the spring upwards.

Any contacts that show signs of burning or which cannot be correctly adjusted should be replaced. A small, insulated mirror can be used to help in the inspection.

The position of the lamp holder relative to the signal lens is factory set and should not be interfered with.

3. 8000 Hour Lamps

The voltage range is higher than a conventional SL35 main filament. See NR/SMS/PartZ/Z01 (Signal – Reference Values) for details.

The auxiliary filament of an 8000hr lamp is not long life and should be set to the voltage range listed for a conventional SL35.

A first filament failure in one of these lamps should be treated in the same manner as a conventional SL35, and the lamp replaced to prevent a ‘lamp out’ (black signal) occurring.

4. Quartz Halogen Lamps

Do not touch the glass of quartz halogen lamps as contamination damages the glass envelope when it gets hot. Always use paper tissue when handling the lamp.

Quartz halogen lamps should be run at their rated voltage otherwise there is a possibility of the glass envelope blackening due to tungsten deposits caused by low temperature.

This can lead to low light output and the signal being misread by a driver.

5. Quartz Halogen Lamps Fitted to ML Heads and Indicators

Some ML signals have been fitted with a 110/10V signal head transformer and should not be adjusted to give a 12V output.

The transformer can become saturated and there is a possibility that sufficient magnetising current will be drawn by the transformer to keep the lamp proving relay energised even when the lamp is removed. This is a wrong side failure. Any signal head found with a 110/10V transformer and a 12V lamp should be reported to your SM(S).

Typical lamp voltages are detailed in NR/SMS/PartZ/Z01 (Signal – Reference Values). All signal lamps should be illuminated during the maintenance visit (if practicable) to check the filaments are operational.

The signal lamp record card should normally be retained in the signal head or adjacent location, where this is not practicable.

If kept in the signal head, the card should be stored in the most restrictive aspect to reduce the risks associated with phantom aspects. They should not be positioned where they could obscure the lamp.

The record card shall be completed at each maintenance visit and whenever a lamp is renewed.

6. Lamp Proving

The GECR relay specification shall be matched to the signal lamp type and circuit provided. An error can result in the lamp proving being ineffective.

COLOUR LIGHT SIGNALS

More information on alignment of colour light signals can be obtained in NR/GN/SIG/19032 or NR/L2/SIG/10158.

7. Signal Visibility

Signals shall be checked during the maintenance visit.

Particular attention should be given to any signs of subsidence or disturbance to the signal structure. A 1° movement in the signal head translates into a movement in the beam alignment of 3.5m (11’6’’) at 183m (200yds).

Signals are to be aligned in accordance with the signal sighting assessment record, this record can be in the form of a paper record card or an entry into the SSIFT database.

Signal mis-alignment is a critical factor in a high number of reported Signal Passed at Danger (SPAD’s).

8. Beam Alignment

The beam alignment designed to position the driver’s eye within the signal beam throughout the readable distance, as train approaches a signal.

It is also designed to minimise the effects of sunlight which might incur phantom aspects to the driver.

Where the signal sighting assessment record is not available on site, this shall be reported as corrective maintenance to your supervisor.

Signalling Technicians are responsible for clearing vegetation which adversely affects visibility of signals.

9. Signal Lenses (Filament Lamp Type Signals)

It is essential that signal lenses are clean and not broken or scratched. Care should be taken when cleaning a polycarbonate lens to prevent scratching, scratched or dirty lens can severely impair signal beam intensity.

Coated polycarbonate lenses are permissible at locations where there is a risk of significant vandalism.

If any signal lens has to be replaced, the 'hot strip' shall be correctly aligned.

The Typical Position of Hot Strip - Signal to Left of Track This can vary on certain signals (e.g. ground mounted heads) refer to the signal sighting form for the correct positioning. If you are in doubt, ask your SM(S)). Figure 1.

Some signals can be fitted with Spreadlite lenses; these shall be replaced by similar lenses in the correct orientation (the strips on the lens shall be vertical).

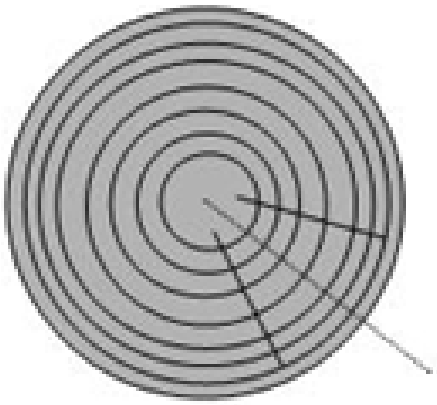


Figure 1 - Typical Hot Strip Position

10. Position Light Junction Indicators and Alpha- Numerical Route Indicators

Lamp failures can result in a false route indication being given to the driver, so it is essential that failed lamps replaced.

In many areas, lamp proving is provided on route indicators. The requirement to test the lamp proving is contained in the SMS and should be carried out for each indication where possible. NR/SMS/PartB/Test/022 (Signal Lamp and Light Module Proving Tests) applies.

In some installations, the lamp proving is set by the provision of a resistor in parallel with the UECR relay coil. A disconnection of the resistor results in the lamp proving becoming ineffective.

Check replacement lamp is matched to the UECR relay specification.

The Light Engine LED unit is a like for like replacement for a SL35 lamp in these indicators.

11. Signal House Fibre Optic Position Light Signal (PLS)

These PLS signals are distinguishable from traditional types by their use of fibre-optic bundles to guide the light from an internal quartz-halogen lamp to the front apertures.

They show two red (or yellow) lights for their 'On' aspect. The lamps to be used in these PLSs are the approved Quartz Halogen 6000hr 10V type.

The units are equipped with main and auxiliary lamps with a filament changeover device, which includes first filament monitoring systems. In the event of a detected first filament failure, the lamps should be changed in accordance with existing instructions for the systems.

If no system is in place, a lamp-changing programme should be maintained with a maximum of 6 months between lamp changes.

12. Light Emitting Diode (LED) Signals

LEDs are commonly used in all types of signalling equipment.

LED colour light signals can be searchlight or conventional multi-aspect presentation with individual LED signal modules for each aspect.

LED signal modules fitted to main colour light signals have a close-up viewing sector which is equivalent to the hot strip on conventional signals. Dependent on the manufacturer, the signal they can be left or right-handed, or they can be universal because the outer lens with the close-up viewing sector can be rotated to the correct orientation.

Because of the different features it is important that the correct replacement LED module is installed and the ‘hot strip’ is correctly aligned.

SEMAPHORE SIGNALS

More information on semaphore signals can be obtained from NR/L3/SIG/19014.

13. General

NR/SMS/PartC/SG12 (Semaphore Signals) applies to both upper and lower quadrant signals and ground signals.

The maintenance of a mechanical signal requires the ‘whole route’ to be examined between the lever tail and the signal.

Where detectors are being maintained, refer to both signal and point maintenance specifications.

Before commencing maintenance on a signal, it is beneficial to operate each signal from the lever. After maintenance work has been completed, the same Technician should again operate the levers to verify any expected improvement.

The Signaller should also operate the signal.

14. Wire Runs

Signals can be operated up to 1760 yards (1600m) from the signal box.

15. Wires

The wire run should at all times be clear of debris, vegetation and the ground.

Wires should be supported to avoid contact with one another and other railway equipment.

Wires should not come into contact with ballast or timber or any railway structure.

Wires should be run in an orderly manner, clear of one another and wires should not cross within the run.

16. Wire Stakes

Wire stakes should be no more than 9 yards (8m) apart. This distance can be reduced if it will prevent the wires fouling the ground.

Angled pulleys may be required to permit the run to negotiate a curve, the height of the wires is not fixed. Stakes shall be firmly fixed in the ground.

Any suggested improvements to the run should be made via your SM(S).

Wires shall not rub against the underside of rails, when signals are operated.

Risk of a short circuit can be reduced by fitting plastic rail clips to the underside of rails.

Orange piping is not designed for signal wires and should not be used for cross track ducting as the condition of the wire within the pipe cannot be seen.

In electrified areas correct insulators shall be fitted into the wire run.

Third and fourth rails in DC traction areas require special care.

17. Ducting

At level crossings, piping or ducting is required.

The wires passing through should be regularly checked. Jointing at one end by “S” hook or split link might be required so the wire can be drawn back for inspection and checking.

Wires should not bind against ducting walls or each other. A maximum of 3 wires should be run through a single pipe.

Do not forget to examine the draw wire. A nylon rope loop can be installed within the duct to assist in quick replacement of the signal wire.

All ducting shall be kept clear of debris.

18. Wire Joints

Wire joints are made by hand. Pliers are only used to initially cut the wire to length. They are not used to help make the joint. Each strand should be separated in turn and the joint made by hand.

Check that wire joints, within the run, cannot snag one another. One joint per bay is recommended.

Joints shall be clear of, and never foul, any stake or pulley. Cross-wires shall be joint free.

19. Wheels & Cranks

Slings and chains are designed to go around wheels. They should be of correct length so that the links and thimbles do not foul the wheel or wheel-frame during operation.

Remember to allow for adjustment by the Signaller.

Cranks in wire runs severely limit travel and can therefore only be used at the signal.

Check they do not choke the operation of a signal.

20. Wire Adjustment

Signal wire length can vary by over 1cm per 18m, depending upon the temperature. If incorrectly adjusted the wire, when cold, can pull a signal falsely off.

Adjustments, usually by a wire adjuster at the signal box, allow for seasonal variations of temperature and expansion / contraction.

Some signals are adjusted on the lever tail. After renewing any substantial length of wire, a visit should be made after one week to check the adjustment is still correct, as the wire could have stretched since installation.

There shall be enough travel / stroke at the lever to operate the signal.

21. Foundations

All wheel and crank foundations shall be solid. Check for rotting timber and movements. Check bolts / coach screws for security.

22. Signal Posts

Signal posts should be vertical. Guy wires and flying stays should be carefully checked.

Staging, handrails and decking should be checked before use.

Bracket and gantry signals should be visually checked for damage and rust on each visit.

No signal shall be climbed if the ladder does not appear to be fit for use.

An inspection of the post at and around ground level should indicate if rusting is taking place.

23. Weights

Weights on balance levers shall not be greater than required to restore the signal wire to normal. Excess weight causes wear and creates extra work for the Signaller to pull the signal.

Weights should be secured by a bolt or chain, to prevent them moving on the lever, or becoming detached.

24. Lubrication

Excess lubrication causes dirt to accumulate and can cause wear. Lack of lubrication can also cause wear. Both excess and lack of lubrication or the wrong type of lubrication can cause wrong side failures.

It is essential, that the correct amount of lubricant is applied sparingly to signalling equipment. No item of mechanical equipment needs flooding.

All old oil and grease shall be brushed / wiped away. When new is applied any excess shall also be wiped off to prevent dirt accumulating.

The wire run and its pulley wheels shall not be lubricated unless using a dry film lubricate.

Wheels, cranks, spindles, and balance weights require only a small regular amount of oil / grease to keep them operating satisfactorily.

Signal arm spindles can be prone to sticking, Check that the oil / grease reaches each end of the bearing. Do not to spill oil and grease over electrical components and any spillage should be completely wiped away.

Check all nipples are clean and permit grease to pass, this includes auto lubrication systems (where fitted). Oil holes shall be kept clean and covered when possible,

25. Repeaters

The arm shall always correspond to the lever and return to the ON position even if a normal check lock is fitted to the lever.

The chart in 'Signal Arm Adjustment' indicates the relevant ON and OFF or Made and Broken positions for arm indicators and for AWS.

If fitted, the backlight blinder should be adjusted to obscure the lamp back light when the arm is at more than 5° from the horizontal.

If fitted, contact boxes should not impinge upon the mechanical operation of the signal.

Arm and indicator correspondence should be regularly checked, especially when wire adjusters are fitted.

Balance lever contact boxes should be adjusted to operate between 0° - 5° and 35° - 65°.

26. Signal Arm Adjustment

Angles for lower quadrant signals are the same below horizontal (a table of these angles is in NR/SMS/PartZ/Z01 (Signal – Reference Values).

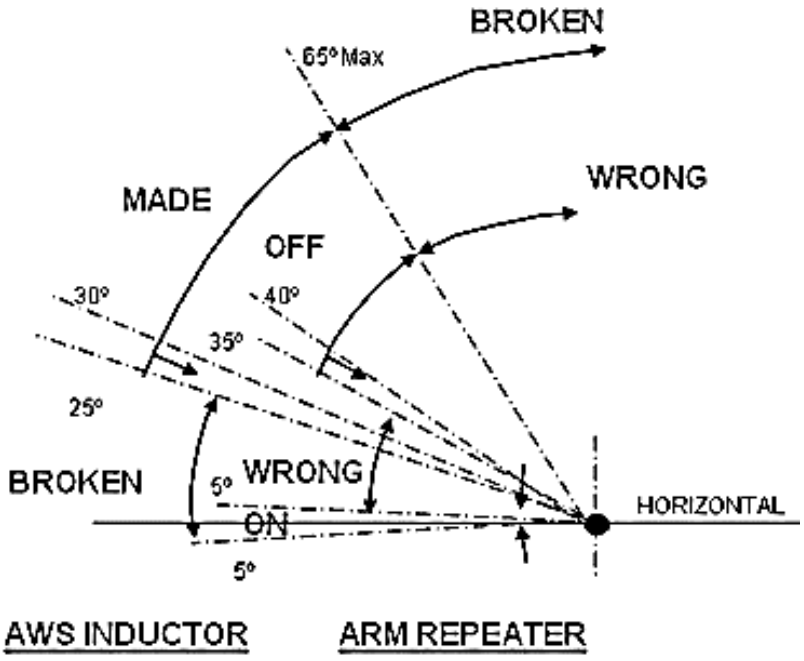


Figure 2 - Signal Indication Angles

27. Signal Sighting Distances

These can be found in on the signal sighting form, typical values are shown in NR/SMS/PartZ/Z01 (Signal – Reference Values).

28. Reflective Boards & Signs

Most railway related reflective boards and signs which are required to be retro-reflective are referenced to BS873 part 6 and divide the requirement into Class 1 (most reflective, Class 2, or non-retro-reflective.

From 01/01/06 BS873 was replaced by BS EN 12899-1. Materials tested to the old standard are not available. The new standard is not exactly equivalent to the old; a conversion table is shown as follows:

BS873 Part 6 reference	BS EN 12899-1 reference
Class 1	Class R2
Class 2	Class R1
Non retro-reflective	Class NR1

Table 1 – Standard Conversion Table

The main difference is that the order of reflectivity has been reversed.

Class R2 retro-reflective material is identified by the surface of the item being made up of small multi-sided cells (micro prismatic).

As a general rule, boards and signs that are to read by an approaching train or road vehicle at any speed above a walking pace are to be class R2 retro-reflective, boards and signs that are to be read by an approaching train or road vehicle at a walking pace are to be class R1 retro- reflective.

If the board or sign is externally or internally illuminated it can be class R1 or NR1 irrespective of the approach speed. This is a general rule, individual or local circumstances can be different, if you are in any doubt about the reflectivity of any board or sign, ask your SM(S).

Road signs at a level crossing that are between the white stop lines on the road surface and the diagram 784 signs (see NR/SMS/PartC/LC00 (Level Crossings: General) are the responsibility of Network Rail.

All other road signs are the responsibility of the local authority, any defects or problems with these signs shall be reported to them directly via your SM(S).

END

SERVICE B

1. Signal Structures

1.1 Clear ballast and vegetation from the base of the structure until the mounting bolts are visible.

If you are unable to clear the ballast from the base you shall advise your SM(S).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG02		
Signal Post and Signal Box Replacement Switches		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Signal Post Replacement and Signal Box Replacement Switches
Excludes:	All other Signal Replacement Devices

SERVICE B

1. Signal Post Replacement Switch (Fig 1)

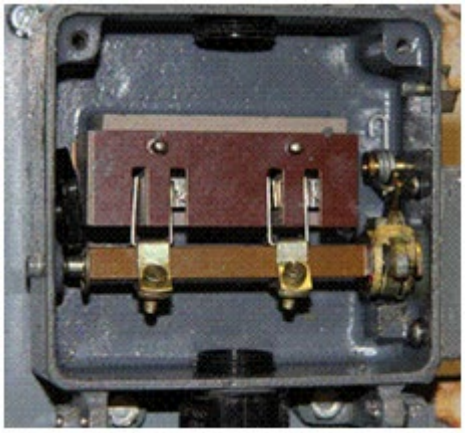


Figure 1 – Signal Post Replacement Switch

1.1 Check the 'Auto/Red' labelling is legible.

1.2 Check each switch is correctly labelled for the signal it controls.

1.3 Lubricate the hinges and apply petroleum jelly to keyhole.

1.4 Dust and examine interior, particularly:

- Cable cores and terminations.
- Armature retaining screws.
- Pivot springs, check for correct operation.
- Cover gasket.

1.5 Check the ceramic contact holder; look especially for cracks around the fixing holes.

1.6 Lubricate the bearings.

1.7 Carry out SPRS TEST - NR/SMS/PartB/Test/023 (Other Signal Tests) - Section 1.

1.8 Check on gantries where more than one switch might be fitted that each switch operates its corresponding signal correctly.

2. Signal Box Replacement Switch (If Provided)

2.1 Carry out SIGNAL BOX ERS TEST NR/SMS/PartB/Test/023 (Other Signal Tests) - Section 2.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG03		
Signal Sighting - Cab Rides		
Issue 03	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Main (Running) Signals
Excludes:	All Other Signals

Clarification

Main (Running) Signals: These could include multi aspect, semaphore, banner, PLJI, block markers and reflectorized signals used to control train movements on both “Passenger and Freight lines”.

On “Freight Lines only”, a risk-based approach to traffic levels and line speed to determine if a visit to sight a signal is deemed unnecessary.

Main (Running) Signals do not include signals such as GPL, PL, MARI, SARI and PoSA etc. which are passed at lower speeds.

Both Passenger and Freight Lines are indicated in Table “A” of the Sectional Appendix.

This check should be carried out during the hours of daylight and preferably during vegetation season (April to September).

If the check cannot be completed from the driving cab, then it can be carried out from ground at the signal sighting point.

Details relating to basic Signal Sighting are shown in NR/SMS/PartC/SG00 (Signals: General).

SERVICE B

1. Supervisory Checks

1.1 Check the sighting of the signal.

1.2 Any issues shall be recorded and actioned.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG05		
Counter-Balanced Signal Support Posts		
Issue No: 02	Issue Date: 01/06/2019	Compliance Date: 07/09/2019

Includes:	Crown Post & Cess-mounted Counter-Balanced Signal Support Posts.
Excludes:	All other Counter-Balanced Signal Support Posts.

Asset Identification Image

Figure 1 - Crown Post signals

Overhead Line Equipment shall be isolated if access to the signal post is required outside the gantry safety cage (i.e. for non-routine maintenance activities, such as failures or component replacement).

Keep your hands and clothing clear of all moving parts as the signal-head is being moved through its full range of travel.

You shall always obtain permission from the signaller before starting work.

SERVICE B

1. Post

1.1 Externally, check that structure and all foundation/mounting bolts and fixings are secure and free from any damage, vandalism or corrosion – report any damage, treat all corrosion, remove all graffiti.

1.2 Check the condition and security of all earth straps and weather seals.

1.3 Check for signs of water ingress (mould) and general degradation of seals.

1.4 Check the security and legibility of all external labels and warning flashes – clean or replace as necessary.

1.5 Check effective operation of any door padlocks.

1.6 Internally – check that structure and all brackets and fixings are secure and free from any damage or corrosion – report any damage, treat all corrosion.

2. Post access door and door mechanism

2.1 Operate door and check that it and its operating mechanism moves freely through the full range of travel.

2.2 Check security and condition of door, door seals and door operating mechanism – checking for no signs of excessive wear or water ingress – report any damage, treat all corrosion.

2.3 Where possible, clean access door open/close lever, door restraining arm and (for gantry-mounted only) signal-head locating/lock rod linkage.

2.4 Where possible, clean door seals.

3. Cess-Mounted Posts only

3.1 Visually check the signal-head raise/lower arm (“T” Handle) and locking handle for security and freedom from any damage or corrosion.

3.2 Where visible, check that the counter-balance weights are free from corrosion – check that the weights are correctly positioned within the weight carriage.

3.3 Check the condition and security of the signal-head raise/lower arm and its attachments.

3.4 Internally – check weather seals for signs of splitting, kinks, water ingress (mould) or general degradation – check all correctly attached and located.

3.5 Check the security and legibility of all internal labels – clean or replace as necessary.

3.6 Check the signal-head carriage upper and lower guide wheel block assemblies and guide wheel channels for signs of damage or corrosion.

3.7 Clean signal-head carriage guide wheel block assemblies – use a lint-free cloth.

Signal-head raise/lower mechanism

3.8 Operate the signal-head raise/lower locking handle over-centre and check that the appropriate resistance is felt – "positive feel". Clean the wire ropes and their connecting bolts on both the signal-head and balance-weight carriages – use a lint-free cloth.

3.9 Check the security and tightness of all wire rope connecting bolts – check that all attachment brackets are secure and free from damage or corrosion.

3.10 Check that the tension of both wire ropes is similar – ropes should feel taught under pull of finger pressure.

3.11 Operate the signal-head through its full range of travel and complete the following:

a) Check the condition of each wire rope – check there is no fraying, broken strands, corrosion or signs of deterioration;

b) Check that wire ropes and pulley assemblies operate smoothly – Check that pulleys turn freely, with no signs of stiffness or juddering felt during up or down travel of signal-head;

c) Check the signal-head carriage guide wheels for signs of stiffness, juddering, wear (flat spots) or general degradation;

d) Check that signal-head carriage structure, brackets, fixings and wheel block assemblies are free from damage or corrosion;

e) Check that the final few centimetres of signal-head carriage travel are dampened in both fully raised and fully lowered positions;

f) Check that damper compression eases as the signal-head is moved away from its fully raised and fully lowered positions;

g) Using a torch and a small dentist-type mirror, check the condition and security of the damper and fixtures.

3.12 Remove post end cap – check correct alignment of each wire rope on respective pulley and security and condition of both pulley assemblies.

NOTE: *A torch will be required*

Lubrication

3.13 Clean all areas that require lubrication – remove old grease.

3.14 Lubricate, by hand application, the wire rope connecting bolts on both carriages – wipe off any excess grease.

3.15 Do not lubricate wire ropes, pulley assemblies, carriage guide wheels or guide wheel channels.

3.16 Lightly lubricate door hinges and open/close linkage.

3.17 Do not lubricate door seals.

3.18 Lubricate all bolts and screw threads exposed to the elements (include foundation bolts).

4. Gantry-mounted post

Signal-head raise/lower mechanism

4.1 Remove old/dirty grease from each chain and their connecting bolts – use a lint-free cloth.

4.2 Check the security and tightness of all chain connecting bolts – check that all attachment brackets are secure and free from damage or corrosion.

4.3 Check the condition and security of each lifting and winding chain top sprocket and bearing housing assembly.

4.4 Check, via the winding mechanism access door, the condition and security of the winding chain bottom sprocket and bearing housing assembly – check that the chain is correctly aligned on its sprocket.

4.5 Check that the tension of both chains is similar – chains should feel taught under pull of finger pressure.

4.6 Operate the signal-head through its full range of travel and complete the following checks:

a) Check the correct alignment of each chain on their respective sprockets;

b) Check the condition of each chain – there should be no distortion, stiff links or corrosion;

c) Check that chains and sprocket assemblies operate smoothly – check that sprocket assemblies turn freely, with no signs of stiffness or juddering felt during up or down travel;

d) Check the signal-head carriage guide wheels for signs of stiffness, juddering, wear (flat spots) or general degradation;

e) Check that signal-head carriage structure, brackets, fixings, wheel block assemblies and guide wheel channels are free from damage or corrosion;

f) Check that the final few centimetres of signal-head travel are dampened in both fully raised and fully lowered positions;

g) Check that damper compression eases as the signal-head is moved away from its fully raised and fully lowered positions;

h) Using a torch and a small dentist-type mirror, check the condition and security of the damper and fixtures.

4.7 Remove the post end cap and check that the lifting and winding chains are correctly aligned on their respective sprockets.

Lubrication

4.8 Clean all areas that require lubrication – remove all old grease.

4.9 Lubricate, using grease applicator on appropriate grease nipples, the lifting and winding mechanisms.

4.10 (Where accessible) – Lubricate, by hand application, the lifting and winding chains and connecting bolts on the signal-head and balance-weight carriages.

4.11 Do not lubricate guide wheel block assemblies or guide wheel channels.

4.12 Lightly lubricate door hinges, door padlock and open/close levers.

4.13 Do not lubricate door seals.

4.14 Lubricate, by hand application, all bolts and screw threads exposed to the elements.

4.15 Report any faults to your SM(S).

4.16 Once all work activities have been completed you shall notify the signaller that the signal has been returned to its normal operating position.

SERVICE R1

Includes:	Crown Post Counter-Balanced Signal Support Posts.
Excludes:	Cess-mounted Counter-Balanced Signal Support Posts.

Counter-Balanced Signal Support Posts.

5. External Inspection

5.1 Check door seals for damage.

5.2 Check earth braid is present and connected to door and casing.

5.3 Check earth braid is not snagging in door hinges.

5.4 Visually inspect condition of the chains.

5.5 Check condition of the tail cable and conduit when raising & lowering head.

5.6 Check chain lifting bracket.

5.7 Check for presence of locking nut on chain connection bolts on the weight basket using an angled mirror.

5.8 Check the winding mechanism for ease of operation for both lowering & raising.

5.9 Check the operation of the damping mechanism.

5.10 Lubricate the padlock.

5.11 Report any faults to your SM(S).

Once all work activities have been completed you shall notify the signaller that the signal has been returned to its normal operating position.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG07		
Main Colour Light Signals – Dorman Lite		
Issue No: 05	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Dorman Lite
Excludes:	Dorman Classic, Integrated Lightweight Signal (iLS), VMS, Signal House and all other LED signals

Identification of LED Signals

Dorman Lite - These signal heads have sloped lens in front of each aspect to reduce contamination.

The signal head configurations can be different to the examples shown.

You shall liaise with the Signaller before displacing any signal light module from its normal position to check there are no approaching trains and the possibility of a driver not being able to observe the aspect.

Figure 1 – Dorman Lite

On Dorman products maintenance can be undertaken from the rear of the signal. In the case of other manufactures, access is also required at the front. If you are unsure about the manufacturer of the signal and the access you require, ask your SM(S).

SERVICE A

1. General

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

1.2 If applicable, visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.3 If applicable, visually inspect cables suspended from the structures above overhead line equipment.

1.4 Check the signal ID plates are displaying the correct details and are not damaged or fading. Check them for security and correct aligned.

1.5 Clean the Signal ID Plates.

2. Signal Heads

2.1 Check the presence of E-clips on the pivot bar for LED module (Dorman Signals only).

Any damaged or missing E-Clips shall be replaced and treated as corrective maintenance.

2.2 Check the vertical tilt alignment bolts are torqued to 40 Nm.

2.3 Check that the lens is clean, not damaged or distorted and not obstructed.

2.4 Clean as required. This task applies to each LED Module.

2.5 If provided, carry out NR/SMS/PartB/Test/023 (Other Signal Tests) - Flasher Unit Test (Flashing Aspects).

SERVICE B

3. Signal Head

3.1 Check the signal identification plate(s). These shall be secure, correctly aligned, clean, legible, and display the correct number.

3.2 Open the access door and examine the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Dust and clean the interior.

Dorman signal heads are not designed to be watertight therefore some moisture/water can be present.

3.3 Examine cable glands, cable entries, and LED module's as applicable to the installation. Close the access door.

3.4 If provided, check the alignment from the integral sighting device.

If this task is not possible due to sighting device being obscured (e.g. painted over) it should be reported as corrective maintenance. Report immediately any actual or possible obstructions to the sighting of the signal/indicator.

3.5 Test and record the supply voltage to the SLM for each aspect (If practicable) on the outgoing links in the location.

3.6 Check and lubricate hinges, thumbscrews and padlocks.

4. Disconnection Boxes (If Provided)

4.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit / disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock. Check they are fitted securely.

5. Final Checks

5.1 Check that all covers, doors, and padlocks are securely refitted, Lubricate hinges and padlocks.

5.2 Check that all aspects and indicators are showing their normal (standing) aspect/indication on completion of maintenance. If you are in any doubt, ask your SM(S).

PERIODIC TASKS

6. LED Modules

6.1 As required, replace SLM module(s).

6.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

END

Includes:	VMS CLS, CLS Stacked, Position Light, Junction Indicators, and MARI / SARI indicators
Excludes:	All other LED Signals

Equipment Types

Figure 1 - Lightweight CLS

Figure 2 - CLS with JI, PL and MARI

Figure 3 - Stacked CLS

Liaise with the Signaller before displacing any signal from its normal position to check that there are no approaching trains.

SERVICE R1

1. General Signal Inspection

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

1.2 Check the signal ID plates are displaying the correct details and are not damaged or fading. Check them for security and correct alignment.

1.3 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.4 If applicable visually inspect cables suspended from the structures above overhead line equipment

1.5 Clean the Signal Aperture / Lens and Signal ID Plates.

1.6 Report any corrective action taken as this type of signal is designed to be self-cleaning.

2. Disconnection Boxes (If Provided)

2.1 Check the cables and cores are undamaged, correctly labelled and free from wet or dry wire degradation.

2.2 Check the terminations for security, corrosion, arcing, and risk of short circuit / disconnection. Protect as necessary.

2.3 Check the cable glands are fitted and effective.

Refit the lid and (if provided) padlock, check they are fitted securely.

END

Includes:	Dorman - Integrated Lightweight Signal (iLS) and iLS Modular (because of the integrated nature of the head design Position Light, Junction Indicators and Main / Sub Alphanumeric signal are included in this SMS)
Excludes:	Dorman Classic and Lite and all other signals

Equipment Types

Figure 2 – Signal with Trunnion

Figure 1 – Trunnion Unit

Integrated Lightweight Signals (iLS) - These signals are mounted on a trunnion unit which has an integrated disconnection box.

Figure 3 – Signal with Enclosure Unit

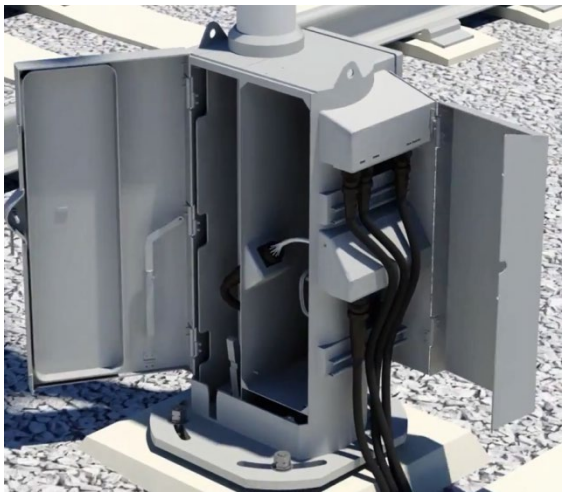


Figure 4 – Enclosure Unit

Integrated Lightweight Signals (iLS) (Modular) - This version differs from standard (ILS) in the fact that the post is mounted through the equipment enclosure which contains the plug couplers and AWS / TPWS equipment.

Liaise with the Signaller before displacing any signal light module or signal post from its normal position to check there are no approaching trains and the possibility of a driver not being able to observe the aspect.

Cleaning of the signal lenses can be undertaken from the front of the signal when it is lowered. Maintenance tasks or module changing can be eased if trunnion mounted signal posts are rotated by 180 degrees such that the modules face upwards.

It is essential that the post is re-rotated and correctly located before once again raising the post. Full details are contained in the maintenance manual. If you are unsure of this procedure, ask your SM(S).

As there is little or no space available in the iLS, wiring details and record cards for the iLS will be stored in the interlocking room that controls the signal mounted either on the enclosure or trunnion.

When the PLS is configured to act as a PoSA signal, the signal shall be tested in both the steady and flashing state.

SERVICE A

1. Signal alignment and visibility

1.1 Check the beam alignment from the detachable sighting device. Details on sighting are in NR/SMS/PartC/SG00 (Signals General).

1.2 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

2. External Inspection – Post, Enclosure / Trunnion

2.1 Check (if provided) that any guardrails and staging are secure.

2.2 Check for fire risks around the iLS. Remove or report any possible risks.

2.3 Check all doors / covers are accessible and not obstructed. Remove or report excessive foliage or obstructions.

2.4 Examine post, trunnion, enclosure metalwork, doors, foundation bolts, for corrosion, damage, obstruction, and security.

2.5 Check the signal ID plates are displaying the correct details and are not damaged or fading. Check them for security and that they are correctly aligned.

2.6 Clean the Signal ID Plates.

2.7 Check enclosure identities are clearly labelled.

2.8 Check locks are fitted and in good order.

2.9 If provided, check the earthing continuity between the enclosure / trunnion and the earth rod. Check that all connections are secure and the earth rod is secure in the ground.

2.10 AC/DC Traction Areas, check the structure bond is in place and secure.

2.11 If provided, check that any safety / warning labels / signs are correctly displayed and legible.

These can include No Smoking, Wear PPE, No Mobile Phones etc.

2.12 Lubricate locks and hinges. Before leaving site, check that covers, doors and locks are properly fitted and secure.

3. Internal Inspection – Enclosure or Trunnion

3.1 Examine cables and wires for security and damage. In enclosures, check particularly when arranged in a harness and where they pass above a heater, transformer, or any other heat source. Report any damage as a corrective maintenance item.

Immediate action shall be taken on any exposed conductors. Damage includes any new wet / dry degradation. Rodent damage can occur to wiring in harnesses which might not immediately visible.

3.2 Check that wire degradation signs are in place if this is present in the enclosure.

3.3 Check site copy diagrams are available, properly stored and fit for purpose. Submit a request for replacements as required. Report to your SM(S) any handwritten or temporary alterations to the site copy.

3.4 Check internal equipment for signs of contamination, damage or failure.

3.5 Remove any dirt / infestation.

4. Power Supplies (Transformers/ Rectifiers, TFU etc) (Enclosure unit only)

4.1 Examine earth connections.

4.2 Examine terminations.

4.3 Check for signs of overheating.

4.4 Measure the power supply and busbar voltages (±10% of rating) for all signalling supplies.

Current readings on power supplies should also be taken if this is practicable.

See the notes in NR/SMS/PartC/EL00 (Electrical Equipment General) on hazards associated with electrical supplies. Investigate any significant variation from previous records.

5. Earth Tests (Enclosure unit only)

5.1 Carry out NR/SMS/PartB/Test/051 (Busbar Earth Test) to each power supply not continually monitored (excluding earth return circuits).

5.2 Rectify any earth fault found in step 5.1 that is outside the acceptable limit.

Report to your SM(S), the problem and any difficulties in rectifying it. Failure to rectify shall be reported to your SM(S) for necessary remedial action.

The report shall be made within 24 hours.

5.3 If any earth fault is found on a circuit with a voltage above the reportable voltage NR/SMS/PartZ/Z07 (Earth Leakage - Reference Values), report it to your SM(S).

5.4 The report shall be made within 24 hours. Your SM(S) shall decide if any further action is required.

6. Rack / Shelf Mounted Equipment (Enclosure unit only)

6.1 Carry out the following steps for associated relays, T/J, resistor units, component boards.

6.2 Check internal enclosure fittings, racks, shelves, and backboards.

6.3 Clean equipment as necessary.

6.4 Check ventilation is not obstructed.

6.5 Check equipment is correctly labelled.

6.6 If not managed by a relay re-servicing database, check a sample of relays to see that they are within their Service date. Report any missing labels to your SM(S).

6.7 Check equipment for security and signs of damage, degradation, moisture, overheating, and cover distortion.

7. Cables & Cable Terminations and Internal Wiring

7.1 Check that all plug coupled connections are free from damage, secure and their cables are correctly retained.

This includes the protective covers for unused plug couplers if fitted.

Secure means firmly tightened by hand until a “click” is felt when the cover correctly engages with the receptacle.

The tightening of plug couplers by the use of tools is prohibited.

7.2 If fitted, check cables are secure and free from damage / chafing / rodent damage.

Cable clamps should be fitted to reduce the possibility of short circuits occurring if the cable is pulled from outside the enclosure.

7.3 Check wiring is correctly routed, and free from insulation damage (e.g. chafing / wire ties / rodent damage) especially if located above a heat source.

NOTE: *The examination of cables and wires for changes in wire degradation and the related timescales are now covered by NR/L2/SIG/11655 (Management of Cable and Wire Insulation).*

Harnesses should be in good condition and support the wiring.

7.4 On WAGO terminals, check that red insulation stops are fitted as required.

7.5 Check un-terminated cores and wires are correctly insulated.

7.6 Check ‘red straps’ are secure and labeled.

SERVICE B

8. All LED Modules

To carry out clause 8.1, iLS signals mounted on enclosures will have to be disconnected by means of the post plug coupler before lowering.

8.1 Check that the front apertures are clean, not damaged, distorted, discoloured and not obstructed. Clean as necessary.

Report any permanent damage or discolouration as corrective maintenance. This task applies to each LED Module.

8.2 if provided, check the indicator hoods and anti-vandal guards.

8.3 If fitted and practicable, carry out NR/SMS/PartB/Test/022 (Signal Lamp and Light Module Proving Tests).

8.4 If fitted and practicable, carry out NR/SMS/PartB/Test/023 (Other Signal Tests) – Section 6 – Flasher Unit Test (Flashing Aspects).

8.5 If fitted and practicable test and record the SLM input for each aspect and any additional unit such as PLJI, PLS, MARI's and SARI's.

Where tests 8.3 to 8.5 are not practicable, note this on the record card and on your work order.

SERVICE C

9. Cable Testing (Modular signal enclosure unit only)

9.1 Test lineside cables not monitored by a ELD equiped busbar, carry out NR/SMS/PartB/Test/054 (Cable Insulation Tests).

END

Includes:	Dorman Classic, Dorman Tunnel and Signalhouse LED
Excludes:	Integrated Lightweight Signal (iLS), VMS and all other LED signals

Identification of LED Signals

- Dorman Classic – These signal heads are used as a replacement for a filament style head. The lenses are convex.

- Signal House - These signal heads have a hexagon shaped layout of their LED aspects.

Figure 2 - Dorman Classic

Figure 1 – Signal House

Figure 4 – Tunnel Signal with Integrated PLS

Figure 3 – Tunnel Signal

- The signal head configurations can be different to the examples shown.

You shall liaise with the Signaller before displacing any signal light module from its normal position to check there are no approaching trains and the possibility of a driver not being able to observe the aspect.

On Dorman products maintenance can be undertaken from the rear of the signal. In the case of other manufactures access is also required at the front. If you are unsure about the manufacturer of the signal and the access you require, ask your SM(S)

SERVICE A

1. General

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

1.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

1.4 Check the signal ID plates are displaying the correct details and are not damage, fading. Check them for security and are correctly aligned.

1.5 Clean the Signal ID Plates.

2. Signal Heads

2.1 Check the presence of E-clips on the pivot bar for LED module (Dorman Signals only). Any damaged or missing E-Clips shall be replaced and treated as corrective maintenance.

2.2 Check the vertical tilt alignment bolts are torqued to 40 Nm (Dorman Signals only).

2.3 Check that the lens is clean, not damaged or distorted and not obstructed.

2.4 Check the fan is working and the venting is not obstructed (Signal House type only).

2.5 Clean as required. This task applies to each LED Module.

2.6 If provided, carry out NR/SMS/PartB/Test/023 (Other Signal Tests) - Flasher Unit Test (Flashing Aspects).

SERVICE B

3. Signal Head

3.1 Open the access door and examine the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Dust and clean the interior.

Dorman signal heads are not designed to be watertight therefore some moisture/water can be present.

3.2 Examine cable glands, cable entries, and LED module's as relevant to the installation. Close the access door.

3.3 If provided, check the alignment from the integral sighting device.

If this task is not possible due to sighting device being obscured (e.g. painted over) it should be reported as corrective maintenance. Report immediately any actual or possible obstructions to the sighting of the signal/indicator.

3.4 If practicable, test and record the supply voltage to the SLM for each aspect on the outgoing links in the location. If this is not possible, it shall be recorded on the card.

3.5 Check and Lubricate hinges, thumbscrews and padlocks.

4. Disconnection Boxes (If Provided)

4.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit / disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock, check they are fitted securely.

5. Final Checks

5.1 Check that all covers, doors, and padlocks are securely refitted, Lubricate hinges and padlocks.

5.2 Check that all aspects and indicators are showing their normal (standing) aspect/indication on completion of maintenance.

PERIODIC TASKS

6. LED Modules

6.1 As required, replace SLM module(s).

6.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all replaced modules.

Reliability – Centred Maintenance

SERVICE R1

Excludes:	Any signal located in a hostile or dirty environment

7. Reliability Centred Maintenance

Removal of the cover to gain access to the cable terminations is NOT required for any of the following tasks.

7.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

7.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

7.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

7.4 Check the signal ID plate for damage, fading, security and correct alignment.

7.5 Check all other signs is displaying correct signal number & type.

7.6 Wipe all signs.

7.7 Check signal structure including - post, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective meshing, hoods, (etc.). For signs of serious corrosion before using.

7.8 Check the presence of E-clips on the pivot bar for LED module (Dorman Signals only). Any damaged or missing E-Clips shall be replaced and treated as corrective maintenance.

7.9 Check for loose or damaged fittings.

7.10 Check for obvious hazards.

7.11 Check for the security of traction bonding (where fitted).

7.12 Check for effectiveness of signal & indicator door locking mechanisms.

7.13 Check the Signal head, lens hoods, backgrounds, & if provided anti- vandal guards.

7.14 Check the front aperture is clean, not damaged, distorted or obstructed.

7.15 Report any damage or discolouration.

7.16 Clean the front aperture as necessary.

7.17 Clean the interior of the signal head.

7.18 Examine the interior of the signal head for deterioration and moisture ingress.

Dorman signal heads are not designed to be watertight).

7.19 Examine the cable entries & glands, plug couplers and visible cable within the signal head.

7.20 Test and record the supply voltage to the lit SLM, on the outgoing links in the location.

7.21 Report any problems that cannot be immediately rectified

7.22 When informing the Signaller that you have completed the work on a signal, check the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG11		
Main Colour Light Signal - Filament Type Head		
Issue No: 11	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Main Colour Light Signals- illuminated using standard filament lamps, 8000 hr lamps, Light Engines. SPAD signals. Ansaldo Signals
Excludes:	All other Signals

SERVICE A

1. General

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

1.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

1.4 Check the signal ID plates are displaying the correct details and are not damage or fading. Check them for security and correct aligned.

1.5 Clean the Signal ID Plates.

2. Signal Heads

2.1 Check the signal head, lens hoods and backgrounds.

2.2 Check all exterior lenses are clean, not damaged or distorted, are correctly aligned and not obstructed. Polycarbonate lenses shall be cleaned using an approved cleaner. Report any permanent damage or discolouration as corrective maintenance.

2.3 Open the door and check the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary.

Doors on filament lamp heads shall not be opened if there is a train approaching as the driver might get a phantom aspect.

2.4 Check that the seals on the door(s) are effective.

2.5 Check that any ventilation slots in the rear of the head/indicator are clear of obstructions.

2.6 Check and lubricate hinges, thumbscrews and padlocks.

2.7 If provided carry out NR/SMS/PartB/Test/023 (Other Signal Tests) - Flasher Unit Test (Flashing Aspects).

3. Electro-Mechanical Searchlight Signals

3.1 Check that the mechanism is working correctly and releases smartly.

SERVICE B

4. Signal Heads

4.1 Open the access doors/plates, examine the units and weatherproof seals. Dust and Clean the interior.

4.2 Examine the following items as applicable:

a) Internal fixings, bolts and setscrews.

b) Internal lenses, glasses, reflectors and filters, polish with a clean, dry lint free cloth.

c) Cable entries and cable glands.

d) Internal wires and cable cores. Check that these are correctly routed, secured and terminated.

e) Exposed termination blocks. Clean and protect as necessary.

f) Relays, transformers and lamp holders. Check that transformers show no signs of corrosion; this can alter characteristics causing lamp proving to incorrectly function.

g) Spare lamps and record cards are available. The availability of spare lamps at the signal is optional.

4.3 Renew the normally lit lamp(s).

Check that the replacement(s) is/are seated correctly, and the main filament(s) is/are lit. If it is fitted with an auxiliary filament. Check that this works.

4.4 Where practicable and if required, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) all signal aspects (main and auxiliary) and indicators, adjust as necessary.

4.5 Where practicable and if provided, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all signal aspects.

4.6 Where provided, carry out NR/SMS/PartB/Test/023 (Spad Indicator Test).

Where tests 4.4, to 4.6 are not practicable, test the available aspects. Note any aspect not tested on the record card and on your work order.

4.7 Check in the immediate vicinity of the signal unit(s) for any preventable sources of vibration. Report any found to your SM(S).

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Final Checks

6.1 Check that all covers, doors, and padlocks are securely refitted, lubricate hinges and padlocks.

6.2 Check that all aspects and indicators are showing their normal (standing) aspect/indication on completion of maintenance. If you are in any doubt, ask your SM(S).

PERIODIC TASK 1

7. LED Light Engine Replacement

7.1 Renew LED Light Engine module(s).

SMTH testing is required when replacing a LED Light Engine Module.

7.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests), all replaced modules.

SERVICE R1

Includes:	Main Colour Light Signals - illuminated using 8000 hr lamps with full lamp proving of main signal.
Excludes:	SL35 signals in dirty or hostile environments, flashing aspects, SPAD indicators, searchlight signals, FOCL and other filament lamps.

Doors on filament lamp heads shall not be opened if there is a train approaching, also care shall be taken when working at night with the use of hand/head torches as either might lead to the driver getting a phantom aspect.

8. Signal Head and Structure

8.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

8.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

8.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

8.4 Check the exterior lenses for damage, distortion or obstructed.

8.5 Check the exterior lenses have correctly aligned 'Hot Strips'.

8.6 Check interior of signal head for deterioration, water ingress or contamination.

8.7 Any signal head ventilation is effective.

8.8 Door seals are effective.

8.9 Clean and examine the exterior lenses, if they are polycarbonate use an approved cleaner.

8.10 Clean the interior of signal head, including lenses.

8.11 Clean and examine all internal electrical components & terminations for security & corrosion.

8.12 Protect terminations as required.

8.13 Examine the condition of lamp contact springs for pitting (using dentist mirror).

8.14 Examine cable entries, glands & clamps for damage.

9. Testing

Where practicable, to carry out the following tests, after liaising with the Signaller.

9.1 Remove the lit lamp from its holder.

In Non-SSI areas

9.2 Check the GECR or similarly names proving relay de-energises.

9.3 Renew the lamp and check the relay re-picks.

For SSI areas

9.4 Check with Signaller that a lamp out alarm was received.

For all areas

9.5 Test and record the main filament voltage for all aspects.

Adjust, if necessary, in line with NR/SMS/PartZ/Z01 (Signal – Reference Values).

9.6 Check for 0v on auxiliary filaments with main filament illuminated.

9.7 Check auxiliary filaments voltage for all aspects by disconnecting each aspect main filament in turn using 'Faston' connection if fitted.

9.8 Check that the main filament is extinguished & auxiliary filament illuminated when the main filaments are disconnected.

9.9 Report any damage or discolouration of lenses as corrective maintenance.

9.10 When informing the Signaller that you have completed the work on a signal, check that the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

SERVICE R2

Includes:	Main Colour Light Signals - illuminated using Light Engines with full lamp proving of main signal
Excludes:	Signals in dirty or hostile environments, flashing aspects, SPAD indicators, searchlight signals, FOCL and filament lamps

The resistor on the back of the LED lamp unit can become very hot, caution should be used when working near these units.

Figure 1 – LED Lamp Unit

10. Signal Head

10.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

10.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

10.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

10.4 Check the exterior lenses for damage, distortion or obstructed. Report any damage or discolouration of lenses.

10.5 Clean exterior lenses. For polycarbonate lenses use an approved cleaner.

10.6 Check each lenses 'Hot Strips' is correctly aligned.

10.7 Check the interior of signal head for deterioration, water ingress or contamination.

10.8 Clean and examine the interior of signal head including lenses.

10.9 Examine all internal electrical components & terminations for security & corrosion.

10.10 Protect terminals as necessary.

10.11 Check signal head ventilation is effective.

10.12 Check the door seals are effective.

10.13 Examine the condition of lamp contact springs for pitting.

10.14 Examine cable entries, glands & clamps.

11. Test

11.1 Contact the Signaller for permission before starting tests.

11.2 Where practicable carry out the following: Test the lamp proving for each aspect by disconnecting them using the 'Faston' connection (if fitted).

For non-SSI areas

11.3 Check the GECR or similarly named lamp proving relay de-energises.

11.4 Check the GECR relay re-picks when lamp reconnected.

For SSI areas

11.5 Check with the Signaller that a lamp out alarm was received.

For all areas

Check and record the signal lamp voltages for, where practicable, as many aspects as possible. Details of the voltage range can be found in NR/SMS/PartZ/Z01 (Signal – Reference Values).

Any problems that cannot be immediately rectified should be reported to your SM(S).

11.6 When informing the Signaller that you have completed the work on a signal, check the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

PERIODIC TASK 2

12. LED Light Engine Replacement

12.1 Renew LED Light Engine module(s).

SMTH testing is required when replacing a LED Light Engine Module.

12.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests), on all replaced modules.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG12		
Semaphore Signals		
Issue No: 08	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Upper and Lower Quadrant Main and Subsidiary Signals, Mechanical Disc Signals, Fixed Signals
Excludes:	All other signals

SERVICE A

1. Signal Visibility

1.1 Carry out a NR/SMS/PartB/Test/302 (Signal Visibility Check).

2. Wire Runs

2.1 Examine signal wire for each signal, from the lever tail and / or wire adjuster, through to the arm of the signal. Arrange for any rusting or damaged wire to be replaced as soon as possible.

2.2 Check there are no kinks or joints in the vicinity of any pulley wheels.

2.3 Remove all obstructions from around the wire run and surrounding area.

2.4 Vegetation shall be cut back / killed. Anticipate growth, particularly in spring and summer.

2.5 Where necessary, wires shall be adjusted to allow for seasonal temperature variations.

2.6 Observe the operation of the signal at wheels, pulleys, detectors and at the post. Check for the correct operation of all components.

2.7 Observe the operation of the signal wire at rail crossings, boarding and footways.

2.8 In electrified areas, check the insulators. Insulations shall be at each end of the wire.

If there is any doubt about the integrity of the insulation, report immediately to your SM(S) to arrange replacements.

2.9 Examine all slings and chains, and associated wheels. Slings and chains shall be undamaged. If showing signs of damage or wear, they shall be changed as soon as possible (corrective maintenance).

3. Stakes

3.1 Check pulley stakes are vertical, solid and the alignment and spacing are correct. All wires shall be clear of the ground and any other equipment.

3.2 Check pulley wheels are correctly secured to the stakes by the designed fastenings and are free from damage. Check each pulley rotates freely. Pulley wheels shall not be lubricated unless using a dry film lubricate.

3.3 Examine all wire runs to check no signal wire comes into contact with the running rails or conductor rails. Wires shall not normally come into contact with the rails; plastic rail clips shall be fitted where required.

4. Benches and Timbers

4.1 Examine the benches and timbers on which the wheels and cranks are mounted. Check they are secure and free from damage and deterioration.

5. Wheels

5.1 Examine the foundations of the wheels. In particular look for signs of movement.

5.2 Examine wheel castings for cracking, chipping and other damage.

5.3 Check all pins and split pins.

5.4 Check nipples are clear and unblocked, and then sparingly lubricate the wheels with lithium-based grease. Oil may be required in place of grease. Lubricate with dry film lubrication if no grease nipple is provided.

