Ref:	**NR/SMS/Part/E**
Issue:	12
Date:	04 June 2022
Compliance date:	03 September 2022

NR/L3/SIG/10663

NR/SMS/Part/E

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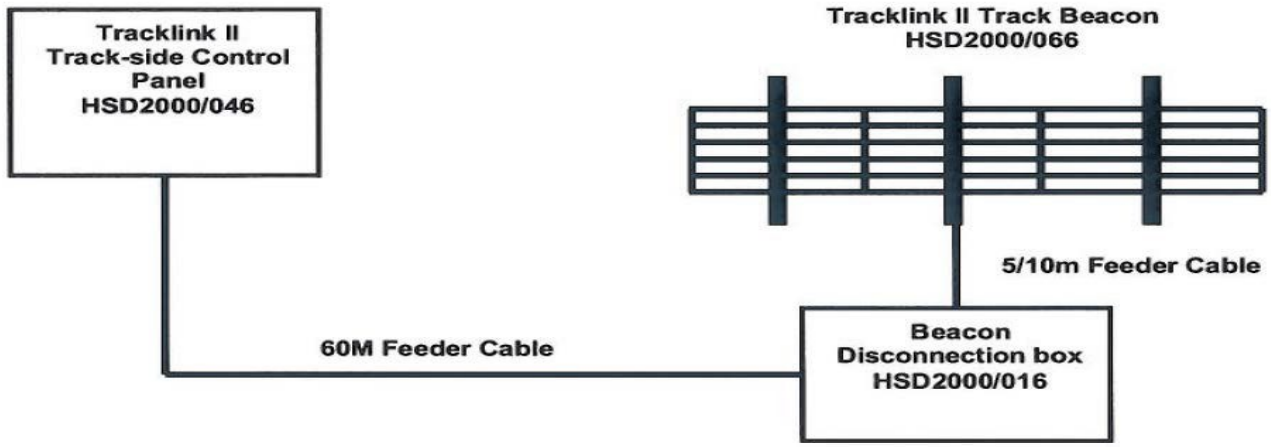
NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part E/BA12		
Platform Identification Beacon System (PIBS)		
Issue 03	Issue Date: 04/03/17	Compliance Date: 31/05/17

Includes:	Beacon and support beams, disconnection box, feeder cables, PIBS enclosure, transmitter control unit, power supply unit, coding plugs, LED switch indicators, panel condensation heater and thermostat, termination
Excludes:	Any other type of Beacon or Balise, Train borne equipment

The function of PIBS is to identify which platform the train enters at a station with multiple length platforms, in order to maximize the number of doors that can be released, rather than defaulting to the shortest platform length at the station.

A typical PIBS installation consists of the following components:



As PIBS performs a great deal of self-checking on a continual basis and any malfunctions will be identified as each train passes the beacon, routine maintenance operations are minimal.

SERVICE B

1. Beacon Assembly

1.1 Check the beacon assembly and fixings for security and physical damage.

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

1.3 Check all the connectors and glands are in place and they are securely attached.

1.4 Check all cables for damage or signs of fraying.

1.5 Check the external labels for security.

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2. Disconnection Box

2.1 Check the disconnection box for security and physical damage.

2.2 Check that the lid (and padlock, if provided) are securely fitted.

2.3 Check for rodent damage and protect as necessary.

2.4 Check all the glands are in place and securely attached.

2.5 Check all cables for damage or signs of fraying.

2.6 Check the external labels for security.

3. Transmitter Control Panel Enclosure

3.1 Check the transmitter panel enclosure for security and physical damage.

3.2 Check that the padlock is in place.

3.3 Check all that all the connectors and glands are in place and securely attached.

3.4 Check all cables for damage or signs of fraying.

3.5 Check the external labels for security.

3.6 Open the panel door and visually Check for water and dust ingress.

3.7 Check that the panel LEDs illuminate.

3.8 Check the security of all connections to the terminal rail.

3.9 Check for the security of earth connections, internal and external.

3.10 Check for security of the coding plugs.

End

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Development

An axle bearing on a train that has lost its lubrication will run hot, smoke badly and eventually seize up. This could lead to the derailment of the train.

Before the wide spread deployment of Power Signal Boxes covering large areas of route miles, smaller Mechanical Signal Boxes were numerous, this along with higher levels of track side staff due to more labour intensive procedures meant that the observation of passing trains was higher and therefore the detection of overheated axle boxes was intensive.

To overcome the reduction of human observation due to modernisation, Hot Axle Box (now usually referred to as Bearing) Detector (HABD) equipment was developed to check the axles bearings of passing trains and if found to be overheated, send an alarm to the monitoring Signal Box.

Generic Operation

Heat is radiated as infrared radiation, HABDs use various types of sensor (depending on make and age) to detect this radiation at a specific point; compare it to various parameters and the ambient temperature.

If pre-set conditions are not met, an alarm will be generated. Transducers or wheel sensors are used before and after the heat sensor to govern the operation of the HABD.