During the winter period, the use of an anti-frost type lubricant helps counteract the effects of freezing temperatures.

Auto lubrication can also be used as required.

5.5 Check that ‘top hats’ are fitted to oil type wheels. Report any movement or damage to wheels as corrective maintenance.

5.6 Examine all thimbles, duplex links, c clips or shackles for wear and damage.

6. Wire Cranks

6.1 Check wire cranks are not overstroked.

The outer most holes should normally be used, to allow maximum travel of the cranks. Midway position should be 30% either side of centre.

6.2 Check the foundations are secure and the pins are undamaged.

6.3 Check (if fitted) nipples are clear and unblocked, and then sparingly lubricate the centre pin and thimble pins as necessary. Lubricate with dry film lubricate or oil if no grease nipple is provided.

During the winter period, the use of an anti-frost type lubricant helps counteract the effects of freezing temperatures.

Auto lubrication can also be used as required.

7. Structure

7.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh caps / finials (etc) are secure, not damaged and free from serious corrosion.

7.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

8. Signal Fittings

8.1 Check the security of all signal fittings. Lubricate as necessary. Replace any worn components (corrective maintenance). Check that plates and legends are secure and legible.

8.2 Examine balance weight mountings and brackets.

8.3 Check the weights are secure on the arm and the correct method of fastening is employed.

8.4 Lubricate the balance weight spindle.

8.5 Check the wire / down rod and intermediate supports. Adjustable rods shall have their fastenings cleaned. Lock nuts shall be checked for tightness.

8.6 Examine ground signal castings. Look for damage and signs of fracture. All vegetation and debris shall be well clear of the balance weights.

9. Signal Arm

9.1 Clean the signal arm front and rear. If faded or damaged report as corrective maintenance.

9.2 Check that the signal arm fixing bolts are tight.

9.3 Wipe the spectacles with a clean oil free cloth. Check for damage, transparency and discolouration.

9.4 If no automatic lubricator is fitted, Check the signal arm spindle grease nipple is clean, both components shall be cleaned of all old grease or oil before being re-lubricated. Then lubricate as necessary with lithium-based grease.

9.5 Signal arm spindles can be prone to sticking if un-lubricated or over-greased.

9.6 Check when greasing the spindle, that fresh grease exudes from each end. Wipe away any excess.

Some spindles are lubricated using oil, apply just enough oil to work the arm. The spindle and arm bearing may require stripping and cleaning.

During the winter period, the use of an anti-frost type lubricant helps counteract the effects of freezing temperatures.

9.7 Check the arm spindle for wear and there is enough clearance between the lamp and the spectacle frame to allow free movement of the arm. Significant wear shall be reported as corrective maintenance.

9.8 Check and sparingly lubricate backstop buffer springs and the down rod spring. Change weak or broken springs as corrective maintenance. Dry film lubricate or an adhesive type grease can be used on the down rod spring.

9.9 Check that backboards are clean and fit for purpose, where fitted.

9.10 Check correct operation of the signal.

9.11 Check the signal returns to danger after being cleared, even if the signal lever is returned slowly into the frame.

10. Signal Arm and Slot Repeaters

10.1 Check the operation of the circuit controller, see NR/SMS/PartC/LV31 (Circuit Controllers).

Seized controllers have in the past caused signal arms to ‘stick off’.

11. Signal Lamp (Electrically Lit Filament Lamps)

11.1 Check the lamp bracket and lamp for security. Clean the glass.

11.2 Check the backlight and blinder, where fitted. The backlight shall be obscured when the arm reaches 5° from the horizontal.

11.3 Examine tail cables and terminations. Protect as necessary.

12. Signal Lamp (NRS LED Disc Unit)

12.1 Open the signal case and remove the lamp unit.

12.2 Remove the lid from the lamp unit (4 screws) and examine the unit for signs of damage.

12.3 Clean all the lenses. Use a lint free cloth and an approved cleaner.

12.4 Disconnect and remove the battery. Insert a new replacement battery and fit connector to socket.

The disposable dry battery pack used in this unit has a six-month working life. Disposal of old battery packs shall be as per current environmental policy, see NR/SMS/PartA/A14 (Environmental Issues). The connector is polarised and only fits one way.

12.5 Check that the battery wires are clear of the LEDs and that both LEDs are illuminated.

12.6 Replace the lid and secure the screw. Replace the lamp unit in the signal. Check that the larger of the two windows faces the front of the signal. Check that a satisfactory light is given from the front of the signal and (if provided) the backlight.

13. Signal Lamp (Dorman LED Universal Semaphore Unit)

These can be battery powered or fed from an external power supply.

Battery Powered Units:

13.1 Remove the existing batteries and replace with new batteries. Check that the LEDs are illuminated.

The batteries can be with the unit itself or in a separate battery box banded to the post at ground level.

13.2 The final check is to operate the signal from the controlling point and observe correct operation.

SERVICE B

14. Auto Lubricator (If Provided)

14.1 Replace the lubricator with and equivalent and set using the procedure shown in Appendix A.

14.2 Remove any excess grease from around the auto lubricator fittings.

NOTE: *Automatic lubrication systems allow a controlled flow of grease into the spindle. These units used low temperature-based lithium grease. See appendix A*

15. Signal Lamp (Electrically Lit Filament Lamps)

15.1 Replace the signal lamp(s). Check the replacement(s) is/are seated correctly and the filament is lit.

15.2 Examine the lamp holder, fittings and terminations. Protect as necessary.

15.3 Carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).

15.4 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests).

16. Signal Arm and Slot Repeaters

This task does not apply to Ex WR circuit controllers that have a linear movement.

16.1 Ask the Signaller to operate the signal arm to determine correct operation of the circuit controller, whilst observing On, Wrong and Off indications in the signal box.

16.2 Observe the movement of the circuit controller checking the bearing is free and not binding in any way. Report any circuit controller that does not have free movement as corrective maintenance.

17. Disconnection Boxes (If Provided)

17.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

17.2 Refit the lid and padlock, check both are fitted securely.

18. Final Checks and Tests

18.1 Gauge the signal arm, see NR/SMS/PartC/SG00 (Signals : General).

18.2 The final check is to operate the signal from the controlling point and observe correct operation.

PERIODIC TASKS 1

19. Signal Lamp (Dorman LED Universal Semaphore Unit – high intensity lamp)

19.1 Replace the entire lamp unit with a new (or serviced) unit.

19.2 Check that a satisfactory light is given from the front of the signal and (if provided) the backlight.

PERIODIC TASKS 2

20. Signal Lamp (NRS LED Disc Unit and Dorman LED Universal Semaphore Unit – low intensity lamp)

20.1 Replace the entire lamp unit with a new (or serviced) unit. On the NRS LED Disc Unit the larger of the two windows shall face the front of the signal.

20.2 Check that a satisfactory light is given from the front of the signal and (if provided) the backlight.

APPENDIX A - Automatic Lubrication systems

The Simalube automatic lubricator system is for use on mechanical signal grease points.

For signal spindles, a configuration dependent on the number of grease points is required.

Single lubrication points require 1 x 30ml unit, other configurations require a 15ml lubricator for each lubrication point.

Crank boss lubrication points require a 30ml unit whilst connecting pins require a 15ml unit.

Care should be taken to fill lubricant voids within fittings prior to installation of the lubricator.

Remove the green cap from the lubricator base and connect to the fitting as shown below.

The lubricator timer should be set to 12 by inserting the Allen key into the top of the lubricator and rotating it number to align with the arrow on the outer edge of the timer unit.

NOTE: *Setting 12 will give 1 year of lubrication. Lubricant level may be monitored via the viewing window.*

Figure 1 – Auto Lubrication Delivery systems

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG13		
Electro-Mechanical Banner Repeater Signal		
Issue No: 07	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Electro-mechanical banner repeater signals
Excludes:	LED Banner repeater signals, Banner repeater signals using Quartz Halogen lamps with fiber optic systems

SERVICE A

1. General Structure Inspection

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

1.2 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.3 If applicable visually inspect cables suspended from the structures above overhead line equipment.

AC Traction Areas

1.4 Check the structure bond is in place and secure.

1.5 Examine the tail cables for chafing, condition of glands.

1.6 Check signal identification plates. Check that they are correctly aligned, clean, and legible.

1.7 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

2. Signal Head: External Inspection

2.1 Examine signal head assembly, including:

a) Assembly casting and fixings.

b) Front glass. Wipe as necessary. The arm shall be clearly visible through the glass.

c) Front glass fixings.

d) Visible parts of banner arm and connections.

e) Condition of rear white face. If the interior is degraded or damaged, this should be reported to your SM(S).

2.2 Observe correct operation, where practicable.

2.3 Remove rear access cover and examine lamp holder, signal lamp, and terminations.

2.4 Carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).

2.5 Replace and secure cover, lubricate thumbscrews and padlocks.

SERVICE B

3. Signal Operating Mechanism

3.1 Remove the cover plate and examine castings, fixings and water seal.

3.2 Check interior of casting and remove accumulated moisture and debris. Replace seal if moisture ingress if found.

3.3 Examine terminal block, internal cabling, wiring and cable terminations. Look for wire contamination, degradation, and risk of short circuit against metal parts. Clean and protect terminations as necessary.

3.4 Examine operating solenoid assembly (coils, rockers, terminations, pivots, balance weights, and fixings).

Look particularly for signs of overheating and excessive rubbing, which can result in the banner jamming in one position.

Report any such signs as corrective maintenance. The solenoid assembly shall only be renewed in a workshop environment.

3.5 Examine contact assemblies, including:

a) Spindle bearings.

b) Operating cams.

c) Fixing screws and set screws.

d) Contact springs and contact faces. Clean using a lint free cloth moistened with an approved cleaner.

e) Wiring and terminations.

3.6 Examine connection to banner arm assembly, including:

a) Connection to spindle.

b) Top and bottom lock nuts on screw thread.

3.7 Observe correct operation, where practicable. Movement shall be smooth and all components secure.

4. Banner Signal Assembly

4.1 Examine banner arm assembly, pivot and connections.

4.2 Lubricate the centre pivot with a few drops of mineral oil.

4.3 Where necessary, remove front glass and clean the glass interior, rear face and remove accumulated debris. Examine the water seal. Replace if damaged.

4.4 Examine wiring to lamp holder.

5. Signal Lamp

5.1 Replace the signal lamp(s). Check that the replacement(s) is/are seated correctly, and the filament(s) is/are lit.

5.2 Examine the lamp holder(s), fittings, and terminations. Protect as necessary.

5.3 Carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests).

5.4 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests).

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, heck they are fitted securely.

7. Final Checks and Tests

7.1 Test the ‘arm proving’ circuit, by operation of the signal to the ON and OFF positions, where practicable.

7.2 Replace all covers, without trapping any wires. Secure and Lubricate fixing bolts and thumb screws.

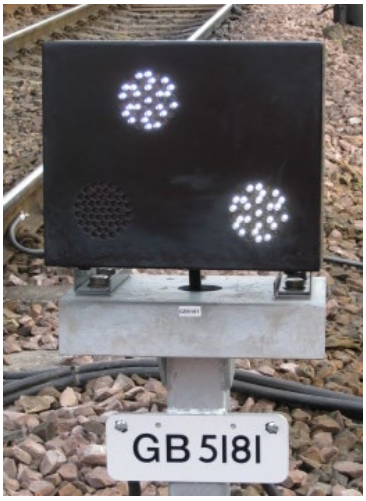
7.3 Observe correct operation of the signal.

END

Includes:	Position Light Signals (all types – filament lamp, fibre optic, and LED) independent (ground or post mounted) or in association with a main colour light signal (subsidiary) PoSA Proceed on Sight Authority
Excludes:	Position Light signals which are integrated into Dorman iLS and iLS (Modular) signals. Position Light Junction Indicators

Examples of Types of Position Light signals

Dorman - PLS



VMS - PLS

Filament - PLS

Figure 1 - Types of Position Light signals

The acronym PLS is used to describe Position Light Signals.

Not all the tasks are applicable to all PLSs; only undertake tasks relevant to the PLS type you are working on. If you are in doubt, ask your SM(S).

When the PLS is configured to act as a PoSA signal the signal shall be tested in both the steady and flashing state.

SERVICE A

1. Signal Mountings (all types)

Independent Ground Mounted PLS

1.1 Check that the signal mounting fitment is secure in the ground and undamaged.

1.2 Check that the signal is securely fixed to the mounting.

Independent Post Mounted PLS

1.3 Check the post and ladder are secure, not damaged, and free from serious corrosion.

1.4 Check that the signal is securely fixed to the post.

Subsidiary PLS

1.5 Check that the signal is securely fixed to the post.

2. General Signal Inspection (ground and post mounted)

2.1 Check that the signal aspects are clearly visible, have an uninterrupted view from the sighting distance and are not open to any misinterpretation.

The generic distance at which an independent or a subsidiary signal PLS should be visible is 100m or the length of the line, whichever is shorter.

3. Signal Heads (all types)

3.1 Check the signal head, lenses, hoods, and if provided anti-vandal guards.

3.2 Check all exterior lenses or SLMs are clean, not damaged or distorted, are correctly aligned and not obstructed. Report any permanent damage or discolouration as corrective maintenance.

3.3 Check the PLS identification plate. These shall be secure, correctly aligned, clean, legible, and display the correct number. Subsidiary PLS's do not have a separate number.

3.4 On subsidiary PLS's, check that there is no backlight, or it has been blanked off. Independent filament lamp PLS's might have a backlight, LED versions do not.

3.5 Open the door and check the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Doors on filament lamp heads shall not be opened if there is a train approaching as the driver might get a phantom aspect.

3.6 Check that the seals on the door(s) are effective.

3.7 Check that any ventilation slots in the rear of the head are clear of obstructions.

4. Fibre Optic Heads

4.1 Examine the Quartz Halogen lamp and reflector assembly for signs of blackening or deterioration. Replace the lamp if the glass envelope shows signs of blackening and replace the reflector assembly if bright white light can be seen from behind it.

4.2 Where first filament failure is not monitored and the next inspection is more than six months after the last lamp change, renew all the lamps.

4.3 Observe that the standing aspect illuminates correctly.

If practicable, arrange with the Signaller to illuminate the proceed aspect. Any inconsistencies in illumination could be caused by misaligned fibre optics, advise your SM(S).

4.4 Report any permanent damage or discolouration.

SERVICE B

5. Signal Heads (All Types)

5.1 Open the doors or covers. Examine the units and weatherproof seals.

5.2 Dust and clean the interior. Terminal boxes on LED PLS's should not be opened.

5.3 Examine the following items, as applicable:

a) Internal fixings, bolts, and setscrews.

b) Signal light modules.

c) Internal lenses, glasses reflectors and filters.

d) Polish with a clean, dry cloth (not Quartz Halogen lamp reflectors).

e) Cable entries and cable glands. Including fibre optic cables and associated clamps.

f) Internal wires and cable cores. These shall be correctly routed, secured, and terminated.

g) Exposed termination blocks. Clean and protect as necessary.

h) Lamp holders. A dentist mirror is useful for checking the condition of lamp holder springs.

i) The fibre optic cables shall be securely fitted to the lamp holder assembly in the control box and that the colour coding is correct.

5.4 Record cards should be kept in a safe location.

Filament Style Lamps

5.5 Replace the normally illuminated lamps, check that the replacements are seated correctly and are illuminated.

It is advisable to use a clean paper tissue or clean cloth to handle the replacement lamp to avoid contaminating the glass envelope.

5.6 If practicable, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) on all aspects (stop and proceed). Record any aspect not tested on the record card and on your work order.

LED Modules

5.7 Test and record the supply voltage to the SLM, on the outgoing links in the location. Record any aspect not tested on the record card and on your work order.

All Types

5.8 If practicable and as provided, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all aspects.

5.9 Check in the immediate vicinity of the signal for any preventable sources of vibration. Report any found to your SM(S).

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Final Checks

7.1 Check that all covers, doors, and padlocks are securely refitted. Lubricate hinges and padlocks.

7.2 Check that the aspects are showing their normal (standing) aspect on completion of maintenance. If you are in any doubt, ask your SM(S).

PERIODIC TASK

8. SLM Modules

8.1 As required, replace SLM module(s).

8.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules

SERVICE R2

Includes:	Dorman PLS
Excludes:	All other types of PLS

9. General

NOTE: *Removal of the cover to gain access to the cable terminations is NOT required for any of the following tasks.*

9.1 Clean the signal lens, check the front aperture is not damaged, distorted or obstructed.

Report any damage or discolouration.

9.2 Clean the signal ID plate and check for damage, fading, security and correct alignment.

9.3 Check all other signs are displaying correct signal number and type.

9.4 Wipe all signs.

9.5 Check signal structure including - post, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective meshing, hoods, (etc.). For signs of serious corrosion before using.

9.6 Check for loose or damaged fittings.

9.7 Check for obvious hazards.

9.8 Check for the security of traction bonding (where fitted).

9.9 Check for effectiveness of signal and indicator door locking mechanisms.

9.10 Check the Signal head, lens hoods, backgrounds, and if provided anti-vandal guards.

9.11 Examine the SLM for deterioration and moisture ingress.

NOTE: *Dorman signal heads are not designed to be watertight.*

9.12 Examine the cable entries and glands, plug couplers and visible cable within the signal head.

9.13 Test and record the supply voltage to the SLM, on the outgoing links in the location

9.14 Report any problems that cannot be immediately rectified.

9.15 When informing the Signaller that you have completed the work on a signal, check the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG15		
Position Light Junction Indicator		
Issue No: 07	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Position Light Junction Indicators (Filament, Light Engine and LED)
Excludes:	VMS and Dorman iLS PLJI and all other Position Light Indicators

Equipment Identification

Figure 1 - Filament / Light Engine Type

Figure 2 - LED Type

The acronym PLJI is used to describe Position Light Junction Indicators.

See NR/SMS/PartC/SG00 (Signals: General) for more details on colour light signals, including signal sighting, lenses, and handling Quartz Halogen lamps.

Not all the tasks are applicable to all PLJI, only undertake tasks relevant to the type you are working on. If you are in doubt, ask your SM(S).

SERVICE A

1. Signal Structure (all types)

1.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

1.3 Check that the signal is securely fixed to its mounting point.

2. General Signal Inspection

2.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

3. Signal Heads (all types)

3.1 Check the signal head, lenses, hoods, and if provided anti-vandal guards.

3.2 Check all exterior lenses or SLMs are clean, not damaged or distorted, are correctly aligned and not obstructed. Report any permanent damage or discolouration as corrective maintenance.

3.3 Open the door and check the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Doors on lamp heads shall not be opened if there is a train approaching as the driver can get a phantom aspect.

3.4 Check that any ventilation slots in the rear of the head are clear of obstructions.

SERVICE B

4. Signal Heads (All Types)

4.1 Open the doors or covers. Examine the units and weatherproof seals.

4.2 Dust and clean the interior.

Terminal boxes on LED JPLI's should not be opened.

4.3 Examine the following items, as applicable:

a) Internal fixings, bolts, and setscrews.

b) Signal light modules (If fitted).

c) Internal lenses, glasses reflectors and filters. Polish with a clean, dry cloth (not Quartz Halogen lamp reflectors).

d) Cable entries and cable glands. Including fibre optic cables and associated clamps.

e) Internal wires and cable cores. These shall be correctly routed, secured, and terminated.

f) Exposed termination blocks. Clean and protect as necessary.

g) Lamp holders (if fitted). Inspect lamp holder springs for pitting and signs of damage.

h) Record cards should be completed.

Filament Style Lamps

4.4 If practicable, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) for all routes. Record any route not tested on the record card and on your work order.

LED Modules

4.5 Test and record the supply voltage to the SLM, on the outgoing links in the location. Record any aspect not tested on the record card and on your work order.

All Types

4.6 If practicable and as provided carry out, NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all aspects.

4.7 Check in the immediate vicinity of the signal for any preventable sources of vibration. Report any found to your SM(S).

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Final Checks

6.1 Check that all covers, doors, and padlocks are securely refitted. Lubricate hinges and padlocks.

PERIODIC TASK 1

7. LED Light Engine Replacement

7.1 Replace LED Light Engine module(s).

SMTH testing is required when replacing a LED Light Engine Module

7.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

PERIODIC TASK 2

8. SLM Modules

8.1 Replace SLM module(s).

8.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

Reliability – Centred Maintenance

SERVICE R1

Includes:	Dorman - Position Light Junction Indicators
Excludes:	Signals in dirty or hostile environments

9. Exterior

9.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

9.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

9.3 Check exterior lenses or glass fronts for damage, distortion or obstruction and clean as required.

9.4 Check exterior lenses are correctly aligned.

9.5 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

10. Signal Proving

All Types

10.1 If practicable and as provided, NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all aspects.

SERVICE R2

Includes:	Position Light Junction Indicators fitted with Light Engines
Excludes:	Signals in dirty or hostile environments

The resistor on the back of the LED lamp unit can become very hot, caution should be used when working near these units.

Figure 3 – LED Lamp Unit

11. Signal Head

11.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

11.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

11.3 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

11.4 Check the exterior lenses for damage, distortion or obstruction. Report any damage or discolouration of lenses.

11.5 Clean exterior lenses. For polycarbonate lenses use an approved cleaner.

11.6 Check each lenses 'Hot Strips' is correctly aligned.

11.7 Check the interior of signal head for deterioration, water ingress or contamination.

11.8 Clean and examine the interior of signal head including lenses.

11.9 Examine all internal electrical components and terminations for security and corrosion.

11.10 Protect terminals as necessary.

11.11 Check signal head ventilation is effective.

11.12 Check the door seals are effective.

11.13 Examine the condition of lamp contact springs for pitting.

11.14 Examine cable entries, glands and clamps.

12. Test

12.1 Where practicable carry out the following: Test the lamp proving for each aspect by disconnecting them using the 'Faston' connection (if fitted).

For non-SSI areas

12.2 Check the GECR or similarly named lamp proving relay de-energises.

12.3 Check the GECR relay re-picks when lamp reconnected.

For SSI areas

12.4 Check with the Signaller that a lamp out alarm was received.

For all areas

12.5 Check and record the signal lamp voltages for, where practicable, as many aspects as possible. Details of the voltage range can be found in NR/SMS/PartZ/Z01 Signal – Reference Values.

12.6 Any problems that cannot be immediately rectified should be reported to your SM(S).

12.7 When informing the Signaller that you have completed the work on a signal, check the signal is displaying the correct aspect and that it corresponds to the signal box indications. This is especially important when any signalling equipment has been operated by means other than a train.

SERVICE R3

Includes:	Position Light Junction Indicator - 8000 hr lamps
Excludes:	Signals in dirty or hostile environments, and other filament lamps

Doors on filament lamp heads shall not be opened if there is a train approaching. Also, care shall be taken when working at night with the use of hand/head torches as either might lead to the driver getting a phantom aspect.

13. Signal Head

13.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

13.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

13.3 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check).

13.4 Check the exterior lenses for damage, distortion or obstruction.

13.5 Check the exterior lenses have correctly aligned 'Hot Strips'.

13.6 Check interior of signal head for deterioration, water ingress or contamination.

13.7 Confirm that any signal head ventilation is effective.

13.8 Check that door seals are effective.

13.9 Clean and examine the exterior lenses, if they are polycarbonate use an approved cleaner.

13.10 Clean the interior of signal head, including lenses.

13.11 Clean and examine all internal electrical components and terminations for security and corrosion.

13.12 Protect terminations as required.

13.13 Examine the condition of lamp contact springs for pitting (using dentist mirror).

13.14 Examine cable entries, glands and clamps for damage.

14. Testing

Where practicable carry out the following tests, after liaising with the Signaller.

14.1 Remove the lit lamp from its holder.

In Non-SSI areas

14.2 Check the GECR (or similarly named proving relay), de-energises.

14.3 Replace the lamp and check the relay re-picks.

For SSI areas

14.4 Check with Signaller that a lamp out alarm was received.

For all areas

14.5 Test and record the main filament voltage for all aspects.

14.6 Adjust, if necessary, in line with NR/SMS/PartZ/Z01 Signal – Reference Values.

14.7 Check for 0v on auxiliary filaments with main filament illuminated.

14.8 Check auxiliary filaments voltage for all aspects by disconnecting each aspect main filament in turn using 'Faston' connection if fitted.

14.9 Check that the main filament is extinguished and auxiliary filament illuminated when the main filaments are disconnected.

14.10 Report any damage or discolouration of lenses as corrective maintenance.

14.11 Report any problems that cannot be immediately rectified.

When informing the Signaller that you have completed the work on a signal, check that the signal is displaying the correct aspect and that it corresponds to the signal box indications. This is especially important when any signalling equipment has been operated by means other than a train.

END

Includes:	Filament/Fibre Optic Style SARI and MARI Alphanumeric Route Indicators. Filament/Fibre Optic Style CD/RA indicators, platform 'OFF' indicators and Preliminary Route Indicators (PRIs)
Excludes:	LED MARI and SARI Route Indicators associated with Dorman iLS and VMS type signals. All other types of LED Route Indicators

Equipment Identification

Figure 1 - Filament - SARI

Figure 2 - Fibre Optic - SARI

Figure 3 - Fibre Optic - MARI

The acronym SARI is used to describe a Standard Alphanumeric Route Indicators these are sometimes called Theatre Indicators.

The acronym MARI is used to describe a Miniature Alphanumeric Route Indicators these are sometimes called Stencil Indicators.

See NR/SMS/PartC/SG00 (Signals General) for more details on colour light signals, including signal sighting, lenses, and handling Quartz Halogen lamps.

Not all the tasks are applicable to all Indicators only undertake tasks relevant to the PLS type you are working on. If you are in doubt, ask your SM(S).

Orientation of Dichroic lamps is important (e.g. Bombardier (formerly Adtranz) manufactured Fibre Optic Indicators). Incorrect orientation can lead to a wrong-side failure condition where a failed filament falls onto the filament support and short circuits the lamp proving circuit despite no indication being displayed.

SERVICE A

1. Signal Structure

1.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged, and free from serious corrosion.

1.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

1.3 Check that the indicator is securely mounted, not damaged, and free from serious corrosion.

2. General Signal Inspection

2.1 Check that the indicator is clearly visible and not open to any misinterpretation.

3. Signal Heads

3.1 Check the signal head, lenses, hoods, and if provided anti-vandal guards.

3.2 Check all exterior lenses are not damaged or distorted, are correctly aligned and not obstructed. Report any permanent damage or discolouration as corrective maintenance.

3.3 Open the door and check the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Doors on filament lamp heads shall not be opened if there is a train approaching as the driver can receive a phantom aspect.

3.4 Check that the seals on the door(s) are effective.

3.5 Check that any ventilation slots in the rear of the head are clear of obstructions.

4. Fibre Optic Indicators

4.1 Examine the Quartz Halogen lamp and reflector assembly for signs of blackening or deterioration. Replace the lamp if the glass envelope shows signs of blackening and replace the reflector assembly if bright white light can be seen from behind it.

4.2 Check that the lamp(s) are correctly installed.

When undertaking maintenance on Bombardier (formerly Adtranz) fibre optic signals and indicators, a correctly installed lamp shall have the wires protruding from the bottom of the lamp assembly.

4.3 Observe that the standing aspects illuminate correctly.

4.4 Report any permanent damage or discolouration.

SERVICE B

5. Signal Heads

5.1 Open the doors or covers. Examine the units and weatherproof seals.

5.2 Dust and clean the interior.

5.3 Examine the following items, as applicable:

a) Internal fixings, bolts, and setscrews.

b) Signal light modules.

c) Internal lenses, glasses reflectors and filters.

d) Polish with a clean, dry cloth (not Quartz Halogen lamp reflectors).

e) Cable entries and cable glands. Including fibre optic cables and associated clamps.

f) Internal wires and cable cores. These shall be correctly routed, secured, and terminated.

g) Exposed termination blocks. Clean and protect as necessary.

h) Lamp holders. A dentist mirror is useful for checking the condition of lamp holder springs. The fibre optic cables shall be securely fitted to the lamp holder assembly in the control box and that the colour coding is correct.

i) Record cards shall be completed.

Filament Style Lamps

5.4 If practicable and as required, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) on all aspects (stop & proceed). Record any aspect not tested on the record card and on your work order.

All Types

5.5 If practicable and as provided, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all aspects.

5.6 Check in the immediate vicinity of the signal for any preventable sources of vibration. Report any found to your SM(S).

6. Disconnection Boxes (If provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Final Checks

7.1 Check that all covers, doors, and padlocks are securely refitted. Lubricate hinges and padlocks.

7.2 Check that the aspects are showing their normal (standing) aspect on completion of maintenance. If you are in any doubt, ask your SM(S).

Reliability - Centred Maintenance

SERVICE R1

8. General Maintenance

8.1 Clean all signs related to the signal.

8.2 Check signs for damage.

8.3 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

8.4 If applicable visually inspect cables suspended from the structures above overhead line equipment.

8.5 Check for loose or damaged fittings.

8.6 Check for obvious hazards.

8.7 Check for the security of traction bonding (where fitted).

8.8 Check for effectiveness of signal & indicator door locking mechanisms.

8.9 Check the signal head, lens hoods, backgrounds, and if provided anti- vandal guards.

8.10 Check the front aperture is clean, not damaged, distorted or obstructed.

8.11 Report any damage or discolouration.

8.12 Clean the front aperture as necessary.

8.13 Clean the interior of the signal head.

8.14 Examine the interior of the signal head for deterioration and moisture ingress.

8.15 Examine the cable entries and glands, plug couplers and visible cable within the signal head.

8.16 Test and record the supply voltage for each lamp. Replace any Halogen lamps that are discoloured / blackened. Check that all lamp(s) are correctly installed.

When undertaking maintenance on Bombardier (formerly Adtranz) fibre optic signals and indicators, a correctly installed lamp shall have the wires protruding from the bottom of the lamp assembly.

8.17 Report any problems that cannot be immediately rectified.

8.18 Check that the indicator is clearly visible and is not open to any misinterpretation.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG17		
Alphanumeric Route Indicators – LED SARI & MARI		
Issue No: 04	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

Includes:	LED Style SARI and MARI Alphanumeric Route Indicators. LED CD/RA indicators, platform 'OFF' indicators and Preliminary Route Indicators (PRIs)
Excludes:	MARI and SARI Route Indicators associated with Dorman iLS and VMS type signals and all filament lamp and fibre optic style Route Indicator.

Equipment Identification Image

Figure 1 - LED - MARI

The acronym SARI is used to describe a Standard Alphanumeric Route Indicators these are sometimes called Theatre Indicators.

The acronym MARI is used to describe a Miniature Alphanumeric Route Indicators these are sometimes called Stencil Indicators.

Not all the tasks are applicable to all Indicators only undertake tasks relevant to the type you are working on. If you are in doubt, ask your SM(S).

SERVICE A

1. Signal Lens and Signal Plate (Dirty Environment)

1.1 Check the signal lens are clean, not damaged, distorted or obstructed.

1.2 Clean the signal lens and plate, as necessary.

Report any damage or discolouration.

2. General Signal Inspection

2.1 Check that the indicator is clearly visible and are not open to any misinterpretation.

The generic sighting distance for an indicator is 100m or the length of the line (whichever is shorter).

SERVICE R1

3. General Maintenance

3.1 Check the signal lens are clean, not damaged, distorted or obstructed.

3.2 Clean the signal lens and plate, as necessary.

Report any damage or discolouration.

3.3 Measure and record the supply voltage to the SLM for each aspect on the outgoing links in the location. If this is not possible, it shall be recorded on the card.

3.4 If practicable, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests).

3.5 Check signal structure including - post, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective meshing, hoods, (etc.). For signs of serious corrosion before using.

3.6 Check for loose or damaged fittings.

3.7 Check for obvious hazards.

3.8 Check for the security of traction bonding (where fitted).

3.9 Check for effectiveness of signal and indicator door locking mechanisms.

3.10 Check the signal head, lens hoods, backgrounds, and if provided anti-vandal guards.

3.11 Examine the cable entries and glands, plug couplers and visible cable within the signal head.

Report any problems that cannot be immediately rectified.

3.12 Check that the indicator is clearly visible and are not open to any misinterpretation.

The generic sighting distance for an indicator is 100m or the length of the line (whichever is shorter).

PERIODIC TASKS

4. SLM Modules

4.1 Replace SLM module(s).

4.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

END

Includes:	Point indicators, Departure direction points indicators, Points and Point departure indicators, Loading/unloading indicators and Internally lit signals.
Excludes:	All other Signals/ Indicators

You shall liaise with the Signaller before displacing any signal light module from its normal position to check there are no approaching trains and the possibility of a driver not being able to observe the aspect.

SERVICE A

1. General

1.1 Check from the sighting distance that the signal aspect(s) is clearly visible and not open to any misinterpretation of the displayed aspect(s).

1.2 Inform your SM(S) and ICC immediately of any actual or possible obstructions or problems to the sighting of the signal/indicator.

1.3 If provided, check the identification plate. These shall be secure, correctly aligned, clean, legible, and display the correct number.

2. Signal Heads

If applicable carry out the following:

2.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

2.2 If applicable visually inspect cables suspended from the structures above overhead line equipment

2.3 Check the indicator, lens hoods, backgrounds, and if provided anti-vandal guards.

2.4 Check all exterior lenses are clean, not damaged or distorted, are correctly aligned and not obstructed.

2.5 Polycarbonate lenses shall be cleaned using an approved cleaner. Report any permanent damage or discolouration.

2.6 Check that any ventilation slots in the rear of the head/indicator are clear of obstructions.

2.7 Check and lubricate hinges, thumbscrews and padlocks.

2.8 If provided, NR/SMS/PartB/Test/023 (Other Signal Tests) - Flasher Unit Test (Flashing Aspects).

SERVICE B

3. Signal Head

3.1 Open the access doors/plates, examine the units and weatherproof seals. Dust and clean the interior.

3.2 Dorman signal heads are not designed to be watertight therefore some moisture/water can be present.

3.3 Examine the following items as applicable:

a) Internal fixings, bolts and setscrews.

b) Internal lenses, glasses, reflectors and filters, polish with a clean, dry lint free cloth.

c) Cable entries and cable glands.

d) Internal wires and cable cores. Check that these are correctly routed, secured and terminated.

e) Exposed termination blocks. Clean and protect as necessary.

f) Relays, transformers and lamp holders. Check that transformers show no signs of corrosion; this can alter characteristics causing lamp proving to incorrectly function.

g) Spare lamps and record cards are available.

The availability of spare lamps at the signal is optional.

3.4 If provided, check the alignment from the integral sighting device.

If this task is not possible due to sighting device being obscured (e.g. painted over) it should be reported as corrective maintenance. Report immediately any actual or possible obstructions to the sighting of the signal/indicator.

3.5 If practicable and as required, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) all signal aspects (main and auxiliary) and indicators, adjust as necessary.

If practicable and as provided, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all signal aspects.

Where tests 3.4 and 3.5 are not practicable, test the available aspects. Note any aspect not tested on the record card and on your work order.

Filament Type Indicators

3.6 If practicable, test and record the lamp voltages of each indicator.

LED Type Indicators

3.7 If practicable, test and record the supply voltage to the SLM for each aspect on the outgoing links in the location. If this is not possible it should be recorded on the card.

All Types

3.8 Check and Lubricate hinges, thumbscrews and padlocks.

4. Disconnection Boxes (If Provided)

4.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit / disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock. Check they are fitted securely.

5. Final Checks

5.1 Check that all covers, doors, and padlocks are securely refitted, Lubricate hinges and padlocks.

5.2 Check that all aspects and indicators are showing their normal (standing) aspect/indication on completion of maintenance. If you are in any doubt, ask your SM(S).

PERIODIC TASKS

6. LED Modules

6.1 As required, replace SLM module(s).

6.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG19		
Banner Repeater Signal - Filament Type Head		
Issue No: 03	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Banner Repeater Signals - illuminated using standard filament lamps, 8000 hr lamps, Light Engines or Halogen lamps
Excludes:	Electro/Mechanical Banners and all other Signals

SERVICE A

1. General

1.1 Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check) on full size banner repeaters only.

2. Signal Heads

When undertaking maintenance on Bombardier fibre optic signals and indicators Check that the replacement lamp is correctly installed.

A correctly installed lamp shall have the wires protruding from the bottom of the lamp assembly.

2.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

2.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

2.3 Check all exterior lenses are clean, not damaged or distorted, are correctly aligned and not obstructed. Report any permanent damage or discolouration.

2.4 If fitted, check the Quartz Halogen lamp and reflector assembly for signs of blackening or deterioration. Replace the lamp if the glass envelope shows signs of blackening and replace the reflector assembly if bright white light can be seen from behind it.

2.5 Open the door and check the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Doors on filament lamp heads shall not be opened if there is a train approaching as the driver might get a phantom aspect.

2.6 Check that the seals on the door(s) are effective.

2.7 Check that any ventilation slots in the rear of the head/indicator are clear of obstructions.

2.8 If provided, check the alignment from the integral sighting device. Details on sighting signal are in NR/SMS/PartC/SG00 (Signals – General) If this task is not possible due to sighting device being obscured (e.g. painted over) it should be reported.

2.9 Check and Lubricate hinges, thumbscrews and padlocks.

SERVICE B

3. Signal Heads

3.1 Open the access doors/plates, examine the units and weatherproof seals. Dust and Clean the interior.

3.2 Examine the following items as applicable:

a) Internal fixings, bolts and setscrews.

b) Internal lenses, glasses, reflectors and filters, Polish with a clean, dry lint free cloth.

c) Cable entries and cable glands.

d) Internal wires and cable cores. Check that these are correctly routed, secured and terminated.

e) Exposed termination blocks. Clean and protect as necessary.

f) Relays, transformers and lamp holders. Check that transformers show no signs of corrosion; this can alter characteristics causing lamp proving to incorrectly function.

g) Spare lamps and record cards are available. The availability of spare lamps at the signal is optional.

3.3 If practicable and required, carry out NR/SMS/PartB/Test/021 (Filament Signal Lamp Tests) all signal aspects, adjust as necessary.

If practicable and if provided, carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) all signal aspects.

4. Disconnection Boxes (If Provided)

4.1 Remove the lid and Check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock. Check they are fitted securely.

5. Final Checks

5.1 Check that all covers, doors, and padlocks are securely refitted, Lubricate hinges and padlocks.

5.2 When informing the Signaller that you have completed the work on a Signal, take care to check that the signal is displaying the correct aspect and that it corresponds to the signal box indications. This is especially important when any signalling equipment has been operated by means other than a train.

PERIODIC TASKS

6. Light Engines

6.1 Replace all Light Engines.

6.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

Reliability – Centred Maintenance

SERVICE R1

Includes:	Banner Repeater Signals- illuminated using 8000 hr lamps with full lamp proving.
Excludes:	Banner Repeater Signals in Dirty or hostile environments, and other filament lamps.

Doors on filament lamp heads shall not be opened if there is a train approaching, also care shall be taken when working at night with the use of hand / head torches as either might lead to the driver getting a phantom aspect.

7. Signal Head

7.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

7.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

7.3 Check the exterior lenses for damage, distortion or obstructed, carry out NR/SMS/PartB/Test/302 (Signal Visibility Check) on full size banner repeaters only.

7.4 Check interior of signal head for deterioration, water ingress or contamination.

7.5 Any signal head ventilation is effective.

7.6 Door seals are effective.

7.7 Clean and examine the exterior lenses, if they are polycarbonate use an approved cleaner.

7.8 Clean the interior of signal head, including lenses.

7.9 Clean and examine all internal electrical components & terminations for security & corrosion.

7.10 Protect terminations as required.

7.11 Examine the condition of lamp contact springs for pitting (using dentist mirror).

7.12 Examine cable entries, glands & clamps for damage.

8. Testing

Where practicable, to carry out the following tests, after liaising with the Signaller.

8.1 Remove the lit lamp from its holder.

In Non-SSI areas

8.2 Check the GECR or similarly names proving relay de-energises.

8.3 Replace the lamp and check the relay re-picks.

For SSI areas

8.4 Check with Signaller that a lamp out alarm was received.

For all areas

8.5 Test and record the voltages for all aspects. Adjust, if necessary, in line with NR/SMS/PartZ/Z01 (Signal – Reference Values).

8.6 If fitted check auxiliary filaments / lamp voltage for all aspects by disconnecting each aspect main filament in turn using 'Faston' connection if fitted.

8.7 If fitted check that the main filament /lamp is extinguished & auxiliary filament /lamp illuminates when the main filament / lamp is disconnected.

Report any damage or discolouration of lenses as corrective maintenance.

8.8 Report any problems that cannot be immediately rectified.

When informing the Signaller that you have completed the work on a Signal, check that the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

SERVICE R2

Includes:	Banner Repeater Signals - illuminated using Light Engines with full lamp proving.
Excludes:	Banner Repeater Signals in Dirty or hostile environments, and filament lamps.

The resistor on the back of the LED lamp unit can become very hot, caution should be used when working near these units.

Figure 1 – LED Lamp

9. Signal Head

9.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

9.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

9.3 Check the exterior lenses for damage, distortion or obstructed. Report any damage or discolouration of lenses, Carry out NR/SMS/PartB/Test/302 (Signal Visibility Check)on full size banner repeaters only.

9.4 Clean exterior lenses. For polycarbonate lenses use an approved cleaner.

9.5 Check the interior of signal head for deterioration, water ingress or contamination.

9.6 Clean and examine the interior of signal head including lenses.

9.7 Examine all internal electrical components & terminations for security & corrosion.

9.8 Protect terminals as necessary.

9.9 Check signal head ventilation is effective.

9.10 Check the door seals are effective.

9.11 Examine the condition of lamp contact springs for pitting.

9.12 Examine cable entries, glands & clamps.

10. Test

Contact the Signaller for permission before starting tests.

10.1 Where practicable carry out the following: Test the lamp proving for each aspect by disconnecting them using the 'Faston' connection (if fitted).

For non-SSI areas

10.2 Check the GECR or similarly named lamp proving relay de-energises.

10.3 Check the GECR relay re-picks when lamp reconnected.

For SSI areas

Check with the Signaller that a lamp out alarm was received.

For all areas

10.4 Check and record the signal lamp voltages for both indications where practicable. Details of the voltage range can be found in NR/SMS/PartZ/Z01 (Signal – Reference Values).

10.5 Any problems that cannot be immediately rectified should be reported to your SM(S).

10.6 When informing the Signaller that you have completed the work on a signal, take care to check that the signal is displaying the correct aspect and that it corresponds to the signal box indications. This is especially important when any signalling equipment has been operated by means other than a train.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/SG20		
Reflective Boards and Signs		
Issue No. 07	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Reflective Distant Signal Boards, Reflective Boards associated with RETB, Externally Lit Notice, Reflective Trackside Boards associated with Level Crossings, Public Information Boards Attached to Light Units or Telephones at Level Crossings, ETD telephone number signs on signal with limited clearance, 'STOP' & STOP and Await Instruction etc. signs, 'Limit of Shunt' Signs, AWS Gap Signs, White Diamond Signs, Signal Countdown Markers, Radio channel change boards for CSR, GSMR and NRN, Fouling point markers in RETB areas.
Exclude:	TSR and PSR boards , other Trackside Information Boards

For more information on reflective boards and signs, see NR/SMS/SG00.
This SMS can be used generically for preventative maintenance of signs not directly related to signalling with authority, from the responsible Local Manager/ Engineer.

SERVICE A

1. General Inspection

1.1 Check that the post(s), brackets, fittings, supports, etc. are not corroded and securely fixed in the ground.

1.2 Repair or report any structures that are corroded or not securely fixed in the ground as corrective maintenance.

1.3 Check that the sign is clean and the legend is legible. Clean as necessary with a non- abrasive cleaner.

1.4 Report any signs that have faded or have been damaged rendering the legend unreadable as corrective maintenance.

Public information signs in Wales are required to be bi-lingual (Welsh & English).

1.5 Check on externally lit signs that the lighting works.

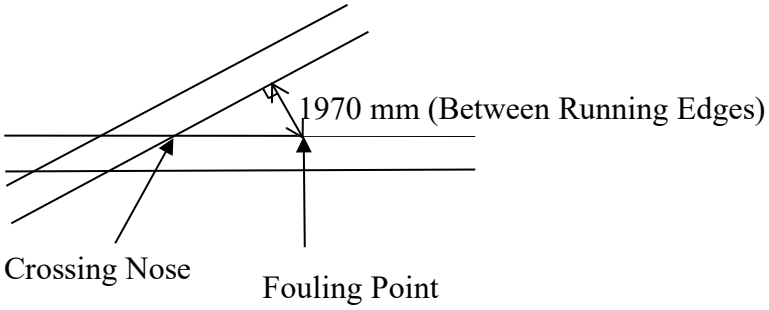
1.6 On signs that are not externally lit, check that the sign is of the correct retro-reflective material.

1.7 Report any defects with the external lighting to the appropriate responsible party.

1.8 Check that the sighting of the sign is not obscured by encroaching vegetation. Cut back as required, if this is not possible on the day report as corrective maintenance.

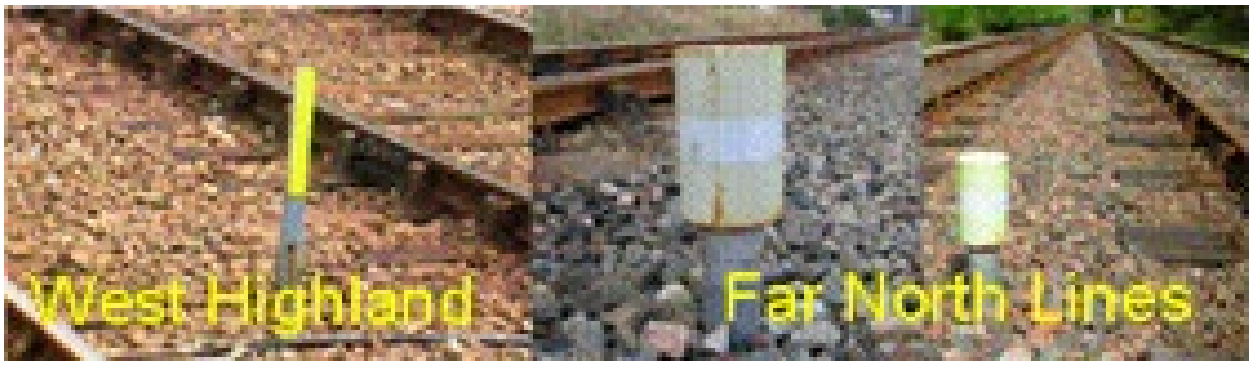
2. Fouling point Markers:

This is a position a short distance away from the point of running line divergence (crossing nose) as shown below.



2.1 Check the distance between running edges of the two rails is 1970mm, measured at right angles from the diverging line. Report to your SM(S) if the measurement is less.

3. Fouling point Marker identification



End of Service A

Reliability – Centred Maintenance

Includes:	All signs included in SG20
Exclude:	Signs in dirty or hostile environments, signs in area prone to vandalism,signs prone to vegetation overgrowth, signs that are in poor condition (e.g. rusted mounting post/fixing or unstable ground), external lit signs if the lighting source is considered likely to fail in lease than a year, TSR and PSR boards and other Trackside Information Boards

Service RA: Carry out service A of this SMS

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG21		
Signal Lens - Clean		
Issue No: 03	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

Includes:	All signal types

PERIODIC TASK

1. General

1.1 Clean the signal lens or lenses and signal ID plate(s).

1.2 Check that the visibility of the signal is not at risk of becoming obstructed by encroaching vegetation. Cut back as required where it is safe to do so, or report as corrective maintenance.

END

Includes:	Banner Repeater Signal - LED
Excludes:	All other Signals

Figure 1 – LED Banner Signals

Provided a train is not approaching, it is possible to clean the front aperture of Dorman LED main signals from the rear by unlatching and tipping back the modules.

Support the weight of the module when tipping back. Check that cables do not get trapped when latching back into place.

SERVICE A

1. General Signal Inspection

1.1 If applicable visually check posts, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective mesh (etc) are secure, not damaged and free from serious corrosion.

1.2 If applicable visually inspect cables suspended from the structures above overhead line equipment.

AC/DC Traction Areas

1.3 Check the structure bond is in place and secure. On SMIS-W interlocking areas.

1.4 Check that the serrated nuts are fitted to confirm the earthing integrity.

1.5 Check from the sighting distance that the signal aspect(s) is clearly visible and not open to any misinterpretation of the displayed aspect(s).

1.6 Inform your SM(S) and ICC immediately of any actual or possible obstructions or problems to the sighting of the signal/indicator.

2. LED Banner Repeater Signals

2.1 Check that the front screen is clean and not damaged or distorted and not obstructed. Clean as necessary. Report any permanent damage or discolouration.

It is possible to clean the front aperture of Dorman LED banner repeater signals from the rear by unlatching and tipping back the module, support the weight of the module when tipping back.

SERVICE B

3. LED Banner Signals

3.1 Check the signal identification plate(s). These shall be secure, correctly aligned, clean, legible, and display the correct number.

3.2 Open the access door and examine the interior of the signal head for deterioration, moisture ingress, or contamination. Rectify any problems as necessary. Dust and clean the interior.

Dorman signal heads are not designed to be watertight therefore some moisture/water can be present.

3.3 Examine cable glands, cable entries and LED module(s). Close the access door.

3.4 If provided, check the alignment from the integral sighting device. If this task is not possible due to sighting device being obscured (e.g. painted over) it shall be reported.

3.5 Report immediately any actual or possible obstructions or problems to the sighting of the signal/indicator as corrective maintenance.

3.6 Test and record the supply voltage to the SLM, on the outgoing links in the location.

3.7 Check and lubricate hinges, thumbscrews and padlocks.

4. Disconnection Boxes (If Provided)

4.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit / disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

4.2 Refit the lid and (if provided) padlock. Check they are fitted securely.

5. Final Checks

5.1 Check that all covers, doors, and padlocks are securely refitted. Lubricate hinges and padlocks.

5.2 Check that all aspects and indicators are showing their normal (standing) aspect/indication on completion of maintenance. If you are in any doubt, ask your SM(S).

PERIODIC TASKS

6. LED Modules

6.1 Replace SLM module(s). The VMS Banner Repeater Signal is equivalent to an LED module.

6.2 Carry out NR/SMS/PartB/Test/022 (Signal Lamp & Light Module Proving Tests) on all replaced modules.

Reliability - Centred Maintenance

SERVICE R1

Removal of the cover to gain access to the cable terminations is NOT required for any of the following tasks.

7. LED Banner Signals

7.1 Check the signal ID plate for damage, fading, security and correct alignment.

7.2 Check all other signs is displaying correct signal number and type.

7.3 Wipe all signs.

7.4 Check for signs of serious corrosion before using signal structure including - post, brackets, fittings, supports, ladders, anti-vandal ladder guards, staging, handrails, protective meshing, hoods, (etc.).

7.5 Check for loose or damaged fittings.

7.6 Check for obvious hazards.

7.7 Check for the security of traction bonding (where fitted).

7.8 Check for effectiveness of signal and indicator door locking mechanisms.

7.9 Check the signal head, lens hoods, backgrounds, and if provided anti-vandal guards.

7.10 Check the front aperture is clean, not damaged, distorted or obstructed.

7.11 Report any damage or discolouration.

7.12 Clean the front aperture as necessary.

7.13 Clean the interior of the signal head.

7.14 Examine the interior of the signal head for deterioration and moisture ingress.

NOTE: *Dorman signal heads are not designed to be watertight.*

7.15 Examine the cable entries and glands, plug couplers and visible cable within the signal head.

7.16 Test and record the supply voltage to the SLM, on the outgoing links in the location.

7.17 Report any problems that cannot be immediately rectified.

7.18 When informing the Signaller that you have completed the work on a signal, check the signal is displaying the correct aspect and that it corresponds to the signal box indications.

This is especially important when any signalling equipment has been operated by means other than a train.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SG90		
Rock Fall Detection Apparatus - Pass of Brander		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Only the Rock Fall Detection Apparatus at Pass of Brander
Excludes:	All other Rock Fall Detection Equipment

GENERAL

This maintenance specification applies to the “stone screen” and “lever posts” Rock Fall Detection Apparatus which is designed to detect the presence of any rocks potentially fouling the line. It is situated in the Pass of Brander on the Crianlarich to Oban line.

The apparatus essentially comprises a specially adapted fence mechanically linked to semaphore signals. The signals are normally held in the “off” position but revert to danger if large boulders break the fence wires.

DEFINITIONS

Stone Screen

A system comprising a specially adapted fence mechanically linked to semaphore signals, normally held in the “off” position but designed to revert to danger if large boulders break the fence wires before falling onto or near the track.

Lever Post

Is the timber post where counterweight mechanisms detecting the tension in particular fence wires are installed. Such mechanisms are provided where wires terminate on each side of the post. The mechanisms incorporate down rods, any one of which causes the associated signal to return to danger.

Down Rod

A rod which connects the fence wire counterweight mechanism to the trigger which causes the signal to return to danger. On each side of a lever post, five such rods connect five counterweight mechanisms to one common trigger pin. To accommodate all five rods, each features a long slot at the top to allow one rod to pull the trigger pin down whilst the other rods stay in their original positions.

Perch

The position on the side of the lever post where a brass roller is held in place by the trigger balance weight lever.

Basket

An arrangement of wire netting attached to the lowermost fence wire at places where there is a depression in the ground under the fence. The netting is designed to catch small boulders which would otherwise pass undetected under the fence or deflect large boulders to break the lower wires.

SERVICE A

1. External

1.1 Obtain the Banavie Signaller's permission to undertake the following tests:

1.2 At each lever post, for the equipment on one side of the lever post:

1.3 Clean and grease all bearings, slots in the down rods and pulley wheel axles.

1.4 Examine all cotter pins and shackles; replace as necessary.

1.5 Check that the associated signal arm is in the "Off" Position.

1.6 Check there is a gap of at least 3 inches between the trigger lever pin and lower end of each slot in the five down rods. Rectify by means of adjustment to the down rod.

1.7 Taking care to avoid the trigger lever pushing the lower end of a slot in the five down rods, release the trigger balance weight lever from its perch (position of fixed brass roller attached to post). Check the signal arm drops freely and that tension in cross wire has released when the trigger balance weight arm is lifted up.

1.8 Check that the signal is now in the "On" position. Rectify as necessary by adjusting length of the cross-wire to the signal post.

1.9 With another person supporting the associated signal arm in the "Off" position, restore the trigger mechanism to its perch.

1.10 Check that with the trigger on its perch, the signal arm is now in the "Off" position.

1.11 Repeat all the above for the equipment on opposite side of the lever post.

SERVICE B

2. External

2.1 On each lever post, carry out NR/SMS/PartC/SG12 (Semaphore Signals). Pay particular attention to inspecting the condition of the posts where they enter the ground.

2.2 Check the full length of the stone screen for condition and integrity of the ten detection wires. Confirm that each wire runs through the correct pulley wheels and that joints are positioned approximately halfway between stakes.

In addition, inspect the condition of the stakes together with their pulley wheels and check the integrity and positioning of the wire mesh baskets which deflect boulders up to the detection wires.

Components which require renewal shall be reported in writing to the SM(S).

2.3 Minor repairs shall be carried out during this service as far as practicable.

2.4 If access to the lever posts or stone screen is seriously impeded by vegetation, report it to the SM(S).

END

Includes:	Machine manufactured by British Power Railway Signal Co, General Railway Signal Co, Siemens & General Electric Railway Signal Co
Excludes:	Machine manufactured by WRSL

SERVICE A

1. General Assembly

1.1 Examine the following:

a) Mounting bracket and fixing bolts.

b) The motor shall be secure on the signal post.

c) Assembly casting.

d) Look particularly for signs of cracking.

e) Crank arm.

f) Set screw and locknut or spindle nut and split pin, whichever is applicable.

2. Motor Assembly

2.1 Examine motor holding down bolts.

2.2 Examine motor terminations. Clean and protect as necessary.

2.3 Examine retaining mechanism including all split pins.

3. Circuit Controller

3.1 Examine circuit controller fixing bolts.

3.2 Examine circuit controller, including:

a) All split pins.

b) Circuit controller shaft retaining nut and split pin.

c) Terminations. Clean and protect as necessary, except contact faces.

d) Cut-off contacts. Clean and replace cut off contacts if necessary.

4. Lubrication

4.1 Lubricate the following with mineral oil:

a) Thumbscrew threads (where applicable).

b) Oil cups on main bearing (where fitted).

c) Motor cover thumbscrews.

d) Gear train.

e) Padlock (use graphite powder).

f) Circuit controller shaft oil holes.

4.2 Apply mineral oil sparingly to motor brush holder spring arm retaining mechanism and front armature bearing.

5. Final Checks

5.1 Arrange for the signal to be operated to both ‘OFF’ and ‘ON’ positions and observe the equipment functions correctly.

SERVICE B

6. General

6.1 Scrape, wash and brush machine casting.

6.2 Remove buffer cylinder and wipe inside with an oily cloth.

7. Motor

7.1 Examine the motor commutator. Clean with lint free cloth moistened with an approved cleaner.

7.2 Examine the motor brushes. The brushes shall slide freely in their holders and seat fully on the commutator. Replace the brushes when worn level with holder.

7.3 Wipe pole face and armature of retaining coil.

8. Circuit Controller

8.1 Clean circuit controller contacts and segments with a lint free cloth moistened with an approved cleaner.

8.2 Clean interior of case and remove any moisture or excess oil.

9. Final Checks

9.1 Arrange for the signal to be operated to both ‘OFF’ and ‘ON’ positions and observe the equipment functions correctly.

END

Includes:	Machine manufactured by WRSL
Excludes:	Machine manufactured by British Power Railway Signal Co, General Railway Signal Co, Siemens & General Electric Railway Signal Co

Signal operating arms shall only be changed and set up in a workshop environment.

Further information on these machines is contained in NR/L3/SIG/19019.

SERVICE A

1. General Assembly

1.1 Examine the following:

a) Mounting bracket and fixing bolts. The motor shall be secure on the signal post.

b) Assembly casting. Look particularly for signs of cracking.

c) Crank arm.

d) Locknut or spindle nut or split pin, whichever is applicable.

2. Motor Assembly

2.1 Examine the following:

a) Motor holding down bolts.

b) Motor terminations, clean and protect as necessary.

c) All split pins on brake gear assembly.

d) Clutch coil securing bolts.

e) All split pins on motion plate assembly.

3. Lubrication

3.1 Lubricate with mineral oil:

a) Thumbscrew threads.

b) Gear wheel and brake block pivot (sparingly).

c) Oil hole below brake drum.

d) All pivot pins on the motion plate (sparingly).

e) Padlock (use graphite powder).

3.2 Apply lithium-based grease or mineral oil to rollers on main gear wheel. Check that they rotate freely.

4. Final Checks

4.1 Arrange for the signal to be operated to both 'OFF' and 'ON' positions and observe the equipment functions correctly.

SERVICE B

5. General

5.1 Scrape, wash and brush machine casting.

5.2 Refill with lithium based grease the grease cup on the main spindle bearing.

5.3 Remove buffer cylinder and wipe inside with a clean oily cloth.

5.4 Examine brake block and brake drum. Check that that the drum is clean and free from grease.

6. Motor

6.1 Examine motor commutator. Clean the motor commutator with a clean lint free cloth moistened with a suitable cleaner.

6.2 Examine motor brushes. The brushes shall slide freely in their holders and seat fully on the commutator. Replace the brushes when worn level with the brush holder.

6.3 Examine cut out contacts. Clean or replace cut out contacts if necessary. With the mechanism normal there shall be 5mm clearance between the nose on the motion plate and the cut out arm.

6.4 Examine clutch coils.

6.5 Wipe pole faces and armature of clutch coils.

6.6 Clean the interior of the case and remove any moisture or excess oil.

7. Final Checks

7.1 Arrange for the signal to be operated to both 'OFF' and 'ON' positions and observe the equipment functions correctly.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SW01		
Signalling Lockout (Staff Protection) System		
Issue No: 04	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Fixed Systems including enabling device and signs
Excludes:	Patrolman's lockout device in the Manchester area (see NR/SMS/SW03)

SERVICE A

1. Housings

1.1 Check unit is securely mounted, and the post is secure, Clean as necessary. Report any sign of structural deterioration or forced entry as corrective maintenance

1.2 Check security locks are in order.

1.3 Check door/water seal.

1.4 Remove any heavy dirt/infestation.

1.5 Check tail cables are correctly routed, secure and not damaged or degraded.

2. Operating Devices

2.1 Check internal labelling is clean and legible.

2.2 Examine switch and mounting plate.

3. Boundary Diagram / Signs

3.1 Check the local boundary diagram is secure and legible. Clean as necessary.

SERVICE B

4. Internal Check & Test

4.1 Examine switch mechanism.

4.2 Examine internal wiring and cable terminations. Clean and protect as necessary.

4.3 Where practical, test operation of the lockout function.

4.4 Confirm with Signaller that associated indications are correctly displayed.

SERVICE RE: Carry out Service A and B of this SMS.

END

Includes:	Fixed Warning Systems -Switches/ Audible Warnings, Technicians 'Call Attention' Klaxon and Staff Annunciator / Warning System
Excludes:	Portable Staff Warning Systems

Service A

1. General

1.1 Check apparatus is secure and undamaged.

1.2 Check housings, where provided.

1.3 Check tail cables are correctly routed, secure and not damaged or degraded.

1.4 Examine switches for security and damage. Apply petroleum jelly to the keyhole.

1.5 Check labels and associated notices are legible.

1.6 Check audible warning devices are secure, undamaged, and correctly aligned towards the area of protection.

1.7 Check system for correct operation (Safe tone and warning tone as appropriate) with the passage of a train.

If this is not achievable, the check shall be carried out via simulation of a train.

1.8 Observe correct operation of associated indications.

1.9 Where provided, Test operation of the signallers 'Call Attention' / Staff Warning function.

End of Service A

Reliability - Centred Maintenance

Service RA : Carry out Service A of this SMS.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SW03		
Patrolman's Lockout Device		
Issue No: 03	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

Includes:	Patrolman's lockout device in the Manchester (Ansaldo) area only
Excludes:	Portable Staff Warning Systems Any other Signalling lockout systems

SERVICE A

1. Exterior

1.1 Check the post, housing, door, door seal, lock, and hinges. Report the requirement for a replacement door seal as a corrective maintenance.

1.2 Examine the control point identification label. Clean as necessary. Report the requirement for a replacement identification label as a corrective maintenance.

1.3 Check tail cables and cable ties/clamps.

1.4 Lubricate the lock and hinges.

1.5 External Telephone (if applicable): Maintain in accordance with NR/L3/TEL/30181/011 - Maintenance of Operational Telephones.

2. Interior

2.1 Check that the Normal/Operate keyswitch is in the 'NORMAL' position.

2.2 Check that the TRAFFIC indicator is illuminated. Replace the lamp if failed as a corrective maintenance.

2.3 Examine the track diagram panel and artwork. Report the requirement for a replacement artwork as a corrective maintenance.

2.4 Examine the keyswitch, buttons, and indicators.

2.5 Wipe the diagram, keyswitch, buttons, and indicators.

3. Telephone (If Provided)

3.1 Examine the telephone, cradle, and cable.

3.2 Check that the telephone is operational.

3.3 Clean the handset.

SERVICE B

4. Internal

4.1 Examine the cables, wires, terminations. Clean and protect as necessary.

5. PLOD Key(s)

5.1 Examine the unique key(s). Report the requirement for a replacement if worn as a corrective maintenance.

6. Test

6.1 Carry out NR/SMS/PartB/Test/174 (Patrolman's Lockout Device Test).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/SW20		
Emergency Pull Cable System		
Issue No: 02	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	Pull cable at the Seven Tunnel
Excludes:	Any other pull cable system

SERVICE A

1. Pullkey Unit

1.1 Check each Pullkey unit is mounted securely on the tunnel wall.

1.2 Check the condition of the stainless steel fixings. Pay particular attention for any signs of severe corrosion.

1.3 Check the security of the catch restraint plug and socket on the base of the unit. Clean as necessary. Pay particular attention for any signs of severe corrosion.

1.4 Examine the catch restrain plug and socket for signs of moisture ingress. Lubricate sparingly using non- conductive lithium grease the joint between the plug and socket assembly.

1.5 Clean the Pullkey unit using a solvent free cleaner. Pay particular attention to the cleanliness of the two LED lenses fitted to the side of the unit and the Cats Eye reflectors fitted inside the red control knob on the front of the unit.

1.6 Check the Pullkey unit for signs of damage, rectify as necessary.

1.7 Check the two screws securing the lid of the Pullkey; Check they are tight. Check the lid for security and any signs of damage.

1.8 Check the condition of the two rubber gaiters for signs of damage and perishing. If any damage if found, replace the Pullkey unit. Do not allow any oil to come in contact with the rubber gaiters.

2. Pull Cable

2.1 Check the security and the condition of:

a) Tensioners

b) Eyelets

c) Bulldog grips

d) ‘D’ shackles

Replace any severely corroded items.

2.2 Check that the pull cable is taut. Rectify if necessary by adjusting the tensioner.

2.3 Check each section of the pull cable for any signs of damage to the outer insulation. Rectify as necessary. If the damage is severe, replace the complete section.

2.4 Examine the pigtails for any signs of damage or severe corrosion. Replace where necessary.

2.5 Examine the pigtail mounting bar that is fixed into the tunnel wall. Check that it is secure and examine for signs of severe corrosion.

3. Remote Oscillator

3.1 Check that the oscillator is secure on the tunnel wall.

3.2 Clean the outside of the unit using a solvent free cleaner.

3.3 Examine the catch restrain plug and socket. Lubricate sparingly using non-conductive lithium grease around the joint between the plug and socket assembly.

4. Pull Cable Control Unit

4.1 Dust and wipe the exterior of the cabinet using a damp cloth.

4.2 Check that the incoming cable connections are tight and secure.

4.3 Check the LCD display on the front of the cubicle. It should display that the system is normal with no active alarms

4.4 Using the Technician's line test unit check that each core in the pull cable is earth free. Record the results on the test record card.

5. Pull Cable Remote Display & Alarm Unit

These items are located at Newport PSB and Seven Tunnel Junction interlocking.

5.1 Dust and wipe the exterior of the cabinet using a damp cloth.

5.2 Check that the display is indicating system normal with no alarms.

5.3 Check that the incoming cable connections are tight and secure.

5.4 Operate the test alarm adjacent to the display. Check that the alarm sounds. Operate the switch back to the normal position and check that the alarm ceases.

5.5 Disconnect the modem transmission lines and check that the display indicates 'Link Failure' and that the audible alarm sounds.

5.6 Operate the switch to the failed position and check that the audible alarm ceases.

5.7 Re-instate the modem transmission lines and check that the display indicates system normal and that the audible alarm sounds.

5.8 Operate the switch to the normal position and check that the audible alarm ceases.

SERVICE B

6. Pull Cable

6.1 Clean the pull cable with a non-abrasive solvent free cleaner.

7. Lineside Junction Box

7.1 Open the junction box and check for signs of moisture ingress. Rectify as necessary.

7.2 Check the security of the terminations, tighten where necessary.

7.3 Clean the inside of the junction box. Do not apply any treatments/protection to the terminals as this might damage the cable.

7.4 Replace the junction box cover.

8. System Tests

8.1 Carry out NR/SMS/PartB/059 (Emergency Pull Cable System Tests).

END

1. Track Circuit Types

Track circuits prove the absence of a train; they fall basically into two types, voltage, and frequency.

Voltage track circuits work on a voltage (DC or AC) being supplied at the feed end, which is fed along the rails to energise a relay coil at the relay end. The wheels of a train short out the feed voltage, which de-energises the relay coil.

Voltage TCs are separated from each other by means of Insulated Rail Joints (IRJs). At some locations the negative rail of each individual TC are connected together, this is known as common rail bonding.

Frequency track circuits operate by using the rails as part of a tuned circuit which when resonating provides a voltage to energise a relay coil.

When the wheels of a train short the rails the characteristics of the tuned circuit are altered stopping it resonating, therefore no output voltage is supplied at the relay end, which de- energises the relay coil.

Frequency TCs are separated from each other by means of bonds. These can be a simple rail-to-rail cable in a ‘Z’ pattern or an impedance bond with its own internal electronics.

This is a basic generic description of each type; individuals have their own equipment type and characteristics.

2. Track Circuit Testing

A track circuit maintenance test is carried out as the normal test as part of scheduled maintenance.

A track circuit full test is carried out if whenever alterations to the TC configuration (this includes relaying, tail cable or jumper cable renewal, feed or relay equipment renewal, adjustments) are carried out.

Track circuit testing and the presence of Signalling staff are not required when alterations to the following OLE bonding has taken place:

a) Structure to rail bonds

b) Traction rail to rail bonds

c) Impedance bond centre plate connections (on all types of track circuits employing impedance bonds).

d) Ole along track conductors, including earth wires, return conductors and associated connections to traction rails

e) Return screening conductors and associated connections to traction rails

f) Red bonds.

Signalling staff require to be consulted prior to the following taking place:

g) Any work involving Yellow Bonds

h) Side lead connections to impedance bonds on track circuits employing these.

A full test shall also be carried out if the obtained readings on a maintenance test are significantly different from those previously obtained.

3. Drop Shunt Test

The relay operation when being shunted should be sharp and positive. The value of the drop shunt should be taken when the Track Relay front contacts are fully open or where they exist when the back contacts are just made.

Certain types of Vane Track Relays that are used on AC track circuits have a smooth continuous action; the value of the drop shunt on these shall be obtained by observing the provided indicator.

4. Power Supplies

Most transformer/rectifier (TJs) feeding track circuits output a DC voltage that is actually only rectified AC. They rely on the battery back-up supply to smooth out the supply to provide a constant DC voltage.

On TCs which have electronics in their feeds (e.g. frequency tracks) disconnecting the battery and feeding the TC from the TJ only can result in the TC failing and possible damage to the feed equipment.

If you are in doubt about the power supply arrangements feeding a TC, ask your SM(S) before disconnecting the battery from the TJ.

5. High Voltages

Capacitors store voltage, therefore even when the supply is disconnected a high voltage might still be present across the positive and negative terminals of capacitors found in feed or relay equipment of some types of track circuit. This can be checked by means of a meter.

The voltage can be discharged by use of a linesman Avo meter (or Avo 8, Avo 9) on the resistance range between the positive terminal and earth.

Warning: An electronic meter shall not be used for this task.

Alternatively, the capacitor shall be removed from the circuit by means of insulated tools and discharged by placing a short circuit across the terminals.

NOTE: *Short-circuiting a charged capacitor can result in an arc and loud bang occurring when the short is applied, PPE shall be worn.*

The short circuit method shall not be used whilst the capacitor is still connected in the circuit.

6. Ballast Resistance

Ballast conditions can severely affect ballast resistance and the correct working of a track circuit. Ideally the ballast resistance should be high which results in very little voltage loss between the feed and relay ends of a TC.

A low ballast resistance results in a high voltage loss between the feed and relay and makes the TC prone to failure.

Wet conditions or poor ballast (e.g. ballast saturated with oil, diesel, or other contaminates) reduces the ballast resistance, in these circumstances care shall be taken when adjusting the TC to get the correct balance between feed setting and optimum drop shunt.

You shall inform your SM(S) if ballast conditions prevent you from obtaining an optimum set-up for the TC.

7. Residual Voltage

Certain combinations of ballast and ground conditions can lead to a ‘battery effect’ that can allow a voltage to develop across the rails.

Under some circumstances, this voltage can exceed the pick-up voltage of the track relay and keeps the TR coil energised even when the feed voltage is removed by disconnection or shunt.

To overcome the problem a Feed End Relay is fitted to the circuit, this de-energises when the feed voltage is first shunted. This cuts the feed to the Track Repeating Relay (TPR) even if the Relay End Relay might be still energised.

8. Track Circuit Cable Testing with Clamp Current Meters

Duplication of TC tail cables was introduced to reduce the number of failures caused by open circuit or high resistance connections.

The resistance of the connections can be tested using a current clamp meter to measure the current flowing in each duplicated lead. The reading should be equal in each; a higher reading in one indicates a high resistance or a disconnection.

The clamp meter can also be used to test the connections of jumpers, galvanised bonds and other non-duplicated TC cables by observing if the current reading fluctuates when the connections of the cable/bond under test are gently disturbed.

The use of the clamp meter does not affect the operation of the track circuit.

9. Track Circuit Drop Shunt Values

The table in NR/SMS/PartZ/Z03 (Train Detection - Reference Values) lists the minimum and desired drop shunts values for specific track circuits.

The location for obtaining the shunt is also given in the individual tests.

If a poor shunt is obtained where it has not been taken across the rails, it shall be taken again across the rails. If the minimum drop shunt cannot be achieved your SM(S) shall be informed immediately.

END

Includes:	Overlay Track Circuits, Rail circuits
Excludes:	All other type of Track Circuit

General

Overlay track circuits work in conjunction with conventional track circuits; they are superimposed or 'overlaid' over the conventional one but each work independently and have no effect on each other's operation.

The main principle behind the operation of overlay TCs is that they energise a relay with the occupation of the track circuit as opposed to de-energising a track relay with a conventional track circuit.

They are used to allow equipment to be released/operated when a train is present on the track circuit (e.g. ground frame release of trainman operated barriers etc).

They are also known as rail circuits and in this type of configuration can be used without being 'overlaid' with a conventional TC.

SERVICE A

1. Inspection

On an overlay TC tasks 1.1 to 1.10 can be undertaken as part of the "A" Service of the conventional TC. On a rail circuit TC all steps are applicable.

1.1 Examine the components of each insulated joint. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced "T" pieces.

d) Burred over rails.

e) Moved sleepers or rail fastenings that could short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

1.2 Check the visible tail cables, labelling, and route between rail ends and disconnection box, location or relay room.

Cables should be routed to avoid snagging. Report any damaged or degraded tail cables as corrective maintenance.

1.3 Check that the rail connections and all fittings are intact and that the cables are secure.

1.4 If provided: Visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

1.5 Check that the fishplate bonds are not broken or disconnected. Rectify as necessary. Report as corrective maintenance.

1.6 Check that signal wires, metal services (etc) are insulated from the rails using plastic rail clips.

1.7 Check for displaced rail clips, insulations, and pads (etc) which could cause an overlay TC failure. Report as corrective maintenance.

1.8 Remove conductive debris from the vicinity of the rails. This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate.

1.9 Check for any abnormal rail surface contamination on infrequently used rails.

1.10 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect to operation of the rail circuit. Report any deterioration in condition or build up.

SERVICE B

On an overlay TC tasks 2.1 to 2.2 can be undertaken as part of the “B” service of the conventional TC. On a rail circuit TC all steps are applicable.

2. Disconnection Boxes (if Provided)

2.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

2.2 Refit the lid and (if provided) padlock, check they are fitted securely.

3. Tests

3.1 Carry out NR/SMS/PartB/Test/261 – (Overlay Track Circuit Test).

3.2 Test the continuity of overlay TC double tails using a clamp meter.

The current passing through each leg to the rails of a double tailed overlay TC shall be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

END

Includes:	DC Low Voltage tracks
Excludes:	All types of track circuit and Overlay track circuits

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/251 (DC TC Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section will only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint

1.2 Check for correct stagger between abutting track circuits.

If un-staggered carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

Any track circuits found to be un-staggered shall be reported as corrective maintenance. DC TCs shall have opposite polarities across IRJs.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location.

Cables should be routed or clipped to avoid snagging.

Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails.

Cables should not be stretched by the pipe, as these will prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided and where practicable, examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

Your SM(S) will tell you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or have been ‘tamped’ in the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

3.8 Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or has enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at Catch Points and Trap Points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (if provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out NR/SMS/PartB/Test/251 (DC TC Test) Maintenance Test.

6.2 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

6.3 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

It is recommended that on the 'B' service (If fitted) all primary cells are replaced.

To maintain reliability using this replacement frequency, the capacity of the cells used should be based on the service frequency, and the time the track circuit is in an occupied state.

There are two versions of cells which should be used:

a) AS10/1 600Ah - for low use track circuits.

b) AS10/2 1200 Ah - for heavily used track circuits.

7. Local Policy Requirement

7.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.

PERIODIC TASK 1

8. Residual Voltage Check

This check is not required if the track circuit is fitted with a feed end relay.

8.1 Carry out NR/SMS/PartB/Test/251 (Residual Voltage Check) - Clause 3.

PERIODIC TASK 2

9. Residual Voltage Bonding Check

This check shall only be carried out only if Residual Voltage is identified during NR/SMS/PartB/Test/251 (Residual Voltage Check) - Clause 3.

9.1 Check all bonding, jumpers and any other types of bonding which are duplicated.

SERVICE RA - Carry out Service A of this SMS.

SERVICE RB - Carry out Service B of this SMS.

END

Includes:	DC Medium Voltage tracks
Excludes:	All other types of track circuits

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/251 (DC Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination is dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

1.2 Check for correct stagger between abutting track circuits.

If un-staggered carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

Any track circuits found to be un-staggered shall be reported as corrective maintenance. DC TCs shall have opposite polarities across IRJs.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location.

Cables should be routed or clipped to avoid snagging.

Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails.

Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided and where practicable, examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or have been ‘tamped’ in the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

3.8 Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C).

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at Catch Points and Trap Points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out NR/SMS/PartB/Test/251 (DC TC Test) - Maintenance Test.

6.2 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

6.3 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

It is recommended that on the 'B' service (If fitted) all primary cells are replaced.

To maintain reliability using this replacement frequency, the capacity of the cells used should be based on the service frequency, and the time the track circuit is in an occupied state.

There are two versions of cells which should be used:

a) AS10/1 600Ah (cat no. 54/003198) for low use track circuits.

b) AS10/2 1200Ah (cat no. 54/003199) for heavily used track circuits.

7. Local Policy Requirement

7.1 Check the section of the NR/SMS/PartL/Index (Local Policies) for your area and carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint Test) as directed.

PERIODIC TASK 1

8. Residual Voltage Check

This check is not required if the track circuit is fitted with a feed end relay.

8.1 Carry out NR/SMS/PartB/Test/251 (Residual Voltage Check) - Clause 3.

PERIODIC TASK 2

9. Residual Voltage Bonding Check

This check should only be carried out only if Residual Voltage has been identified during NR/SMS/PartB/Test/251 (DC Track Circuit Test) - Residual Voltage Check.

9.1 Check all bonding, jumpers and any other types of bonding which are duplicated.

END

Includes:	DC Coded Track Circuits
Excludes:	All types of track circuit and Overlay track circuits

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/262 (DC Coded Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

For additional information on DC Coded tracks see SMS Appendix 12.

Track Circuit Examination

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section will only apply if IRJs are provided at one or both ends of the TC. Your SM(S) will tell you if any or all of this section is applicable to the TC you are maintaining.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced ‘T’ pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location.

Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.2 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.3 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.4 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.5 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

This section is only applicable to TCs through S&C.

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or is adequately clear.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out NR/SMS/PartB/Test/262 (DC Coded Track Circuit Test) Maintenance Test.

6.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

6.3 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

6.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

END

Includes:	All Reed versions of track circuit
Excludes:	All other types of track circuits

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/257 (Reed Type RT Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided: And where practicable, examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired immediately. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out NR/SMS/PartB/Test/257 (Reed Type RT Track Circuit Test) Maintenance Test.

6.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

6.3 If provided, Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

6.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

Reliability - Centred Maintenance

Includes:	Standard Reed type RT Track circuit, Single & Double Rail and Simple Loop RX. (Which meet the prerequisites laid down in SIG/10665)
Excludes:	High Power, High Performance & Jointless Reed Track circuits, RT compound loops and Pre type Reed RT track circuits (e.g. AEI GRS large plug in or the variant of Reed tunnel tracks). All other types of track

SERVICE RA - Carry out Service A of this SMS

SERVICE RB - Carry out Service B of this SMS

SERVICE RE

7. General Track Inspection

Traction Areas Only

7.1 Examine the negative return bonding is present and the connections are tight.

At each impedance bond, examine the aluminium tail plate is secure and check for signs of arcing.

7.2 Check the rail leads and cover are tight. Torque settings for these connections can be found in NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

For All Types

7.3 Examine the track circuit for potential causes of track circuit failure.

7.4 Check tail cables are undamaged and protected.

7.5 Confirm that signal wires, point rodding, and metal services (etc) are insulated and clear of rails.

7.6 Check rail to rail, jumper and fishplate bonds.

7.7 Assess the condition of ballast/ground conditions.

7.8 Check the condition of P.Way (Report defects).

7.9 Check for metallic objects in close proximity to track (remove where possible).

7.10 Visually check all associated IRJ's for degradation or damage.

7.11 Where fitted – examine the “Simple RX loop” for damage and security.

7.12 Check track circuit interrupters and connections are undamaged.

For Single Rail Track Circuits

7.13 Check the Stretcher bar insulations.

8. Disconnection Boxes (If Provided)

8.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

8.2 Refit the lid and (if provided) padlock, check they are fitted securely.

9. Test

9.1 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

At the Relay End

9.2 Measure and record, with a digital meter, the AC voltage on the receiver track filter (RT7202, RT7212) between terminals 11 and 12 is between 150mV to 300mV.

9.3 Measure and record the voltage across the track relay coils R1 (+) and R4 (-) is between 11.5V and 13.5V DC.

9.4 Test and record the drop shunt values, see NR/SMS/PartZ/Z03 Train Detection - Reference Values) for values.

9.5 When a track circuit bonding configuration includes ‘Parallel Bonding’. Carry out a Drop shunt at all extremities of the track circuit.

For Single Rail Track Circuits with Parallel Bonding

9.6 Carry out a 0.5ohms drop shunt at each extremity.

For All Types

9.7 Compare the results with previous readings. Where there is a significant variation investigate if necessary

9.8 Report any adjustments made, components replaced or out of specification items on a WAIF.

END

Includes:	50Hz AC Tracks
Excludes:	All other Tracks and Overlay track circuits

GENERAL

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

High voltages might be present on the terminals of capacitors.

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/260 (50Hz AC Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables shall be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these will prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings are intact and the cable secure.

2.3 If provided: And where practicable, examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances might not have to be inspected by a full walk through.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails. This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails. Poor ballast condition and build up against the rails can affect the operation of the track circuit.

Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections.

These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Vane Stop Plate Assembly Inspection (If a VT Relay is Fitted)

6.1 With the relay in the energised position (See Figure1) observe that the vane stop plate has minimal wear (grooving).

If damage of a minor nature is spotted (see as shown in Figure 2) this shall be reported to your SM(S).

If the level of damage is greater and a deep groove has been cut into the stop plate this shall be treated as defective, your SM(S) shall be advised, and arrangements made for the relay to be replaced.

Figure 1 – Vane in the Energised position

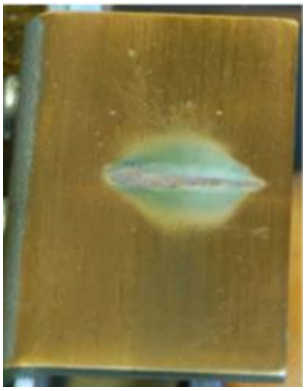


Figure 2 - Reportable Level of Damage

Figure 3 – Defective Level of Damage

7. Track Circuit Tests

7.1 Carry out NR/SMS/PartB/Test/260 (50Hz AC Track Circuit Test) Maintenance Test.

7.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

7.3 If provided, Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

7.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

Reliability - Centred Maintenance

Includes:	AC 50 Hz Track Circuit (including Single & Double rail types)
Excludes:	Track circuits that contain un-staggered IBJs, parallel bonding, isolating transformers at the relay end of a single rail TC, or more than one TC uses the same multi-core/ tail cables within the TC feed or relay arrangements

SERVICE R1

8. General Track Inspection

8.1 Check the track connections are tight.

8.2 Check the impedance bonds, rail leads & covers are tight (if fitted).

8.3 Check the aluminium plate is secure & for signs of arcing.

8.4 Check the tail cables for damage, security and suitably protected.

8.5 Check the condition of P.Way (Report defects).

8.6 Check for any metallic objects in close proximity to track (remove where possible).

8.7 Visually examine, all associated IBJs for degradation or damage.

8.8 Check the Track relay vane for smooth continuous action and that it does not vibrate (as this can indicate problems with DC traction imbalance).

8.9 Report any adjustments made, components replaced or out of specification items on a WAIF.

8.10 Measure and record the ‘Control' coil Relay voltage, (if valve has altered by more than 10% from the previous reading or there is long term trend) then investigate and report (give consideration to weather conditions).

SERVICE R2

9. Disconnection Boxes (If Provided)

9.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

9.2 Refit the lid and (if provided) padlock, check they are fitted securely.

9.3 Check tail cables for damage, security and that they are suitably protected.

9.4 Using a clamp meter, check the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

10. For VT1(SP) Track Circuits Only

10.1 Apply a train shunt set to 0 Ohms across the rails check that the track relay drops. Remove the train shunt and check that the track relay picks after a minimum delay period of 2 seconds. This proves the SP Unit is functioning correctly

11. Vane Stop Plate Assembly Inspection (If a VT Relay is Fitted)

11.1 With the relay in the energised position (See Figure1) observe that the vane stop plate has minimal wear (grooving).

If damage of a minor nature is spotted (see as shown in Figure 2) this shall be reported to your SM(S).

If the level of damage is greater and a deep groove has been cut into the stop plate this shall be treated as defective, your SM(S) shall be advised, and arrangements made for the relay to be replaced.

Figure 4 – Vane in the Energised position

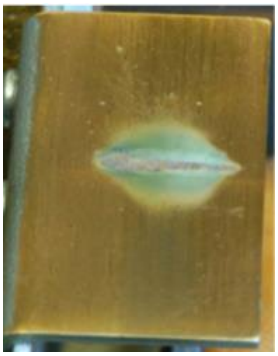


Figure 5 - Reportable Level of Damage

Figure 6 – Defective Level of Damage

12. All Track Circuit Types

12.1 Carry out Drop Shunt at Relay End and record the details on the record card.

For shunt values see NR/SMS/PartZ/Z03 (Train Detection - Reference Values).

12.2 Report any adjustments made, components replaced or out of specification items on a WAIF

12.3 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/TC09		
Track Circuits: FS2600		
Issue 01	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	FS2600 Tracks
Excludes:	All other Tracks and Overlay track circuits (See NR/SMS/TC02)

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment have occurred, then the TRACK CIRCUIT FULL TEST (259) shall be carried out in place of the maintenance test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

- The type and complexity of track layout.
- The amount of bonding.
- Jointed track or Continuous Welded Rail.
- Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

- Metal swarf or filings.
- Broken insulations.
- Broken or displaced 'T' pieces.
- Burred-over rail ends.
- Moved sleepers or rail fastenings that can short against the rail joint.
- Broken or missing bolts.
- Signs of voiding or slurry under the joint

2. Track Circuit Feed, Relay End and Intermediate Impedance Bonds (Where fitted)

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these will prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 Examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

2.5 Carry out TRACK CIRCUIT MAINTENANCE TEST (259) 1.1 to 1.6, 1.14 and 1.15

3. Throughout the Length of Each Track Circuit

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected 'yellow bonds' shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or 'tamped' into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails. This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or is sufficiently clear.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

- Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.
- Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.
- Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out TRACK CIRCUIT MAINTENANCE TEST (259).

6.2 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

End of Service B

Reliability - Centred Maintenance

Includes:	FS 2600 Track Circuits (Which meet the prerequisites)
Excludes:	All other types of track

SERVICE R1

8. General Track Inspection

8.1 Check the track connections are tight.

8.2 Check the impedance bonds, rail leads & covers are tight (if fitted).

8.3 Check the aluminium plate is secure & for signs of arcing.

8.4 Check the tail cables for damage, security and suitably protected.

8.5 Check the condition of P.Way (Report defects).

8.6 Check for any metallic objects in close proximity to track (remove where possible).

8.7 Visually examine, all associated IBJs for degradation or damage. (For examples of damage refer to SMS/PartB /Test041 clause 6)

9. Disconnection Boxes (If Provided)

9.1 Remove the lid and Check the following:

- Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.
- Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.
- Cable glands are fitted and effective.

9.2 Refit the lid and (if provided) padlock, Check they are fitted securely.

9.3 Check tail cables for damage, security and suitable protected.

10. Testing

10.1 Carry out Drop Shunt at Relay End and record the details on the record card. For shunt values refer to SMS/Part Z03

10.2 Complete 0.6 ohm shunt test at intermediate bond if fitted or relay end bond.

11. 0.6 Ohms Shunt Test

11.1 Connect the DVM to the socket using the special test lead.

11.2 Check track clear monitor point voltage.

11.3 Connect the track shunt box across the rails at the intermediate impedance bond or if at the end of track circuit section connect it at the RX bond. Set the shunt box to 0.6ohms and depress the button.

11.4 The LEDs are giving the correct track shunted indications as below.

LED	Track Clear	Track Shunted
Supply	On	On
IP A Running	Flashing	Flashing
Input – A Valid	On	Off
IP B Running	Flashing	Flashing
Input – B Valid	On	Off
Output	On	Off

LEDs Input-A Valid and Input-B Valid may not change states simultaneously when the track is shunted, a momentary delay may be observed.

11.5 Measure the track shunted monitor point voltage then release the shunt button.

Compare the results with previous records obtained under similar conditions. If the results are not similar, investigate the cause and rectify as appropriate. A FULL TEST shall then be carried out.

11.6 Check the RX unit base for silver migration.

11.7 Any adjustments made, components replaced or out of specification items should be recorded on a WAIF

12. Track Circuits Bonding in DC Traction Areas

12.1 Damaged or disconnected bonds (other than red bonds) shall be investigated and actioned appropriately.

12.2 Before traction bonding is connected, all contact surfaces should be wire brushed and a thin film of electrolytic paste applied. Bonds across rail joints should be of a low resistance as this can influence the characteristics of the track.

END

Includes:	Aster SF1 / U type Tracks
Excludes:	Digital 21, TI21, EBI 200 (formally known as TI21) and EBI 400 Track All other tracks and Overlay track circuits

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/254 (Aster SF15 / U Type Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

Earth connections shall be made/re-instated to the centre electrode of type 26A gas-discharge arresters, where these are shown to be provided in standard circuit arrangements.

Where site diagrams carry a note stating that an earth connection shall not be made, this can be disregarded, and the note should be crossed through on site diagrams and treated as Minor records Update when subsequent alterations are made Master records.

Where Type 26A gas-discharge arresters are fitted to other types of track circuit, these can be directly connected to the rail. In these cases, earth connections shall not be made.

Be aware that earth connections can inadvertently be made through the mounting screw of the holder.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced ‘T’ pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, to prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided: Check tuning units, fixings and padlocks. Lubricate padlocks. These should be secure and undamaged.

2.4 If provided: And where practicable, examine impedance bonds, fixings and connections.

2.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances might not have to be inspected by a full walk through.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected 'yellow bonds' shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or 'tamped' into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails. This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Track Circuit Feed & Relay Ends

5.1 If provided, check the condition of wiring and equipment in tuning units.

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Track Circuit Tests

7.1 Carry out NR/SMS/PartB/Test/254 (Aster SF15 / U Type Track Circuit Test) Maintenance Test.

7.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

7.3 If provided, Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

7.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TC12		
Track Circuits: HVI (High Voltage Impulse)		
Issue No: 06	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	HVI Tracks only
Excludes:	All other track circuit types

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

General

In 3rd rail DC traction areas and in dual electrified areas (3rd rail DC and AC overhead line) HVI track circuit transformer/terminal boxes (known as 'bread bins') can experience a catastrophic arcing across the terminals when the 3rd rail DC traction supply is short circuited to the 'signalling' rail. As these traction short circuits can be unpredictable (they can be caused by trains, conductive rubbish etc).

Either:

a) no preventative or corrective maintenance shall be undertaken inside the 'bread bin' with the 3rd rail DC traction current energised. The current shall be isolated for the full instant of the track circuit; or

b) alternatively remove all track leads, including any adjacent leads that are housed in the same bread bin. Measurements shall be taken on the rails.

In 3rd rail DC traction supply areas where track access can be restricted, there can be permanent 'test leads' installed from the rails to a special test box in a position of safety. In this situation the terminations in the test box may be used to obtain measurements where the test asks for readings "on the rails".

The resistance of the test leads (this is shown on the test box) shall be taken into account when obtaining measurements by this method.

This does not apply in non-electrified areas or if the traction supply is by AC overhead line only.

The tests are marked with a **#** symbol. Only the tests applicable to the traction current supply in the area of the track circuit shall be carried out. If you are unsure, ask your SM(S).

If any adjustments or renewal of equipment have occurred, then the NR/SMS/PartB/Test/255 (HVI Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

- The type and complexity of track layout.
- The amount of bonding.
- Jointed track or Continuous Welded Rail.
- Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced ‘T’ pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance, damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided: Check tuning units, fixings and padlocks. Lubricate padlocks. These should be secure and undamaged.

2.4 If provided, and where practicable, examine impedance bonds, fixings and connections.

2.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances might not have to be inspected by a full walk through.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected 'yellow bonds' shall be repaired. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or 'tamped' into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure.

3.6 Remove conductive debris from the vicinity of the rails. This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.7 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.8 Check the condition of the ballast and for any excessive build up against the rails.

3.9 Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at Catch Points and Trap Points. Refit as necessary.

SERVICE B

5. Track Circuit Feed & Relay Ends

5.1 If provided, check the condition of wiring and equipment in trackside units.

5.2 Visually examine the track relay for excessive corrosion or contamination.

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Track Circuit Tests

7.1 Carry out a 0.5 Ohms drop shunt at each extremity.

7.2 Carry out NR/SMS/PartB/Test/255 (HVI Track Circuit Test) Maintenance Test.

7.3 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

7.4 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

7.5 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

SERVICE RE

8. General Track Inspection

Traction Areas Only

8.1 Examine the negative return bonding present and connections are tight.

For All Types

8.2 Examine the track circuit for potential causes of track circuit failure.

8.3 Visually check, all associated IRJ's for degradation or damage.

8.4 Check tail cables for damage, security and protection.

8.5 Signal wires, point rodding, and metal services (etc) are insulated and clear of rails.

8.6 Check rail to rail, jumper and fishplate bonds.

8.7 Assess the condition of ballast/ground conditions.

8.8 Condition of P.Way (Report defects).

8.9 For metallic objects in close proximity to track (remove where possible).

8.10 Track circuit interrupters and connections.

For Single Rail Track Circuits

8.11 Check the stretcher bar insulations.

9. Test

9.1 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

9.2 Carry out a 0.5 Ohms drop shunt at each extremity.

9.3 Carry out NR/SMS/PartB/Test/255 (HVI Track Circuit Test) Maintenance Test.

9.4 Visually examine the track relay for excessive corrosion or contamination.

END

Includes:	Western Region Quick Release Tracks
Excludes:	All other Track Circuits

If any adjustments or renewal of equipment have occurred, then the NR/SMS/PartB/Test/256 (BR-WR Quick Release Track Circuit Test) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

- The type and complexity of track layout.
- The amount of bonding.
- Jointed track or Continuous Welded Rail.
- Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance, damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided, and where practicable, examine impedance bonds, fixings and connections.

2.4 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances might not have to be inspected by a full walk through.

Your SM(S) is responsible for advising you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.2 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.3 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure.

3.4 Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.5 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.6 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit.

Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

This section is only applicable to TCs through S&C.

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at Catch Points and Trap Points. Refit as necessary.

SERVICE B

5. Track Circuit Feed & Relay Ends

5.1 If provided, check the condition of wiring and equipment in trackside units.

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Track Circuit Tests

7.1 Carry out NR/SMS/PartB/Test/256 (BR-WR Quick Release Track Circuit Test) Maintenance Test

7.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

7.3 If provided, Carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

7.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

Reliability - Centred Maintenance

SERVICE RA - Carry out Service A of this SMS.

END

Includes:	AC Rectified (Diode) Track Circuits
Excludes:	All other types of Track Circuit.

General

If any adjustments or renewal of equipment have occurred, then the NR/SMS/PartB/Test/258 (AC Rectified Circuit Test) shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these will prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.2 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.3 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.4 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.5 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit. Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

This section is only applicable to TCs through S&C.

Your SM(S) will advise you if this section is applicable to the TC you are maintaining.

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or is there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Disconnection Boxes (If Provided)

5.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

5.2 Refit the lid and (if provided) padlock, check they are fitted securely.

6. Track Circuit Tests

6.1 Carry out NR/SMS/PartB/Test/258 (AC Rectified Circuit Test) Maintenance Test.

6.2 Carry out NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

6.3 If provided, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

6.4 Using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

END

Includes:	EBI Track 200, (Formally known as TI21) and Aster21 Audio Frequency Track Circuits
Excludes:	All other types of Track Circuit

GENERAL

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

If any adjustments or renewal of equipment has occurred, then the NR/SMS/PartB/Test/253 (EBI Track 200 (Audio Frequency) Track Circuit Test) shall be carried out in place of the Maintenance Test.

Track Circuit Examination:

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination is dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed Track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

1.1 Examine the components of each IRJ. Check for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced ‘T’ pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

2. Track Circuit Feed and Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables shall be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings are to be intact and the cable secure.

2.3 If provided: Check tuning units, fixings and padlocks. Lubricate padlocks. These shall be secure and undamaged.

2.4 If provided: And where practicable, examine impedance bonds, fixings and connections.

2.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances might not have to be inspected by a full walk through.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired immediately. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit.

Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or is clear.

4.4 Check track circuit interrupters and connections. These are usually found at Catch Points and Trap Points. Refit as necessary.

SERVICE B

5. Track Circuit Feed and Relay Ends

5.1 If provided, check the condition of wiring and equipment in tuning units.

6. Disconnection Boxes (if provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Track Circuit Tests

7.1 Carry out NR/SMS/PartB/Test/253 (EBI Track 200 (Audio Frequency) Track Circuit Test) Maintenance Test.

7.2 Carry out an NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Tests).

7.3 If provided, carry out a NR/SMS/PartB/Test/062 (Line Protection Unit Test).

7.4 If fitted, using a clamp meter, test the continuity of TC double tail cables.

The current passing through each leg to the rails of double tailed TC should be approximately equal. Any significant variation indicates a disconnection or high resistance cable.

***NOTE:** The doubling of track circuit leads has been designed out by using different specifications of cable.*

SERVICE C

This service shall only be used on track circuits that are remotely maintained.

Information on faulting procedures for all variants of the EBI Track 200 can be found in NR/SMS/Appendix/08 (General Information on the EBI 200 Audio Frequency Track Circuit Equipment).

8. Remote Maintenance

8.1 Log in to the Monitoring system and search for required asset.

8.2 Check the identity of the track circuit to be reviewed (confirm using Ellipse number) see Figure 1.

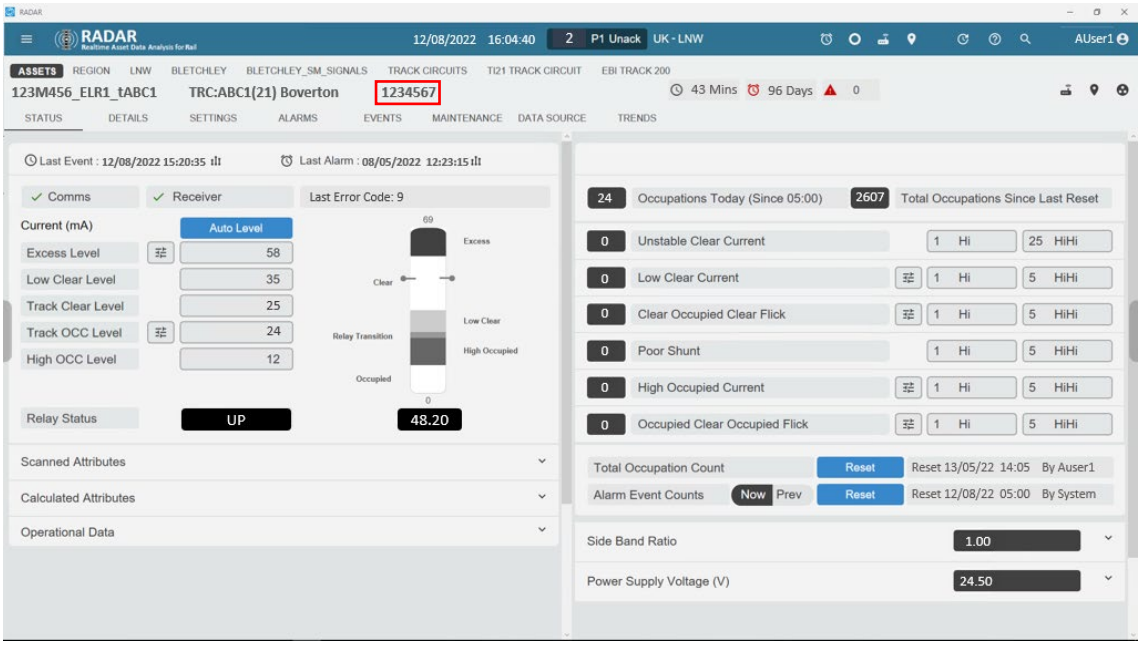


Figure 1 – Screen shot showing Ellipse number highlighted

8.3 Check that the track circuit “Last Event” is up-to-date (less than 6 hours since the last update) See Figure 2.

If the last event recorded is not up-to-date, it shall be referred to Intelligent Infrastructure monitoring staff for investigation.

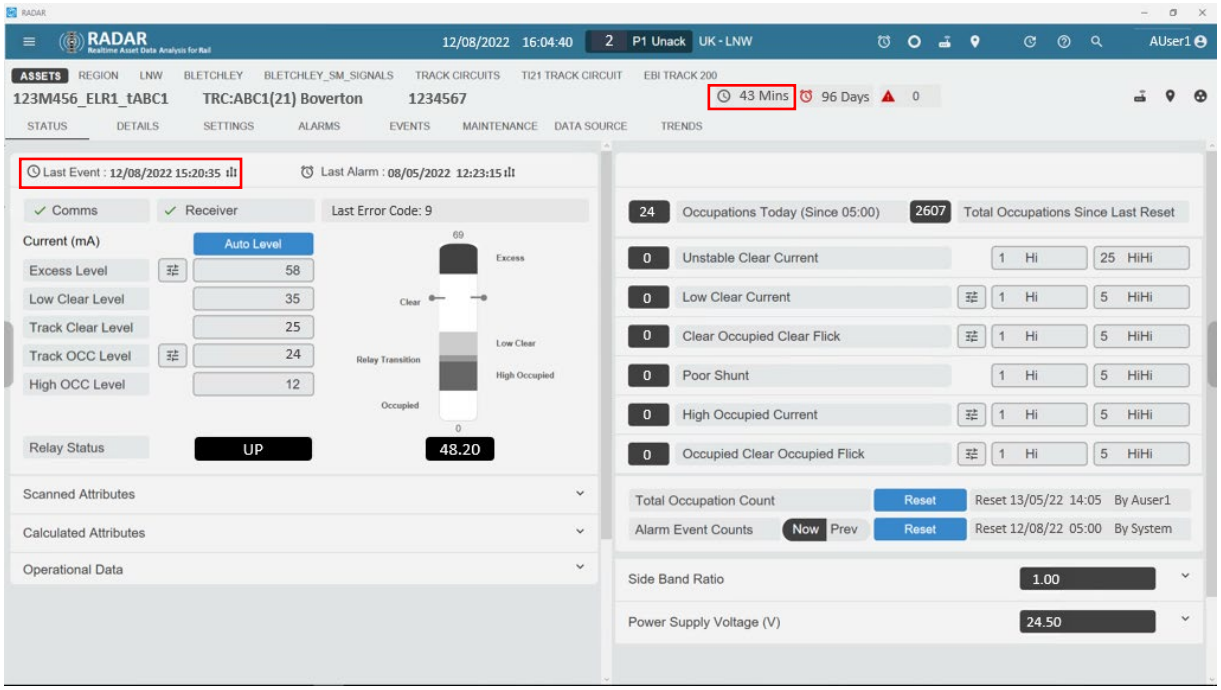


Figure 2 - Screen shot showing Current Status

8.4 If unable to acquire data after 24hrs, carry out an onsite investigation of the logging equipment.

8.5 Once the cause has been identified and rectified, restart from step 8.1.

8.6 Check that the asset monitoring is correctly set up and calibrated. See Figures 3 and 4.

If the “Channel Desc”, or the calibration levels are incorrect, this shall be referred to Intelligent Infrastructure monitoring staff for investigation.

***NOTE:** - MPEC loggers show Track Circuit ID in “Channel Desc”. CDS (VA) loggers show Key Serial Number*

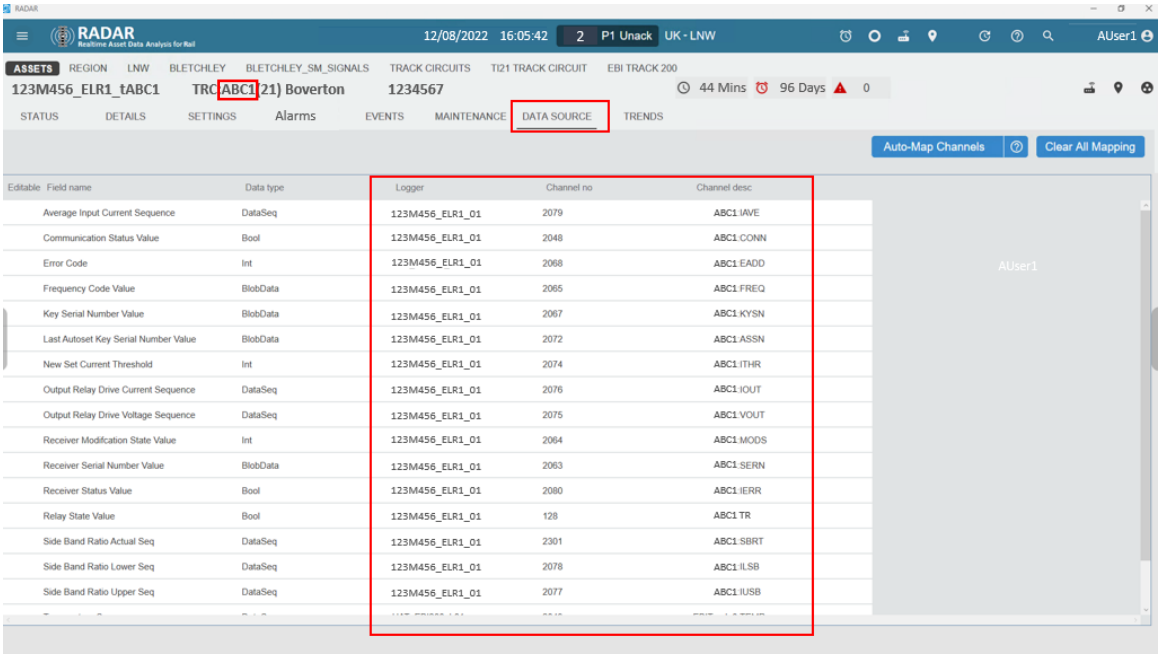


Figure 3 - Screen shot showing Setup

For further information on Calibration see NR/GI/R001 (Remote Maintenance – EBI Track 200 Calibration Guide).

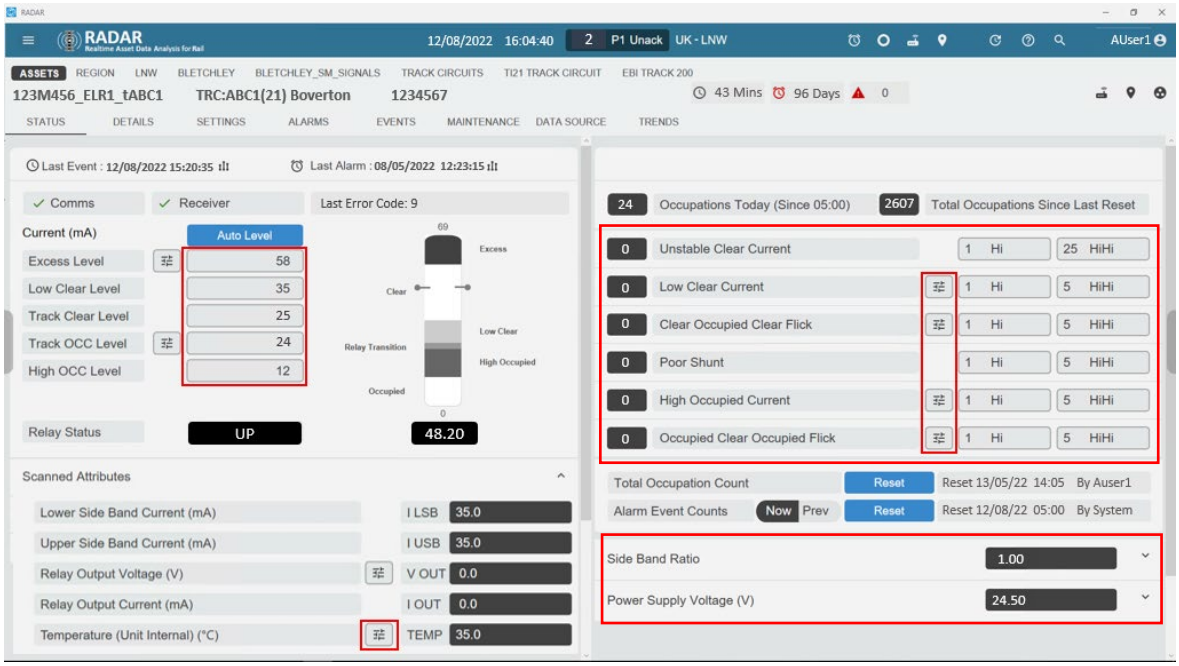


Figure 4 - Screen shot showing Calibration

8.7 If the system is recalibrated, allow trains to traverse the asset for 24 hours then restart from step 8.1.

8.8 Check that there are no Alarms present on the “ALARMS” tab (See Figure 5). If there are no Alarms present, proceed to Step 8.11.

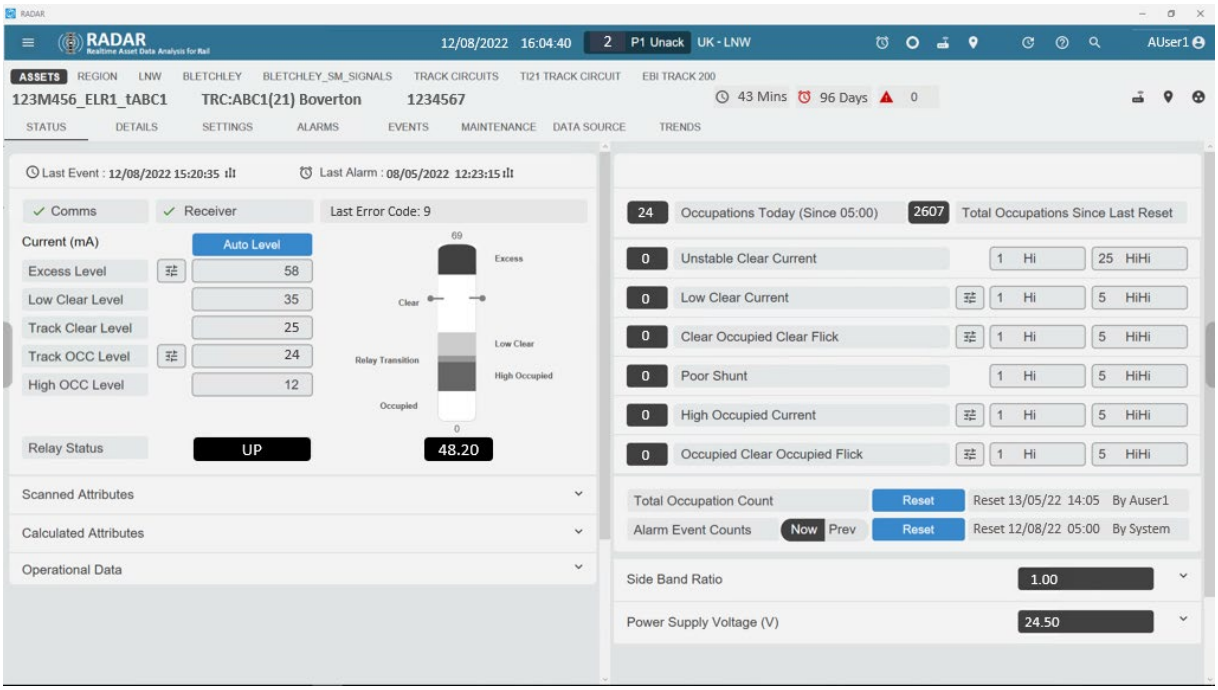


Figure 5 - Screen shot showing Asset free from Alarms

NOTE: *- The "ALARMS" tab will show as* ***CYAN (P3)*** *or* ***RED (P1)*** *if an Alarm is present (See Figure 6).*

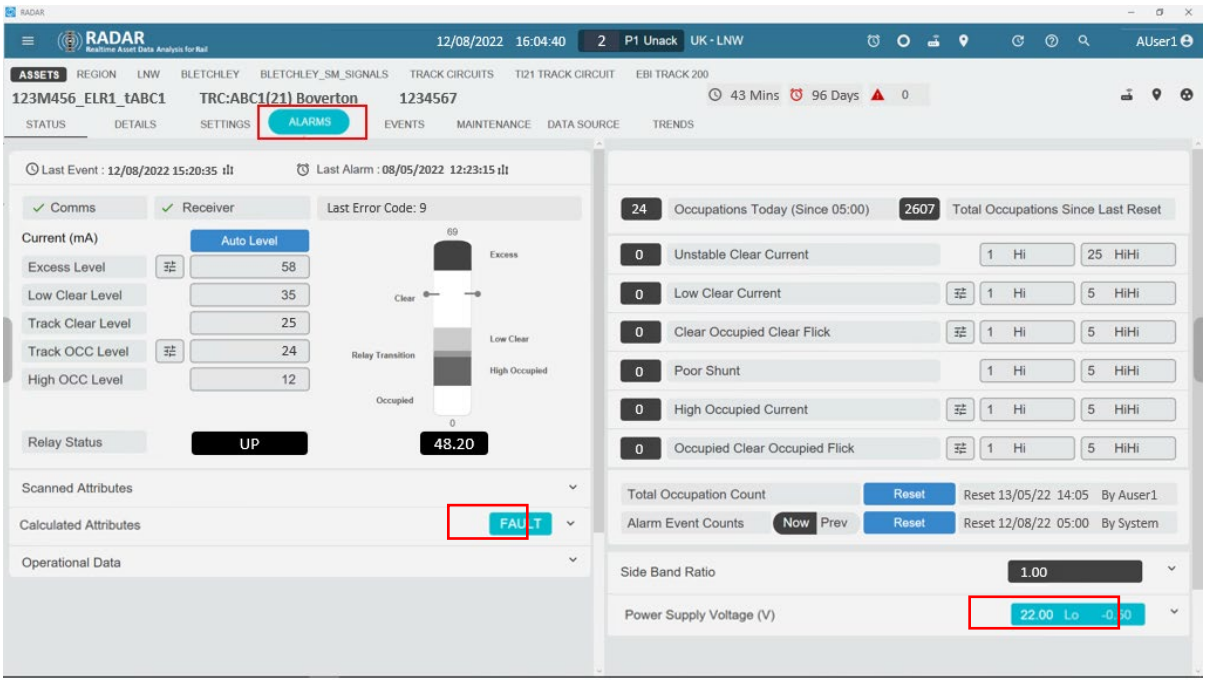


Figure 6 - Screen shot showing Asset with Alarms present

If cyan/red Alarms are present, check the Known Issues Log.

Where the issue is not captured in the Known Issues log, refer to intelligent infrastructure monitoring staff for investigation.

8.9 Once the checks of the cyan/red Alarms have been completed:

a) If the issue has been rectified, restart from step 8.2.

Or

b) If the cause of the cyan/red Alarms are recorded as “known issues”, no further investigation is required at this time.

Or

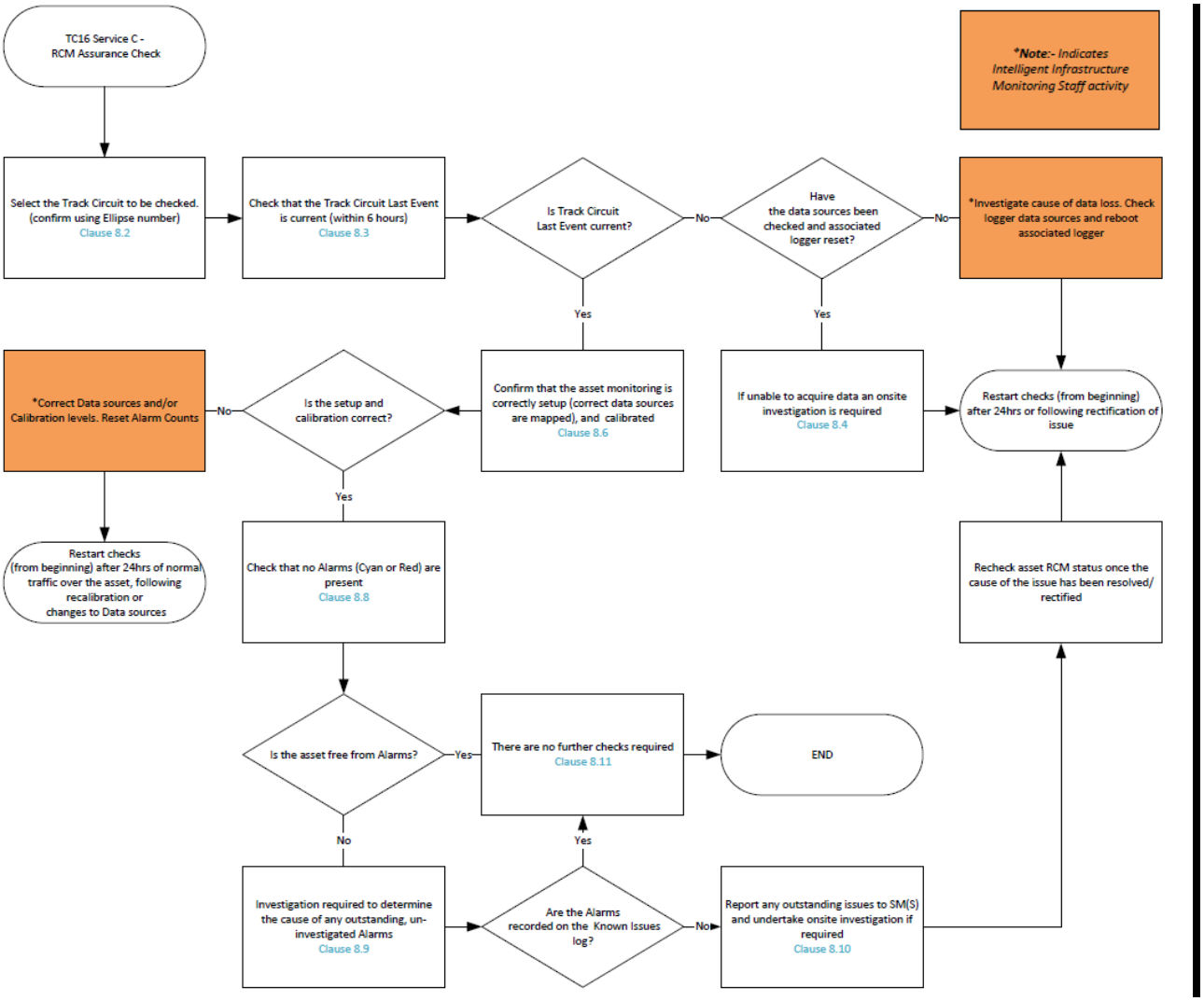
c) Any issues that have not been rectified and are not on the Known Issues log, shall be escalated to your SM(S). Onsite investigation may be required to determine the cause of the Alarm(s)

8.10 All outstanding issues, or cyan/red Alarms shall be reported to SM(S).

NOTE: *Investigations of the track circuit are detailed in steps contained within NR/SMS/Appendix/08. (General Information on the EBI 200 Audio Frequency Track Circuit Equipment).*

8.11 No further checks are required. Update all relevant documentation.

APPENDIX A - Service C - Process Flow Chart



END

Includes:	EBI Track 400
Excludes:	EBI Track 200, Aster 21, and TI21 (Audio Frequency) Tracks and all other Track Circuits

Red bonds are very dangerous if they become disconnected. Never touch them as there could be a dangerous voltage. Report to E.C.O any found.

General

If any adjustments or renewal of equipment have occurred, then NR/SMS/PartB/Test/263 (EBI Track 400) Full Test shall be carried out in place of the Maintenance Test.

Following rail replacement engineering activities, it is good practice to correspondence check the operation of the track circuit with the Signaller's indication.

Track Circuit Examination

The objective of the track circuit examination is to find and remove potential causes of track circuit failure. The extent of the examination will be dependent on:

a) The type and complexity of track layout.

b) The amount of bonding.

c) Jointed track or Continuous Welded Rail.

d) Steel, wooden or concrete sleepers.

SERVICE A

1. Insulated Rail Joints (IRJs)

This section is only applicable if IRJs are provided at one or both ends of the TC.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

1.1 Examine the components of each IRJ. Rectify and/or report defects as corrective maintenance. Look particularly for:

a) Metal swarf or filings.

b) Broken insulations.

c) Broken or displaced 'T' pieces.

d) Burred-over rail ends.

e) Moved sleepers or rail fastenings that can short against the rail joint.

f) Broken or missing bolts.

g) Signs of voiding or slurry under the joint.

2. Track Circuit Feed & Relay End

2.1 Check visible tail cables, labelling and route between rail ends and disconnection box or location. Cables should be routed or clipped to avoid snagging. Report as corrective maintenance damaged or degraded tail cables.

Where provided, orange pipes can be fitted with a clamp to the rails. Cables should not be stretched by the pipe, as these will prevent sideways movement of the pipe if it is struck by tamper tines.

2.2 Check rail connections. All fittings should be intact and the cable secure.

2.3 If provided: Check tuning units, fixings and padlocks. Lubricate padlocks. These should be secure and undamaged.

2.4 If provided: And where practicable, examine impedance bonds, fixings and connections.

2.5 If provided, visually check that any disconnection boxes are stable, securely fixed, and the lid or cover is fitted and (if provided) padlocked.

3. Throughout the Length of Each Track Circuit

TCs on CWR under certain conditions and circumstances may not have to be inspected by a full walk through.

Your SM(S) will advise you if any or all of this section is applicable to the TC you are maintaining.

3.1 Check that track circuit jumper bonds are properly terminated and intact. Disconnected ‘yellow bonds’ shall be repaired immediately. Where the yellow marking is degraded, arrange to renew the marking as corrective maintenance.

3.2 Check that any traction bonds are kept clear of any rails they are not bonded to.

3.3 Check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

3.4 Check that signal wires, metal services (etc) are insulated from the rail using plastic rail clips.

3.5 Check for displaced rail clips, insulations, pads, (etc) which could cause a track circuit failure. Remove conductive debris from the vicinity of the rails.

This is particularly a problem at level crossings and areas where rubbish can be expected to accumulate (stations, bridges, adjacent rights of way etc).

3.6 Check for any abnormal rail surface contamination on infrequently used rails (e.g. crossovers).

3.7 Check the condition of the ballast and for any excessive build up against the rails.

Poor ballast condition and build up against the rails can affect the operation of the track circuit.

Report any deterioration in condition or build up as corrective maintenance.

4. Track Circuits through Switches and Crossings (S&C)

This section is only applicable to TCs through S&C.

Your SM(S) will advise you if this section is applicable to the TC you are maintaining.

4.1 Check any rail-to-rail bonds, jumper bonds and fishplate bonds.

4.2 Check the insulations in stretcher bars.

4.3 Check that point rodding, cabling (etc) is insulated from the rails using plastic clips or there is enough clearance.

4.4 Check track circuit interrupters and connections. These are usually found at catch points and trap points. Refit as necessary.

SERVICE B

5. Track Circuit Feed & Relay Ends

5.1 If provided, check the condition of wiring and equipment in tuning units.

6. Disconnection Boxes (If Provided)

6.1 Remove the lid and check the following:

a) Cables and cores are undamaged, correctly labelled, and free from wet or dry wire degradation.

b) Terminations for security, corrosion, arcing, and risk of short circuit/disconnection. Protect as necessary.

c) Cable glands are fitted and effective.

6.2 Refit the lid and (if provided) padlock, check they are fitted securely.

7. Track Circuit Tests

7.1 Carry out NR/SMS/PartB/Test/263 (EBI Track 400 Track Circuit Test) Maintenance Test.

7.2 Carry out an NR/SMS/PartB/Test/041 (Insulated Rail Joint (IRJ) Test).

7.3 If provided, carry out a NR/SMS/PartB/Test/062 (Line Protection Unit Test).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TC30		
Track Circuits: Additional Bonding Check		
Issue No: 03	Issue Date: 04/12/2021	Compliance Date: 05/03/2022

Includes:	Track Circuits where an additional bonding check is required
Excludes:	All other Track Circuits

General

Missing or defective yellow and parallel bonding could result in a wrong side failure of the track circuit.

Parallel bonding might not have yellow marking (e.g., older installations and manufacturer-fitted rail to rail bonding within S&C).

Reference shall be made to the Bonding Plan to verify that all bonding is present.

SERVICE A

1. Bonding Checks

1.1 Check that any track circuit jumper bonds are properly terminated and intact.

1.2 Check that ‘yellow bonds’ are properly terminated and intact.

1.3 Disconnected ‘yellow bonds’ shall be repaired immediately. Where the yellow marking is degraded, arrange to renew the marking.

1.4 Check all rail connections and bonding are properly terminated and intact and where specified in NR/SMS/PartZ/Z03 (Train Detection Reference Values) are checked to the correct torque. Any defects shall be rectified immediately.

1.5 On stub ends, check that fishplate bonds are not broken, disconnected, or ‘tamped’ into the ballast. Renew or refit as necessary.

SERVICE B

2. Functional Test

2.1 Apply a shunt at the extremities of the track circuit, in accordance with the track plan, and check the track relay drops for each application.

2.2 Minimum Shunt values are detailed in NR/SMS/PartZ/Z03 (Train Detection Reference Values).

END

Includes:	TCAID(N) and TCAID(D)
Excludes:	All other Track Circuit assistance devices

GENERAL

The TCAID is used to detect a 165kHz signal from a train fitted with a Track Circuit Assistor (TCA) and provide a supplementary shunt to the track circuit.

The different types of TCAID are listed below.

a) TCAID(N) Non-direction selective TCAID.

b) TCAID(D) Directionally selective TCAID.

TCAID(N) (&MC)

These installations can be identified by a three-core cable coloured Brown, Blue and Green/Yellow between the TCAID unit and the disconnection box, this is for MOD 0-2 versions only.

For MOD 3 versions these installations can be identified by a two-core cable coloured Brown and Blue between the TCAID unit and the disconnection box.

TCAID(D)

These installations can be identified by a four-core cable coloured Brown, Blue, Black and Green/Yellow between the TCAID unit and the disconnection box.

Whenever the lid of a TCAID unit is removed, its seal needs to be checked for damage and when securing the lid back in place, the lid and seal should be checked for correct alignment.

The TCAID contains no serviceable items; the lid of the unit must only be removed to renew the battery.

TCAID(MC) This is a non-direction selective TCAID mounted in a metal case. This type is not now used, and all should have now been replaced with (N) types. Any found should be reported to your SM(S).

SERVICE A

1. All TCAID Installations

TCAID's that have been de-commissioned but, the disconnection box and cables that are still in place, should also be included in these tasks.

The tasks should be performed as part of the associated Track Circuit Service A.

1.1 Examine the security of the TCAID unit, its mounting stake and associated disconnection box.

1.2 Check the terminations in the disconnection box, protect as necessary.

1.3 Check the cables and rail terminations; they should be secure and undamaged.

1.4 Check the labelling of the TCAID unit, cables and cable glands. They should be secure and legible.

1.5 Lubricate the disconnection box padlock.

SERVICE B

2. **Pre-Leaf Fall Season Checks**

These tasks should be performed within the two months (60 days) prior to leaf fall season.

2.1 Examine the interior of the TCAID unit, if it is found to be damp the unit shall be regarded as faulty and replaced.

2.2 The battery shall be replaced if it has been in service close to its estimated usage calculation.

2.3 Carry out NR/SMS/PartB/Test/043 (Track Circuit Aid (TCAID) Test).

PERIODIC TASK

3. **All TCAID Installations**

3.1 Renew the silica gel sachet. The battery shall also be replaced if it has been in service for 3 years. Check that the lid replaces correctly and that the bag is not trapped.

3.2 Replace the TCAID unit. Check that the replacement is of the correct type.

3.3 Carry out NR/SMS/PartB/Test/043 (Track Circuit Aid (TCAID) Test) before commissioning the new unit.

END

Development

Train describers are a means of passing on an individual train identity between signal boxes or in PSBs between panels and adjacent PSBs and fringe boxes.

In the early days when block working was first introduced train identity was passed between signals boxes by means of a bell code. This method is still used on mechanically signalled or 'green field' areas today.

With the advent of track circuit block working which allows the running of several trains between signals boxes a means of storing train identities was required as a memory aid to the Signaller.

This led to the first development of a train describer that used simple lamp displays with direct wire or simple DC pulsing transmission systems.

With the development of PSBs which control large amounts of train movements more sophisticated train describers were produced in line with technology from electro-mechanical to microprocessor.

Displays

These can vary depending of the age and type of system in use; older PSB systems can use Cathode Ray Tubes (CRTs) or a LED alphanumeric display at the required positions in the panel.

Newer systems combine the TD display on the monitors used for the track display. Older systems at fringe signal boxes can use a cold cathode display tube.

Descriptions

In the early 1960's an alpha/numerical system of classifying and identifying trains was introduced which still forms the basis of all TD systems. The four characters in the description are made up as follows:

Character Position	Character Range	Meaning
First	0 to 9	Class of train
Second	A to Z *	Destination District
Third	0 to 9	Individual train number or local route number
Fourth	0 to 9	

Table 1 - Character Designations

* The letter Q is not used.

Train Describer Terminology

> ***NOTE:*** *This is intended as a general guide to the unique terminology used in TD systems, it is not specific to any one type of system. Some newer systems may have controls and/or functions that might differ from the descriptions given but the basic concept of operation is the same.*

Term	Meaning
Set Up	The keying into the system of a train description by means of a keyboard
Interpose	The transfer of the set-up train description to the chosen address
Cancel	The removal of a train description by keying in the address of the berth or remote location and operating the cancel function
Step	The transfer of a train description from one berth to another when a train moves forwards and causes a specified set of track circuit and signal conditions to be satisfied
Clear Out	This may be manual or automatic. Manual is initiated by a cancel sequence. Automatic is initiated when a train leaves the area covered by the TD system and a specified set of signalling conditions is satisfied
Manual Transmission	This is affected by setting up the address of a fringe signal box and the train description on the operators' panel and operating the interpose function. Likewise, it is the setting up of the train description at a fringe box and operating the interpose function to transfer the description to the PSB
Automatic Transmission	This is the automatic transfer of a train description from one PSB to another when a specified set of signalling conditions is satisfied
Transmission Fault Alarm	The failure of a manual or automation transmission which initiates a visual/audible alarm which must be acknowledged by the Signaller
Equipment Fault Alarm	An alarm initiated by the TD system during its monitoring sequence. An audible alarm is sounded which must be acknowledged and a visual alarm is displayed until the problem is rectified. If the system is fitted with a fault printer/monitor it will be printed at regular intervals or continually displayed
Non-Described Alarm	This is initiated when a train without a description is stepped with the correct signalling conditions satisfied
Interrogate (Train description)	This facility enables the Signaller to determine the description at an address. The information is available after the address has been keyed up and the interrogate function operated on the set-up panel

Term	Meaning
Interrogate (Address)	This facility enables the Signaller to determine the position of a train in the controlled area. Four asterisks are set up in the address and the specified description and operating the interrogate function on the set-up panel
Description Received Warning	This a brief audible alarm generated by the reception of a train description from an adjacent PSB or a fringe box. It is also generated in fringe boxes when a description is received from a PSB
Receiver Full	An indication to the Signaller when all the approaching berths at an adjacent/fringe box are occupied. Any further descriptions will be inhibited
Acknowledge Up Date	This is a co-operative cancel between a main PSB and an adjacent PSB or fringe box. If a Signaller at either end cancels a transmitted description an audible/visual alarm will be given at reception end. The audible alarm will extinguish if not acknowledged after a period of time, but the visual alarm will remain until acknowledged.
Berth	A store and display position for one train description
Ripple Berths	Two or more berths in a permissive section (e.g. goods)
Shuttle Berths	Two berths in a two-way working section (e.g. platform)
Blind Store	A berth without any display facilities
Automatic Code Insertion	When a train enters a terminal platform, a new description will be required for its departure. The system will change the first character of the old description to an asterisk as a reminder to the Signaller (this will operate the not described alarm should the description step without the new code). Some systems will automatically insert a new description.

END

Includes:	Train Describer Electro-Mechanical
Excludes:	All other types of Train Describer

SERVICE A

1. Power Supplies

1.1 Using a meter and/or oscilloscope measure the output voltages of the system power supply and the AC ripple content of the DC voltages. Check they are within the limits as stated in the table below:

Voltage	Limits	Ripple
50V DC	49V to 54V	<100mV
18V DC	17V to 19V	<50mV
12V AC	11V to 12.5V	NA
6V AC	5.5V to 6.5V	NA

Table 1 - Voltage Limits

Report as corrective maintenance any voltage ranges that have been corrected or cannot be corrected.

2. Console

2.1 Clean the facia panel and indication window or screen.

2.2 Check all lamps are working. Ask the Signaller if any are not illuminating correctly.

In Line Type:

Clean the interior and examine all terminations when lamps are renewed. Clean the inner covers and lamps.

WBS Digital Type:

When changing a lamp check that the focus and alignment of the filament is correct.

2.3 Examine all push buttons and rotary switches. Report as corrective maintenance any that are broken.

2.4 Examine the faceplate lettering. Report as corrective maintenance any illegible lettering to be replaced.

SERVICE B

3. Console

These tests shall be performed with co-operation of the Signallers at the transmission and receiving end of the system.

Any failures or defects that cannot be rectified immediately shall be reported as corrective maintenance.

All test descriptions shall be cancelled on completion of maintenance.

3.1 Check that the operation of each push button or rotary switch in turn displays the correct character in the set-up berth.

3.2 Select a description in the set-up berth, operate the interpose button and check that the complete description is transferred to the correct berth.

3.3 Arrange for the adjacent signal box to transmit a description. Check that the transmitted description is received and displayed correctly.

3.4 Where provided, by means of the emergency stepping buttons, step the received description through all the necessary berths.

3.5 Repeat 3.3 and 3.4 for all running lines where descriptions are received.

3.6 Where applicable, set up a description in the transmission berth and transmit to the adjacent signal box. Check that the transmitted description is received and displayed correctly.

3.7 Where applicable, interpose a complete description to the early transmission berth. Set up the signal conditions to affect the transmission and check that the transmitted description is received and displayed correctly at the adjacent signal box.

3.8 Repeat 3.7 for all other early transmission berths.

4. Alarms

4.1 Test the system alarms as follows:

a) Fuse Alarm. Short the common to the fuse busbar.

b) ND Alarm. Manually operate the correct relay.

c) TX Alarm. Manually operate the correct relay.

d) Lockout Alarm (where fitted). Operate the test switch.

END

Includes:	2100, 2108 and variant types within these series
Excludes:	All other types

General

If any readings obtained are outside the limits stated they shall be reported as corrective maintenance.

These systems date from the early 1970's and use two Hewlett Packard 21MX series computers as the basis of the systems. Original interfacing equipment was produced by either Hewlett Packard or Westinghouse.

Over the years various interfacing equipment (e.g. printers and tape readers) have been replaced with more modern equipment from different manufacturers.

The NR/SMS's shall be used for the system type and interface equipment as necessary.

DAILY SERVICES

1. System Fault Printers (Both Series)

1.1 Check both system printers for any failures. Take remedial action as necessary.

1.2 At the same time each day, type the date on both system status printers.

SERVICE A

2. Power Supplies (2100 Series)

2.1 Using a meter and/or oscilloscope, measure the following DC voltages and AC ripple content check that they are within the limits stated:

Cubicle	Identity (WBS)	Monitor Position	Limits	Ripple
C4 & C8	+5.5V	OCB & ETH	+5.2 to 5.8V	<50mV
	+9.5V		+9 to 10V	
	+17.5V		+16.6 to 18.4V	
	+24V(F)		+22.8 to 25.2V	<70mV
	+24V		+22.8 to 25.2V	

Table 1 - Power Supplies (2100 Series)

3. Power Supplies (2108 series)

3.1 Using a meter and/or oscilloscope measure the following DC voltages and AC ripple content. Check that they are within the limits stated:

Cubicle	Identity	Monitor Position	Limits	Ripple
C1	Advance +5vL	Unit Terms	+5V to 5.25V	<50mV
	Advance +5vR		+5V to 5.25V	
	WBS 24vL	OCB & ETH	+23.5V to 24.5V	<70mV
	WBS +24vR		+23.5V to 24.5V	
C4 to C8	WBS +6V		+6V to 7V	<50mV
	WBS +9.5V		+9V to 10V	
	WBS +18V		+18V to 19V	
	WBS +24V		+23.5V to 24.5V	<70mV
C5 to C7	Advance +5V	Unit Sense Terms	+5V to 5.25V	<50mV
	Advance +12V		+12V to 12.5V	
	Advance -12V		-12V to 12.5V	
	WBS +5V Reg	Monitor Sockets	+4.9V to 5.1V	
C6	WBS +5V Reg		+4.9V to 5.1V	
	WBS +12V Reg		+11.9V to 12.1V	

Table 2 - Power Supplies (2108 series)

4. Intermediate Distribution Frame (Both Series)

4.1 Check that the Automatic Voltage Stabiliser (AVS) reading STAB 1,2,3 & 4 are between 105V and 115V. This shall be within the NOM green sector on panel meters.

5. Auto Switch Card (Both Series)

5.1 Switch the operating mode of the computers by turning the ‘Auto’ switch to the opposite mode and then back to the ‘Auto’ position (e.g. if the right hand computer is driving both highway outputs turn the ‘Auto’ switch to the Left then back to ‘Auto’.

5.2 Check the printout for any failures caused by 5.1, take remedial action as necessary.

6. System Fault Printers (Both Series)

6.1 Check that the printers have enough paper and that printer ribbons/cartridges do not need replacing.

SERVICE B

7. HP 21MX Computers (Both Series as Applicable)

Tasks 7.1 to 7.2 applies to both series.

7.1 Dust and clean the computers. Pay particular attention to the heat dissipating areas.

7.2 Turn the 'Auto' switch (in C5) to either the Left or Right depending on which computer is driving both highways.

On the OFF line computer stop the programme by turning the key operate switch to 'Power On' and press the Halt/Cycle button.

The Equipment Failure Alarm (EFA) illuminates and a WGFL or WGFR fault printout is produced.

Operate the fault alarm switch to 'Inhibit' for the remainder of the maintenance.

Tasks 7.3 & 7.4 apply to the 2100 series.

7.3 Remove the two air filters and clean as necessary. Replace on completion.

The filters are held in place by metal 'banana plugs in each corner, pull firmly on these to remove the filter from the frame.

7.4 Using a meter and/or oscilloscope measure the following DC voltages and AC ripple via the test jacks mounted on the rear panel of the computer.

Test Point Voltage	Voltage Limits	Ripple
+30V	+28.5V to +30.5V	<1.5V
+20V	+19.5V to +20.5V	<100mV
+12V	+11.5V to +12.5V	<240mV
+4.85V	+4.65V to +5V	<97mV
-2V	-1.7V to -2.5V	<40mV
-12V	-11.5V to -12.5V	<240mV
-20V	-19.5V to -20.5V	<100mV

Table 3 - Voltage Limits

Tasks 7.5 to 7.13 apply to the 2108 series.

Hazardous voltages might be exposed while the front power shield is removed. Care shall be taken, see NR/SMS/PartC/EL00 (Electrical Equipment - General) - Hazards Associated With Electrical Supplies.

7.5 Operate the AC line-switch on the rear computer panel to the 'OFF' position and withdraw the computer from the cubicle until the lock on the sliding rails activates. Check the cable loom does not snag on the cubicle metalwork.

7.6 Loosen the two quarter-turn fasteners on the operators' panel and lower to the access position.

Place the maintenance table in front of the computer, remove the front panel wire stays from the main frame by removing the fixing bolts, and lower the front panel onto the table.

7.7 Remove the three screws and lock washers securing the front power supply shield to the computer main frame and remove the panel.

Disconnect the key operated switch assembly cable from the lower power supply printed circuit assembly (PCA) connector and remove the front power supply shield. Reconnect the key operated switch key assembly cable.

7.8 Connect the test adaptor to the J8 test point array. Test points are numbered 1-10 reading right to left.

7.9 Operate the AC line switch on the rear computer panel to the 'ON' position. On the operator's panel rotate the key operated switch to 'R' (reset) via 'STANDBY' and then to 'OPERATE'.

7.10 Using a meter and/or oscilloscope measure the following DC voltages & AC ripple via the test adaptor. Connect the common lead (back) of the meter and oscilloscope to TP2 of the test adaptor.

Terminal	Identity	Voltage Limits	Ripple
TP1	-12V	-11.4 to 12.6V	<600mV
TP3	+12V	+11.4 to 12.6V	<600mV
TP4	-2.3V	-2.1V to 2.5V	<115mV
TP6	+5V(m)	4.95V to 5.05V	<250mV
TP9	+12V(m)	+11.4 to 12.6V	<600mV
TP10	-12V(m)	-11.4 to 12.6V	<600mV

Table 4 - Voltage Limits

7.11 Set the key operated switch to 'STANDBY' and operate the AC line-switch on the rear computer panel to the 'OFF' position.

7.12 Disconnect the measuring equipment and remove the test adaptor. Remove the key operated switch assembly cable, thread the lead through the front power shield and reconnect and secure the shield.

Replace the PCA cover and reconnect the front panel stay wires. Replace the operator panel assembly and tighten the two quarter turn screws.

7.13 Operate the AC line switch on the rear computer panel to the 'ON' position and rotate the key operated switch on the computer front panel to R' (reset) via 'STANDBY' and then to 'OPERATE'.

Tasks 7.14 & 7.15 apply to both series

7.14 Re-start the programme in the off line computer. This is detailed in the 'First Line Servicing Manual' under the sub-heading 'Running Programme'.

Do not clear the display before pressing the 'S Register' button (2100 series) or the 'P Register' button (2108 series), as this deletes the instruction at the point where the programme was halted. This results in one or more fault printouts and then requires the reloading of the operational program.

7.15 Repeat 7.2 to 7.4 (2100 series) or 7.5 to 7.13 (2108 series) for the other computer.

Check that the conditions in the 'First Line Servicing Manual' are met in the former off line computer, especially in respect of updating the displays and the ATR clock on the control panel.

8. Standby Battery Module (2100 Series)

8.1 Disconnect the battery in the rear of C5 and C7. Measure using a meter the battery voltage:

- 8v ±1.5V.

Reconnect the battery and check that a fault printout of either BATL or BATR has occurred.

9. Standby Battery Module (2108 Series)

9.1 With the unit operating under normal conditions, measure using a meter the battery voltage at the Battery Test Monitor Points. Confirm the results are as follows:

a) Charge voltage (Test button not pressed) >8V.

b) Discharge voltage (Test button pressed) >7.2V.

If the voltage drops below 7V after 15 seconds with the test button pressed the battery module should be replaced.

10. HP Battery Modules C5/C7

10.1 Operate the battery On/Off switch on the rear of the computer to the 'Off' position.

Check that the Power Fail/Battery lamp on the front of the computer is illuminated. If not replace the lamp or investigate the cause.

10.2 Remove the 2-pin plug from the rear of the computer, then operate the battery On/Off switch to the 'On' position.

10.3 Measure using a meter the charging voltage on the removed 2-pin plug.

a) 17V ±1V.

Measure the battery voltage at the plug socket

b) >12V.

10.4 Operate the battery On/Off switch to the 'Off' position and replace the 2-pin plug into its socket.

Operate the battery On/Off switch to the 'On' position and check that the Power Fail/Battery lamp on the front of the computer extinguishes.

11. Auto Switch Card and System Operating Modules (Both Series)

11.1 Check that each position of the module switch works correctly (Left, Auto, Right & Divide) and that the Highway and Set lamps illuminate correctly.

11.2 Set the fault alarm switch to INHIBIT and check that the fault lamp illuminates with a steady light and the alarm lamps on C4, C8 and the operators set-up panel illuminate.

Press the reset button and check that the fault lamp is momentarily extinguished and the Set Fault lamps extinguish.

11.3 Check that on compilation of these tasks, the auto switch is left in the AUTO position and the fault alarm switch is in the NORMAL position.

12. Paper Tape Reader (Both Series if Provided)

12.1 Clean and dust the tape reader.

12.2 Check the electronic components for signs of overheating, leakage, frayed insulation and any other signs of deterioration.

12.3 Check the mechanical parts for excessive wear, looseness, misalignment, corrosion and any other signs of deterioration.

12.4 Check and clean the glass slide covering the phototransistors, the light holes, the brake surface, the drive capstan, and the plastic covered wire foot that holds the tape flat against the tape head.

Accumulated lint around any of these parts can cause errors in the readout.

12.5 Switch the POWER on and check that all eight reader lamps illuminate.

12.6 Check the oil wick located on the back end of the motor housing. If it appears to be dry lubricate with 2 or 3 drops of a light machine oil (SAE 20).

13. Paper Tape Punch (Both Series if Provided)

13.1 Connect the paper punch and confirm that by using the copy tape routine that data fed to the punch is punched out on the tape.

14. Operation Computers (Both Series if Provided)

14.1 Check all fans are running and air filters are not blocked.

14.2 Clean air filters and rectify faulty fans as necessary. Visually check all plugs, connectors and leads are secure.

15. Modems (2100 Series) Pye D200E

15.1 Measure using a meter and/or oscilloscope the DC voltages and AC ripple on the modem units:

Voltage	Limits	Ripple
-24V	-22V to –26V	<70mV
+12V	+11V to +6.6V	<50mV
-6V	-5.4V to –6.6V	
+6V	+5.4V to +6.6V	

Table 5 - Voltage Limits

Other Types

15.2 Check that the indications and supply voltages are correct Refer to the manufacturer's manual for information.

16. Console Equipment Cathode Ray Tubes (Both Series)

16.1 Disconnect seven cathode ray tubes (CRT) at one time (one distribution box) and dust and clean as required.

Clean the window on the face of the panel. Unscrew and remove the associated Perspex screen from the panel and dust as necessary.

Replace all parts and reconnect the CRT.

17. Common Service Modules (Both Series)

17.1 Place the Volts/Ripple switch into the Volts position and check the following voltages:

Voltage	Reading
100V	95V to 105V
180V	171V to 189V
2kV	Within shaded zone on the meter

Table 6 - Voltage Limits

17.2 Place the Volts/Ripple switch into the ripple position and check that the percentage ripple is less than 5%.

18. Transmission (2108 Series)

18.1 Test each fringe box link by using the main box back-to-back link panel in cubicle 9.

This is detailed in the ‘First Line Servicing Manual’.

19. Fringe Box Units (Both Series)

19.1 Remove the front and rear covers of the unit and dust as required. Check cables, wires and terminations for signs of deterioration or damage.

19.2 Test each fringe box unit in the back-to-back mode. This is detailed in the ‘First Line Servicing Manual’.

20. Gate Box Units (2100 Series)

20.1 Remove the front and rear covers of the unit and dust as required. Check cables, wires and terminations for signs of deterioration or damage.

20.2 Test each gate box unit in the back-to-back mode. This is detailed in the ‘First Line Servicing Manual’.

21. Signal Levels (2100 Series)

21.1 At the main box, measure using a meter the AC signal levels on the line connection unit (pins A1 and A2). Compare the obtained reading with those previously recorded.

21.2 Measure using an oscilloscope the lines to the fringe boxes via pins AN and AR at the rear of the carrier card edge connectors in the carrier cubicle.

If there are any variations in the obtained signal levels from previous recorded ones or if the lines appear unduly noisy, inform your Supervisor.

22. Diagnostics (Both Series)

22.1 Run the diagnostic programs on the computers.

23. Spares and Change (Both Series)

Possession of the train describer shall be obtained before the substitution of the spare units.

23.1 Substitute the spare units in turn into the system. After each change wait for 2 to 3 minutes, if no fault printout occurs continue on to the next unit.

23.2 The substituted units should be left in the system and the former working units now constitute the spares. The spare units shall be stored in a place where they are protected from damage.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/TD31		
Train Describer Vaughan Type 4M		
Issue No.03	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Vaughan Type 4M Small TD and Normal TD
Exclude:	Vaughan Small TDs fitted on the former BR-WR (see SMS/TD32) and TD Scottish Type (See SMS/TD33)

This system along with displaying TDs to the Signaller also provides automatic transmission of the information to adjacent signal boxes or control centres. Provision may also be made for transmission of TDs to management information systems (e.g. ATR, SMART or TRUST).

Small TD systems will generally have only one monitor per site. Normal TD systems will have two or more monitors to enable the display of all the area covered by the signal box or control centre.

Equipment Identification

Fig 1- Combined unit

Fig 2 - Keyboard with Remote PC unit (Black box)

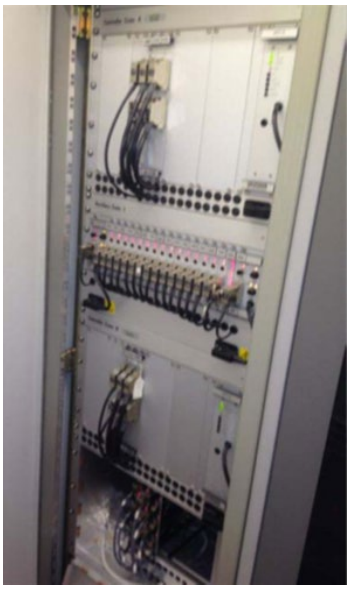


Fig 3 – Remote TD cabinet

SERVICE A

1. System

1.1 Ask the Signaller if they are aware of any faults present on the system. Rectify as necessary.

1.2 Check that an audible ‘Update Alarm’ is received when a new train description is received.

1.3 If necessary ask the signaller at an adjacent box to interpose a description.

2 Cubicle

2. 1 Open the rear of the TD cubicle and visually check that all cards and connectors are secure.

2. 2 Check the indications on the system cards (Appendix A).

2. 3 Close and secure the rear cover.

3 Keyboard

3.1 These tasks shall be done in liaison with the signallers at both ends of the system. During these tasks the TD will continue to step and transmit/receive any descriptions to and from any adjacent system.

3.2 Check that each key performs the correct function.

In most systems the 'Q' key will place the system into ATR mode if it is entered as the first character

3.3 Remove the keyboard assembly from the crate by unscrewing the four fixing screws. Dust and clean as required.

3.4 Hold the keyboard upside down when dusting

3.5 If the keyboard is damaged or cleaning if ineffective, arrange for a replacement.

3.6 Dust and clean the keyboard housing, then refit the keyboard.

3.7 Check that the keyboard operates correctly.

4 Displays

4.1 Dust and clean the monitor display(s).

4.2 Check that the displays are well focused and there is adjustment available on both the brightness and contrast. Check that there are no image burns visible.

4.3 Check that the signaller is satisfied with the display.

4.4 Check that all the leads to the monitor(s) are secure and in good condition.

4.5 Check that the line displays are showing the correct characters. Investigate any problems. Incorrect displays can lead to misleading descriptions.

4.6 Normal TD sites Only: Check that the power indication on the controller unit is illuminated.

5 Power Supplies

5.1 Using a suitable meter Measure the 110V AC supply to the equipment.

5.2 Between 105V and 115V.

5.3 If fitted, Check the security of the constant voltage transformer and associated wiring.

5.4 Using a suitable meter and oscilloscope, Measure the DC output voltages and ripples from the power supply units on each system using the test points on the processor card.. Check that they are within the limits given in the table

Voltage	Limits	Ripple (50/100Hz)
+5V	+5.05 to 5.15V	<50mV
+12V	+12 to 12.5V	
+12V I/F	+11.5 to 12.5V	
-12V I/F	-11.5 to 12.5V	

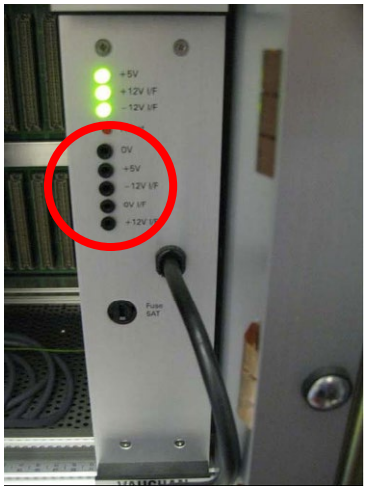


Fig- 4 DC Output Test points

5.5 Check the memory retention battery on each CP-E card. If there is any evidence of corrosion/leakage or if the battery is more than 5 years old, the card shall be replaced with a known good working spare. Check that the battery on the spare card is less than 5 years old.

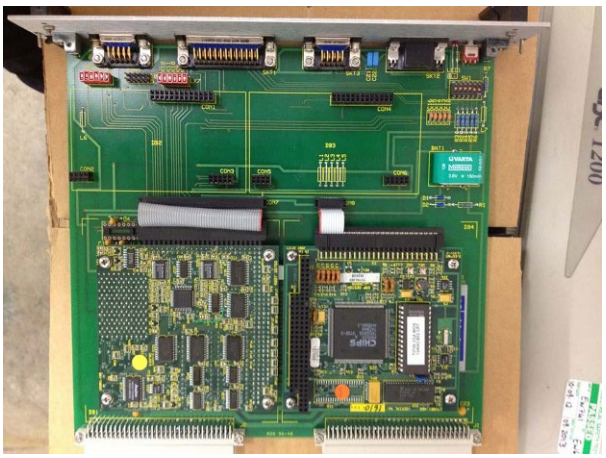


Fig 5 – Battery card

Fig 6 – Close up of a corroded battery terminal

5.6 Check (where fitted) the battery on the SM-T module using the same criteria as 5.5.

6 Line Levels

6.1 Measure the transmit and receive line level readings for each external link. Compare readings obtained to previous ones, investigate any variations.

SERVICE B

7 Tests

7.1 Check the fault alarms are functional by disconnecting then making up each external link in turn.

7.2 Check (where the facility exists) the system can be placed into 'Engineering mode' by typing <CR*ENG*CR>.

7.3 Check the system can be returned to 'OCU Mode' by typing <CR*OCU*CR>. CR indicates the CR key. This test does not affect the stepping of train descriptions.

End of Service B

Reliability – Centred Maintenance

SERVICE R1

8.1 Examine cables / plug couplers on monitor / keyboard & Remote PC unit (Black box), if fitted for security.

8.2 Examine cables & wiring for damage or degradation

8.3 Examine cables / plug couplers to IDF block & to cards in TD cabinet for security

8.4 Examine the memory retention battery on each card. If there is any evidence of corrosion/leakage or if the battery is more than 5 years old, the card shall be replaced with a known good working spare

The battery on spare cards should be isolated from the PCB where possible by positioning the battery enable link to the disabled position; this will prevent the battery from discharging when not in service.
Move to Battery Enable Position (BEN) when installing card in system

8.5 Measure and record the DC output voltages and ripples from the power supply using the test points on the processor card. Check that they are within the limits given in the table shown in clause 5.2 :

8.6 Any adjustments made, components replaced or out of specification item on a WAIF.

APPENDIX A

LED Indications

There are several versions of the boards in use, not all of them will be present in any given system.

Unit	Indication	Colour	Normal State
CP-C	Halt	Red	Extinguished
CP-D	Halt	Red	Extinguished
CP-E	Halt	Red	Extinguished
MS-A	Tx	Red	Illuminated, flickers when data Tx
MS-A	Rx	Red	Illuminated, flickers when data Rx
MS-G	Tx	Red	Illuminated, flickers when data Tx
MS-G	Rx	Red	Illuminated, flickers when data Rx
MS-M	Tx	Red	Illuminated, flickers when data Tx
MS-M	Rx	Red	Illuminated, flickers when data Rx
MS-M	DCD	Red	Illuminated
PP-B		Yellow	Illuminated#

Note that on some older systems this indication is not used.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TD32		
Train Describer Vaughan Small		
Issue No: 03	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Vaughan small TDs fitted on the former BR-WR
Excludes:	Other Vaughan types.

General

At most installations several 'small' TDs are installed and connected together to cover the panel's area of control.

SERVICE A

1. Displays

1.1 Dust and clean all the displays.

.

1.2 Check all the panel displays are well focussed and correctly coloured. Adjust the brightness and contrast if necessary. Check that the Signaller is satisfied with the display.

1.3 Check (where provided) on the ITD monitor that each available map display can be obtained.

1.4 On the alarm screen (xxAL) acknowledge any flashing alarms. Check that all links are showing 'OK'. Some of the links might no longer be in use.

1.5 Check that the correct time is displayed on the ITD monitor. Reset if necessary.

SERVICE B

Electrostatic Precautions shall be taken when handing any of the system cards.

When restarting the system, always press the reset button on the relevant power unit.

2. Cabinets

2.1 Dust and clean the inside and outside of the cabinets.

2.2 Check the cards in the system cabinet(s), confirm they are indicating as shown in Appendix A.

2.3 (Where provided) dust and clean the ITD monitor and keyboard. Hold the keyboard upside down when dusting.

2.4 Using a meter measure the main cabinet 110V AC supply. It should be between 105V and 120V.

2.5 Using a meter and oscilloscope, measure the DC output voltages and ripples from the power supply units on each system using the test points on the crate back plane. Check they are within the limits given in Table 1:

Voltage	Limits	Ripple (50/100Hz)
+5V	+5.05 to 5.2V	<50mV
+12V	+11.8 to 12.5V	
+12V I/F	+11.5 to 12.5V	
-12V I/F	-11.5 to 12.5V	

Table 1 – DC Voltages

NOTE: *That the +5V supply is particularly critical.*

2.6 Check the memory retention battery on each CP-E card. If there is any evidence of corrosion/leakage or if the battery is more than 5 years old, the card shall be replaced with a known good working spare.

Check that the battery on the spare card is less than 5 years old.

2.7 Check (where fitted) the battery on the SM-T module using the same criteria as in 2.6.

2.8 Check (where provided) the time on the ITD system. Reset if necessary.

2.9 Check the time on each individual TD system.

2.10 Test all the spare cards in the system. Any that do not function correctly shall be suitably labelled and sent for repair/service.

2.11 Measure all the modem link send and receive line levels (MS-M cards). Compare the readings obtained to previous ones, investigate any variations.

This can be measured via the cable termination frame or alternatively an RS232C 15 way ‘break out’ box may be used.

2.12 Check that the serial link ‘loop back’ plugs work correctly (MS-# cards).

This depends on the type of MS card as different versions are provided; refer to the Vaughan technical manual for further information.

2.13 Test the ‘test’ switches fitted to the MS-M cards. Refer to the Vaughan technical manual.

3. Remote Location Display Screens

3.1 Dust and clean the monitor, modem unit and keyboard. Hold the keyboard upside down when dusting.

3.2 Check that all the TD maps that can be selected, are displayed correctly.

3.3 Check that all the fittings, connectors, cabling and wiring are secure and free from damage.

3.4 Using a meter measure the 110V AC supply to the equipment. It should be between 105V and 120V.

3.5 At a convenient connection point measure the modem link send and receive levels.

Compare the readings obtained to previous ones, investigate any variations.

4. Fringe Units

4.1 Dust and clean the monitor, modem unit and keyboard. Hold the keyboard upside down when dusting.

4.2 Check that all the maps can be selected are displayed correctly.

4.3 Check that all the fittings, connectors, cabling and wiring are secure and free from damage.

4.4 Check that the current loop status LED's (TX and RX pair) fitted at the rear of the card frame cabinet are operational.

4.5 Using a meter measure the 110V AC supply to the equipment it should be between 105V and 120V.

4.6 At a convenient connection point measure the modem link send and receive levels.

Compare the readings obtained to previous ones, investigate any variations.

4.7 Using a meter and oscilloscope measure the DC output voltages and ripples from the power supply units on each system using the test points on the crate back plane. Check that they are within the limits given in Table 2:

Voltage	Limits	Ripple (50/100Hz)
+5V	+5.05 to 5.2V	<50mV
+12V	+11.8 to 12.5V	
+12V I/F	+11.5 to 12.5V	
-12V I/F	-11.5 to 12.5V	

Table 2 – DC Voltage Limits

NOTE: *That the +5V supply is particularly critical.*

4.8 Check the memory retention battery on the CP-E/CP- D card. If there is any evidence of corrosion/leakage or if the battery is more than 5 years old, the card shall be replaced with a working spare.

Check that the battery on the spare card is less than 5 years old

4.9 Check the time on the fringe TD system. Reset if necessary.

4.10 Test all the spare cards in the system. Cards in the Fringe units are unique to this system. Any that do not function correctly shallbe suitably labelled and sent for repair/service.

4.11 Check that the serial link ‘loop back’ plugs work correctly. Refer to the Vaughan technical manual.

4.12 Test the ‘test’ switches fitted to the MS-M cards. Refer to the Vaughan technical manual.

4.13 Check that the audible alarm (fitted inside the keyboard unit) is working correctly. Test by simulating a modem link failure.

APPENDIX A - System Cabinet Normal Indications

Location	Card	Function	Colour	Status
Power Unit	PP-D	Power	Yellow	Lit
Processor	CP-x	Halt	Red	Out
Serial Link	MS-A,	Tx Rx DCD	Red	Flashing # Flashing # Lit
Serial Link	MS-M,	Tx Rx	Red	Flashing # Flashing #
Serial Link	MS-W	Tx Rx	Red	Flashing # Flashing #
Parallel I/F	MI-C	No Indications		
Display Driver	VM-			
Line Interface	3LI, LI-			
Remote VDU Controller	RV-			
Real Time Clock	SM-T			

#: Flashing with messages sent/received

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TD33		
Train Describer – Scottish Type		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	TD Scottish Type (See SMS/TD33)
Excludes:	Vaughan Type 4M Small TD and Normal TD (See SMSTD31) Vaughan Small TDs fitted on the former BR-WR (see SMS/TD32)

GENERAL

This system along with displaying TDs to the Signaller also provides automatic transmission of the information to adjacent signal boxes or control centres. Provision may also be made for transmission of TDs to management information systems (e.g. ATR, SMART or TRUST).

Small TD systems will generally have only one monitor per site. Normal TD systems will have two or more monitors to enable the display of all the area covered by the signal box or control centre.

SERVICE A

1. System

1.1 Ask the Signaller if they are aware of any faults present on the system. Rectify as necessary.

1.2 Check that an audible ‘Update Alarm’ is received when a new train description is received.

1.3 If necessary, ask the Signaller at an adjacent box to interpose a description.

2. Cubicle

2.1 Open the rear of the TD cubicle and visually check that all cards and connectors are secure.

2.2 Check the indications on the system cards (Appendix A).

2.3 Close and secure the rear cover.

3. Keyboard

3.1 These tasks shall be done in liaison with the Signallers at both ends of the system. During these tasks the TD continues to step and transmit/receive any descriptions to and from any adjacent system.

3.2 Check that each key performs the correct function.

In most systems the ‘Q’ key places the system into ATR mode if it is entered as the first character.

3.3 Hold the keyboard upside down when dusting

3.4 If the keyboard is damaged or cleaning is ineffective, arrange for a replacement.

3.5 Dust and clean the keyboard housing.

3.6 Check that the keyboard operates correctly.

3.7 Check the cooling fans are working (where provided)

4. Displays

4.1 Check that the Signaller is satisfied with the berth display unit.

4.2 Check that all the leads to the monitor(s) are secure and in good condition.

5. Power Supplies

5.1 Using a meter measure the 110V AC supply to the equipment.

5.2 Between 105V and 115V.

5.3 If fitted, check the security of the constant voltage transformer and associated wiring.

6. Line Levels

6.1 Measure the transmit and receive line level readings for each external link. Compare readings obtained to previous ones, investigate any variations.

SERVICE B

7. Tests

7.1 Check the fault alarms are functional by disconnecting then making up each external link in turn.

7.2 Operate test switch on computer swing frame to test the routing system and display function.

APPENDIX A - LED Indications

There are several versions of the boards in use, not all of them will be present in any given system.

Unit	Colour	Normal state
Control Card – SD "OK"	Green LED	Illuminated, flicker Card is Tx or Rx
Control Card - Rx Fault	Yellow LED	Extinguished
Control Card - Fault	Red LED	Extinguished
Power Supplies- Module PK55 No1	V1- Red LED, V2- Green LED & V3- Yellow LED	All Illuminated
Power Supplies- Module PK55 No 2	V1, V2 &V3 - Green LEDs	All Illuminated
Power Supplies-12V 5 Amps Module	Green LED	Illuminated
Unit	Colour	Normal state
Control Card – SD "OK"	Green LED	Illuminated, flicker Card is Tx or Rx
Control Card - Rx Fault	Yellow LED	Extinguished

NOTE: *On some older systems this indication is not used.*

END

Includes:	Train Describer WRSL VME Bus Based
Excludes:	Other types

GENERAL

Software loading and upgrades shall only be carried out by authorised personnel; it is not a first line maintenance operation.

System events are recorded onto the Technicians' terminal equipment and kept for 14 days before it is deleted.

The maintenance and repair of the train describer is based upon automatic system monitoring and fault reporting.

The system checks the health of each serial link and the associated equipment, reporting any defects to the Technicians terminal.

Serial link activity is also shown on the LED indications on the modems, TD changeover housing, serial cards and processors.

SERVICE A

1. System Changeover

This task shall be carried out during a light traffic period in liaison with the Signaller.

1.1 Observe on the front of the CM-2 module that the following LED's are indicating as follows:

LED	Status
Sys1 / Sys2	Either illuminated for the system on line
Watchdog	On line system flashing Off line system extinguished
Available	On line system illuminated Off line system extinguished
Auto Latch	Flashing
PSU Fail	Extinguished

Table 1 - Module LED Indications

If any of the LEDs are not indicating as shown, rectify the fault before proceeding.

1.2 Set the rotary switch to manually select the off line system and observe that the systems switch over.

Check the Technicians' terminal fault reports to confirm that the system is working correctly.

1.3 Set the rotary switch to the 'Auto' position and check that the Auto Latch LED is flashing. If it is not press the 'Latch Reset' button.

1.4 Record the results of the changeover in the system log book.

2. Link Status

This enables a report to be obtained on the statistics with any external communications links. The items reported are:

a) Transmitted messages successfully acknowledged.

b) Transmitted messages not acknowledged.

c) Transmitted messages with no response.

2.1 Using the on line Technicians terminal select the report command (ALT+R) and the link statistics command (L).

The link statistics are stored on the Technicians' terminal.

2.2 Examine the screen listing for the previous 24-hour period and rectify any problems found. To obtain a printout for this listing, the procedure in the manufacture's manual should be followed.

3. Equipment

3.1 Visually check all cards, leads and connectors are secure.

3.2 Clean using a lint free cloth the exterior of the TD cubicle. Check both the front and rear access doors are closed when cleaning.

3.3 Clean the screens of the monitors using an anti-static screen cleaner to the manufacturer's instructions.

3.4 Clean the mouse using a soft cloth with a detergent solution diluted to the manufacturer's instructions. Do not use abrasive cleaners or pads.

3.5 Dust and clean the keyboards using a soft brush and a soft cloth dampened with a detergent solution diluted to the manufacturer's instructions.

Do not use abrasive cleaners or pads.

Do not allow the keyboard to become wet. Hold keyboards upside down when dusting.

3.6 If provided, check the operation of the mouse. If it has become jerky or intermittent, remove the ball from underneath the mouse and clean the ball and rollers as required.

3.7 Check that the Technicians' terminal processor fans are running without excessive noise.

3.8 Check that the line displays are showing the correct characters. Investigate any problems. Incorrect displays can lead to misleading descriptions.

SERVICE B

4. TD Cubicle

4.1 Clean using a dry lint free cloth the equipment faceplates and blanking plates. Pay particular attention to the heat dissipation areas.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TD36		
Train Describer WRSL Small Bus Based (STD)		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	WRSL Small train describer and Medium train describer
Excludes:	Other types of Train Describer

General

Software loading and upgrades shall only be carried out by authorised personnel; it is not a first line maintenance operation.

The 'Medium Train Describer' uses the same hardware as the 'Small Train Describer' but with a larger number of berths or links.

The maintenance and repair of the train describer is based upon automatic system monitoring and fault reporting.

The system checks the health of each serial link and the associated equipment, reporting any defects to the Technicians' terminal.

Serial link activity is also shown on the LED indications on the modems, TD changeover housing, serial cards, and processors.

System events are recorded on the on-line system printer.

SERVICE A

1. System Status

1.1 Check that the printers are supplied with enough paper and that printer ribbons/cartridges do not need replacing.

1.2 Request a list of the current faults on the system from the on line printer. Rectify any faults as necessary.

The command for a fault printout is CCPF <RETURN>.

1.3 Check that the time and date on the printout is correct. Rectify if necessary.

2. System Changeover (Duplicated Systems)

This task shall be carried out during a light traffic period in liaison with the Signaller.

2.1 Manually force a system changeover to the off line system by using the rotary switch provided. Observe that the system switches over correctly. Return the switch to the 'Auto' position.

2.2 Check the now 'on line' printer for faults as detailed in 1.2.

3. Equipment

3.1 Visually check all cards, leads and connectors are secure.

3.2 Clean the screens of the monitors using an anti-static screen cleaner to the manufacturer's instructions.

3.3 Dust and clean the keyboards using a soft cloth with a detergent solution diluted to the manufacturer's instructions. Do not use abrasive cleaners or pads.

Do not allow the keyboard to become wet. Hold keyboards upside down when dusting.

3.4 Check that the line displays are showing the correct characters. Investigate any problems.

3.5 Incorrect displays can lead to misleading descriptions. Carry out 3.1 to 3.3 at all Fringe box or Gate box units.

SERVICE B

4. Equipment

4.1 Dust and clean the interior of the TD cubicle.

END

Includes:	Train Describer GEC/GE Micro Processor Based
Excludes:	All other Train Describers

SERVICE A

1. Signal Box (Equipment Room and C.I.S.)

1.1 Check the following LED indications:

Indication	State
PSU Failed	Extinguished
None 'Memory Read'	Illuminated

1.2 Check that the line driver/receiver LEDs are flashing at least once per second.

This does not apply to C.I.S.

1.3 Check that the following LED indications on the Borer modem:

Indication	State
Power	Illuminated
Carrier	Illuminated
Tx and Rx	Intermittent Flashing

1.4 Check that all the fans in the cabinet are working.

1.5 Withdraw the fan unit and check that the microswitch works correctly by stopping the fans running.

1.6 Clean the fan unit and refit, Check on replacement all the fans are working.

1.7 If a printer is available, Check there is sufficient paper available and that the print quality is satisfactory.

Reload with paper and replace the cartridge/ribbon if necessary.

1.8 If a printer is available, use the control 'R' and Check that the system is clear of faults.

Stored faults can be interrogated by using the following codes:

- T? For time.
- D? For date.
- C? For categories being printed.

1.9 Check that the EFA lamp is extinguished.

1.10 Using a suitable meter/oscilloscope measure the cubicle +5V DC supply and AC ripple to the computer rack at each end of the mircobin busbar are between:

- +5V and 5.2V
- Ripple <50mV.

Check the second busbar if provided.

1.11 If it is outside these limits, adjustment can be made via the 'Set Volts' potentiometer on the PSUs.

1.12 Using a suitable meter/oscilloscope Measure the other +5V PSU's verifying they are between:

- +5V and 5.2V
- Ripple <50mV.

1.13 If any adjustments are made via the 'Set Volts' potentiometer on the PSU recheck that the mircobin busbar(s) levels are still within the limits stated in 1.12.

1.14 Using a suitable meter/oscilloscope Measure the DC voltages and AC ripple on the other PSUs. Check that they are within the limits stated in the table below:

Voltage	**Limits**	**Ripple**
+12V	+11.6V to 12.4V	<50mV
-12V	-11.6V to 12.4V	
+24V	+23.6V to 24.4V	
+50V (Not C.I.S.)	+48V to 54V	<75mV

1.15 Using a suitable meter Measure the voltage drop across the PSU reversionary diodes it should be:

- 0.7V

If the obtained value is not as stated, isolate the PSU, disconnect the diode and carry out a resistance test.

An open circuit reading should be obtained reading one way across the diode with a short circuit reading the other way.

2. Signal Box (Operating Floor)

2.1 Check that all the display PSU indications are illuminated.

2.2 Check that the line receiver LEDs are flashing at least once per second.

2.3 Check that the TD stepping is working correctly.

2.4 Using a suitable meter/oscilloscope Measure the DC output and AC ripple from the PSUs ensuring they are within the limits stated below:

Voltage	Limits	Measured At	Ripple
+5V	+5V to 5.25V	U33 & U35 of Node	<50mV
+12V	+11.6V to 12.4V	Display PSU	
-12V	-11.6V to -12.4V	Display PSU	

When using the extender cord to measure the voltages on the edge connectors, allow for a small additional volt drop on the 5V supply at the node.

SERVICE B

The tasks in this service require close liaison with the signaller or are undertaken with a system possession.

3. Signal Box (Equipment Room)

3.1 Clean and Dust the cubicles.

3.2 Check the condition of the printer head drive belt. Clean as necessary.

3.3 Using the printer ascertain by using ‘Control R’ which step node is on line, then by using the following instruction:

- IU(Loop Address)(Node Address)U.

e.g. IU@CU.

3.4 Check that the off line node goes on line. Re-enable the former node by using the following instruction:

- IU(Loop Address)(Node Address)A.

e.g. IU@CA.

3.5 Check that the stepping is still occurring and that ‘No Faults’ is the response to a ‘Control R’ command.

3.6 Restore the original step node back on line and repeat for each pair of step nodes.

3.7 Check that the fault detection is functioning correctly.

This can be achieved by failing a power supply and breaking the message-passing ring.

3.8 Check that the printer reports when faults are cleared.

3.9 Check that the alarms operate correctly by pressing the 'Test' button.

3.10 Insert the spare battery and main cards in rotation around the sub-systems. Check that no faults are reported before replacing the next card.

3.11 Check that the battery cards have had sufficient time to charge (at least 6 hours) before any planed power test.

4. Signal Box (Operating Floor)

4.1 Dust and examine the operating panel.

4.2 Remove and clean all the filter glasses in front of the operating panel and set up the panel LED display units.

4.3 Dust and Clean the keyboard.

5. Fringe Signal Box

5.1 Using a suitable meter Measure the 110V AC system supply voltage is between:

- 95V and 120V.

5.2 Clean and dust all the equipment.

5.3 Check that the monitor picture quality is satisfactory.

5.4 Check that all the equipment is undamaged and that all connections are secure.

5.5 Check that the TD stepping is functioning correctly.

5.6 Place the Fringe box/Main box modem link into back- to-back mode (AL).

5.7 Check that the VDU screen fills with character sets.

5.8 Check that each alpha-numeric keyboard letter when depressed effects a change in one character of the continuously filling screen set.

5.9 Place the modem back to normal operation. Check that the map re-appears or will do so when the 'Recall' button is depressed.

5.10 Check that a set-up is possible in the scratch pad area. Erase after test.

6. All Sites

6.1 Measure all cubicle and panel earth points for continuity to earth.

7. Spare Change

Appropriate Electrostatic precautions shall be taken before handling any electronic components.

7.1 Exchange all spare PSUs and PCBs into the system.

Check that no faults are reported before replacing the next unit.

All microprocessor boards (Mk.1 & 2) shall be patched where appropriate with correct EPROMS, address plugs, RAMS and where applicable baud rate switches'.

Most EPROMS are unique to position and site, therefore they cannot be interchanged between different card slots and signal boxes.

All spare units are to be stored in anti-static bags or boxes.

End

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part C/Test/TD38		
GE PC based Small Train Describer		
Issue No. 1	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	GE PC based Small Train Describer
Exclude:	Other train describer equipment

Before working on system use appropriate ESD precautions

GENERAL

The PC Small Train Describer, PC-STD, comprises a fanless PC system fitted with a processor module incorporating graphics, mouse, keyboard, printer port and USB interfaces, serial Input/output module(s), digital Input/output module(s). Connections to the peripheral equipment, i.e. Signalman OCU's/Workstation's, Information display's (Map terminals), Display Distributors, and external systems SSI, TDM, TDMX, ATR, TRUST, SMART, adjacent box train describers, etc. are via the serial I/O module(s) fitted in the system. The PC unit can be shelf/desk mounted or housed in a 19inch cubicle.

RECORDS.

All activities carried out on the PC-STD are to be recorded in line with current maintenance standards.

A Discrepancy Report Form provides a method of logging equipment and system discrepancies/faults that have occurred on a commissioned system. A form should be completed and accompany any returned equipment In the event that it is not practical to return the faulty equipment due to its size or installation, the form should be returned to GE as a means of advice of a problem.

Any failures found should be reported to the supervisor/manager.

1 Service A

1.1 Check that the power supply indications are indicating correctly.

1.2 Check that the links to the PC-STD are reported as OK, rectifying any defect.

1.3 Check that the PC-STD keyboard and trackball (where provided) is functioning and that the display screen is working correctly. Check that there is a working spare keyboard on site.

2 Service B

2.1 Clean the display screen and housing using a proprietary anti – static screen cleaner, used in accordance with the manufacturer's instructions. Disconnect and clean the keyboard as required, then reconnect.

3. Periodic Task

3.1 Change out the PC-STD with the spare unit. Check that the detail of each unit location and serial number is recorded in the site log-book.

End

Includes:	GETS Dual TD at Birmingham New Street Signal Box
Excludes:	All other GETS Train Describers

General

The dual train describer (DTD) comprises of two identical train describer crates (CCA & CCB) operating in a control and standby mode.

Connections to the peripheral equipment, for example Signallers OCUs, information VDUs (map displays), display distributors and external systems (SSI, TDM, TDMUX, ATR, TRUST, SMART and adjacent signal box train describers etc) is via an auxiliary serial changeover system.

The controller crates and the auxiliary serial changeover system are housed in a 38U cubicle. System ‘A’ boots up first and is the default control system.

This system scans both its watchdog inputs and those of system ‘B’ which is in standby. If it has stopped pumping its own watchdog but ‘B’ system is still pumping an automatic changeover will occur.

The standby system will then be the control system and vice versa. To prevent continual switching between systems under certain fault conditions, further automatic changeovers are prevented until a manual reset has taken place.

There is also a signalling input system (SIS) in the equipment cubicle; this converts the local stepping inputs into serial data format for the TD.

This system is functionally the same as a TDMUX.

Data Logging (Archive) PC

This is fitted to store and log all train movement messages and signalling data on a daily basis. The data is logged over a seven-day period, on the eighth day the first day’s data is overwritten.

The archived data can be downloaded at any time for analysis at a later date.

Refer to the manual for instructions on how to correctly transfer and analyse the data.

DAILY SERVICES

1. Fault Logging Terminal (WYSE)

1.1 Check the terminal is operational and switches between the A and B control crates.

1.2 Check for any outstanding faults. Rectify as necessary.

1.3 Check that the area is clean and tidy, remove any debris or rubbish.

2. Data Logging (Archive) PC

2.1 Check that the link between the logger PC and the DTD is reported as OK. Rectify any problems as necessary.

3. Control Equipment Cubicle

3.1 Observe that all the power supply indications are showing correct for all the units. Investigate any problems.

REGULAR SERVICES

4. Control Equipment Cubicle

4.1 Check that the area is clean and tidy, remove any debris or rubbish.

4.2 Where fitted, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

5. Data Logging (Archive) PC

5.1 Download the previous days data to confirm that the Logger PC is correctly recording the data.

SERVICE A

6. System Changeover

6.1 Prior to carrying out a manual changeover, print a list of all the current system faults using the ‘EFAS’ and ‘FLTS’ commands on the engineering terminal. Several minutes after the changeover use the same commands to print another list of system faults and compare the two.

Rectify any differences between the two.

6.2 Force a manual changeover of the control and standby crates by use of the select pushbutton on the 3AC-AP. Check the system is working correctly. Leave the ‘control’ and ‘standby’ crates in this configuration.

This task shall be performed in liaison with the Signaller.

6.3 Force a manual changeover on the SIS system by using the control and fault monitoring panel.

Check the system is working correctly. Leave the SIS system in this configuration.

Check that the changeover switch is left in the centre (auto) position.

6.4 Record the results in the system logbook.

7. Power Supplies

7.1 Using a meter and/or oscilloscope, measure the DC voltages and AC ripple on the auxiliary changeover controller modules (3AC-AP/SP) using the monitoring points on the front panels. Check that they are within the limits shown below:

Supply	Limits	Ripple
12V Logic	10.8V to 13.2V	<50mV
+12V Interface	+10.8V to +13.2V	
-12V Interface	-10.8V to -13.2V	

Table 1 - Voltage Limits

Any module with readings outside this range shall be replaced.

7.2 Using a meter and/or oscilloscope, measure the DC voltages and AC ripple on the control equipment crate power supply modules (6PP-B) on the back connector of each PSU. Check that they are within the limits shown below:

Supply	Limits	Ripple
5V Logic	4.5V to 5.5V	<50mV
+12V Interface	+10.8V to +13.2V	
-12V Interface	-10.8V to -13.2V	

Table 2 - Voltage Limits

Any module with readings outside this range shall be replaced.

7.3 Using a meter and/or oscilloscope, measure the DC voltages and AC ripple on the SIS crate power supplies (6PP-C) using the monitoring points on the front panels. Check that they are within the limits shown below:

Supply	Limits	Ripple
5V Logic	4.5V to 5.5V	<50mV
7V Logic	6V to 8V	
12V Interface	10.8V to 13.2V	

Table 3 - Voltage Limits

7.4 Using a meter and/or oscilloscope, measure the DC voltages and AC ripple on the AP-H that provides power to the 6PP-C units. Check that it is within the limits shown below:

Supply	Limits	Ripple
48V	40V to 51V	<100mV

Table 4 - Voltage Limit

8. Equipment Inspection and Cleaning

8.1 Check the Anthorn (formally Rugby) clock unit on the front panel, confirm the correct date and time is being displayed.

Check the operation of the antenna symbol to confirm the clock is receiving a signal. Report any problems to your SM(S).

Note that the Anthorn clock is switched off on the first Tuesday of each month and for two weeks in the summer for maintenance.

8.2 Dust and clean the display screens and housings of all monitors using a proprietary anti-static 'dry' screen cleaner in accordance with the manufacturer's instructions.

Check that the displays are well focused and there is adjustment available on both the brightness and contrast. Check that the Signallers are satisfied with their displays.

8.3 Disconnect and dust and clean all keyboards. Hold the keyboard upside down when dusting. If the keyboard is damaged or cleaning if ineffective, report as corrective maintenance.

8.4 Visually check all connecting leads are secure and undamaged.

8.5 On each industrial PC, check that front and rear cooling fans are both running, and the fan covers are not obstructed. Check the air intake filters are clean, renew as necessary.

SERVICE B

9. Cubicle Cleaning and Inspection

9.1 With the front and rear doors closed, clean the outer surfaces using a dry lint free cloth.

9.2 Carefully dust the interior faceplates and blanking panels using a dry lint free cloth.

9.3 Check that on completion of cleaning that the cubicle doors are securely closed. The cubicle provides EMC protection, any signs of damage or deterioration should be reported to your SM(S).

9.4 Check that all the spare program and database proms are available and current for all systems.

PERIODIC TASKS

10. Industrial PCs

Technical support staff and/or equipment specialists may manage tasks 10.2 & 10.3 separately.

10.1 Change all working industrial PC's over to the spare units. Confirm that the details of each unit location and serial number are recorded in the site logbook.

10.2 Replace the following equipment cooling fans on each PC with new units of the same type. Check after replacement that each fan works correctly.

a) PC front air intakes.

b) Internal PC processor fan.

c) PC power supply.

10.3 Replace on each PC the internal clock and Bios chip battery with a new battery of the same type.

END

General

Electrostatic precautions shall be taken before handling any electronic components.

The Automatic Code Insertion (ACI) terminal automatically changes the descriptions of trains arriving at terminating locations to the timetabled outgoing descriptions.

It is a dedicated PC located on the Signalling Centre operating floor and connected via a serial link to the TD.

The PC is loaded with a database containing a definition of the berths at locations where ACI action is required and lists of linked incoming and outgoing trains for each location.

Records

Record all activities in the relative system log book.

SERVICE A

1. System Performance

1.1 Check that the link between the ACI Terminal and the Train describer is reported as OK. Rectify any defects or report via FMS as necessary.

1.2 Check the power supply indications are indicating correctly for all units.

1.3 Check that the ACI keyboard is functioning and that the display screen is working correctly. Check that there is a working spare keyboard on site.

SERVICE B

2. System Maintenance

2.1 Change out the ACI PC with the spare unit. Check that the detail of each unit location and serial number is recorded in the site log-book.

2.2 As provided, clean all monitor screens and housings with a proprietary anti-static dry screen cleaner.

2.3 As provided, and if necessary, disconnect and clean any tracker or mouse ball and rollers. This is necessary if the operation has become intermittent or jerky.

2.4 As provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

3. Equipment Cubicles

3.1 Clean the exterior surfaces and carefully dust the interior of equipment cubicles using a dry lint free cloth.

3.2 As provided, check the front air intake filters on all PC based equipment, clean or renew as necessary.

3.3 Check that the cubicle doors are closed when cleaning the exterior and check leads, and connectors are not disturbed during cleaning.

PERIODIC TASKS

4. Equipment Servicing

4.1 Arrange to send the PC to the supplier for service and replacement of PSU and processor fans, battery, and hard drive.

END

General

TPWS usually consists of two sets of track-mounted equipment (OSS & TSS) and the trackside equipment; including the TPWS control equipment, power supply, and signalling interface.

More information on TPWS systems can be found in NR/GN/SIG/19048.

1. Generic Layout of a TPWS Installation (Not to Scale)

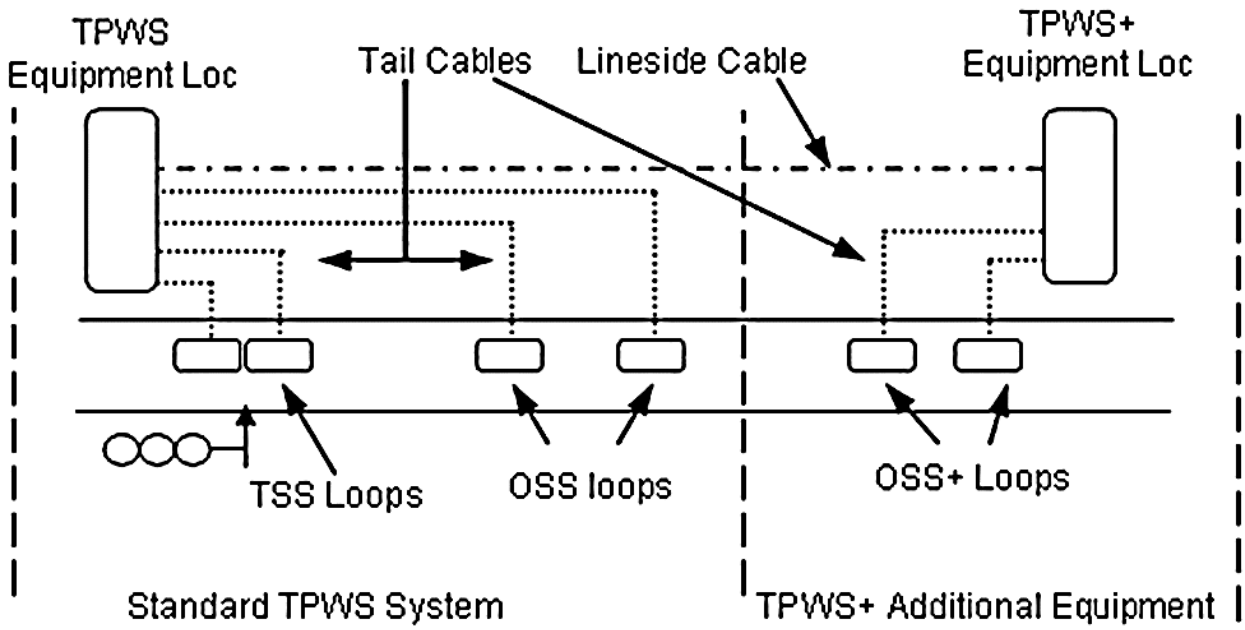


Figure 1 - Generic Layout

2. Principles of Operation

The track-mounted OSS & TSS loops transmit electromagnetic fields at defined frequencies, which are detected by a receiver on the train.

The TPWS will only be energised if the signal is at red.

3. Overspeed Sensors (OSS)

These are positioned a distance apart on the approach to the signal. If the TPWS is energised as the train passes over the arming loop a timer is started on the train.

If the train passes over the trigger loop with the timer still running a brake application will be automatically made.

4. Trainstop (TSS)

These are positioned together at the signal. If the TPWS is energised the train will first receive an arming frequency, then a trigger frequency whilst the arming frequency is still present. A brake application will then be automatically made.

5. OSS & TSS

TPWS OSS and TSS may be provided in various combinations. Some signals may only be fitted with a TSS, while some signals will have one or more OSS.

PSRs or buffer stops will only be fitted with an OSS and the TPWS will be permanently energised.

The exception to this is remote PSRs operated by a self-powered battery. The TPWS will only be energised when the associated treadle has been operated.

TPWS loops are energised whenever the controlling signal is displaying a stop aspect and no subsidiary aspect.

Some older installations may suppress the TSS and not the OSS for a proceed subsidiary aspect.

Some installations have OSS suppressed by the lie of points, these are known as complex approaches.

6. TPWS+ Systems

Conventional TPWS systems give protection against SPADs at approach speeds up to 120kph (75mph).

TPWS+ systems have an additional OSS loop (known as an OSS+ loop) fitted at approximately 750m (± 25m) on the approach to the signal.

This gives the TPWS+ system protection against SPADs at approach speeds up to 161kph (100mph).

The provision of the OSS+ loop at a greater distance than the conventional OSS loop entails an additional trackside apparatus case to house the control equipment.

7. TPWS Control Inputs

TPWS control modules have two inputs, the main input (‘Main I/P’) and the suppression input (‘Supp I/P’).

TPWS loops are energised by applying a voltage to the main input and suppressed by applying a voltage to the suppression input.

A voltage applied to the suppression input in the absence of a voltage applied to the main input will not cause the loops to transmit.

In normal operation the Main I/P is energised by either the relay controlling the signal main aspect (HR), or by a direct connection to the signal red aspect 110 V AC feed.

The Supp I/P is normally controlled by the relay controlling the subsidiary signal proceed aspect ((PL)GR), however, where self-reversion controls are required, the suppression input can be controlled by a 'V(Supp)R' or, in the case of complex approaches, by the lie of points indication or operating relays.

8. Position Light associated with Main Signal ((PL)GR)

With the main signal "On" a main signal input will be applied to the TSM and OSM and with the position light signal "Off" a suppression input will be applied to the TSM only.

9. Transmitter Loop Position

The position of the loops is critical to the designed operation of the system. The signalling record diagrams on site should show the combination of transmitter loops and frequencies for each signal, and the nominal distances.

The TSS loop distances are measured from the centre point of the two transmitter loops.

The OSS arming and trigger loop distances are measured from the leading edge of the loop, in the direction of travel.

The longitudinal centre of the loop shall be within +/- 10mm of the centre line of the track.

The loop fixing bars have a hole through the centre to assist in alignment. This is particularly important for bars Hilti bolted to concrete sleepers or screwed to timber sleepers.

Fixing bars designed to be secured by the rail fastening (e.g. Pandrol clips) will be automatically set to the correct position.

The distance below rail level from the top of the transmitter loop shall be between 60mm and 100mm.

Loops on concrete slab track shall be installed as stated in the Table 1.

Approx. Loop Feeder Cable Length	Distance Beneath Rail Head Level	
	Min	Max
0-50m & all Mini Buffer Loops *	20mm	60mm
50-150m	20mm	50mm
150-250m	20mm	40mm
250-350m	20mm	30mm
350-500m	20mm	20mm

Table 1 – Slab Track Loop Length's

*: The bottom of the Buffer Stop Mini Loop shall be at least 50mm above concrete slab track.

The maximum cable length shall be 500m.

For mini loops on steel sleepers, the bottom of the transmitter loop panel shall be separated by at least 70mm from the top surface of the steel sleeper.

The transmitter loop panel shall not overhang the steel sleeper by more than 50mm. Cable insulation testing shall not be undertaken with the cables connected to loops.

10. Self-Reversion

In some areas TSS loops have to be installed closer to the replacement block joint than the required 3.5m, or even ahead of it.

A TPWS fitted train passing over these loops would replace the signal to danger, and re-energise the TSS loops, before the train's antenna had passed over them causing the train's brakes to be applied.

This is known as Self Reversion. To avoid this situation additional signalling controls are included to suppress the energisation of the TPWS loops until the train borne antenna has passed over them.

11. VCPR

There is a risk that because the VCPR is permanently energised the front contacts could remain made when there is no current on the coil.

Where a VCPR is provided, the power supply shall be disconnected to check the front contacts break.

Disconnecting the TPWS power supply will cause the simultaneous activation of the Signaller's TPWS failure alarm.

12. Fault Reporting

For signals, failure of TPWS to transmit when required is reported in the signal's ECR circuit, or, for buffer stops, in the platform starter signal's EKR circuit.

TPWS at PSRs will not normally have remote fault reporting.

This does not apply to mechanical signals as a separate FIU is used.

On ex -WR sites the EKR may be known as G(M)ECR.

13. TPWS Equipment

Part number details for Thales TPWS equipment are listed in NR/GN/SIG/19048, Signalling Equipment Technical Advice Notice (SIGTAN 48) – Train Protection and Warning System (TPWS) Trackside Equipment.

Baseplate:

This is a purpose-built plug-board, which contains one signalling interface module (SIM) and one other TPWS module.

It can be fitted in a location or a relay room on standard relay racking. Some installations will avoid using the baseplate due to space constraints.

Trackside Enclosure:

This is a purpose-built housing, which contains either one, two or four TPWS functions. It is mounted track side, normally at the location of the fitted signal or PSR.

Any failure within a TPWS base-plate assembly, internal wiring, and terminations will require the entire unit to be changed. The units are not user serviceable.

Any failure within the wiring of a trackside enclosure can be rectified by replacement of the backplane of the failed function.

Siemans Rail Object Controller (Signal) [OC(S)]:

Within the OC(S) enclosure there is a bespoke TPWS baseplate.

This is an integral part of the OC(S) and mounts two TPWS functions, one TSS and one OSS. These are always provided in wiring and are used as shown on local site records.

This version of TPWS equipment is powered at 24Vdc. References in this SMS to power supplies at 110Vac [BX110] should be understood to mean 24Vdc [B24].

A separate MCB is provided to connect / isolate the TSS and OSS function as appropriate.

Any failure of the TPWS backplane in an OC(S) will require replacement as directed by your SM(S).

Transmitter loops:

This refers to the TPWS train-stop system (TSS) and overspeed sensor system (OSS) track mounted equipment.

Over-speed sensor:

This system has a function of demanding a brake application if a train passes the sensor above a pre-defined speed. It consists of a pair of loops on the approach to the signal, set a distance apart corresponding to the set speed.

Train-stop sensor:

This system has a function of demanding a brake application on a train that passes a signal at danger without authority. It consists of a pair of loops abutting each other, normally placed in line with the foot of the signal.

TSS or OSS modules:

These are plug-in electronic modules associated with the TSS and OSS, known as the train-stop module (TSM) and overspeed sensor module (OSM) respectively. Separate modules exist for normal and opposite directions of travel.

Failure Indication Unit (FIU):

This is an indication unit placed on the signal box block shelf for indicating TPWS failures where it is not appropriate to use the ECR circuit of the fitted signal.

The track mounted TPWS equipment is connected to the trackside equipment by means of feeder cables and tail cables.

The TPWS control equipment is wired into the existing signalling system as shown on local site records.

Where a separate TPWS housing is provided, there will be a 12-core signalling interface cable.

Many TPWS sites are wired within existing locations, using equipment that is mounted on a baseplate.

Some installations will directly connect to a plugboard and not use a baseplate due to space constraints.

14. System Reset

To reset the 'Fault' LEDs (red), isolate the BX110 supply for 5 seconds by removing the fuse in terminal no.1 or operate the MCB.

The fuse-holder should not become detached from the terminal block.

When you re-connect the fuse/MCB, the 'Power on' LEDs (green), on all modules should be lit and all 'Fault' LEDs should be unlit.

Voltages will still be present on the signalling inputs and fault outputs following isolation of the system at the TPWS trackside enclosure or apparatus case.

Do not attempt to reset the system by removing and replacing a module.

15. System Reset - Siemens Rail Object Controller (Signal) [OC(S)].

To reset the 'Fault' LEDs (red), isolate the B24 supply for 5 seconds by operating the MCB.

The MCB will then become tripped and should not become detached from the breaker. When re-operating the MCB, the 'Power on' LEDs (green), on all modules should be lit and all 'Fault' LEDs should be unlit.

Voltages will still be present on the signalling inputs and fault outputs following isolation of the system at the TPWS trackside enclosure or apparatus case.

Do not attempt to reset the system by removing and replacing a module.

16. Test Equipment

A 'Fluke TPWS' digital multi-meter shall be used.

A TPWS calibrated Mk.2 yellow test aerial with lead and integral 100Ω resister, and TPWS maintenance Jig is required.

To take measurements, position the aerial in the Maintenance Jig at the centre of and in the plane of the transmitter loop. Do not hold the meter directly above the loop so as not to affect the reading taken. See figure 2

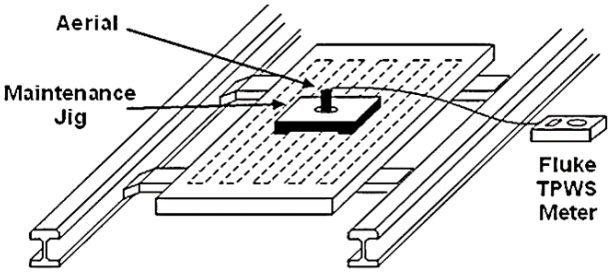


Figure 2 – Maintenance Jig Positioning

17. Component Changing

If any item of TPWS equipment is changed, comply with NR/SMTH requirements.

18. Fault Finding

Flow charts to assist finding faults within Thales TPWS trackside equipment can be found in NR/SMTH/Part10/FF12 (Faulting Guide: Train Protection Warning System (TPWS)) & NR/SMTH/Part10/FF13 (Faulting Guide: Train Protection Warning System (TPWS) Fault Finding Flow Charts).

TPWS IN RADIO ELECTRONIC TOKEN BLOCK (RETB) AREAS

To facilitate the use of TPWS in RETB signalled areas, a Trackside Radio Control Unit (TRCU) and associated subsystems are used.

TRCU is the term used to describe the whole system that include the Trackside Radio Module (TRCM), the Global Positioning System (GPS), the Radio Antennas, the Location Identity Device (LID) and the Trackside Functional Modules (TFMs).

It can be located in a Relocatable Equipment Room (REB) or in a suite of Trackside Apparatus Cases (Locations).

The TRCU also receives the electronic tokens issued from the Signaller to the driver. If a valid token is detected by the system, the TPWS loops are suppressed and a flashing indication to the driver via the lineside status indicator.

The TRCU will keep the TPWS suppressed until either:

a) The TRCU recognises the return of a token to the Signaller.

b) A pre-set suppression time period has elapsed.

c) Cancellation by a treadle on the departure side of the stop board.

d) When a shunt token is recognised by the TRCU, all TPWS equipment protecting the single line from the token exchange point (TEP) are simultaneously suppressed. All LSIs will change from an illuminated state to a flashing state.

Engineering tokens are not recognised by the TRCU therefore no TPWS will be suppressed.

The system operates independently of the main RETB system; it is for the operation of the TPWS system only.

19. Trackside Radio Control Module

The TRCM is a plug-in module at the heart of the system, it is a unique piece of equipment designed and built specifically for the fitment of TPWS to RETB lines.

It uses Alstom Mk3 TFMs to provide the input and output capability required for the site.

It has an event logging memory that can store the last seven days events (receipt of tokens, operations of the inputs and outputs etc). This information can be downloaded to a laptop computer that has the necessary software.

20. Lineside Status Indicator

The lineside status indicator is a blue single aspect light emitting diode (LED) indicator.

It is fitted to the ‘Stop and Obtain Token’ board and informs the driver of the status of the TRCU/TPWS system.

The LSI is illuminated when no valid token has been issued and flashing when a valid token has been issued.

21. Radio Antennas and GPS

There are three antennas within the TRCU, two for token reception that are located on a mast close to the locations or equipment room and one for the GPS mounted on one of the locations or equipment room.

The GPS system is to provide date and time information for the TRCM event logging memory.

22. TPWS

The TPWS loops and trackside equipment are identical to those fitted on ‘standard’ installations; therefore, the information in the previous section applies. The only difference is that the TPWS is driven by the output of the TRCU and not a signal.

23. Uninterruptible Power Supplies (UPS)

The TPWS UPS system is identical to that fitted in mechanically signalled areas.

24. TPWS at No Signaller Key Token (NSKT) Systems

These systems indicate to the driver in a very similar way to TPWS in RETB areas although the equipment is different.

When the driver stops at the ‘Stop and Obtain Token’ board in place of obtaining a token from the RETB, a physical token is obtained from a token machine in a trackside location.

The removal of the token as well as locking the machine deactivates the TPWS loop and activates lineside status indicator for a set period of time.

The driver is then able to proceed in the normal manner.

END

Includes:	All types of TPWS installations
Excludes:	n/a

The position of the transmitter loops is critical to the designed operation of the system. If you find that the position of loop(s) has been disturbed (relaying work etc), arrange for the loop positions to be re-checked.

You can find more information about TPWS systems and equipment in NR/SMS/PartC/TP00. (Train Protection Warning System (TPWS) General

SERVICE A

1. Track Sub-System Control Modules

1.1 Check the internal and external labelling. The labels shall clearly identify the correct system. Where the SIMs are part number 604366-00, arrange for these to be replaced with the latest part number.

1.2 Check the LED indications on all modules are as follows:

LED	Colour	State
Power On	Green	Lit
Fault	Red	Unlit

1.3 Invensys Rail Object Controller (Signal) [OC(S)].

In the OC(S), TPWS equipment has the following LED indications illuminated for any proceed aspect in an associated signal:

LED	Colour	State
Power On	Green	Lit
Main I/P	Yellow	Lit
SUPP I/P	Yellow	Lit

Record details on the record card. Investigate and rectify any fault that is indicated. If you cannot rectify the fault, advise the Signaller.

1.4 Check that the yellow signal status LED indications (“Main I/P” and “Supp I/P”) correspond with the signal aspects being displayed.

2. TPWS Enclosures (or base-plate)

2.1 Examine the assembly and fixings. Any failure within the internal wiring of a baseplate, modules, mountings, or connections requires a replacement unit.

Any failure within the internal wiring of a trackside enclosure requires replacement of the backplane for the failed function.

2.2 Examine the following items:

a) Module fixing and retaining clip.

b) Earth braids and terminations.

c) Terminal rail and terminations. Look for loose disconnection links, connections, wires, or wire strands.

d) Door, hinges, and locks.

e) Door seal.

2.3 Check the trackside enclosures for signs of moisture ingress.

2.4 Lightly lubricate the hinges and lock.

3. Cables and Disconnection Boxes

3.1 Examine tail cables, feeder cables, and disconnection boxes.

3.2 Cables shall not be kinked, trapped, or damaged. They shall be correctly routed, and securely terminated.

3.3 Dis-boxes, where provided, shall be secure, weatherproof, and structurally sound. Dis-box and feeder cable labels shall be fixed and legible.

3.4 Check the condition and security of the plug coupler on the tail cable at the loops.

3.5 Remove any accumulated debris from the vicinity of the transmitter loops and supporting structures.

3.6 Examine each of the transmitter loop and fixings. The loops shall be securely fixed to the fixing bars and undamaged. The fixing bars shall be securely fixed to the track.

The position of each loop, relative to the signal post and signal replacement IRJ is critical. The nominal positioning information can be found on the site wiring diagrams. If there is any obvious sign of movement from the specified position, arrange for a re- check.

4. Failure Indication Unit (FIU) – Where Provided

4.1 Examine installation, cables, and fittings for security and signs of deterioration or breaks. Renew or refit items requiring attention.

4.2 Check that the Power On (White) LED is illuminated and Measure the voltage between the B12 and N12 busbar:

- Between 9V and 15.6V.

4.3 Check that each unit is not excessively hot.

4.4 Press the “Test” button. Observe that all the lights flash at the correct frequency and that the audible alarm sounds.

If flashing rate or audible sound are distorted, change the Master FIU.

4.5 Clean the units and check equipment is correctly installed.

5. Self-Powered OSS Unit (SPOSS)

This task is only applicable if a SPOSS is fitted.

5.1 Examine the batteries and connections. Clean and Protect as necessary.

If damage or corrosion is present the batteries and/or connections/leads should be replaced.

6. VCPR Check (Where Provided)

6.1 This task shall be carried out with the agreement of and in liaison with the Signaller.

6.2 Disconnect the power supply to the TPWS equipment by removing the main BX110 feed fuse, or by operating the B24 MCB in an Invensys Rail Object Controller (Signal) [OC(S)]

6.3 Check that the VCPR front contacts have broken.

6.4 Restore the power supply and check that the VCPR has re-energised.

6.5 Check that the signaller’s failure alarm has reset. Any problems shall be reported as corrective maintenance.

SERVICE B

7. Self-Powered OSS Unit (SPOSS)

This task is only applicable if a SPOSS is fitted.

7.1 Replace both batteries (unless new batteries have been fitted in the last 9 months).

7.2 Remove the SPOSS battery fuses F1 & F2 before replacing the batteries.

New batteries should be tested prior to installation, a 60Ω resistor (URL part number NRSP/000919) shall be connected across the terminals and using a suitable meter a voltage of at least 11.5V for 30 seconds should be observed.

7.3 Carry Out NR/SMS/PartB/Test/233 (TPWS Self-powered OSS (SPOSS) Trackside Equipment Test)

8. Full Test (If not a SPOSS)

8.1 Carry out NR/SMS/PartB/Test/230 (Train Protection & Warning System (TPWS) Tests)

PERIODIC TASKS

9. UPS Battery Replacement

This task is only applicable if a UPS is fitted.

9.1 Replace the UPS battery Check that the new battery pack is undamaged before installation.

Replacement battery pack cannot usually be charged before installation, check a few days after they have been installed so that they are charging correctly.

9.2 Carry Out NR/SMS/PartB/Test/057 (Uninterruptible Power Supply Test)

Reliability – Centred Maintenance

Includes:	All types of TPWS installations
Excludes:	TPWS without fault detection,TPWS with self powered OSS (SPOSS) or Lineside status indicators (LSI)

Service RA Carry out service A and B of this SMS.

END

Includes:	TRCM, GPS Sub-system, Interface TFMs, LID and Radio antennae.
Excludes:	All other Trackside Radio Control Units

SERVICE A

1. Trackside Radio Control Unit

1.1 Visually Examine the equipment, terminals, cables and cable connectors. Look for physical damage, overheating and arcing.

1.2 On the TRCM Check that the location identity device (LID) is securely fitted.

1.3 On the TRCM Observe that the indicators are showing as follows:

Indication	Colour	State
Power	Red	Illuminated
TRCM OK		
TRCU OK		

Table 1 - TRCM Indications

1.4 On each TFM Observe that the indicators are showing as follows:

Indication	Colour	State
Power	Red	Illuminated
System		
Rx Data		
Outputs		

Table 2 - TFM Indications

1.5 On the TRCM, turn up the volume on radio channel 1 and check that messages are being received. Turn the volume down & repeat for radio channel 2.

SERVICE B

2. Radio Antennae

2.1 Using a compass check that the radio antennae are orientated in the direction as shown on the site diagrams. Report any problems as corrective maintenance.

END

Includes:	LSI only. For signs see NR/SMS/SG20, For TRCU see NR/SMS/TP22
Excludes:	

Do not obstruct the sighting of the indicator to the driver of an approaching train during any maintenance activity.

SERVICE A

1. Operation

1.1 Observe that the LSI is steadily lit when no valid token has been issued.

1.2 If possible, Observe the operation of the LSI during the passage of a train. Check that the LSI is steadily illuminated when no valid token has been issued and flashing when a valid token has been issued.

2. Indicator Inspection

2.1 Check the following items:

a) Indicator Head.

b) Cable Entry, Check that glands are effective.

c) Lenses and lens hoods. Clean lenses as necessary.

2.2 Check that all the LEDs on the LSI are illuminated. If any are found not to be, replace the whole LSI unit.

3. Final Checks

3.1 Check the visability of the LSI, verify that the steady/flashing blue light is bright and clearly visible.

3.2 Check that the sighting is not obscured by vegitation, cut back as required.

End

TREADLES

They have an actuating arm made of high tensile stainless steel. This absorbs the energy produced by the shock of the wheel flange and controls the electrical contacts.

An oil dashpot has a damping effect and delays the return of the arm. The dashpot is adjustable between 0 – 13 seconds.

The damping makes sure that the reverse contacts are closed and also prevents the treadle arm from rising between each axle of a moving train.

Type 69 - “Cautor” Single Arm Treadles

These are bi-directional and can detect trains running in either direction.

These have a shorter operating arm and are available as the ‘Cautor’ single arm configuration only. See Figure 1.

Figure 1 - Type 69 “Cautor” – Single arm treadle

Type 69 “Forfex” Double Arm Treadles

These have a longer operating arm and are available as ‘Cautor’ single arm or ‘Forfex’ double arm treadles. See Figure 2.

These are available as either bi-directional (standard model) or uni-directional models.

The uni-directional model has the two reverse contacts mounted on one arm. This treadle can only detect trains running in one direction (e.g. A-B or B-A).

Figure 2 - Type 69 “Forfex” - Double arm treadle

The direction is indicated on the treadle using an arrow shaped label or metal label with an arrow point end. See Figure 3.

Figure 3 - An example of the direction indicating arrow

Figure 4 - Examples of treadle labels

Uni-directional treadles are often associated with level crossings and are indicated on the signalling plan with an arrow. See Figure 5.

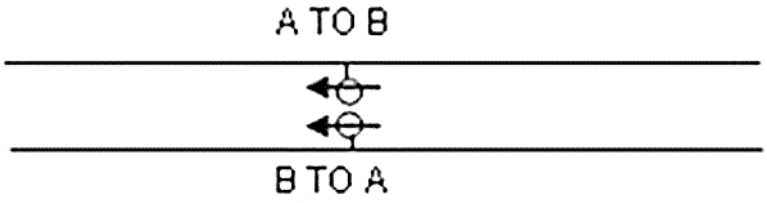


Figure 5 – Signalling plan symbol for a Uni directional model

The bi-directional model has two, independent reverse contacts, one on each arm, which correspond to the two directions of travel.

This can detect trains running in either direction.

When changing treadles check the correct direction is installed on each rail.

Where directional treadles are fitted to both rails, a pair of opposite handed treadles are required.

Dashpot Fluid

This shall cover the narrow lower portion of the dipstick and topped up as required.

Treadle Renewal

This shall be arranged before the treadle arm wears below 50% of its original diameter. The slot in the treadle arm gauge can be used to check this.

Treadle Arm Guards

These shall not be fitted and shall be removed if found on existing installations. Inform your SM(S) if any are found.

Integrated Treadle Gauge

The gauge has been designed for use on both standard rail brackets and euro brackets.

Each of the gauges described in this section are identified on the Integrated Treadle Gauge and have been engraved into the gauge.

Calibration is required every 5 years or if the gauge becomes damaged, it is recommended that all gauges are entered into the National Calibration Register. Drawings are available within the Product Acceptance file for calibration measurements and tolerances.

The gauge has been designed and tested to conform to BS 8020:2011 for use on Third Rail Traction areas.

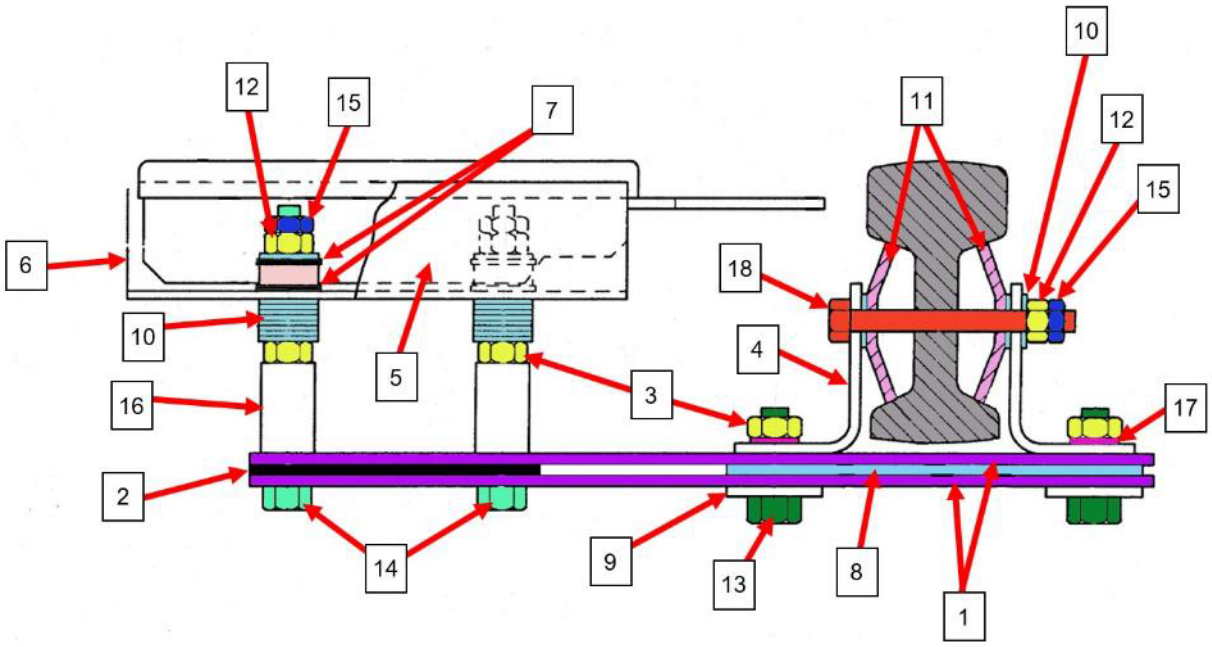
Users of the gauge are advised to operate and extend the gauge once the gauge end has been placed on the rail furthest away from any raised traction rail – this prevents the gauge coming into contact with the traction rail.

Installation

To minimise vibration, ideally treadles should not be installed within 3m of a rail joint. The exact position of a treadle can be critical and is often associated with a timing function.

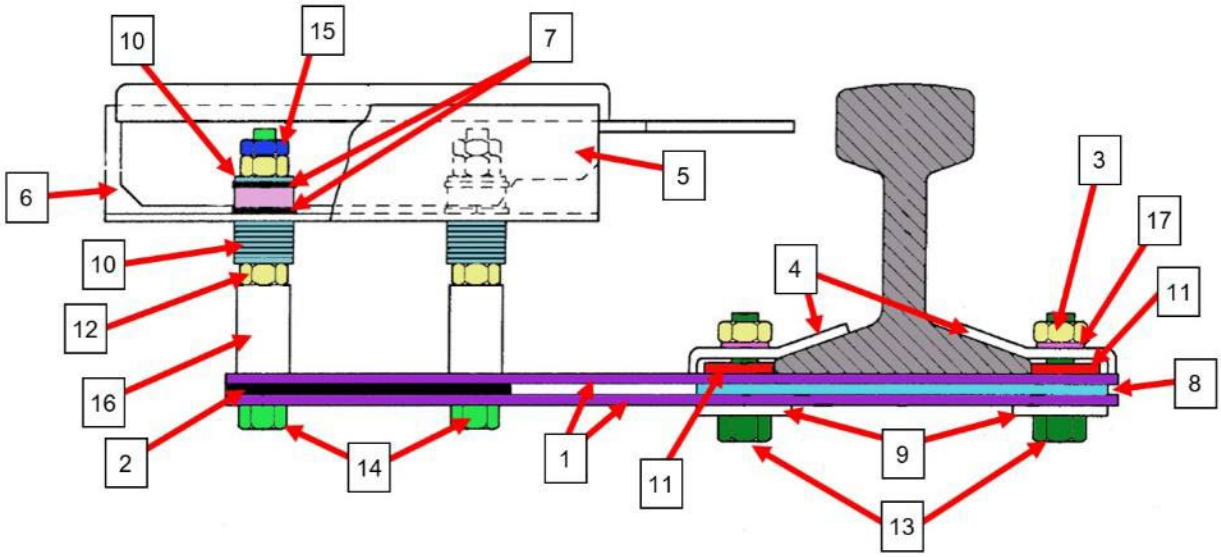
Treadles shall not be repositioned without the prior authority of a competent and authorised person.

APPENDIX A - Parts List – Bullhead Rail



No	Description	Quantity
1	Frame	4
2	Rubber Plate	2
3	Nut 16mm Hex Std	4
4	Bracket	2
5	Guard Plate	1
6	Guard Plate	1
7	Rubber Washer	8
8	Mounting Wedge	2
9	Tie Plate	2
10	Steel Washer 12mm	As Required
11	Web Plate	4
12	Nut 16mm Hex Std	10
13	Bolt 16mm dia *60mm long	4
14	Bolt 12mm dia *150mm long	4
15	Nut 16mm Hex lock	6
16	Spacer	4
17	Star Washer 16mm	4
18	Bolt 12mm dia *120mm long	2

APPENDIX B - Parts List – Flat Bottom Rail



No	Description	Quantity
1	Frame	4
2	Rubber Plate	2
3	Nut 16mm Hex Std	4
4	Rail Clip	4
5	Guard Plate	1
6	Guard Plate	1
7	Rubber Washer	8
8	Mounting Wedge	2
9	Tie Plate	2
10	Steel Washer 12mm	As Required
11	Butt Plate	4
12	Nut 12mm Hex Std	8
13	Bolt 16mm dia *70mm long	4
14	Bolt 12mm dia *160mm long	4
15	Nut 12mm Hex lock	4
16	Spacer	4
17	Star Washer 16mm	4

APPENDIX C - European Treadle Bracket

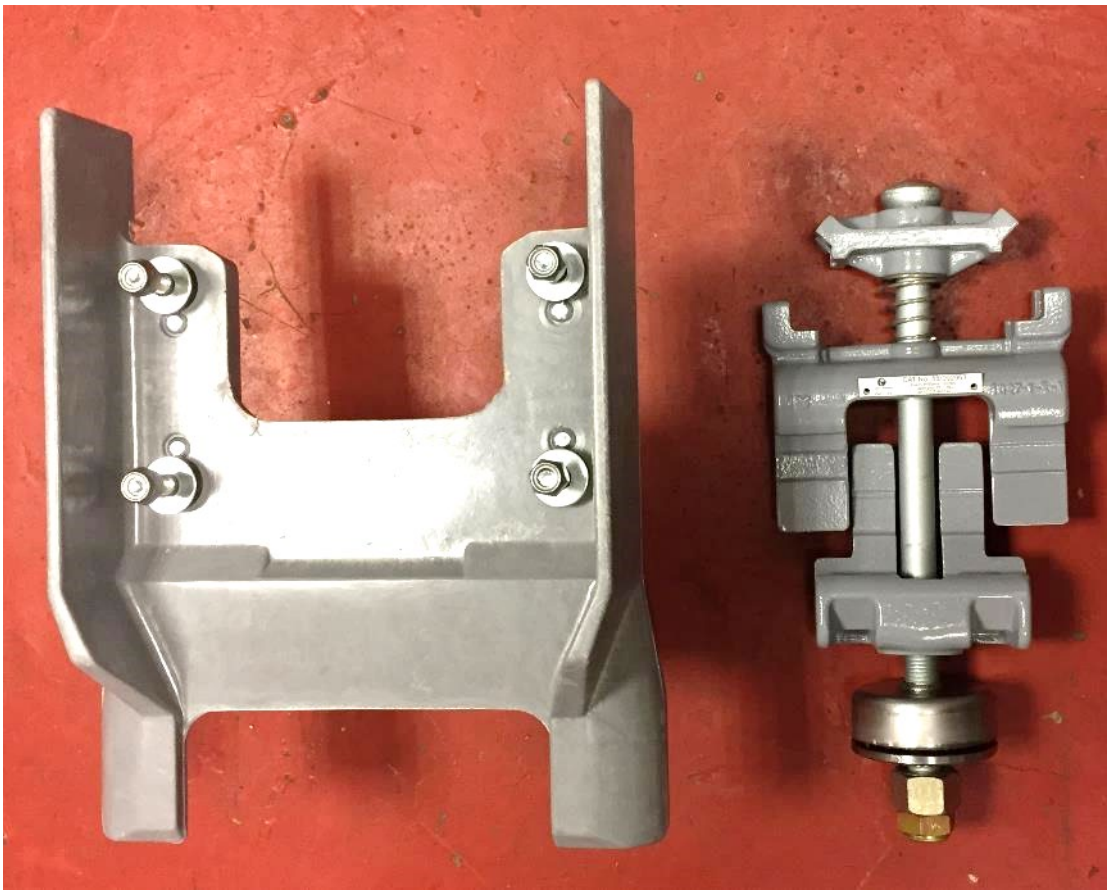


Figure 6 – European Treadle Bracket Parts

END

Includes:	Type 69 Single arm (Cautor) and Double arm (Forfex)
Excludes:	Electronic (Freddy Sensor), SEU/AzL and all other types

Any defects found during maintenance shall be dealt with as corrective actions and reported to your SM(S).

For more information refer to NR/SMS/PartC/TQ00 or the installation handbook.

SERVICE A

1. Inspection

1.1 Remove any rubbish, potential obstruction, and fire risks.

1.2 Check security of the treadle mounting baseplates, brackets, and fixings to rail (including locknuts). Report any voiding or wet spots.

Brackets are bolted through bull head rails. Brackets are clamped to flat bottom rails. Star washers are to be fitted to reduce vibration on the bracket securing bolts. (See Figure 2).

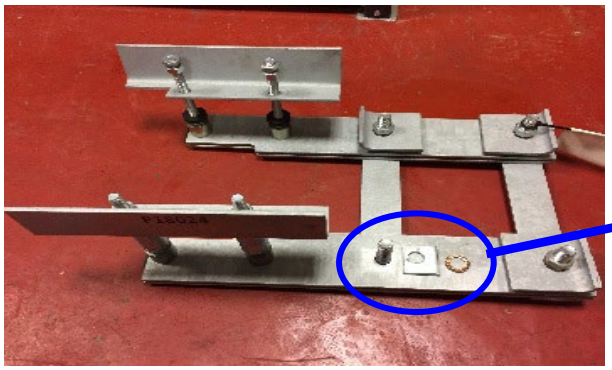


Figure 1 - Bracket

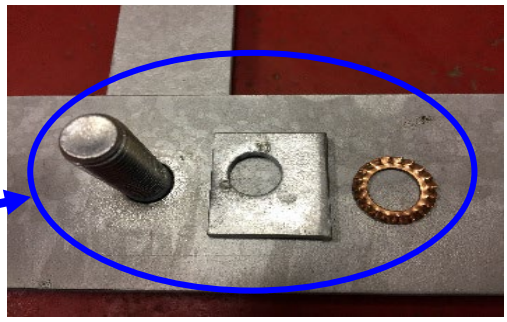


Figure 2 - Butt Plate & Star Washer

1.3 Check the security and condition of the rubber vibro washers which are provided to insulate the treadle from rail vibration. corrective maintenance is required if found perished or damaged. (See Figure 3).

Figure 3 - Examples of Damaged, Worn and Perished Vibro Washers

1.4 Examine the treadle assembly and cable entries. The treadle shall be secure and correctly aligned.

All cable entries shall be fitted with a gland and sealed.

The lid and fixings shall be secure and properly fitted.

1.5 Check that the treadle arm(s) is/are intact and have not worn below 50% (3.5mm) by using the treadle gauge.

1.6 Examine the actuating arm sealing grommet. This shall be replaced if found perished or missing. (See Figure 5)

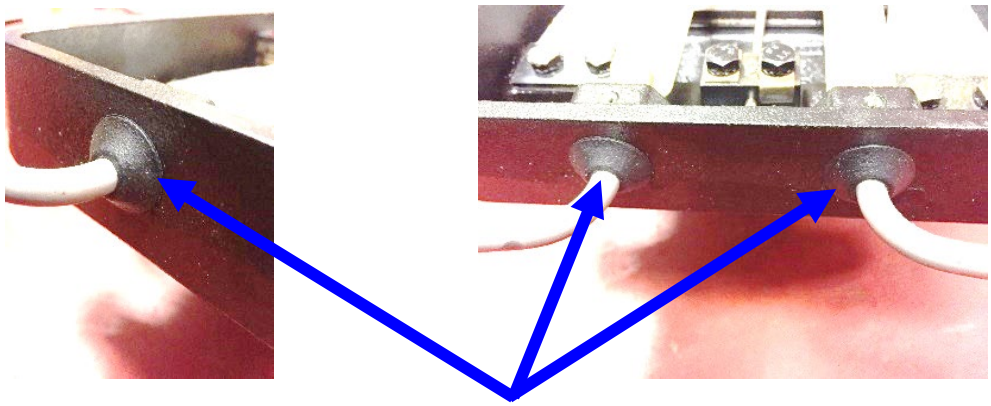


Figure 4 - Treadle Arm Rubber Gromets

1.7 Lubricate (lithium grease) the treadle lid fixing screws.

Latest version treadles are fitted with new spring clips and lithium grease is not required.

1.8 Check the visible tail cable, orange pipe and route for any damage.

1.9 Examine the dashpot, plunger, and fixings.

a) The plunger shall be securely attached to the torsion shaft.

b) Look for oil leakage around the gasket. (Refer to TQ00).

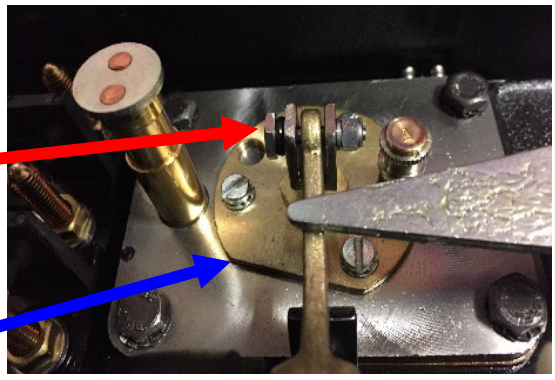


Figure 5 - Dashpot Area

1.10 Check the dashpot oil level; replenish as necessary. (refer to TQ00 for oil level)

1.11 Check and examine the letter stamped on the timing screw. (refer to TQ00)

If an X is found on the timing screw, replace the timing screw with one that has either a V or A stamped on the top.

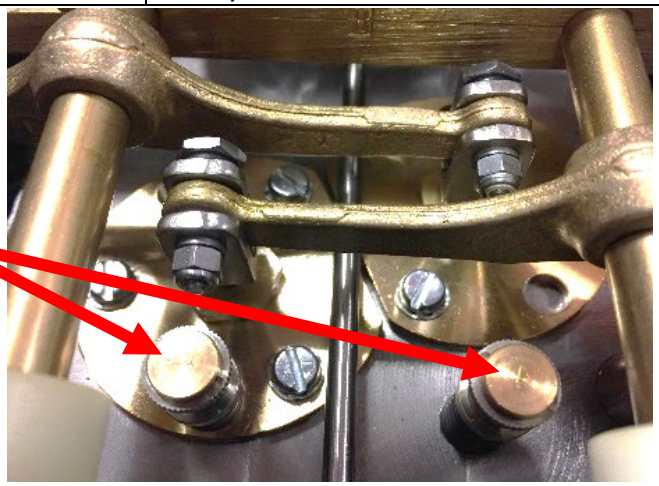


Figure 6 - Timing Screws

1.12 Clean and examine the exterior and interior of the treadle unit and lid. Do not disturb the timing adjusting screw.

1.13 Check visually that the actuating arm journal holes are free of manufacturers grease and apply a few drops of dashpot oil to each of the journal oil holes. See to Figure 7.

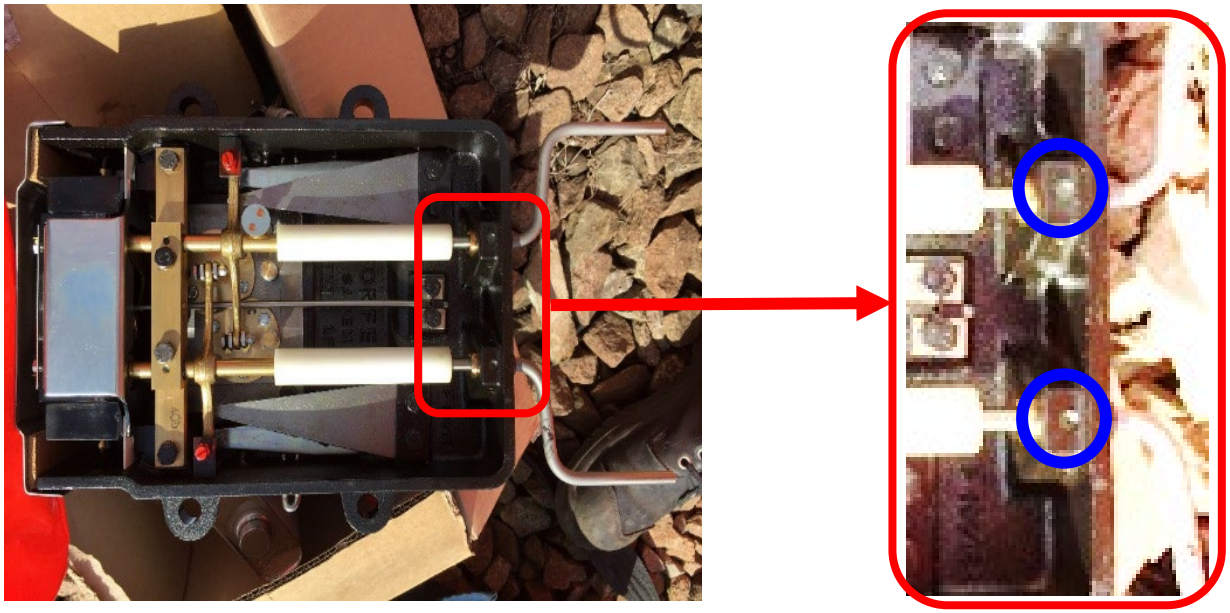


Figure 7 - The Location of Journal Holes Circled in Blue

1.14 Check the actuating arm grub screws are lubricated by applying a few drops of the dashpot oil to prevent corrosion issues which can lead to the inner brass collar moving away from its fix position. Refer to fig 2.

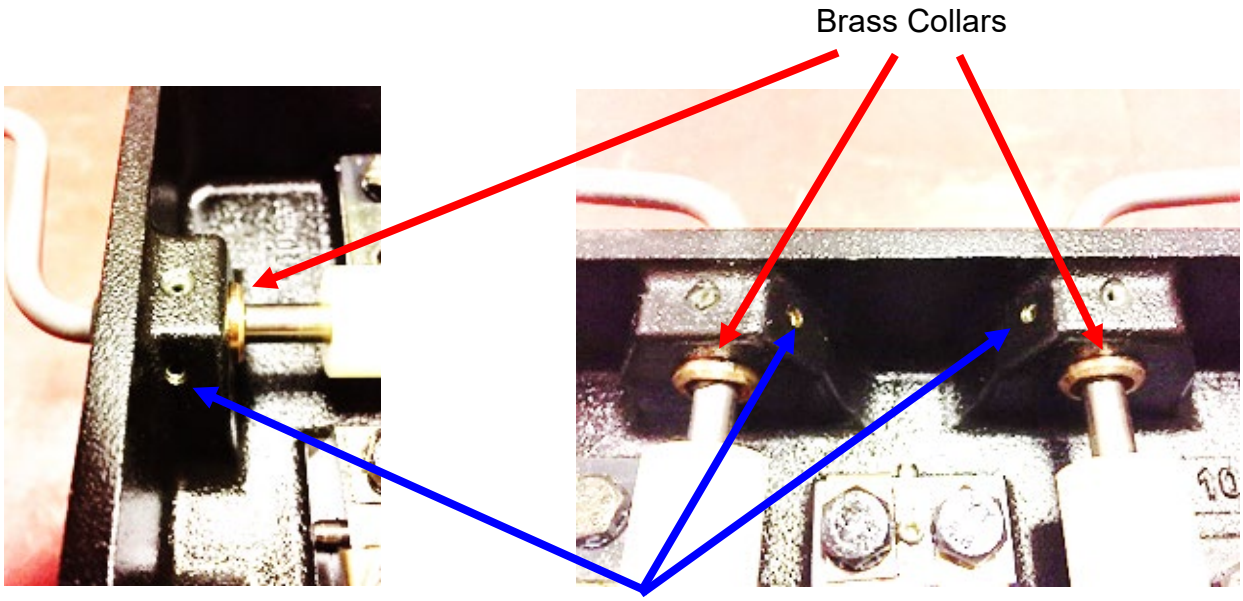


Figure 8 - Brass Collar and Grub Screw Locations

1.15 Check the brass collar situated within the treadle frame for signs of wear, replace if worn.

Verify it is secure by checking the position of the grub screw heads. (See Figure 8).

The grub screws should be 2-3mm below the level of the housing.

SERVICE B

2. Treadle Interior

2.1 Clean and examine the exterior and interior of the treadle unit and lid. Do not disturb the timing adjusting screw.

2.2 Examine the dashpot, plunger, and fixings (3). The plunger shall be securely attached to the torsion shaft. Look for oil leakage around the gasket.

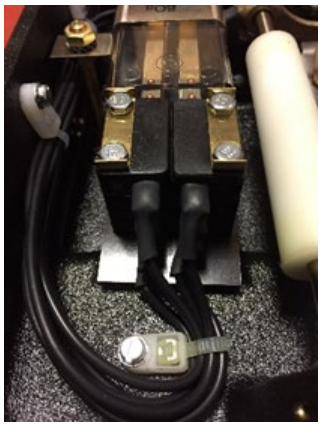
2.3 Check the dashpot oil level; replenish as necessary.

NOTE: *HVI 13 oil should only be used as per RIA 66.*

2.4 Examine tail cable terminations; clean and protect as necessary.

2.5 Examine internal wiring. Check that the insulation is not degraded by oil. Advise your SM(S) of any degradation identified.

2.6 Examine contacts, contact assembly, and retaining clamp and seal.



2.7 Visually check the miniature relay base and internal contacts for Verdigris. Advise your SM(S) if any degradation is seen.

Figure 9 – Miniature Relay Base

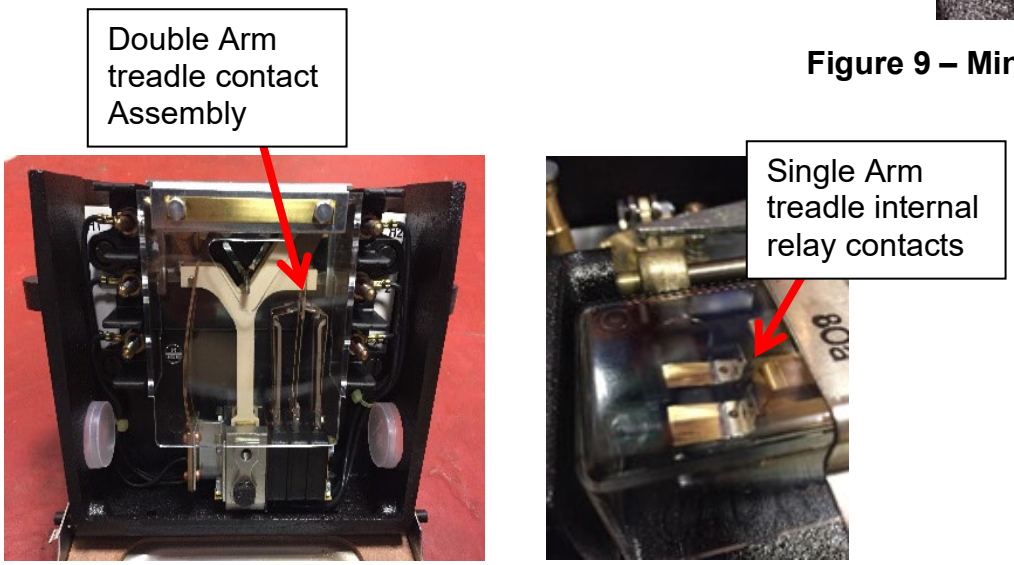


Figure 10 – Contact Assemblies

2.8 Examine return spring, seal and fixings; Wipe and smear with mineral oil.

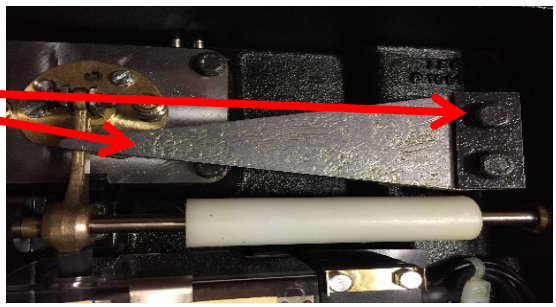


Figure 11 – Return Spring and Fixings

2.11 Carry out NR/SMS/PartB/Test/177 (Treadle Gauging Test).

2.12 Carry out NR/SMS/PartB/Test/044 (Treadle Timing and Adjustment Test).

Replace and secure the lid the correct way around, without trapping the internal wiring.

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TQ11		
FREDDY Sensor (Electronic Treadle)		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	FREDDY Sensors
Excludes:	All other treadle types

Freddy treadles are not approved for use on Network Rail Infrastructure and will be removed in due course.

This NR/SMS is provided only for maintenance of existing Freddy treadles, pending their removal.

Where the sensor and control unit are powered from a battery-backed supply, the battery shall not be disconnected without first disconnecting the AC feed.

The presence of any metallic object (tools, rings, watches, steel toe caps in boots etc) above and close to the sensor will be detected, and connected control systems will be activated.

The abbreviation 'Freddy' stands for Flange Reading Electronic Detector Designed at York.

SERVICE A

1. Inspection

1.1 Examine the Freddy for damage and check it is securely fixed to the mounting plate.

1.2 Check the mounting plate is securely fixed to the rail. If loose, tighten using a torque wrench to 60nm.

1.3 Measure the height from the top face of the sensor to the rail level.

- 48mm ±3mm.

1.4 Clean the whole of the Freddy with particular attention to the top.

On 1.2 to 1.4 no metallic object shall be brought close to the top of the sensor, if necessary arrange a disconnection of the system before any adjustments using tools are made. Remove rings and watches before cleaning the unit.

1.5 Examine the cable entry gland and check the cables are secure and undamaged. Check the security of the rail connections.

1.6 Check the disconnection box (where provided), the tail cable and any orange piping and/or route.

1.7 Check that the green LED on the side of the sensor unit is lit (for normally energised types) and is out (for normally de-energised types).

1.8 Check (if fitted) that the orange or yellow LED on the side of the sensor unit is illuminated.

SERVICE B

2. Operation

2.1 Measure the DC supply to the sensor.

- Between 22V and 30V

NOTE: *Voltages in excess of 30V might cause damage to the sensor.*

2.2 Measure the AC ripple voltage of the DC supply.

- <1.2V

If the value is higher the PSU shall be replaced.

2.3 Pass a metallic object over the top of the sensor and observe the following:

- The green LED is extinguished (for normally energised types) or is illuminated (for normally de-energised types).
- There is a 6 to 8 second delay after the LED is extinguished/illuminated before it illuminates/extinguishes (depending on type).
- The orange or yellow LED (if fitted) is extinguished during the sensor's normal operation.

Illumination indicates either low power supply or a sensor malfunction. This shall be investigated and rectified.

2.4 Check that any relays that the sensor unit operates (e.g. QNR, QRR) respond to the sensors operation. If the sensor is used to operate a track relay, check this relay de-energises.

If any items fail to respond correctly the cause shall be immediately determined and any faulty units replaced.

2.5 Check that after any operation of the sensor, controlled circuits are normalised.

END

Includes:	SEL/AzL Electronic Treadle
Excludes:	All other types of mechanical or electronic treadle

Always take possession of the equipment operated by the treadle before adjusting the rail contacts.

Metallic objects shall be kept away from the rail contacts as they can cause false operation.

This 'treadle' uses the same rail contacts and EAK (lineside junction box) as the axle counter systems.

The output from the EAK feeds relays (QNR/QRR) in place of an evaluator.

A single rail contact (SK11) or double rail contacts (SK30) may be used. An EAK30 is used (If a signal rail contact is used there will only be one SE card fitted).

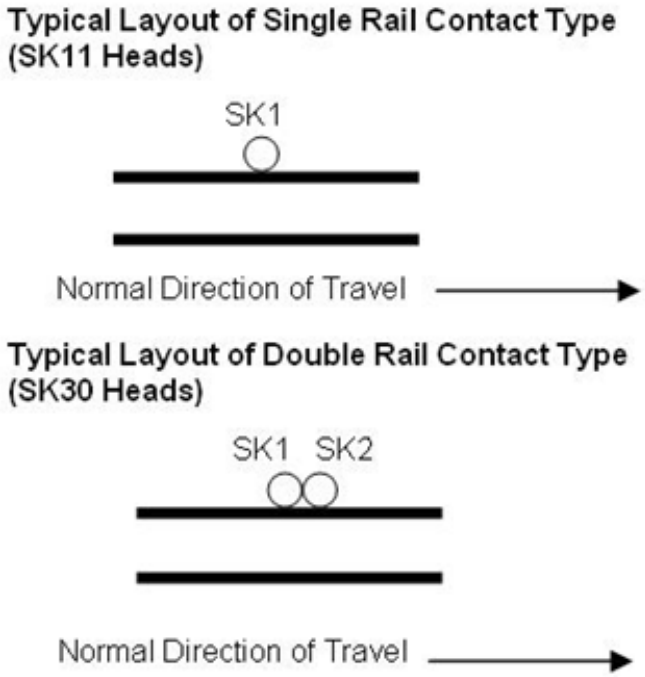


Figure 1 - Typical Layout of Single Rail Contact Type (SK11 Heads)

SERVICE A

1. Rail Contacts

1.1 Examine the rail contacts, rail insulations and bolts. The Tx head shall not touch the railhead. If a head or fixing is loose, check alignment NR/SMS/Test/PartB/045 (Thales Axle Counters Dummy Wheel Test (AxLM & AzLE)) and tighten bolts.

1.2 Examine all tail cables, connections, and clamps.

1.3 Check the protection plates and flux plates (if fitted) are tight.

2. Lineside Junction Box (EAK30)

2.1 Examine the lineside junction box including all cables and connections.

2.2 Check all terminals are tight.

SERVICE B

3. Rail Contacts

3.1 Check torque settings of fixings.

4. Lineside Junction Box (EAK30)

4.1 Remove and examine cover, interior and connections. Do not remove cover if it is raining.

4.2 Check terminals are tight.

4.3 Check the green LED(s) on the SE card(s) are lit. Single rail contacts only have one SE card.

4.4 Measure using the test switch box connected to the socket on the Rel As card (plug goes in with cable entry at bottom) and a meter the following voltages:

With the meter connected to LTG1 (yellow +ve, black –ve):

a) Incoming supply +55V to 115V DC.

With the meter connected to the switch position terminals (red +ve, black –ve):

b) Stabilised supply 1 (switch pos. 3) +22V to +25V DC.

c) Stabilised supply 2 (switch pos. 4) +22V to +25V DC.

d) MESSAB 1 (switch pos.10) +55mV to +200mV DC.

e) MESSAB 2 (switch pos.12) +55mV to +200mV DC. (Double rail contacts (SK30) only).

f) PEGUE 1 (switch pos.11) +55mV to +200mV DC.

g) PEGUE 2 (switch pos.13) +55mV to +200mV DC (Double rail contacts (SK30) only).

Measure using a meter the transmitter outputs at terms 19/20 for SK1 and 21/22 for SK2.

h) SK1 35V to 49V AC @ 30 to 31.3kHz.

i) SK2 35V to 49V AC @ 27.4 to 28.6kHz (Double rail contact (SK30) only).

4.5 Carry out NR/SMS/Test/PartB/045 (Thales Axle Counters Dummy Wheel Test (AxLM & AzLE)).

Single rail contact (SK11) use tasks applicable to SK1 only.

4.6 Influence the rail contact(s) with the dummy wheel. Check when influenced the correct QNR relay drops and the QRR relay picks.

After approximately ten seconds check that the QRR relay drops and the QNR relay picks. Remove the dummy wheel.

4.7 Disconnect the test switch box, grease fixing studs, and replace cover.

4.8 Check that after operation of the treadle that all controlled circuits are normalised.

END

Includes:	Siemens WSR Sensor used with FREDDY Control Unit
Excludes:	Any other use of the WSR Wheel Sensor

General

Always take possession of the equipment operated by the sensor before undertaking any intrusive maintenance.

Metallic objects shall be kept away from the rail contacts as they can cause false operation. Live mobile phones or similar radio systems shall not be taken within 2M of the units.

Report as corrective maintenance any voiding or wet spots in the vicinity of the unit.

Whenever the sensor is physically moved or adjusted, the operational test in this SMS shall be performed. If this test fails, then the wheel sensor shall be re-calibrated in accordance with Appendix A.

SERVICE B

1. Fixing to Rail

1.1 Clean the wheel sensor and examine the sensor and its fixings to the rail for damage and security.

1.2 Remove any metallic debris within 1m of the wheel sensor.

1.3 Check the height from the top face of the wheel sensor to the rail surface is 45 mm +/- 1 mm. (See Figure 1) Adjust height as necessary. Tighten bolts using a torque wrench to 70-80 NM.

Whenever the sensor is physically moved or adjusted, Appendix A shall be carried out followed by the operational test.

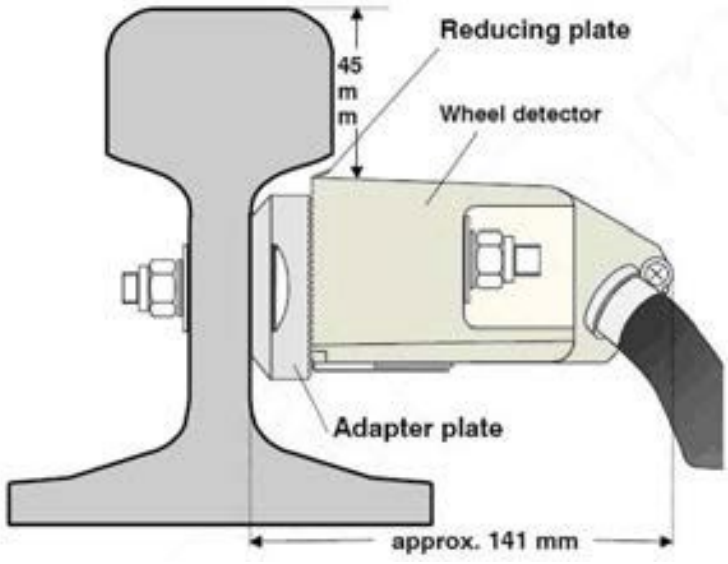


Figure 1 – Wheel Sensor Mounted on Rail

1.4 Examine the cables for damage. Check that the connections are secure.

1.5 Check the disconnection box and tail cable connections for security.

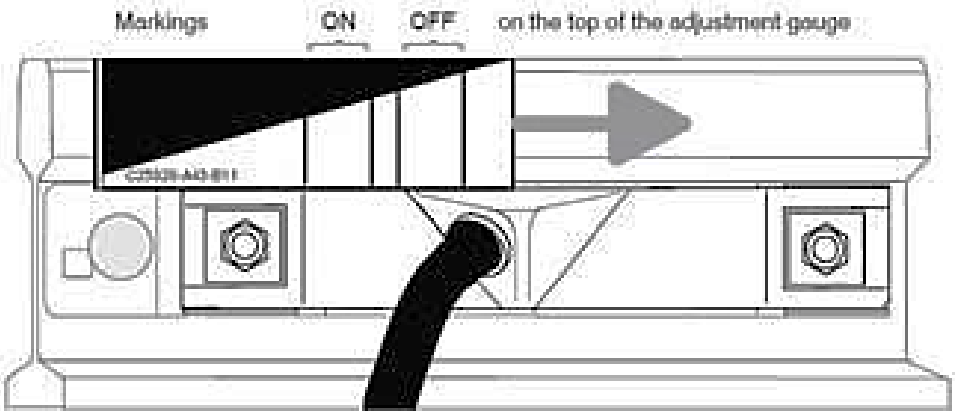


Figure 2 – Placement of Gauge on the Rail

2. Operational Test

2.1 Place the adjustment gauge on the wheel sensor so it is in contact with the rail head and then slide it along the rail over the wheel sensor. In the direction of the arrow (as shown in Figure 2). Check the follower relay operates when the centre marking on the wheel sensor housing is within the 'ON' section markings on the adjustment gauge.

2.2 The sliding movement shall take place within 30 seconds of the gauge being placed on the rail. Otherwise remove the gauge and try again after a delay of 1 minute.

2.3 Slide the gauge back along the rail to its original position. Check the follower relay returns to its original state, when the centre marking on the wheel sensor housing is within the 'OFF' section markings of the gauge.

2.4 If the relay fails to respond correctly, re-calibrate in accordance with Appendix A, and repeat this test as necessary.

2.5 Where practical, observe the passage of a train over the sensor. Report any excessive deflection in the rail due to track issues as corrective maintenance.

2.6 Excessive deflection in the rail might damage the sensor.

APPENDIX A - Calibration

> ***NOTE:*** *The wheel sensor shall be calibrated to match the site conditions. This is necessary whenever a new sensor is installed, or an existing sensor is moved or physically adjusted for height or position.*

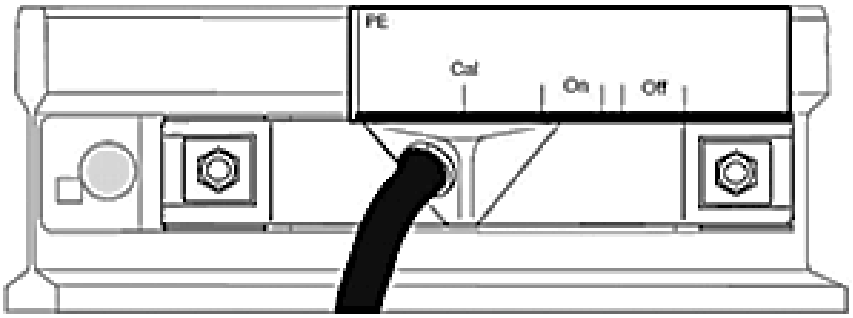


Figure 3 – Placement of Gauge on Rail for Calibration

1. Remove power to the unit. Wait at least 15 seconds and then restore power.

2. Within 15-20 seconds after restoring power, place the adjustment gauge on the wheel detector and in contact with the rail head. With the “Cal” marking on the adjustment gauge over the centre marking on the wheel detector housing. (As shown in Figure 3). Observe that the follower relay operates.

3. Leave the adjustment gauge on the wheel sensor for 15-40 seconds.

4. Remove the gauge. After approximately 25 seconds the wheel detector adopts its calibration value. Observe that the follower relay returns to its original state.

END

Includes:	GETs Treadle Unit
Excludes:	All other types of Treadle

Always take possession of the equipment operated by the sensor before undertaking any intrusive maintenance.

Metallic objects shall be kept away from the rail contacts as they can cause false operation. Live mobile phones or similar radio systems shall not be taken within 2 meters of the units.

Report as corrective maintenance any voiding or wet spots in the vicinity of the unit.

This 'treadle' uses the same rail contacts and junction box as the GE (SCA2) axle counter systems. See Figure 1.

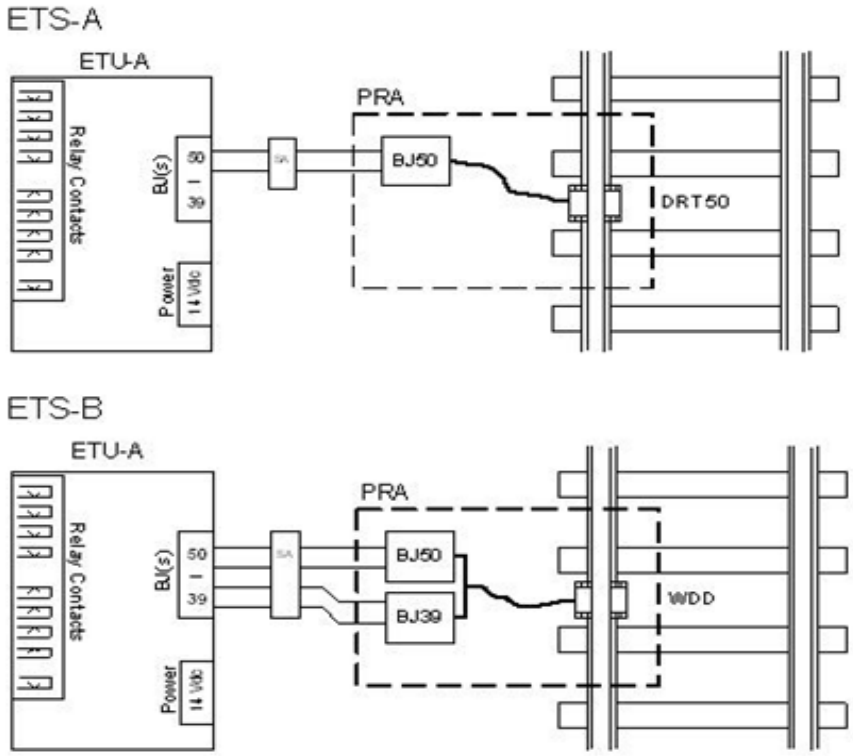


Figure 1 – Equipment Layout

SERVICE B

1. Rail Contacts

1.1 Examine the rail mountings, detector heads, and bolts. Once the GE detector heads are mounted correctly there is no further adjustment required.

1.2 Check that all the fixings are secure. See datasheet 99EH038-A-SPE4.

1.3 Examine all the tail cables, connections, and clamps.

2. Lineside Junction Box (BJ39 BJ50)

2.1 Examine the lineside junction box (BJ) including all cables and connections.

2.2 Remove and examine the cover, interior, and connections. Do not remove the cover if it is raining.

2.3 Check that all the terminals are tight.

2.4 Measure using a True RMS multimeter (TPWS meter) the DC Voltage present on pin 8 (+) with respect to pin 7 (-). This voltage should be greater than 8.35V.

2.5 Measure using a True RMS multimeter (TPWS meter) measure the mVAC between TP11 and TP12 (See Figure 2) the readings should fall between 26.5 – 29mV for an existing installation.

2.6 Voltage below 26.4mV immediate action shall be taken to rectify.

NOTE: *Voltage above 31mV on TP11 & TP12 have potential to cause WSF*

If readings are found to be out of spec refer to Appendix A: Set up of a new or replacement wheel sensor section f) installation of shim. If adjustment is not possible to 27 – 29mV a new wheel sensor should be installed

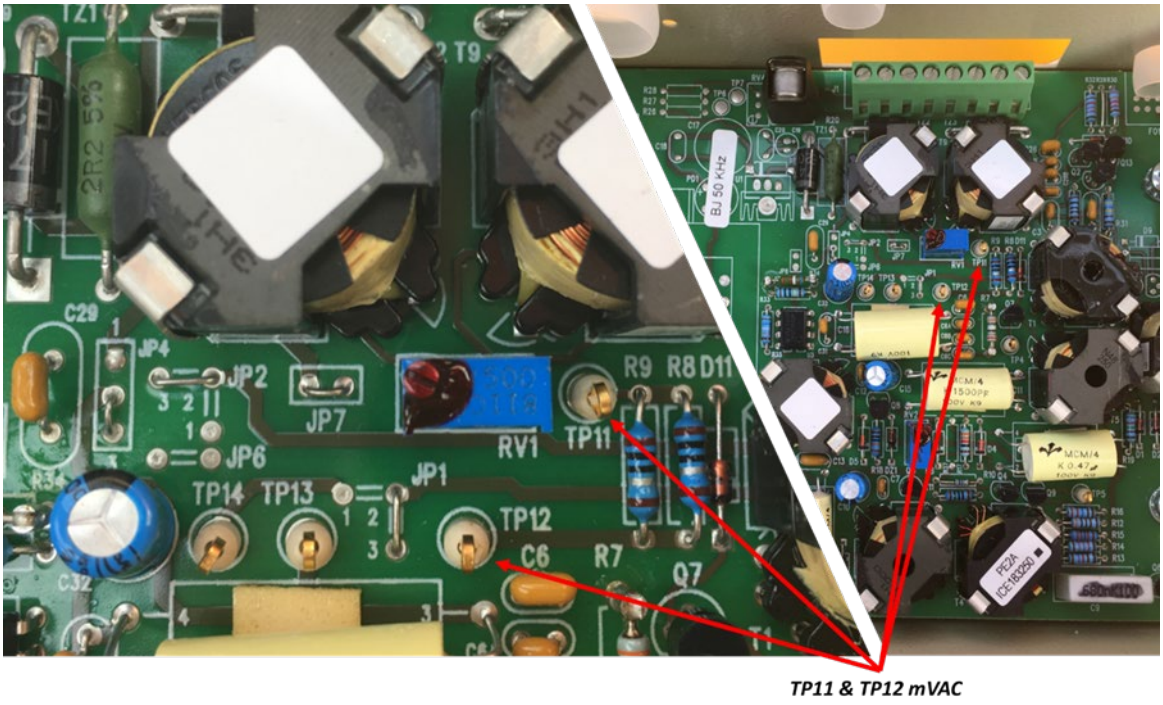


Figure 2 - BJ Unit TP11 & TP12

3. ETU

3.1 Examine the connections, check that they are secure.

3.2 Check all the terminals are tight.

3.3 On the terminal connection side of the ETU measure the voltage of the local PSU terminals (PSU A IN and PSU B IN). The measured voltage should be between 11.2 – 14.4 VDC.

3.4 Check the indications on the ETU. Check that the TRU and PWR FAULT LEDs are extinguished. If a fault indication is lit press the RST button, if this does not clear the fault or the fault recurs within 1.5 seconds the unit requires replacing.

Replacing the unit shall be classed as corrective maintenance

4. FINAL FUNCTION TESTS (ETU)

4.1 As a final function test of the ETS the output relay shall be proven to be operating correctly in conjunction with the operation of the treadle by following these steps:

4.2 Swipe the electronic treadle with the test block for the normal direction of travel.

4.3 Check that the ETU indication shows occupied.

4.4 Check that the relevant relay driven by the ETU output (QNR or other) deenergises.

4.5 Check that the ETU indication reverts to not occupied after the relevant time expires.

4.6 Check that the relevant relay driven by the ETU output (QNR or other) energises.

5. Dual Surge Arrestor

5.1 Measure the voltage across each signal connector on both the line and clean sides, these should measure greater than 11V.

A fault on the Surge Arrestor can cause a permanent occupation indication.

APPENDIX A - SET UP OF A NEW OR REPLACEMENT WHEEL SENSOR.

The following steps shall be followed for each BJ in the system. Where WDD wheel sensors are used the test block should be placed over the end of the wheel sensor whose frequency corresponds to that of the BJ under adjustment.

When installing new wheel sensors, they shall be symmetrically installed either side of the rail this has a direct correspondence to the setup, check mounting blocks are of the correct type and from the same batch checked by ensuring the branding on the blocks is of the same font and size.

This is shown by the label on the top of the WDD sensor.

a) Unplug the 8-way connectors at the BJ(s).

b) Power up the system and check that the voltage present at pin 8 of the BJ connector(s) is positive with respect to pin 7, measuring 8 to 15V.

c) Disconnect the power from the system, reconnect the BJ(s).

d) Power up the system.

e) Monitor the DC voltage between TP1(+) and TP2(-), adjust T9 transformer core until the largest peak voltage is found. This should be greater than 13.5VDC.

f) Using a True RMS multimeter monitor the mVAC between TP11 & TP12, for a new wheel sensor the reading should be between 27 – 29mV, if adjustment is required make a minor adjustment to the position of the internal wheel sensor, if this doesn't work insert a chamfered 1-3mm or 1-4mm shim (see figure 3) between the mounting bracket and base of the INNER wheel sensor, angle the wheel sensor away from the railhead to increase voltage or toward to reduce. The external wheel sensor requires NO adjustment

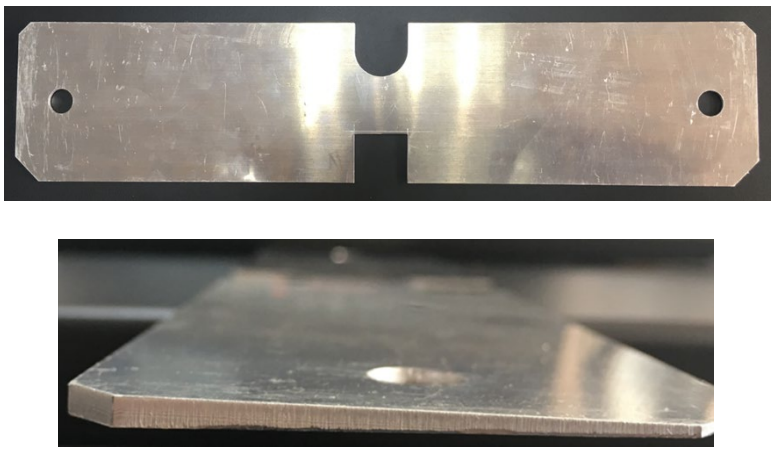


Figure 3 - 1-3mm chamfered shim

g) Check that the ETU ‘OCP’ LED illuminates when the test block is swiped across the internal detector, and the ‘CLR’ LED is illuminated after the time delay set by the configuration unit.

h) Check that when the test block is placed on the external detector the ETU does not indicate ‘OCP’, the green ‘CLR’ LED should remain illuminated.

i) Replace the BJ(s) lids and close and secure the mushroom lid.

END

Includes:	Electro-Pneumatic Trainstops
Excludes:	All other types of Trainstop

SERVICE A

1. Pump Unit

1.1 Check that the unit is secure on base.

1.2 Check the hydraulic fluid level, top up as necessary.

1.3 Examine the cable entry, cable gland, and tail cable sheath.

1.4 Check the terminations, clean and protect as necessary.

1.5 Examine the internal wiring.

1.6 Examine the actuator hoses and connections. Pay particular attention to:

a) Signs of leakage.

b) Chafing and damage.

c) Security.

Do not over tighten

1.7 Check the locking wires on hose connectors are intact.

1.8 Check the cover and unit and lubricate the padlocks.

1.9 Observe correct operation.

2. Trainstop Mechanism

2.1 Isolate the hydraulic mechanism by removing the fuse.

2.2 Remove all fire risks and potential obstructions from on or near the mechanism; e.g. oily waste, paper and ballast.

2.3 Where possible, observe the vertical movement of the track during passage of a train.

A movement of more than 25mm (1") shall be reported as corrective maintenance.

2.4 Clean and examine the cover, trainstop spring unit, stop arm, stop screw, journals, hydraulic actuator, mechanical connections, split pins, fixing bolts, microswitch and termination boxes, base assembly and sleeper packing.

2.5 Check that, when raised, top of trainstop arm is 76mm (± 5mm) above rail level.

2.6 Check that centre-line of train stop arm is 228mm (± 5mm) from running edge and observe that the trainstop is parallel to the track.

2.7 Check that both stop screws bear equally against the stop arm that tab washers are closed and locking wires are in place.

2.8 Examine the rubber gaiter for signs of damage and perishing.

2.9 Clean and lightly lubricate with lithium-based grease the main journal pin and detection return unit (enclosed spring unit).

2.10 Liberally apply adhesive grease the trainstop return spring.

2.11 Lubricate (oil) the remaining journals and pins.

2.12 Observe operation by manually depressing the stop arm and allowing the spring to return the arm to the 'ON' position.

2.13 Examine the tail cable, cable entry, cable gland, and check that the cables are not chafing.

3. Internal Connections

3.1 Examine wiring and terminals, clean and protect as necessary.

3.2 Examine microswitch assemblies and carriage for security and damage.

4. Tests

Carry out NR/SMS/PartB/Test/026 (Trainstop Calibration Test).

SERVICE B

5. Pump Unit Service

5.1 Carry out NR/SMS/PartC/PB11 (Clamp Lock Hydraulic Points) - Section 2 (excluding references to Power/ Manual Switch).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TS02		
Tripcock Tester		
Issue No: 03	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Tripcock Tester located at Finsbury Park
Excludes:	All other Tripcock Testers

SERVICE A

1. Tripcock Tester

1.1 Remove all fire risks and potential obstructions from or near the Tripcock tester and associated equipment.

1.2 Examine the Tripcock tester for security and wear. Report any voiding.

1.3 Examine Tripcock tester springs for damage and wear.

1.4 Check the security of the treadle mounting base plates, brackets, and fixings.

1.5 Clean Tripcock ramps.

1.6 Test by operation of the ramps that they do not bind or catch during their travel back to the normal position.

1.7 Examine the treadle assembly, cable entries and cable glands for security and damage

1.8 Check that the treadle arm is intact and aligned and has not worn below 50% of original thickness.

1.9 Gauge Tripcock ramps to correct height using calibrated height gauge and adjust if necessary.

1.10 Check that when a 2mm gauge is placed between ramp and the height gauge that the bottom contacts of the treadle are made. Adjust the height of the treadle if necessary.

1.11 Clean and examine the exterior and interior of the treadle unit and lid. Do not disturb the timing screw.

1.12 Check the oil level and replenish as necessary using approved oil only (HVI-13).

1.13 Examine tail cable terminations. Clean and protect as necessary.

1.14 Examine internal wiring.

1.15 Test by operation of the ramps that the treadle timing is 3.5 to 4.5 seconds.

1.16 Apply lubrication (lithium grease) to the lid securing screws.

1.17 Replace and secure the treadle lid, taking care not to trap any wiring.

1.18 Apply lubrication to the ramps.

END

Includes:	Trainstops on the Northern City Line (NCL), Trainstop style "J" (self-lubricating), Trainstop style "HO", Trainstop fixed, Glass enclosed (GE) valve, separately attached (SA) valve
Excludes:	Electro-hydraulic Trainstops

General

The principle of operation of the Trainstop is by a head fitted to a moving arm which is fitted to the permanent way in such a manner, that when the signal is at danger (red) the arm is raised and when the signal clears the arm is moved down.

A Tripcock in the train braking system pipe work (train-pipe) below each driver's cab has its arm positioned downwards, and in this position isolates the train-pipe from atmosphere.

This Tripcock is aligned with the Trainstop arm so that when the arm is raised the Tripcock on a passing train will strike it and be rotated backwards, opening the train-pipe to atmosphere and so applying the train's brakes.

The Tripcock remains open to the atmosphere until reset by the train operator. The control circuits of the train are arranged so that motoring cannot take place if the emergency brake is being applied.

When the arm is down (signal clear) it does not obstruct the path of the Tripcock which consequently passes over unaffected.

The Trainstop is positioned in the track in line with the signal and the train Tripcock is fixed just rear of the driving position. This allows a train to draw up to the signal without being tripped.

The Trainstop is fixed outside the running rail on the right-hand side in the direction of traffic.

When in the danger or ON position the top of the arm is above the running rail level and when in the clear or OFF position the arm is lowered against the direction of traffic so that its highest point is at rail level or below.

The ON/OFF positions of the Trainstop arm are electrically detected by an integral circuit breaker box.

Every Trainstop is operated by a compressed air motor or cylinder. The compressed air is supplied from the air main via an EP Air Valve.

When the signal clears, air operates the motor thus depressing the arm to the lowered position (OFF).

When the signal goes to danger (red) the air is exhausted to atmosphere and the arm is returned to the up position (ON) by the integral spring(s) of the Trainstop.

SERVICE A

1. Trainstop Exterior

1.1 Isolate the train stop by operation of the main air cock. With the Trainstop arm in the lowered position, remove all retained air pressure by manually depressing the GE valve EP magnet to open the exhaust ports.

This causes the Trainstop head to rise and any associated signal to be replaced to danger.

1.2 Remove all fire risks, debris, and surplus ballast from the immediate area around the Trainstop.

1.3 Examine the Trainstop holding down bolts and tighten where necessary.

1.4 Examine the Trainstop casting for cracks and evidence of oil leaks.

1.5 Examine the blanked off cover on the casting for condition and security.

1.6 Examine the cover holding down screws.

1.7 Examine the Trainstop head and fixing bolts together with all connections to the Trainstop head including all split pins. Renew the split pins as necessary.

1.8 Lubricate the turn pins at the oil nipples provided.

1.9 Examine the filter cap for tightness and check the security of the retaining chain.

1.10 Examine the drain plug and tighten if necessary.

1.11 Examine the flexible air hose connections and plugs including the hose clips.

1.12 Examine the air hose between the Trainstop and the GE valve.

1.13 Examine the cable entry and the cable to the disconnection box. Tighten the retaining plates as necessary.

1.14 Examine the Trainstop packing for security and condition.

1.15 Examine the Trainstop ramp(s) and retaining plates and check the fixing bolts and screws for tightness.

1.16 Examine the earth bonding connections and cables for condition and security.

1.17 If the Trainstop is installed on bullhead rail, check that all adjacent rail keys are present and secure.

1.18 Check the setting of the Trainstop head in the raised position using a calibrated gauge (drawing N° CS 49901) as follows:

a) The top of the Trainstop head shall be 3 inches ± 1/8 inch (76mm ± 3mm) above a straight line joining the tops of the running rails.

b) The middle of the Trainstop head nearest the running rail shall be 6 inches ± 1/8 inch (152mm ± 3mm) from the inside edge of the running rail.

c) The width of the top of the Trainstop head shall not be less than 5 ½ inches (140mm).

1.19 Check that the air motor/cylinder is free from water and foreign bodies.

1.20 Check all cable terminations.

1.21 Check the interior of the Trainstop casting and remove any accumulated water and debris.

1.22 Check that the detection rod adjuster seal is intact.

1.23 Check all sealing gaskets and gaiters for condition.

1.24 Check all visible contact faces for cleanliness, flaking burning or excessive wear. Clean or replace contacts where necessary.

1.25 Check the Trainstop head return mechanism and springs for condition and correct operation.

1.26 Examine all split pins for security and condition. Replace where necessary.

1.27 Check the oil filter for cleanliness and condition.

1.28 Check the oil reservoir for cleanliness and correct level. Top up, if necessary, via the filter cap/filter with Shell “Tonna” T220 oil or equivalent.

Under no circumstances shall oil be added direct into the Trainstop casting.

1.29 Examine the turn pin connections to the detection box operating rod and the main shaft piston actuating roller and lubricate with Shell “T220” oil or equivalent.

1.30 Reconnect the air supply at the main air cock.

1.31 With the Trainstop head lowered, check all the hose connections for air leaks.

1.32 When all work is complete and covers replaced and locked, check the Trainstop for correct operation and confirm that the Trainstop head moves freely and smoothly between its full limits of travel.

For fixed Trainstops only:

1.33 Examine the fixed Trainstop head for condition and security. Check the fixing bolts for condition and security.

2. Glass Enclosed (GE) Valve

2.1 Brush and clean the outside of the valve and check for damage.

2.2 Clean the glass and check for ingress of water.

2.3 Clean the interior of the terminal box.

2.4 Check the security of the mountings and fixings.

2.5 Check the security of the locking device.

2.6 Check the cable entry for condition and security.

2.7 Clean and lightly lubricate the armature, valve stem, and magnet face. Check for damage or overheating.

2.8 Check that the exhaust ports are not obstructed.

2.9 Check and clean the air filters.

2.10 Check the air connections for tightness and leaks.

2.11 Check all electrical connections for condition and security.

2.12 Clean terminals and protect if required.

2.13 Check the wiring insulation for condition where visible.

2.14 Clean the terminal block and check for damage.

2.15 On completion of all work, confirm that the cap is replaced and secured correctly.

2.16 Test for correct operation.

3. Separately Attached (SA) Valve

3.1 Brush and clean the outside of the valve and check for damage.

3.2 Check the security of the mounting.

3.3 Clean and lightly lubricate the armature, valve stem, and magnet face. Examine for damage or overheating.

3.4 Clean and check the gauze filters.

3.5 Check that the exhaust ports are not obstructed.

3.6 Check the air connections for tightness and leaks.

3.7 Check all electrical connections for security and tightness.

3.8 Check the wiring insulation for condition where visible.

3.9 Check the condition of the insulating washers.

3.10 On completion of all work, confirm that the cap is replaced and secured correctly.

3.11 Test for correct operation of the mechanism.

SERVICE B

4. Trainstop Interior

4.1 Check that the 'ON' contracts in the detection box are broken when the Trainstop arm is depressed by 3/8 inch ±1/16 inch (11mm ±1.6mm), from the fully 'ON' position.

4.2 Check that the 'OFF' contracts in the detection box are made when the Trainstop arm is depressed by between 2 1/16 inch (52.5mm ±1.6mm) from the fully 'ON' position.

4.3 Check that with the "on" contracts of the Trainstop broken, the signal next in rear is held at danger until the Trainstop has returned fully to the "on" position.

4.4 Examine all paddle connections and electrical terminations.

4.5 Open the "Blower-Off" cock adjacent to the air motor and operate the Trainstop to the lowered position for 2-3 seconds by operating the GE valve.

4.6 When all work is complete and covers replaced and locked in position, check for correct operation of the mechanism.

NOTE: *To prevent failures due to freezing, Anti-Freeze (Ethylene Glycol) can be introduced into the air system and into the oil sump of self-lubricating types.*

APPENDIX A - J Style Trainstop

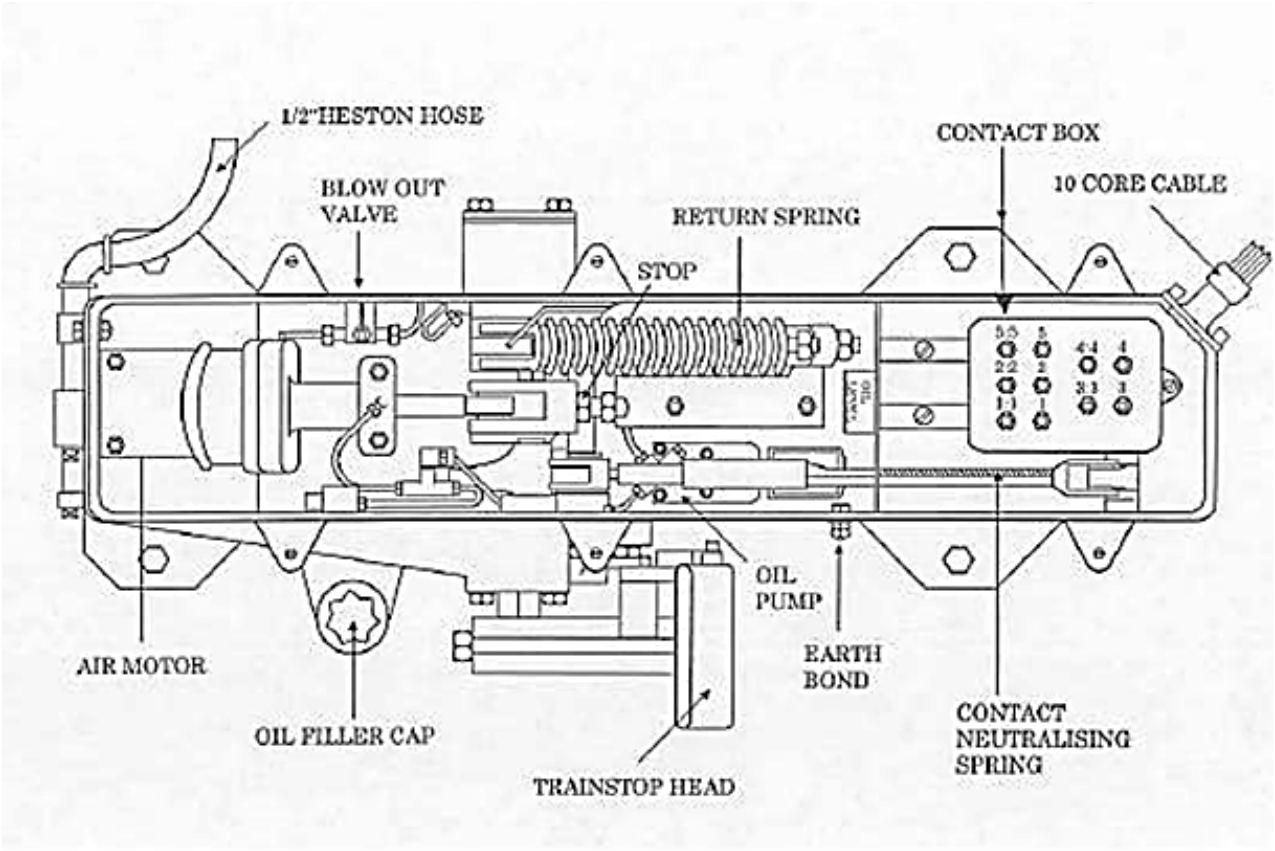


Figure 1 – J Style Trainstop

END

Includes:	Indusi train stop system used in the Pelaw-Sunderland-South Hylton area
Excludes:	All other types of Trainstop

General

Indusi is a German acronym of Induktive Signalsicherung, which means Inductive Signal Protection in English.

The system was first introduced on German railways in 1934 as a train control system with functionality similar to that of TPWS.

The German trackside equipment consists of passive resonant circuits using frequencies of 500Hz, 1000Hz and 2000Hz.

On the Tyne-Wear Metro the Indusi system is configured purely as a train stop and only the 1000Hz and 2000Hz frequencies are used.

Indusi trackside units are passive resonant circuits, referred to as Indusi Trackside Magnets, which can resonate at either 1000Hz or 2000Hz or be “inactive”.

A VR is provided to operate the Indusi train-stop via a voltage free contact and a contact of the VR is proved in the aspect of any associated stop signal, this prevents the signal from clearing before the Indusi train-stop has cleared.

There is no means of proving the ‘position’ of an Indusi train-stop itself.

Indusi Train Stops Associated with a Stop Signal.

a) With VR energised, the train-stop is active at 1000Hz and the train stop is Off.

b) With VR de-energised, the train-stop is active at 2000Hz and the train stop is On.

Indusi Train Stops Associated with Speed Control Train-Stops

a) With VR energised, the train-stop is inactive.

b) With VR de-energised, the train-stop is active at 2000Hz and the train stop is On.

Train-born ‘magnets’ continuously emit simultaneous AC magnetic fields at 1000Hz and 2000 Hz. When the train born magnet passes a trackside magnet, the trackside magnet resonates at either 1000Hz or 2000Hz absorbing energy from the train-born magnet.

The voltage in the associated resonant circuit on board the train drops, causing an associated train-born relay to de-energise. The trains response is determined by which relay de- energises.

When a Metro-train is authorised to pass a signal at danger, the driver of the Metro-train operates an override button on his console whilst passing the signal at danger, this imposes a 30kph speed restriction on the train until the train detects the next "green" Indusi trackside magnet.

If the 30kph speed limit is exceeded for 5 seconds, then an emergency brake application is imposed.

If a Metro-train passes a signal at danger without the use of the driver's 'override' button, the train-born train-stop system automatically applies magnetic track-brakes (located on the train's bogies) when the train passes over the trackside Indusi train-stop.

The magnetic track-brakes 'magnetically clamp' the train to the rails and bring the train to a stand within 150m.

The driver of the metro-train cannot then release the brakes until the speed of his train has reduced to below 3 kph.

After resetting the train stop following a red signal application, or when overriding a red signal (and when the Metro- train is first powered up) a 30kph speed limit is imposed until a green magnet is passed.

A white indicator light, 'the train-stop test/monitor indicator light', is provided on the metro-trains driver's console, this indicator light is continuously lit except when passing over active train-stop magnets.

The change of state of this indicator light whilst the train passes over the trackside magnet proves the presence of the Indusi train-stop trackside magnet. The yellow speed limit indicator lamp illuminates momentarily when passing over a 'green' trackside magnet.

REGULAR CHECK

1. Operational Check by Cab-Ride

1.1 Arrange to travel by Metro-train. Stand in a position to view the operation of the driver's train- stop test/monitor lights at the leading drivers cab. This shall be done without causing distraction to the driver.

1.2 As the train passes over each Indusi trackside magnet train-stop associated with a stop signal observe the operation of the driver's train-stop test/monitor lights and confirm that they are briefly extinguished as the train passes over each Indusi train stop.

Appendix A lists the action to be taken if the Test/Monitor lights fail to extinguish.

SERVICE A

This service shall also to be carried out after Pway work, or if Pway on-track machines (tampers etc) have been working in the area of the trackside magnets.

A test of all train-stops in the area affected by the work shall be carried out before Metro services are permitted to run again.

Particular care shall be taken to examine the Indusi Tail cable for damage where it passes under the rail.

2. All Indusi Trackside Magnets

2.1 Remove all fire risks from or near the Indusi Trackside Magnets Oily waste, paper etc.

2.2 Check that the Indusi Trackside Magnet and its fixings are clear of ballast.

2.3 Check that all cables are correctly located, secured and free from damage, check particularly where the cable passes under rails.

2.4 Check for physical damage to the Indusi Trackside Magnet and its mountings.

2.5 Check fixing lugs adjacent to the rail web for signs of fracture.

2.6 Gauge and Record the Indusi train-stop.

a) Running edge to longitudinal centre line of magnet: 220mm ±5mm.

b) The top of the Indusi train stop should be level with crest of the rail, or up to 10mm below crest of rail level.

It is vital to the safety critical operation of the train stop that the height of the Indusi Trackside Magnets is no more than 10mm below crest of the rails. The 10mm is to allow for rail wear.

It is recommended that a treadle line / bob weights and associated gauge or rule are used in to measure the height of the Indusi Trackside Magnet.

2.7 Check that all fixings are secure and that spring washers and locknuts are fitted where required.

2.8 Check that the Indusi train stop is mounted centrally in the ballast bay, or near the fastening first approached by normal traffic, Rectify as necessary.

2.9 Clean the Indusi Trackside Magnet.

2.10 When required, sparingly Lubricate threaded mounting components with grease This is to prevent corrosion and to assist with the future removal of components.

3. Indusi Trackside Magnets Associated with Stop Signals

3.1 With the associated signal at red, Test the Indusi train-stop trackside magnet (Appendix E). Record the obtained values on the record card.

3.2 With the associated signal displaying a precede aspect: Test the Indusi Train Stop trackside magnet (Appendix E).

Record the obtained values on the record card.

Information on the operation of the available testers are given Appendixes B, C and D.

Tables of results are given in Appendix E.

4. Indusi Trackside Magnets Associated with Speed Control

4.1 Using the Indusi Trackside Magnet Tester set to 2000Hz, operate the treadle or track circuit and measure the time to the change in the 2000Hz reading occurring.

Record the time on the record card and confirm it is in agreements with the other times recorded.

4.2 Using the Indusi speed control train stop trackside magnet set at 2000Hz, Test the Indusi Trackside Magnet. Record the obtained values on the record card.

4.3 With the Indusi speed control train-stop trackside magnet under test set to Inactive, Test the Indusi Trackside Magnet. Record the obtained values on the record card.

Information on the operation of the available testers are given Appendixes B, C and D.

Tables of results are given in Appendix E.

5. All Indusi Trackside Magnets

5.1 Where possible observe the vertical movement of the track in the vicinity of the Indusi trackside magnet during the passage of a train. Any vertical movement greater than 12mm (0.5") shall be reported as corrective maintenance.

SERVICE B

6. Cables

6.1 Carry out NR/SMS/PartB/Test/054 (Cable insulation Test) on all tail cables.

APPENDIX A - Actions if the Test/Monitor lights fail to extinguish

If the Trains Test/Monitor Indicator Lights Fail to Extinguish or If a train stop fails to extinguish the drivers train-stop test/monitor indicator lights in the metro-trains cab then the following actions are to be undertaken:

1. The Signaller at Tyneside IECC shall be informed and signals in rear reading towards the suspect train stop shall be signed out of use until the suspect train-stop is retested using the train stop tester.

2. The following details shall be recorded and details forwarded via fault control for attention of the Tyne- Wear System Controller at Gosforth:

    a) Metro-train number.

    b) Leading cab designation.

APPENDIX B - Use of the Indusi Trackside Magnet Instruments

Indusi Trackside Magnet test current (Strom) values should be to a maximum value of 27mA for a new Indusi Trackside Magnet. However, due to aging of the Indusi Trackside Magnet components, these test values can rise gradually between maintenance visits up to maximum permissible value of 35mA.

Provided this rise is gradual, readings up to a maximum value of 35mA are acceptable. However, if a sudden rise of greater than 5mA occurs between maintenance visits and the new value is now above 27mA, the train stop is to be treated as defective.

Should a defective train stop be found using the train stop tester, then all stop signals reading up to the defective train stop shall be signed out of use until the defective train stop magnet is replaced.

APPENDIX C - Description of Indusi Trackside Magnet Test Instruments Manufactured by Siemens

There are currently two versions of Indusi Trackside Magnet Tester manufactured by Siemens One instrument has a push-button marked pruef-T and the other instrument has a two-way toggle switch (Toggle one way to set up the instrument and the other way to perform the test).

The Siemens trackside magnet testers are contained within a metal yellow enclosure with all the controls and indications on the top panel.

An internal rechargeable battery powers the unit; a socket provided for the power lead is located on the front panel.

Spacers on the base of the unit maintain the correct air gap between the Indusi trackside magnet and the tester for test purposes.

At the bottom left are two displays and to the right of them is a selector switch and variable frequency switch.

German Legend	English Meaning
Aus	Off
SPG	Battery Charge Level
Laden	Charge
Strom	Current
Pruef	Test

Table 1 - Operation of the Siemens Trackside Magnet Tester

1. Check that the Indusi trackside magnet tester is fully charged: by selecting SPG on the selector switch and reading the value in the Strom display: The current value should be between 110mA and 150mA.

A current value below 110mA indicates the Indusi trackside Magnet Tester requires re-charging.

To recharge the Battery, set the selector switch to SPG and plug the unit into the mains.

A green LED illuminates to indicate when the charging has ceased and the unit is fully charged.

Charging can take up to 7 hours depending upon the state of the charge in the battery. Fully changed battery will allow 100 tests to be performed.

With the tester is at least one metre away from any metallic objects, select either 1000Hz or 2000Hz.

Depending on the type of Indusi trackside magnets tester press and hold the 'pruef' button or select and hold the calibrate toggle switch.

After 1-2 seconds the frequency is displayed.

Adjust to the correct frequency using the variable frequency adjustment.

The current display 'Strom' should show a reading of 90mA (+1mA).Figure 1

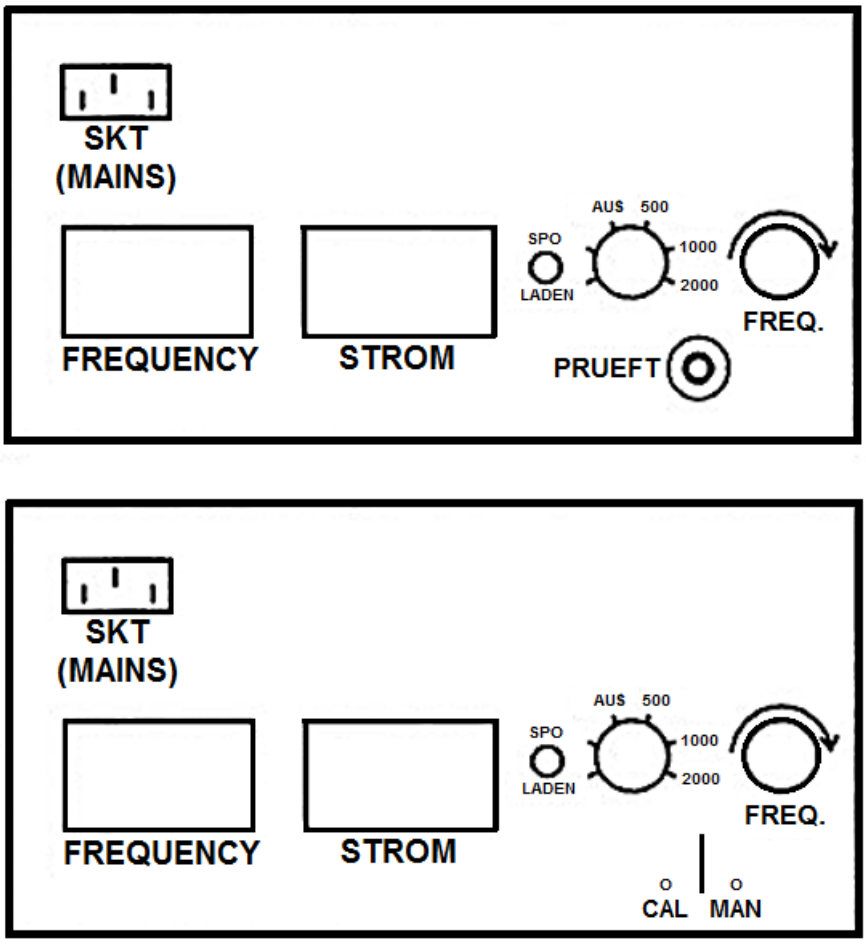


Figure 2 - Trainstop Magnet Testers Front Panel

APPENDIX D - Description of Indusi Trackside Magnet Test Instruments Manufactured by IPM Systems Ltd

This tester has been reversed engineered by IPM Systems Ltd for use on the Indusi system.

The IPM Systems trackside magnet tester is contained within a metal yellow enclosure with all the controls and indications on the top panel.

An internal rechargeable battery powers the unit; a socket provided for the power lead is located on the front panel.

A single overnight charge fully recharges a depleted battery. An icon in the top left of the screen displays the battery condition at all times.

There are four blue operation push buttons and a red power on/off button positioned to the right of the screen.

The blue buttons are unnumbered as their function is listed on the screen, but for clarity purposes button one is at the top and button four at the bottom.

Spacers on the base of the unit maintain the correct air gap between the trackside magnet and the tester for test purposes.

Figure 3 - IPM Systems Trackside Magnet Tester

1. Operation of the IPM Systems Trackside Magnet Tester

Figure 4 - Start Screen of Tester

1.1 At switch on the screen shown above is displayed. The relevant frequency is selected via button 1 or 2. Once the operating frequency has been selected, the unit should be held clear of any metal objects and the display checked to confirm the current reading is circa 80mA.

Figure 5 - Display with 2000Hz selected

1.2 Button 3 from the start screen displays the information page. Button 4 exits the last selected test or information screen and returns you to the start screen.

Figure 6 - Display showing information page (battery being charged)

1.3 The unit automatically switch off 60 seconds after the last button operation to save power.

APPENDIX E - Indusi Trackside Magnet Test

Signal Aspect	Frequency Selected	Frequency in Display	Current Reading
Stop	1000Hz	993Hz to 1019Hz	>60mA <80mA
	2000Hz	1988Hz to 2035Hz	>0mA <27mA
Proceed	1000Hz	993Hz to 1019Hz	>0mA <27mA
	2000Hz	1988Hz to 2035Hz	>60mA <80mA

Table 2 – Frequency and Current Indications

Indusi Trackside Magnets associated with Speed Control:

Trainstop Condition	Frequency Selected	Frequency in Display	Current Reading
Active at 2000Hz	1000Hz	993Hz to 1019Hz	>60mA <80mA
	2000Hz	1988Hz to 2035Hz	>0mA <27mA
Inactive	1000Hz	993Hz to 1019Hz	>60mA <80mA
	2000Hz	1988Hz to 2035Hz	>60mA <80mA

Table 3 - Frequency and Current Indications with Speed Control

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TS21		
JE Style Trainstops		
Issue : 01	Issue Date: 03/03/18	Compliance Date: 31/05/18

Includes:	Siemens - JE Style Trainstops
Excludes:	All other types of Trainstop

Trainstops contain moving parts which can cause severe personal injury.

Protection / Possession arrangement shall be taken before commencing work on any Trainstop.

Additional Maintenance equipment

- Trip arm gauge

SERVICE A

1. Routine Maintenance

1.1 Isolate the supply to the Trainstop.

1.2 Check the area surrounding the machine and remove any debris that could affect the operation of the machine, particularly in the area under the Trip Arm.

1.3 Check the interior of the Trainstop is free of accumulated water.

If water is found, remove it (drain plugs are provided in the base).

1.4 Check the condition of the sealing strip around the inside of the top cover.

1.5 Check the machine casing shows no evidence of cracks.

If cracks are suspected, report this should be reported to the SM(S).

1.6 Check the four fixings securing the machine to the bearer are secure. Tighten if necessary.

1.7 Check that any ramps are secure and undamaged. Tighten fixings if necessary.

1.8 Check that the Trainstop casing is bonded to the specified earth and that the bonding cable is protected where it passes under any rail.

1.9 Check that the electrical cable linking the Trainstop to the disconnection box is undamaged - Look particularly for cuts through the insulation and for crushing. Report any damaged cable.

1.10 At the Dashpot, unscrew the cover and check the oil level. If necessary top up to the fill mark using 20W-50 engine oil (see Figure 1).

1.11 Clean up any spilt oil using a clean cloth.

1.12 Replace the dashpot cover and screw up finger tight.

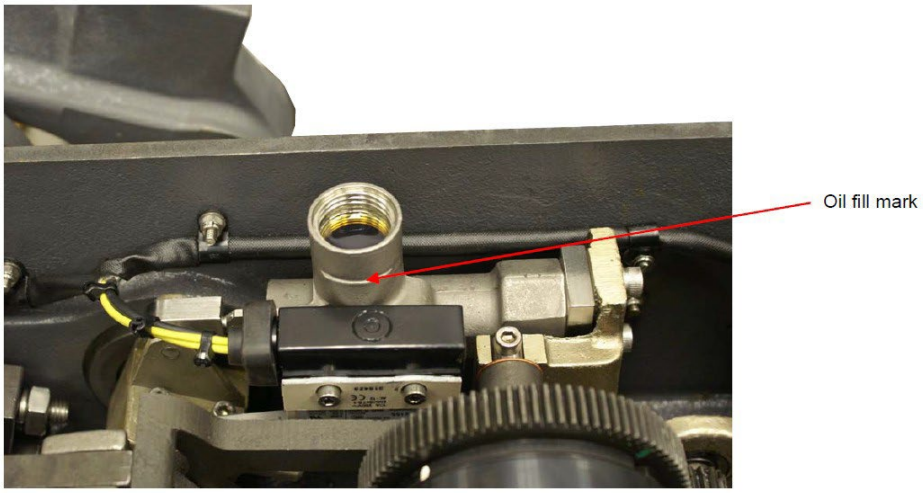


Figure 1 – Dashpot Oil Fill Mark

1.13 Check the operation of the damper as follows:

- Manually lower the Trip Arm (firm push required);
- Release the Trip Arm and check it returns to the raised position, taking more than one second. It should not slam back up, causing mechanical shock to the machine.

1.14 Carry out SMS Test 028 - JE Style Trainstop Positioning Check.

1.15 Carry out SMS Test 027 - JE Style Trainstop Detection Test

PERIODIC TASK

2 Full Overhaul

2.1 The Trainstop shall be removed from service and sent for re-servicing.

End

Includes:	Train Stops at Manchester Metro
Excludes:	All other Types of Train Stops

Equipment Identification

SERVICE B

1. Inductor between Rails

1.1 Remove debris from the area of the inductor between the rails.

1.2 Examine inductor for damage.

1.3 Examine fixings are undamaged and secured to the sleepers.

1.4 The inductor must have its transversal axis in the axis of the track with a tolerance of ± 1 cm.

1.5 The top of the inductor must be at the level of the rail top with a tolerance of +0, -5cm.

2. Test

2.1 In the location case, with the signal off, measure and record the voltage across the links W1/V1 feeding the Trainstop:

The expected voltage range is 4.5v to 7.5v (Results are generally 4.9v to 5.0v)

2.2 In the location case, with the signal off, measure and record the current at the links W1/V1 feeding the Trainstop:

The expected current range is 110mA to 190mA.

If the current is outside the 100 to 200mA range then advise the SM(S).

All result should be recorded on either paper or digital record card.

END

Includes:	Wheel Stops (Trainstops) located at Battersea Pier and Slade Green
Excludes:	All other types of Wheel Stop and Trainstops.

SERVICE A

1. Pump Unit (all types)

1.1 Check the concrete base, power unit mounting and fixings. The pump unit should be reasonably level (to the eye) and secure.

1.2 Check the visible tail cable and route.

1.3 Remove the pump unit cover.

1.4 Check that the pump unit cover opens freely, Lubricate as necessary.

1.5 Check the manual control selection mechanism and solenoid valve block is secure.

1.6 Check that the normal / reverse selector cannot be operated with the switch turned to ‘Power’.

1.7 Turn pump to “Manual” Position.

1.8 Check that the switch cannot be turned to power whilst operating the normal/reverse selector.

1.9 Examine cable entry, cable gland and tail cable sheath.

1.10 Clean and examine terminals, terminal block assembly and fixings. Protect as necessary.

1.11 Examine internal wiring.

Hydraulic fluid can cause degradation of insulation.

1.12 Clean and examine the pump unit, motor assembly and all fixings.

Look for leaks, particularly around the base of the hand pump mechanism, the cover plate gasket and at the base of the motor.

Unused ports shall be sealed to prevent fluid from being expelled from the reservoir. Check for leaks.

Power packs are labelled:

- MN, MR – Main Normal, Main Reverse
- BN, BR – Supplementary Normal,

Supplementary Reverse Power packs fitted with Snorkel Valves have a label saying ‘Snorkel Valve Fitted’ or a blue patch fixed to the power pack body.

1.13 Examine the motor brushes. Brushes shall slide freely in the holders and seat fully on the commutator. Brushes shall be replaced when worn to 10mm in length.

This task does not apply to brushless motors.

1.14 Check the hydraulic fluid level and (where fitted) the level indicator. If a top up greater than 0.5 litres is required check for leaks in the hydraulic system, Rectify as required.

If a leak cannot be found, advise the SM(S) before the end of the shift.

If more than 1 litre is required, carry out TEST FOR AIR (015).

1.15 Examine hydraulic ram hoses and connections. Pay particular attention to: Signs of leakage.

- Chafing and damage.
- Security.
- Significant corrosion.

Do not over tighten hose connections.

1.16 Check that the hose length does not exceed the requirement for purpose.

Beware of excess length of hose being wrapped around the power pack.

1.17 Check the locking wires on hose connectors are intact.

1.18 Examine the manual override pins for signs of contamination / corrosion. Clean the manual override pins and apply mineral oil to the pins.

1.19 Operate the normal/reverse selector a number of times and Check that they do not stick or remaining depressed following operation.

1.20 Refit the cover to the unit. Check that a RKB222 padlock is fitted to the local control unit hinged lid.

2. Exterior (All Types)

2.1 Examine and Dust exterior casing.

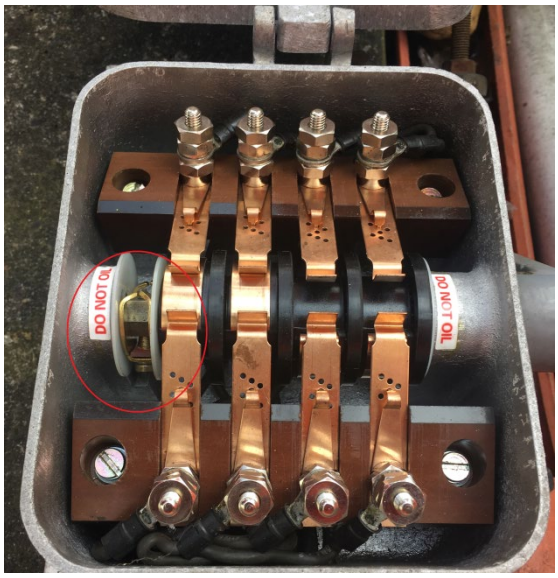
2.2 Examine fixing screws and bolts.

2.3 Check the linkage to the circuit controller. Lubricate as necessary.

2.4 Examine cable entry, cable gland and tail cable sheath.

2.5 Check that all terminal shrouds are fitted.

2.6 Check the spreading clamp screw is tight on the circuit controller's cam shaft. (circled in red)



3. Internal (All Types except Allen Bradley)

3.1 Examine interior and cover. Look particularly for contamination by metallic dust, dirt, or particles.

If any is found, carefully clean and report the condition to your SM(S). More details on this can be found in NR/SMS/LV00.

3.2 Check the lid gasket is undamaged and effective.

3.3 Examine drive, pivots, studs, rollers, spiral pins, split pins and drive lock locknuts. Check they are not seized.

3.4 Lightly Lubricate (wipe away excess) pivots and pins.

4. Wiring (All Types except Allen Bradley)

4.1 Examine cables and wires. Look particularly for:

a) Degraded or damaged (chafing) insulation.

b) Trapped wires.

c) Unsupported wires.

d) Risk of short circuit (electrical contact with adjacent terminals, casing or metal parts).

e) Fouling by moving parts.

f) Contamination.

4.2 Examine terminations clean and protect as necessary.

5. Contact Finger Type Circuit Controllers

5.1 Examine contact bands/ segments and contact fingers. If any are worn, damaged, or loose, report as corrective maintenance.

- Clean with a lint free cloth moistened with switch cleaner.
- Apply a protection agent as required (except contact faces).
- Apply an approved contact lubricant to the contact bands / segments.

6. Bearings (All Types except Allen Bradley)

6.1 Check and Lubricate bearings.

Caution: Bearings made from OILITE or nylon shall not be oiled (see NR/SMS/LV00).

7. Wheel Stop

7.1 Check the Wheel Stop and rail bracket for obvious signs of cracking on castings.

7.2 Check locking wire is installed on the hydraulic hose to actuator where suitable.

7.3 Check that the Wheel Stop is visibly painted yellow.

7.4 Check and Clean wheel stop number plate.

7.5 Remove any potential fire risks and obstructions.

7.6 Clean, check and examine all linkages, Pivots and split pins for security.

7.7 Lubricate all linkages and pivots.

7.8 Check torque (200Nm) wheel stop assembly to rail.

Indicated by the red circles on the picture to the right.

7.9 Grease pivots via grease nipples located above the actuator on the casting and adaptor block to wheel stop.

7.10 Check that the locking nut is tight connecting the actuator to adaptor block and the actuator end stop.

Indicated by the red circles on the picture to the right.

8. Final

8.1 Check for any slackness or maladjustment and that the equipment operates correctly. If any defects are found, the equipment shall be treated as faulty and the signaller informed.

8.2 Check and carefully replace cover/ gasket and secure/ lock. Lubricate padlock where fitted.

8.3 Protect exposed external screw threads with adhesive type grease.

8.4 Operate equipment and observe correct operation.

SERVICE B

9. Pump Unit (all types)

9.1 Renew the motor brushes. Check that they slide freely and seat fully on the commutator.

This task does not apply to brushless motors.

9.2 If not monitored by ELD, carry out DYNAMIC EARTH TEST (052).

Where this is not practical or safe to do, it can be undertaken as part of the location or equipment room tasks (NR/SMS/EL21 or NR/SMS/EL31).

10. Circuit Controllers

10.1 If a circuit controller is found to be operating incorrectly or is incorrectly adjusted, it shall be treated as faulty and taken out of service immediately.

11. Wheel Stop Detection Test

11.1 Carry out NR/SMS/Test 006 – Wheel Stop Detection Test.

END

Includes:	Marconi V322 and V327 (with separate or combined CCU), Pye SuperLynx, Rediffusion Link 109 and associated equipment
Excludes:	All CCD (digital) cameras and associated equipment

General

The camera column, winch gear, and safety devices shall be inspected by a competent person.

High voltages are present in the camera housing; extreme caution shall be taken (See NR/SMS/PartC/EL00 (Electrical Equipment - General) - Hazards Associated with Electrical Supplies).

SERVICE A

1. CCTV Location

1.1 Maintain the trackside apparatus case or equipment room in accordance with NR/SMS/PartC/EL21 (Trackside Apparatus Case) or NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

1.2 Switch the CCTV over to the standby power supply and check that the Signaller receives a satisfactory picture. Switch the main power on again and check that the cameras operate correctly.

2. Analogue Cameras

2.1 Ask the Signaller for permission to work on one of the two cameras. Lower the camera that is not in use to the bottom of the column.

2.2 Clean and examine the wiper blades. Replace degraded wipers or rubber inserts.

2.3 Lightly lubricate the wiper arm hinge and bearing.

2.4 Wipe and open the camera housing. Carefully wash both sides of the glass window

Use a clean lint free cloth moistened with isopropyl alcohol or a proprietary glass cleaner. Remove any smearing.

2.5 Check that the heater, thermostat, and fan are working. This depends on the ambient conditions. Lightly lubricate fan bearings.

2.6 Dust the inside of the housing as required.

2.7 Carefully clean the camera lens. Use a special lens cleaning tissue or camel-hair brush. Do not scratch the lens.

2.8 Examine all plugs and connections.

2.9 Check that the lens iris and shutter correctly operate.

2.10 Examine the inside of the camera housing for water leaks. Report any leaks as corrective maintenance.

2.11 Close up the camera housing; Check that all seals and electrical connections are intact. Check the camera and wiper operation. Check that the wiper parks out of sight of the camera.

2.12 Repeat 2.1 to 2.11 for the other camera.

2.13 Raise the camera and examine the camera cable outer sheath. Look particularly for cracking and water penetration.

3. Level Crossing Monitoring Point

3.1 Maintain the CCTV apparatus to NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

3.2 Clean and examine the level crossing monitors and control panel. Check that each camera provides a satisfactory picture:

a) During daylight, and

b) During darkness (this might be arranged separately).

The crossing picture shall be clear and cover the whole of the crossing area between the road STOP lines (the LC ground plan shows the area to be covered).

Do not do anything that reduces the picture coverage.

c) Image: Check that the image of the level crossing is not excessively burned onto the screen.

d) Focus: It is particularly important to check the focus during darkness because focus adjustment is more critical when the lens iris is wide open

e) Picture Quality: If you need to adjust the picture quality, use the brightness and contrast controls.

If there are external controls available, you might also adjust the vertical hold, horizontal hold, focus, scan, synchronisation, and height.

If the picture quality is bad, you should also check that the bridge / terminate switches on the back of the monitors are set correctly (‘Terminate’ for one coaxial cable, ‘Bridge’ for two coaxial cables).

If you cannot obtain a satisfactory picture, report it as corrective maintenance.

3.3 Repeat 3.2 for the spare / standby monitor:

3.4 Confirm with the Signaller that all camera and wiper functions are working; confirm that they have a good picture and good view of the crossing.

SERVICE B

4. Full System Test

4.1 Carry out NR/SMS/PartB/Test/046 (Level Crossing CCTV Camera Test).

4.2 If provided, carry out NR/SMS/PartB/Test/047 (CCTV Transmission System Tests).

4.3 If provided, on the HF Tx system NR/SMS/PartB/Test/062 (Line Protection Unit Test).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TV02		
Level Crossing CCTV Digital Systems		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Panasonic CD20; Philips LD0702, LD0502; Grundig FA85, Mk2H, FA878 and associated equipment
Excludes:	All Analogue (Vidicon) cameras and associated equipment

General

The camera column, winch gear, and safety devices shall be inspected by a competent person.

There should be a record on site. Tell your SM(S) if this record is missing or out of date.

SERVICE A

1. CCTV Location

1.1 Maintain the trackside apparatus case or equipment room in accordance with NR/SMS/PartC/EL21 (Trackside Apparatus Case) or NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

2. CCD Cameras

Where the cameras are a CCD type mounted in a modern housing designed specifically for CCD cameras, then there is usually no requirement to lower the cameras at this service. if in doubt, ask your SM(S).

2.1 In liaison with the Signaller, check that:

a) They are satisfied with the quality of pictures from both cameras.

b) That all functions on both cameras operate correctly. Investigate and rectify any problems found.

2.2 From ground level, visually check the camera housings, column, cable, and fittings.

Investigate and rectify any problems found.

3. Level Crossing Monitoring Point

3.1 Maintain the CCTV apparatus to NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

3.2 Clean and examine the level crossing monitors and control panel. Check that each camera/monitor combination provides a satisfactory picture:

a) During daylight, and

b) During darkness (this may be arranged separately).

The level Crossing ground plan shows the area to be viewed by the cameras.

The crossing picture shall be clear and cover the whole of the crossing area between the barriers and normally out at least as far as the road STOP lines.

Do not do anything that reduces the picture coverage below that in the ground plan.

c) Image: Check that the image of the level crossing is not excessively burned onto the screen.

d) Focus: It is particularly important to check the focus during darkness because focus adjustment is more critical when the lens iris is wide open.

e) Picture Quality: If you need to adjust the picture quality, use the brightness and contrast controls.

If there are external controls available, you may also adjust the vertical hold, horizontal hold, focus, scan, synchronisation and height.

If the picture quality is bad, you should also check that the bridge/terminate switches on the back of the monitors are set correctly (‘Terminate’ for one coaxial cable, ‘Bridge’ for two coaxial cables).

If you cannot obtain a satisfactory picture, report it to your SM(S).

3.3 Repeat step 3.2 for the spare/standby monitor:

SERVICE B

4. CCD Cameras

4.1 Ask the Signaller for permission to work on one of the two cameras. Lower the camera that is not in use to the bottom of the column.

4.2 Clean and examine the wiper blades. Replace degraded wipers or rubber inserts.

4.3 Lightly lubricate the wiper arm hinge and bearing.

4.4 Wipe and open the camera housing. Carefully Wash both sides of the glass window. Use a clean lint free cloth moistened with isopropyl alcohol or a proprietary glass cleaner. Remove any smearing.

4.5 Check that the heater and thermostat are working. This depends on the ambient conditions.

4.6 Dust the inside of the housing as required.

4.7 The camera should be sited as far back in housing as it can go without the sides or top of housing, or the wiper appearing in the field of view.

This is to give the camera lens maximum shading from direct sunlight, which can otherwise cause a problem at certain times of the day.

4.8 Carefully clean the camera lens as required. Use a special lens cleaning tissue or camel-hair brush. Do not scratch the lens.

4.9 Examine all plugs and connections.

4.10 Examine the cable gland for security and tightness.

4.11 Examine the inside of the camera housing for water ingress. Report any leaks to your SM(S).

4.12 Carry out NR/SMS/PartB/Test/046 (Level Crossing CCTV Camera Tests).

4.13 Close up the camera housing; Check the camera and wiper operation; make sure that the housing lid is seated correctly on the seal; Check that the wiper parks out of sight of the camera.

4.14 Raise the camera; Examine the camera cable outer sheath for problems. Look particularly for cracking and water penetration.

4.15 Confirm with the Signaller that all camera and wiper functions are working; confirm that they have a good picture and good view of the crossing.

4.16 Repeat 4.1 to 4.15 for the other camera.

4.17 If provided, carry out NR/SMS/PartB/Test/047 (CCTV Transmission System Tests).

4.18 If provided on the HF Tx system, carry out NR/SMS/PartB/Test/062 (Line Protection Unit Test).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TV03		
Tail Lamp CCTV Digital Systems		
Issue No: 02	Issue Date: 05/12/2020	Compliance Date: 05/06/2021

Includes:	Plettac FAC858NRF cameras, TEW LCD TFT monitors and associated equipment
Excludes:	All other types of CCTV digital systems

General

Tail lamping cameras and associated monitors in signal boxes are usually provided to allow the Signaller to check that a train is complete, after it has traversed a section of track that might not be fully track circuited.

Installations can vary using only one camera and monitor or a duplicated system as in level crossing CCTV systems.

SERVICE A

1. CCTV Location

1.1 Maintain the trackside apparatus case or equipment room in accordance with NR/SMS/PartC/EL21 (Trackside Apparatus Case) or NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

2. CCD Cameras

Where the cameras are a CCD type mounted in a modern housing designed specifically for CCD cameras, (PADS number: 089/12743) then there is usually no requirement to lower the cameras at this service. If in doubt, ask your SM(S).

2.1 In liaison with the Signaller, check that:

a) They are satisfied with the quality of pictures from both cameras.

b) That all functions on both cameras operate correctly.

Investigate and rectify any problems found.

2.2 Visually check the camera housings, column, cable, and fittings. Investigate and rectify any problems found.

3. Camera Monitoring Point

3.1 Maintain the CCTV apparatus to NR/SMS/PartC/EL31 (Equipment and Relay Rooms).

3.2 Examine and the Tail Lamp observation monitors and control panel. Clean as required. Use approved cleaning materials.

3.3 Check that each camera/monitor combination provides a satisfactory picture during daylight, and during darkness (this may be arranged separately).

At night, moving trains appear to have a 'jerky' motion, this is normal.

a) Image: Make sure that the image is not excessively burned onto the screen (with the monitor turned OFF).

b) Focus: It is particularly important to check the focus during darkness because focus adjustment is more critical when the lens iris is fully open.

c) Picture Quality: If you need to adjust the picture quality, use the brightness, contrast and sharpness controls (via the on-screen menu system).

If the picture quality is bad, check that the bridge/terminate switches on the back of the monitors are set correctly ('Terminate' for one coaxial cable, 'Bridge' for two coaxial cables).

If you cannot obtain a satisfactory picture, report it to your SM(S).

3.4 Check that the tail lamp of a passing train is clearly visible.

3.5 If provided repeat 3.2 and 3.3 for the spare/standby monitor/camera.

SERVICE B

4. Camera(s)

4.1 Ask the Signaller for permission to work on the camera. On systems with two cameras, ask for permission to work on one of the cameras.

4.2 Clean and examine the wiper blades. Replace degraded wipers or rubber inserts.

4.3 Lightly lubricate the wiper arm hinge and bearing.

4.4 Wipe and open the camera housing. Carefully wash both sides of the glass window.

Use a clean lint free cloth moistened with isopropyl alcohol or a proprietary glass cleaner. Remove any smearing.

4.5 Check that the heater and thermostat are working. This is dependent on the ambient conditions.

4.6 Dust the inside of the housing as required.

4.7 Check that the camera is sited as far back in housing as it can go without the sides or top of housing, or the wiper appearing in the field of view.

This is to give the camera lens maximum shading from direct sunlight, which can otherwise cause a problem at certain times of the day.

4.8 Carefully clean the camera lens as required. Use a special lens cleaning tissue or camel-hair brush. Do not scratch the lens.

4.9 Examine the following:

a) All plugs and connections.

b) Cable gland for security and tightness.

c) The inside of the camera housing for water ingress. Report any leaks as corrective maintenance.

4.10 Carry out NR/SMS/PartB/Test/048 (Tail Lamp CCTV Camera Tests).

4.11 Close up the camera housing. Check the camera and wiper operation. Check that the housing lid is seated correctly on the seal. Check that the wiper parks out of sight of the camera.

4.12 Examine the camera cable outer sheath for problems. Look particularly for cracking and water penetration.

4.13 Confirm with the Signaller that all camera and wiper functions are working, have a good picture and good view of train tail lamps.

4.14 If provided, repeat 4.1 to 4.13 for the other camera.

4.15 If provided, NR/SMS/PartB/Test/047 (CCTV Transmission System Test).

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TW01		
Airport Trip Wires		
Issue No: 03	Issue Date: 07/03/2020	Compliance Date: 06/06/2020

Includes:	All Airport Tripwires, Also Bank-Slip Detectors using similar principles
Excludes:	All other types of Tripwires and Airport Trip wires in Scotland (TW02)

Airport tripwire systems are required where airport runways have railway lines nearby.

They detect planes overrunning the runway and sound an alarm in the Signal box and replace protecting railway signals to danger.

They are either based on a mechanical wire holding off a weighted circuit controller or an isolated 50V electrical wire circuit holding up a standard signalling relay.

Whichever system is used, the wire is supported on telegraph poles or similar posts approximately 8-12 feet high parallel to the railway across the line that an aircraft could overrun.

There might be arrangements for degraded working provided in the Signalling system that in the event of a failure of the Tripwire system.

These often restrict aspects of signals over the protected section to single yellow.

SERVICE A

1. Mechanical Wire Systems Only

1.1 From Ground level inspect all posts. Check for rot in wooden posts, especially at or near ground level. Check any guy ropes are tight.

1.2 Visually check the wire throughout its length for corrosion. Check pulleys appear to be supporting the wire correctly.

1.3 Carry out NR/SMS/PartC/LV31 (Circuit Controllers), on the circuit controller.

1.4 In conjunction with the Signaller, function test the system by releasing the wire at the end furthest from the circuit controller and check with the Signaller that the alarms operate, and the protecting signals return to Red or cannot be cleared from Red.

1.5 Re-terminate the mechanical wire and restore the Tripwire system to normal use.

2. Electrical Wire Systems Only

2.1 From Ground level inspect all posts. Check for rot in wooden posts, especially at or near ground level. Check any guy ropes are tight.

2.2 Visually check the wire and any insulators throughout its length for problems.

2.3 In conjunction with the Signaller, function test the system by removing a fuse or a link at the power supply end of the circuit and check with the Signaller that the alarms operate, and the protecting signals return to Red or cannot be cleared from Red.

2.4 Replace the fuse/link and restore the Tripwire system to normal use.

3. Degraded Working (Where Provided)

3.1 In conjunction with the Signaller, function test any signalling controls provided for degraded working in the event of a failure of the Tripwire system.

3.2 This shall normally include protecting signals being restricted to single Yellow

END

NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartC/TW02		
Airport Trip Wires – Scotland		
Issue No: 02	Issue Date: 04/06/2022	Compliance Date: 03/09/2022

Includes:	Airport Trip wires in Scotland
Excludes:	All Airport Tripwires, Also Bank-Slip Detectors

GENERAL

Airport tripwire systems are required where airport runways have railway lines nearby. They detect planes overrunning the runway and sound appropriate alarms in the Signal box and replace protecting railway signals to danger.

They are either based on a mechanical wire holding off a weighted circuit controller or an isolated 50V electrical wire circuit holding up a standard signalling relay.

Whichever system is used, the wire is supported on telegraph poles or similar posts approximately 8-12 feet high, parallel to the railway across the line that an aircraft might overrun.

There may be arrangements for degraded working provided in the Signalling system that in the event of a failure of the Tripwire system. These often restrict aspects of signals over the protected section to single yellow.

SERVICE A

1. Mechanical Wire Systems Only

1.1 From Ground level inspect all posts. Check for rot in wooden posts, especially at or near ground level. Check any guy ropes are tight.

1.2 Visually check the wire throughout its length for corrosion. Check pulleys appear to be supporting the wire correctly.

1.3 Carry out NR/SMS/PartC/LV31 (Circuit Controllers) on the circuit controller.

a) At Prestwick a ladder shall be required to reach this equipment.

b) At Glasgow, also inspect the balance weight arm, check cotter pins and grease bearings.

1.4 With agreement from the Signaller, test the system as follows:

a) At Prestwick, removal of the tension at the far end of the rope activates the circuit; this can be achieved by raising the balance weight at the opposite end from the circuit controller.

b) At Glasgow, release the shackle for the wire rope on the balance weight arm. This simulates the trip wire breaking, permits the balance weight to fall and thus operates the circuit controller.

c) At Edinburgh, slip the relevant link in the location case to disconnect the current carried by the aerial conductor wire and thus simulate the wire breaking.

d) For Prestwick and Glasgow, check that the Signaller in Paisley Signalling Centre confirms that the indications for the relevant signals in rear on both Up and Down lines have changed to “on”, the audible alarm is functioning and the alarm cancel button is illuminated. In addition, confirm that when the alarm cancel button is pushed the audible alarm (buzzer) ceases and the button remains lit. This applies separately for the Prestwick and Glasgow alarms.

e) For Edinburgh, check that the Signaller in Edinburgh Signalling Centre confirms that the indications for the relevant signals in rear on both Up and Down lines have changed to “on”, the audible alarm is functioning and the alarm cancel button is illuminated. In addition, confirm that when the alarm cancel button is pushed the audible alarm (buzzer) ceases and the button remains lit.

1.5 Re-terminate the mechanical wire and restore the Tripwire system to normal use.

2. Electrical Wire Systems Only

2.1 In the location case, examine the fuse holder(s), fuse(s), internal wiring, terminals and relay dedicated to the “trip wire” circuit for arcing, overheating, contamination, or other signs of deterioration. Clean these components as necessary.

2.2 Inspect the tail cable(s) connecting from the location case to the circuit controller or aerial conductor wire for good condition and protection.

2.3 From Ground level inspect all posts. Check for rot in wooden posts, especially at or near ground level. Check any guy ropes are tight.

2.4 Visually check the wire and any insulators throughout its length for problems.

2.5 In conjunction with the Signaller, function test the system by removing a fuse or a link at the power supply end of the circuit and check with the Signaller that the alarms operate, and the signals return to Red or cannot be cleared from Red.

2.6 Replace the fuse/link and restore the Tripwire system to normal use.

3. Degraded Working (Where Provided)

3.1 In conjunction with the Signaller, function test any signalling controls provided for degraded working in the event of a failure of the Tripwire system.

NOTE: *This might normally include protecting signals being restricted to single Yellow*

END

Includes:	Vehicle Identification System used in the Sheffield Tram-Train Project Network Rail mainline infrastructure, between the Sheffield Supertram network and Parkgate Tram Stop.
Excludes:	Vehicle Identification System used on the Sheffield Supertram Network

GENERAL

For information on Loop Tuning see NR/SMS/PartB/025 (Vehicle Identification Loops (VIS) Loop Tuning Setup).

ROUTINE TASKS

1. VIS OTU Cubicle Equipment

1.1 Check relevant LEDs to confirm health status of the equipment, these are as follows:

a) Microcontroller Module – 3.3V LED illuminated. Note the 3.3V, LINK, 10, 100, COL, STAT, RXD, and TXD relate to ethernet communications and are therefore only applicable to the Tinsley OTU equipment.

b) Loop Module – COM flashing with all other LEDs illuminated.

c) Power Supply Module - +V, 24V and 5V LEDs illuminated.

d) Relay Module – Loop Fault and Watchdog LEDs illuminated

NOTE: *See the table in Appendix D for further information.*

1.2 Visually confirm that there is no damage to the tail cable connections and no degradation of the VIS relay module output wiring.

1.3 Use Orion test probes on rack output to confirm values are within the parameters specified in Table 1.

Reading	Approx. Output Volts (pp)
10	1.7
20	3.3
30	5
40	6.7
50	8.3
60	10
70	11.7 (Normal Setting)
80	13.3
90	15
100	16.7

Table 1 – Rack Output Voltages using Test Probes

1.4 Check the output from the loop in the four-foot using the Test Box and Table 2.

Reading	Comment
25	Borderline
26 - 50	Acceptable
51+	Good

Table 2 – Box on the Loop

SERVICE B

2. External Checks

2.1 Examine the tail cable for damage where it passes under the rail.

2.2 Remove all fire risks from or near the VIS loop antenna.

2.3 Check that the VIS loop antenna and its fixings are free from ballast.

2.4 Check that all cables are correctly located, secured and free from damage.

2.5 Check that tuning unit is correctly located, secured and free from damage.

2.6 Check for physical damage to the VIS loop antenna, its mountings and fixings.

2.7 Check that the VIS loop antenna is mounted centrally in the 4ft, rectify as necessary.

2.8 Clean the VIS loop antenna.

2.9 Test the VIS loop antenna field strength using Orion test meter and record the values in the relevant documentation.

APPENDIX A - Orion Test Meter

The Orion Test Meter comprises a moving coil meter with drive circuit, pickup antenna and battery located in a plastic housing.

This unit can be used to measure the voltage at the rear of the OTU cubicle using test leads or the loop radiated voltage by placing the unit at the centre of the loop.

Figure 1 - Orion Test Meter

APPENDIX B - Orion Tram Simulator

This Tram Simulator is used to simulate a tram over a trackside loop to allow the phase setup of the Loop cards to be checked and for commissioning checks in the absence of a test tram.

The equipment is comprised of a cut-down tram rack, fitted with reduced size backplane, standard tram Operator Interface, Antenna, and PSU cards plus integrated battery support. A standard tram Antenna (mounted on a stainless steel backplate) and incorporating a short length of antenna cable is also provided. A wooden pole is also supplied, with a 350mm height marking, to be used as an antenna mount during phase testing.

Figure 2 - Orion Tram Simulator

END

Ref:	**TI 182: Issue 3**
Issue date:	16th November 2023
Compliance date:	16th November 2023
Expiry date:	15th November 2024

Technical Instruction: TI 182

Standard/control document affected:
NR/L3/SIG/10663 (Issue 16,17 & 18), Signal Maintenance Specifications NR/SMS/Part C
NR/L2/SIG/30014 (Issue 21 & 22), *Signal Works Testing Handbook NR/L2/SIG/30014/D115*
NR/GN/SIG/19047 (Issue 3), SIGTAN047 - Points (General)

The affected standards/control documents will be reviewed and up-issued before this technical instruction expires on 15th November 2024.

For further information contact:

Samantha Jackson, Senior Engineer (Control, Command & Signalling), 07734649013

---

1 Reason for issue

Due to the age of point machines, asbestos may be present in the clutch friction plates.

Clutch slip tests have been identified as a potential for the release of asbestos fibres. To date, sampling of extensive clutch testing and air testing has returned no fibre concentrations above the limit of quantification (concentrations were below detection limits). Furthermore, there has been no evidence of asbestos fibre from debris sampling of contamination within the machine from the clutch.

This instruction is to prohibit the clutch slip test on point machines that have not been confirmed to be free from asbestos fibre risks.

The prohibition of the clutch slip test has been taken as a precaution whilst further comprehensive testing is completed across the population of machines listed below.

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

2 Scope

All point machines that contain a friction-based clutch plate. This affects the following types of point machines:

- HW1000 Style
- Style JEA50 / ML3-1
- MV-GRS Model 5
- SGE Style HB
- SGE Style HA
- WRSL Style 63
- WRSL Styles M3 & M3A

This instruction applies to **reserviced** point machine as it is unknown if they could still contain asbestos in the clutch. These can be is installed and tested as per NR/SMTH/Part04/PC51 or NR/L2/SIG/30014/D115/DT3-52 but 'clutch slip test' shall not be carried out.

This instruction does not apply to **new** point machine as these are known to be manufactured without the asbestos clutch. These can be installed and tested as per NR/SMTH/Part04/PC51 or NR/L2/SIG/30014/D115/DT3-52.

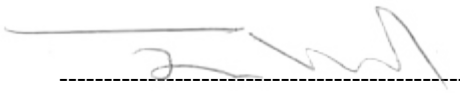
3 Requirements

Clause/sub-clause	Change
NR/SMS/Part C **PC05 Step 11.4,** **PC22 Step 15.5,** **PC31 Step 11.6,** **PC33 Step 16.5,** **PC41 Step 14.4** **PC42 Step 17.2**	Staff shall not complete these clutch slip test steps unless it has been confirmed asbestos is not present or does not present a risk from potential asbestos fibres.
NR/L2/SIG/30014/D115/DT3-52 **Step 1.2** **Step 1.3** **Section 2**	Staff shall not complete these clutch slip test steps unless it has been confirmed asbestos is not present or does not present a risk from potential asbestos fibres.
NR/GN/SIG/19047 **Clause 8.8**	Staff shall not complete this clutch slip test step unless it has been confirmed asbestos is not present or does not present a risk from potential asbestos fibres.

Ref:	**TI 182: Issue 3**
Issue date:	16th November 2023
Compliance date:	16th November 2023
Expiry date:	15th November 2024

Approval of Standard and Control Document Owner

Approved by:



Jeremy Morling, Network Technical Head Signalling

Approval of Delivery Function Authority

Approved by:

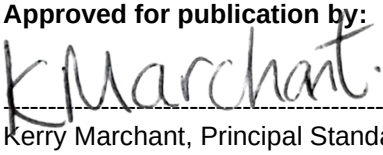
Stephen Dapre

Stephen Dapre
I am approving this document as Regional Head of Eng (S&T) Southern Region
2023-11-16 12:03Z

Stephen Dapre, Regional Head of Engineering [Signalling & Telecoms]

Approval of Standards and Controls Management Team

Approved for publication by:



Kerry Marchant, Principal Standards & Controls Manager

4 Recipients

Name	**Post**
Stephen Dapre	Regional Engineer (Southern)
Adam Lowery	Regional Engineer (Eastern)
Imtithal Aziz	Regional Engineer (NW&C)
Matthew Redstone	Regional Engineer (Wales & Western)
Lynsey Hunter	Regional Engineer (Scotland)
Simon Read	Programme Engineering Manager (Test & Commissioning) (Route Services)
David Slater	Colas - Lead Engineer S&T - Infrastructure (STEF Chair)

5 Details of briefing or cascade communication process

This Technical Instructions is of interest to:

Cascade briefing is to be carried out as per table below.

Role(s)	**Function**	**Posts Responsible for Briefing Cascade**
Regional Engineer/Route Engineer (or equivalent)	Regions	Author (at S-ATR)
Chief CCS Engineer	Technical Authority	
Network Technical Head (S&C)	Technical Authority	
CCS Engineer	Technical Authority	Chief CCS Engineer
S&C Engineer	Technical Authority	Network Technical Head (S&C)
Asset Engineer	Regions	Regional Engineer/Route Engineers (or equivalent)
Signal & Telecoms Maintenance Engineer	Regions (Maintenance)	
Works Delivery Managers (Signals)	Regions (Works Delivery)	Regional Engineer/Route Engineers (or equivalent) or S&TME
Section Manager (Signals)	Regions (Maintenance)	Signal & Telecoms Maintenance Engineer
Signalling Technical Support Staff	Regions (Maintenance)	
S&T Maintenance Test Engineers	Regions (Maintenance)	
Signal Team Leaders,	Regions (Maintenance)	Section Manager (Signals)

Role(s)	Function	Posts Responsible for Briefing Cascade
Technicians and Operatives	Regions (Maintenance)	
Works Delivery Supervisor (Signals)	Regions (Works Delivery)	Works Delivery Manager (Signals)
Project Engineer	Regions (Works Delivery)	
Technician and Operative	Regions (Works Delivery)	
Engineering Expert (CCS)	Technical Authority	Author (at DRG)
Programme Engineering Manager (Capital Delivery)	Regions (Capital Delivery)	Author (at DRG)/ Engineering Expert (CCS)
Programme Engineering Manager (Test & Commissioning)	Regions (Capital Delivery)	
Programme Engineering Manager (CCS) (System Operator)	Regions (Capital Delivery)	
Principal Innovations Engineer [Signalling]	Route Services	
Project Engineer	Regions (Capital Delivery)	Programme Engineering Managers (Capital Delivery)
Test & Commissioning Engineer	Route Services	Programme Engineering Manager (Test & Commissioning)
Workforce Development Specialists	Route Services	Author
Signalling Suppliers	Suppliers	Author (STEF)

Ref:	**TI 184**
Issue date:	04 September 2023
Compliance date:	29 September 2023
Expiry date:	29 September 2025

Technical Instruction: TI 184 Issue 1

Standard/control document affected:

- **NR/L2/SIG/11201 Module X39 (Issue 2), System Application Specification for Overlay Miniature Stop Light Level Crossings**
- **NR/L3/SIG/10661 (Issue 23), Signalling Maintenance Task Intervals**
- **NR/L3/SIG/10663 Signal Maintenance Specifications – NR/SMS/PartC/LC71 (Issue 04), Vamos Crossing System**

This technical instruction will be withdrawn when all Vamos crossing systems have been fitted with IMC040A boards in response to NR/SIN/216.

For further information contact: Jonathan Evans, Network Technical Head Level Crossings Engineering, 07825766715

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1 Reason for issue

This Technical Instruction (TI) has been issued to mitigate the risk of wrong side failures of Vamos overlay miniature stop light (OMSL) level crossing systems between the completion of the activities associated with Special Inspection Notices (SINs) 211 and 212 and the deployment of modified IMC040 boards (which will be known as IMC040A boards). The IMC040A boards are intended to significantly reduce the potential for the identified wrong side failure mode to occur.

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

2 Scope

This TI is applicable to all Vamos crossing systems on Network Rail (NR) managed infrastructure.

These changes have been made on a temporary basis. The requirements in this TI apply until the Vamos crossing system concerned has been fitted with the IMC040A boards.

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

3 Requirements

Clause/sub-clause	Change
NR/L2/SIG/11201 Module X39	Add Appendix A of this TI (attached at the back of this TI). ***NOTE:*** *Clause 3 of Appendix A sets out an additional process to support Routes in determining whether it is appropriate to bring a new Vamos crossing system into service at a particular level crossing in advance of the modified components being available.* *Clause 4 of Appendix A contains additional controls which apply should it be decided to bring a new Vamos crossing system into service at a particular level crossing in advance of the modified components being available.* *These controls align with current good practice as implemented on existing Vamos crossing systems in response to NR/SIN/211 and NR/SIN/212.*
NR/L3/SIG/10661	Add temporary Service A activity for Vamos crossing systems

Ref:	**TI 184**
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<table>
<tr><td>6.1</td><td>(NR/SMS/PartC/LC71) as follows:

<table><tr><th>NR/SMS Ref</th><th>Service</th><th>Normal Interval</th><th>Maximum Interval</th></tr><tr><td>LC71</td><td>A</td><td>0091</td><td>0091</td></tr></table>
NOTE: There is no change to the Service B frequency for LC71.</td></tr>
<tr><td>NR/L3/SIG/10663</td><td>Add Appendix B to NR/SMS/PartC/LC71 (attached at the back of this TI).

This is an additional regime of site inspections for Vamos crossing systems that has been introduced as a temporary Service A activity in NR/SMS/PartC/LC71.

NOTE: There are no changes to the tasks within Service B of LC71.</td></tr>
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Approval of Standard and Control Document Owner

Approved by:

Jeremy Morling, Network Technical Head [Signalling]

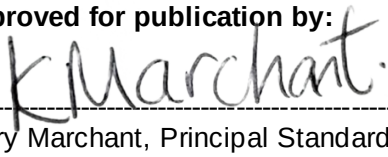
Approval of Delivery Function Authority

Approved by:

Paul Percival, Regional Head of Engineering [Signalling & Telecoms]

Approval of Standards and Controls Management Team

Approved for publication by:



Kerry Marchant, Principal Standards & Controls Manager

Ref:	**TI 184**
Issue date:	04 September 2023
Compliance date:	29 September 2023
Expiry date:	29 September 2025

4 Recipients

Name	**Post**
Various	Regional Engineer (Signalling) or equivalent
Various	Route Engineer (Signalling) or equivalent
Various	Route Level Crossing Managers or equivalent
Simon Read	Programme Engineering Manager (Test & Commissioning)

5 Details of briefing or cascade communication process

Name	**Post**
Author	Regional Engineers (Signalling) or equivalent
Author	Route Engineer (Signalling) or equivalent
Author	Route Level Crossing Managers or equivalent
Author	Programme Engineering Manager (Test & Commissioning)
Regional Engineers/Route Engineers or equivalent	Signal & Telecoms Maintenance Engineers
Signal & Telecoms Maintenance Engineers	Section Managers (Signals)
Signal & Telecoms Maintenance Engineers	Works Delivery Managers (Signals)
Section Manager (Signals) / Works Delivery Managers (Signals)	Team Leader (Signals)
Section Manager (Signals) / Works Delivery Managers (Signals)	Technician (Signals)
Programme Engineering Manager (Test & Commissioning)	Test & Commissioning Engineers

Ref:	TI 184 – Appendix A
Issue:	1
Date:	4th September 2023
Compliance date:	29th September 2025

TI184 – Appendix A

Appendix to NR/L2/SIG/11201 Module X39 System Application Specification for Overlay Miniature Stop Light Level Crossings

Endorsement and Authorisation

For Endorsement and Authorisation, please refer to TI184

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Ref:	TI 184 – Appendix A
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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.

Ref:	TI 184 – Appendix A
Issue:	1
Date:	4th September 2023
Compliance date:	29th September 2025

Reference documentation

Notice Board 215 Frauscher Wheel Sensor RSR123

Legislation

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

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Contents

Ref:	TI 184 – Appendix A
Issue:	1
Date:	4th September 2023
Compliance date:	29th September 2025

1 Scope

This appendix to NR/L2/SIG/11201 Module X39 applies to all proposals to bring new Vamos crossing systems into service on Network Rail (NR) managed infrastructure until such time as modified IMC040 boards (to be known as IMC040A boards) have been accepted for use and are available for installation as part of new Vamos crossing systems.

This appendix is not applicable to other Overlay Miniature Stop Light (OMSL) systems.

2 Definitions

For the purposes of this document the following terms are defined:

- Current IMC040 board – the version of IMC040 board (encompassing both hardware and software) which is referenced on product acceptance certificate PA05/05850 issue 8 (or earlier).
- IMC040A board – a version of the IMC040 board with amended software which has been developed by Frauscher to eliminate a potential wrong side failure mode within the Vamos system. The IMC040A board has been accepted for use on NR infrastructure and plans for its deployment to replace current IMC040 boards in Vamos crossing systems are currently being developed. The board replacement activity is outside the scope of this document and TI184.

Refer to NR/L2/SIG/11201 Module X39 for other definitions.

3 Vamos Crossing System Entry into Service Decision Process

3.1 Overview

3.1.1

Figure 1 below is a flowchart representation of the process for deciding whether it is appropriate to bring a new Vamos crossing system into service before IMC040A boards are available for operational use at the crossing in question.

The numbers in brackets within the flow chart are cross-references to the subsequent sections of this appendix which set out the requirements and guidance associated with each step.

3.1.2

The considerations and outcome of the decision process set out in this appendix for each level crossing considered shall be documented.

Rationale: To provide an audit trail of decision making.

There is no mandatory template for recording the issues considered and outcome of the decision process, however, adopting a format which reflects the structure of the process flowchart set out in Figure 1 enables subsequent readers of the document to confirm that all the relevant issues were considered.

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3.1.3

The outcome of the decision process shall be accepted by the Route Engineer (Signalling) and Route Level Crossing Manager, or equivalent roles, before entry into service activities commence on site.

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

Consultation with other affected parties, such as operations management, may also be appropriate during the decision process.

It is envisaged that working through the decision process will be led by Route teams, but it can be undertaken by any party with access to the information needed to consider the questions and issues raised within the process.

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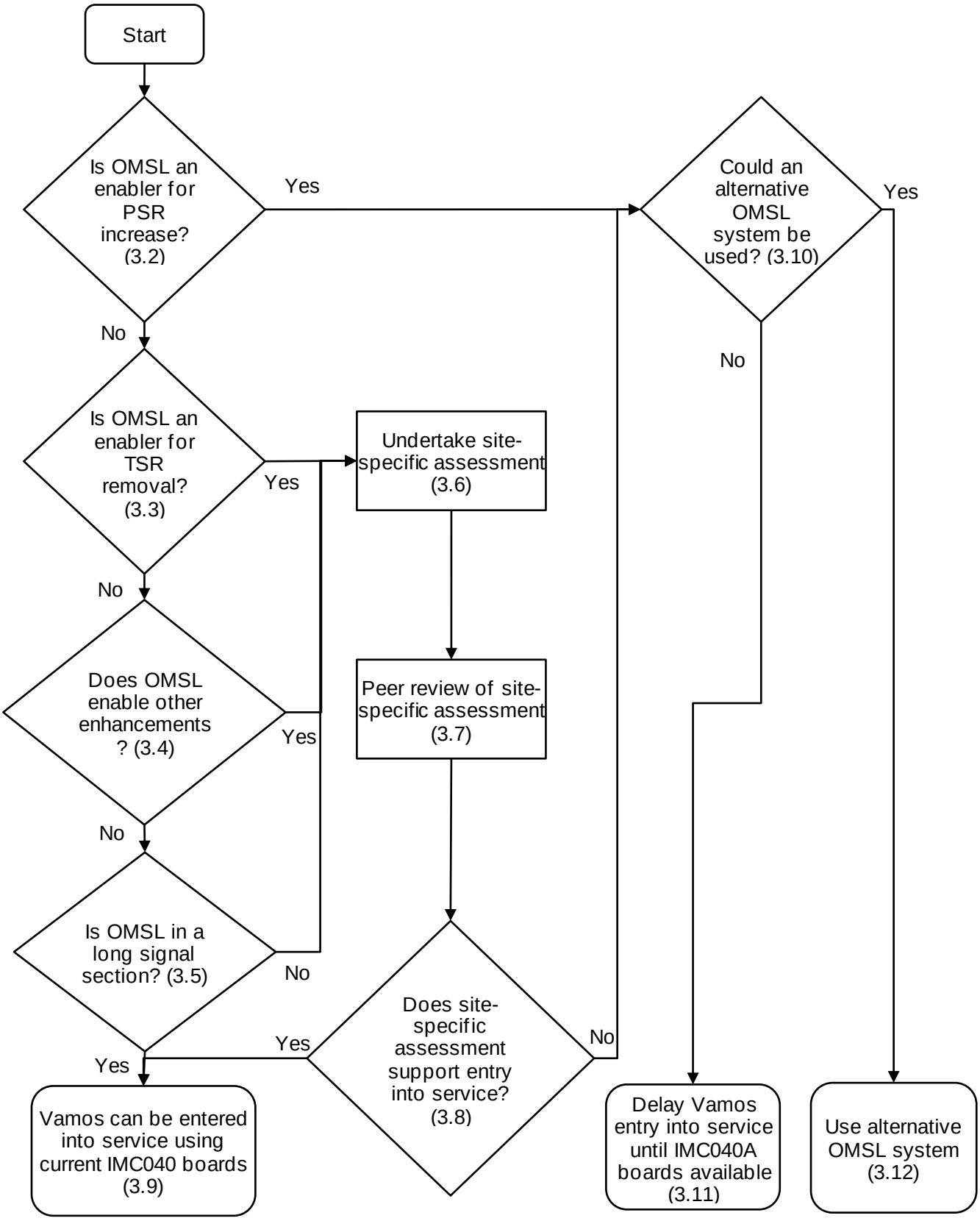

Figure 1 – Vamos Crossing System Entry into Service Decision Flowchart

3.2 Permanent Speed Restriction Changes

3.2.1

Where the provision of an OMSL system is proposed in order to permit a permanent speed restriction (PSR) to be increased, a Vamos crossing system shall not be brought into service if it is equipped with the current IMC040 boards.

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

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

3.2.2

If the provision of an OMSL has been proposed in order to permit a PSR increase, the next step in the decision process is covered by section 3.10. If no PSR increase is proposed, the next step in the decision process is covered by section 3.3.

3.3 Temporary Speed Restriction Removal

3.3.1

Where the provision of an OMSL system is proposed in order to permit temporary speed restrictions (TSRs) to be removed, a site-specific assessment of the current situation at the crossing and the implications of introducing a Vamos crossing system equipped with the current IMC040 boards shall be undertaken.

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

This circumstance typically arises at a level crossing where crossing users' available sighting distance for trains approaching at the PSR is deficient and TSRs have been applied to reduce train speeds to a level commensurate with the available sighting distance.

3.3.2

Section 3.6 sets out further requirements and guidance related to completing the site-specific assessment when the provision of a Vamos crossing system is intended to allow TSRs to be removed.

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

If there are no proposed changes to TSRs, the next step in the decision process is covered by section 3.4.

3.4 Other Proposed Enhancements

3.4.1

Where the provision of an OMSL is proposed in order to permit an enhancement of the wider railway system, excluding changes to speed restrictions, a site-specific assessment shall be undertaken which considers:

a) The current situation at the crossing, and

b) The implications of introducing a Vamos crossing system equipped with the current IMC040 boards.

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

Enhancements in this context refers to changes to the railway system which have the potential to impact the number of trains passing over the level crossing or the behaviour of trains in the vicinity of the level crossing. This could include, for example, a planned increase in train service frequency or the proposed removal of whistle boards associated with the level crossing.

3.4.2

Section 3.6 sets out further requirements and guidance related to completing the site-specific assessment when the provision of a Vamos crossing system is intended to allow an enhancement to the wider railway system.

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

If there are no proposed enhancements relevant to the level crossing, the next step in the decision process is covered by section 3.5.

3.5 Long Signal Sections

3.5.1

Where the level crossing at which an OMSL is proposed to be installed is not located within a long signal section, a site-specific assessment of the current situation at the crossing and the implications of introducing a Vamos crossing system equipped with the current IMC040 boards shall be undertaken.

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

Long signal sections are characterised by the lengthy transit times for trains travelling at the permitted speed between two consecutive stop signals. The signaller has low awareness of the precise position of a train in a long signal section and this can lead to prospective crossing users being instructed to wait for considerable periods when they contact the signaller for permission to cross. Users often fail to understand why the signaller cannot provide an exact indication of where the train is and can become frustrated at waiting for an unknown and often lengthy period of time. Consequently, they might decide to cross without confirmation from the signaller that it is safe to do

so. The provision of an OMSL solution at level crossings within long signal sections can be an effective mitigation for this risk.

In shorter signal sections the signaller has a better understanding of the position of trains relative to the level crossing, user waiting times are shorter and, consequently, the likelihood of users choosing to cross when it is unsafe to do so is lower.

The Level Crossing Manager will generally be able to advise whether a particular level crossing is in a long signal section. This information may also be recorded in the level crossing risk assessment.

3.5.2

Section 3.6 sets out further requirements and guidance related to completing the site-specific assessment when the provision of a Vamos crossing system is not within a long signal section.

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

If the OMSL is located within a long signal section, the next step in the decision process is covered by section 3.9.

3.6 Undertaking Site-specific Assessment

3.6.1

A site-specific assessment is relevant to those level crossings where the proposed introduction of a Vamos crossing system is:

a) Intended to allow the removal of TSRs, or

b) Intended to allow other enhancements which are not related to changes in speed restrictions, or

c) Not located in a long signal section.

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

3.6.2

Where the removal of TSRs is proposed, the site-specific assessment shall consider the following:

a) The extent to which the existing TSRs are effective at managing the hazards that exist at the level crossing,

b) Whether the TSRs have an impact on any other level crossings in the vicinity,

c) The vulnerability of the level crossing to a wrong side failure of the Vamos crossing system,

d) Any other site-specific factors that influence the risk at the level crossing.

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

3.6.3

Where the existing TSRs are not fully effective at managing the hazards present at the crossing, consideration should be given to the potential to reduce train speeds further to enable the TSRs to become fully effective. Where this is unsupportable, for example, due to a significant adverse performance impact, it may be appropriate to bring a Vamos crossing system into service with the current IMC040 boards.

3.6.4

Where the existing TSRs are having a negative impact on another level crossing in the vicinity, for example, by creating excessive or inconsistent warning times, it may be appropriate to bring a Vamos crossing system into service with the current IMC040 boards.

3.6.5

The vulnerability of the Vamos crossing system to a wrong side failure is influenced by the following factors:

a) The proportion of time the Vamos crossing system would be expected to display a red aspect to level crossing users. This is relevant because the greater this proportion of time is, the greater the "window of opportunity" for the wrong side failure mode to present itself. The proportion of time the Vamos crossing system would be expected to display a red aspect to level crossing users is influenced by:

   a. The number of trains traversing the level crossing,

   b. The required warning time,

   c. Actual train speeds approaching the level crossing and the magnitude and frequency of variations from the permitted speed,

   d. The presence of signals, stations or other stopping places near the level crossing.

b) The type of level crossing users

c) The number of level crossing users

d) The track condition in the vicinity of the level crossing. In this context track condition includes the formation and ballast, etc. Repeated significant movement of the track when trains are passing (for example, as a consequence of voiding) may lead to the fixings securing the strike-out wheel sensors to the rail to work loose which is a known precursor to a wrong side failure mode.

e) The degree of protection afforded to the cables associated with the strike-out wheel sensors. Damage to these cables may be a precursor to a wrong side failure mode and cables lying on the ballast are particularly vulnerable to damage. Cables can be protected by housing them within a cable trough route or similar.

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3.6.6

Other factors which may be relevant to consider at a specific level crossing include:

a) Any other site-specific hazards which could be mitigated by a Vamos crossing system.

b) The projected improvement in Fatality Weighted Index (FWI) arising from Vamos crossing system introduction (taking account of the wrong side failure potential).

c) Any known issues regarding user behaviour which might be impacted by the provision of a Vamos crossing system.

3.6.7

Where enhancements which are not related to changes in speed restrictions are proposed, the site-specific assessment shall consider the following:

a) The effects of the proposed enhancement on the hazards present at the level crossing,

b) The extent to which a Vamos crossing system will be effective in managing those hazards,

c) The vulnerability of the level crossing to a wrong side failure of the Vamos crossing system,

d) Any other site-specific factors that influence the risk at the level crossing.

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

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

3.6.8

Where the level crossing is not located in a long signal section, the site-specific assessment shall consider the following:

a) Whether the current method of working requires any crossing users to contact the signaller for permission to cross,

b) The extent to which the current method of working is effective at managing the hazards that exist at the level crossing,

c) The vulnerability of the level crossing to a wrong side failure of the Vamos crossing system,

d) Any other site-specific factors that influence the risk at the level crossing.

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

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

3.6.9

If crossing users do not have to contact the signaller for permission to cross, the length of the signal section has limited relevance to the current risk profile of the level crossing.

3.6.10

The effectiveness of the current method of working can be influenced by a range of factors, including:

a) The proportion of crossing users who are instructed to seek permission to cross from the signaller,

b) The extent to which those crossing users who are instructed to seek permission to cross actually do so (this can be assessed by comparing evidence of actual level crossing usage with records of communication with the signaller),

c) The signaller's workload,

d) Whether there are crossing users who use the level crossing multiple times during the day (as they may be less likely to seek permission to cross),

e) The potential for more than one train to be approaching the level crossing at broadly the same time (as there is a risk that a crossing user may see the first train pass and assume it is now safe to cross, putting them in the path of the second train),

f) The length of time which crossing users typically have to wait at the level crossing.

3.6.11

The findings of the site-specific assessment shall be documented in preparation for a peer review.

Rationale: To provide an audit trail of decision making.

There is no mandatory template for recording the issues considered and outcome of the decision process, however, adopting a format which provides clear traceability to the factors highlighted in section 3.6 enables subsequent readers of the document to confirm that all the relevant issues were considered.

The next step in the process is covered by section 3.7.

3.7 Peer Review of Site-specific Assessment

3.7.1

The findings of site-specific assessments shall be peer reviewed at the national Control, Command and Signalling (CCS) variations panel meeting.

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

The national CCS variations panel meeting meets weekly on Monday afternoons. To request an agenda slot to present a site-specific assessment, contact Signalengineers@networkrail.co.uk

It is good practice for the author of the site-specific assessment, or other knowledgeable individual who has been involved in its production, to attend the national CCS variations panel meeting to present the assessment and respond to feedback from the panel.

3.7.2

The conclusions of the peer review discussion shall be documented and shared with the relevant Route Engineer (Signalling) and Route Level Crossing Manager, or equivalent roles.

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

It is good practice to add the record of this discussion to the site-specific assessment document.

The next step in the process is covered by section 3.8.

3.8 Site-specific Assessment Conclusions

3.8.1

The Route Engineer (Signalling) and Route Level Crossing Manager, or equivalent roles, shall use the findings of the site-specific assessment and the conclusions of its peer review to decide whether it is appropriate to bring a Vamos crossing system equipped with the current IMC040 boards into service at this level crossing.

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

It is good practice to record this decision in the site-specific assessment document.

3.8.2

If it has been decided not to bring a Vamos crossing system equipped with the current IMC040 boards into service, the next step in the process is covered by section 3.10

If it has been decided that a Vamos crossing system equipped with the current IMC040 boards can be brought into service, the next step in the process is covered by section 3.9.

3.9 Bringing a Vamos Crossing System Equipped with the Current IMC040 Boards into Service

3.9.1

In addition to level crossings which have received positive support for entry into service through the site-specific assessment activities set out in sections 3.6 to 3.8, it is considered that level crossings which reach this step in the decision process will typically include those at locations where one or more of the following conditions apply:

a) The level crossing is located in a long signal section resulting in the signaller having a limited awareness of train position relative to the exact location of the level crossing,

b) The level crossing has a history of persistent abuse or near misses for which the absence of an active warning system has been identified as a contributory factor,

c) Signaller workload is high and the introduction of the OMSL is intended to materially reduce workload.

3.9.2

Vamos crossing systems equipped with the current IMC040 boards may be brought into service at level crossings which reach this step in the decision process, subject to the agreement of the Route Engineer (Signalling) and Route Level Crossing Manager, or equivalent roles in accordance with requirement 3.1.3.

3.9.3

Section 4 sets out requirements which apply to the entry into service activities for Vamos crossing systems equipped with the current IMC040 boards.

3.10 Consider Alternative OMSL Systems

3.10.1

Where it has been identified that it is not acceptable to bring a Vamos crossing system equipped with the current IMC040 boards into service, consideration can be given to installing an alternative OMSL system. Factors to consider in deciding whether to pursue this option include:

a) The availability of a product accepted OMSL system which is suitable for application at the level crossing in question.

b) Whether the local maintenance personnel hold the relevant competencies to maintain an alternative OMSL system (or whether it is feasible to train them in the maintenance of the alternative OMSL system to gain the required competence).

c) The requirements for stock holding of spare parts for an alternative OMSL system.

d) The relative timescales for installing an alternative OMSL system and the IMC040A boards becoming available for the Vamos crossing system.

3.10.2

If it is concluded that using an alternative OMSL system is not feasible, the next step in the decision process is covered by section 3.11.

If it is concluded that an alternative OMSL system can be used, the next step in the decision process is covered by section 3.12.

3.11 Delay Vamos Crossing System Entry into Service Until IMC040A Boards Become Available

3.11.1

This section applies where it is determined that a Vamos crossing system is the appropriate solution for the level crossing in question, but it is determined that it is not appropriate to bring it into service with the current IMC040 boards.

In this situation, the existing control measures will continue to apply at the level crossing until the IMC040A boards become available. This prevents the implementation of any speed restriction changes or other enhancements which are dependent upon the availability of an OMSL system at the level crossing.

Although the Vamos crossing system cannot be brought into service until the IMC040A boards become available for installation at this crossing, it is permissible for many elements of the Vamos crossing system to be installed in preparation for this provided that these do not cause an obstruction or present misleading information to level crossing users in the interim period.

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

3.12 Implement an Alternative OMSL System

3.12.1

This section applies where a decision is made to implement an alternative OMSL system.

In this situation, the alternative OMSL system is implemented and brought into service in accordance with the requirements applicable to its use.

Ref:	TI 184 – Appendix A
Issue:	1
Date:	4th September 2023
Compliance date:	29th September 2025

4 Entry into Service Conditions for Vamos Crossing Systems Equipped with the Current IMC040 Boards

4.1 Installation Activities

4.1.1

Nord-Lock NLX24 locking washers shall be used on the M24 fixings which secure each rail claw to the rail.

4.1.2

A torque of 200Nm shall be applied to the M24 fixings which secure each rail claw to the rail.

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

Each wheel sensor is mounted in a rail claw. The rail claw enables the wheel sensor to be fitted to the rail.

Notice Board 215 provides further details of the Nord-Lock locking washers, including part numbers.

4.2 Commissioning Activities

4.2.1

Indelible marks shall be applied, using a paint pen, correction fluid or similar, to the M24 nuts and bolts securing each wheel sensor rail claw to the rail as part of the commissioning of the Vamos crossing system.

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

4.2.2

The integrity of the strike-out wheel sensor cables and security of cable terminations shall be checked as part of the commissioning of the Vamos crossing system.

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

4.3 Maintenance Preparations

4.3.1

Before a Vamos crossing system equipped with the current IMC040 boards is brought into service, the temporary Service A added to NR/SMS/PartC/LC71 shall be scheduled for the level crossing concerned.

Ref:	TI 184 – Appendix A
Issue:	1
Date:	4th September 2023
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Rationale: The temporary Service A inspection regime is a mitigation for the hazard of the wrong side failure mode of the IMC040 boards.

For details of the temporary Service A, refer to Appendix B of TI184.

4.3.2

Before a Vamos crossing system equipped with the current IMC040 boards is brought into service, arrangements shall be made for the Vamos crossing system concerned to report into the Dogfish remote monitoring system.

4.3.3

Before a Vamos crossing system equipped with the current IMC040 boards is brought into service, the Dogfish remote monitoring system shall be configured to send notifications relating to that Vamos crossing system to at least two nominated recipients within the Route organisation.

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

NR currently uses Dogfish as the remote monitoring system for Vamos crossing systems.

Typically, the nominated recipients of the remote monitoring information are roles within the maintenance organisation which have the ability to check for alarms on a regular basis and can arrange prompt attendance by a maintenance team in the event of the Vamos crossing system reporting that it has entered dark mode.

TI184 – Appendix B

Addendum to NR/SMS/PartC/LC71

Includes:	Vamos Crossing System
Excludes:	All other Types of Level Crossings

The checks in service A reduce the risk of a wrong side failure of the Vamos crossing system occurring. It is important that any defects or issues found during service A are reported and rectified promptly to maintain the integrity of the Vamos crossing system.

Protection/Possession arrangement shall be taken before commencing work on the Level Crossing System.

SERVICE A

1. Mechanical and visual check of strike-out wheel sensor RSR123

1.1 Identify the strike-out wheel sensor for each line over the crossing.

1.2 Check that the witness marks on the M24 rail claw nut and bolt are in alignment, indicating that the rail claw is securely fastened to the rail. If they are not aligned:

a) Remove the old witness marks

b) Remove the M24 nut and Nord-Lock washer.

c) Inspect the Nord-Lock washer for signs of damage. Undamaged washers can remain in use. Damaged washers are to be removed, and a new washer inserted (if you do not have a new washer available, reuse the existing washer and report this to your SM(S) so that they can arrange for it to be replaced within 4 weeks). When reusing an existing washer, make sure to fit the two parts with the matching cam faces against one another as shown in green box within Figure 1 below. The narrower serrations should be on the outside faces of the assembled washer.

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

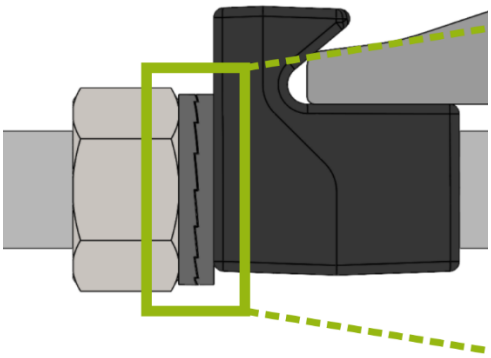

Figure 1 – Nord-Lock washer

d) Fit the new or re-used Nord-Lock washer onto the M24 threaded bar with the domed side of the washer facing outwards. Refit the M24 rail claw nut.

e) Tighten the M24 rail claw nut to 200Nm

f) Complete a Wheel Sensor calibration check as per NR/SMS/PartC/LC71 Service B Part 6

g) Apply new indelible witness marks to the M24 rail claw nut and bolt assembly

h) Complete a Detection Capability Test as per NR/SMS/PartB/Test157

i) Complete a Sequence Test as per NR/SMS/PartB/Test159

j) Report the misalignment and action taken to your SM(S). The SM(S) should report this to the Route Engineer (Signalling) or equivalent and to signalengineers@networkrail.co.uk for trend analysis.

1.3 Examine the wheel sensor rail claw and fixings for heavy soiling, security and external damage.

1.4 Check the area around the wheel sensor (within 2m) is free of such items as:

a) Visible P/way defects

b) Metallic debris

c) New/scrap rails in the four/six foot or cess

d) Traction bonds

e) Excessive ballast

Any issues or objects of concern in the area around the wheel sensor that cannot be rectified shall be reported to your SM(S).

Any identified misalignment of the M24 rail claw fixings that cannot be rectified during this Service shall be reported to fault control and your SM(S) for appropriate action.

2. Visual check of cables and Trackside Connection Box (GAK) for strike-out wheel sensor

2.1 Check the GAK is secure in the ground, undamaged, and the lid secure.

2.2 Remove the cover and examine the security of cable connections.

2.3 Check cable glands and ties. Unused cable entry points should be sealed.

2.4 Check the cable from the GAK to the wheel sensor is undamaged.

2.5 Check the cable from the GAK to the Vamos cabinet is undamaged.

The main focus of this check should be those sections of the cable between the GAK and Vamos cabinet which are not within a cable troughing route.

Any issues or defects identified through these checks that cannot be rectified shall be reported to your SM(S).

Any cable damage identified shall be reported to fault control and to your SM(S) for appropriate action.

END