The latest generation of HABD equipment can also detect hot braking systems along with hot axle bearings.

NOTE This is generic basic detail of operation. Reference should be made to the appropriate equipment manuals for detailed and specific modes of operation.

Equipment Set-up

Due to numerous factors, the set up of the HABD equipment is critical to its correct and reliable operation, this is especially so in older units that do not benefit from the latest advances in electronic technology.

The testing and set-up procedures in the tasks/tests shall be followed. Your SM(S) shall be informed if any of the results of the tasks/tests do not meet the parameters specified.

Equipment Spares

Older versions of HABD equipment are no longer manufactured (e.g. Servo 7788, 7789, 8889 & 9909), avoid damaging any components.

All spare components for these units shall be regarded as strategic spares.

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Maintenance

If any faults or problems are discovered during maintenance, they should be rectified immediately as corrective maintenance. If this is not possible, your SM(S) and the relevant Infrastructure Fault Control informed at once.

Certain tasks and tests may be carried out by other teams (e.g. Signalling Technical Support) or equipment specialists. Your SM(S) will inform you if any of these groups will undertake certain tasks/tests.

Equipment Types

Listed in the following table are outline details of the most common HABD equipment currently in use. Reference to the appropriate manufactures manuals should be made for more details.

The 'R' suffix after certain equipment types stands for 'Retrofit'. This is where a system has had the scanners replaced with a different scanner type or has had different scanner mounting brackets fitted.

System Details

System	Details
Servo 7788 & 7789	HABD systems fitted with ballast mounted scanners, inclined at an angle to the rail.
Servo 7788R & 7789R	HABD systems that have had the ballast mounted scanners replaced by a rail mounted type the same as those used in the Servotrim 9909 series).
Servo 8889	HABD system with rail mounted scanners (but further from and inclined at an angle to the rail compared to the Servotrim 9909 type).
Servo 8889R	HABD system with rail mounted scanner (8889 type) fitted with different mounting brackets so that the scanner is effectively identical to the Servotrim 9909 type.
Servotrim 9909	HABD system with rail mounted scanners, with scanners parallel and close to the rail.
Cyberscan 2000 (Trim II)	HABD system with rail mounted scanners that can have a vertical or inclined optical system.
GETS FÜS	HABD system where the heat measuring sensors are mounted in a hollow steel sleeper that can detect overheated bearings or brakes.

NOTE Due to local conditions there may be slight variations in system fittings, if you are in doubt to the system type, ask your SM(S). Both the Servo 7788 and 7788R use the same DPU System.

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Imperial/Metric

Due to Servosafe and Servotrim equipment being designed to imperial measurements (inches and Fahrenheit), these are the only measurements used.

Later equipment types are designed to metric standards (millimetres and Celsius) therefore these are the only measurements used.

References

All reference to Servosafe and Servotrim scanners are in accordance with the manufacturer's terminology (i.e., in normal direction of travel):

- Rail 1 is the left hand or cess side unit
- Rail 2 is the right hand or six foot side unit

Older Systems

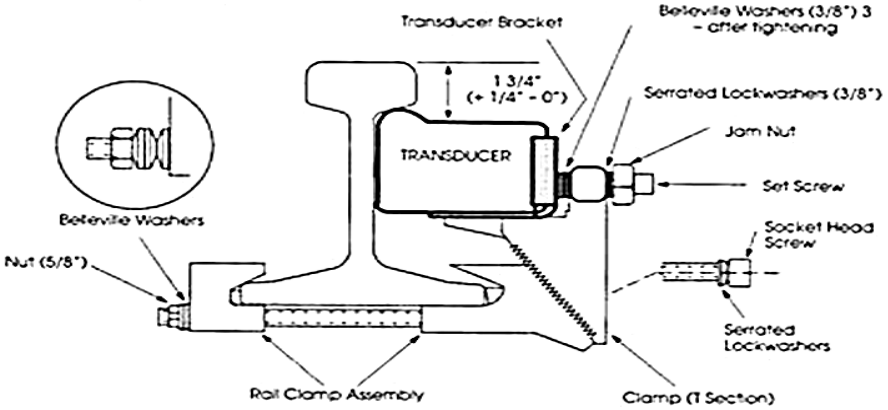
The NR/SMS tasks/tests for the Servosafe and Servotrim systems are based on the manufactures manuals that were written when the systems were new. As with the components page in older systems, tolerances and levels can vary.

They may be at different levels to that stated in the task/test but are working correctly for present system configuration. This condition may also lead to certain tests and measurements in the NR/SMS to be unobtainable.

Certain tasks and tests ask for the removal of cards, in some cases this may lead to damage of the card edge connector and with spares no longer being available the system may become inoperable.

If you think a task/test action or requirement will severely disrupt the operation or reliability of the HABD system you are maintaining, ask your SM(S) before proceeding.

Servotrip Transducer



NOTE On some systems the older larger servo pole transducer still being used, usually on ballast mounted.

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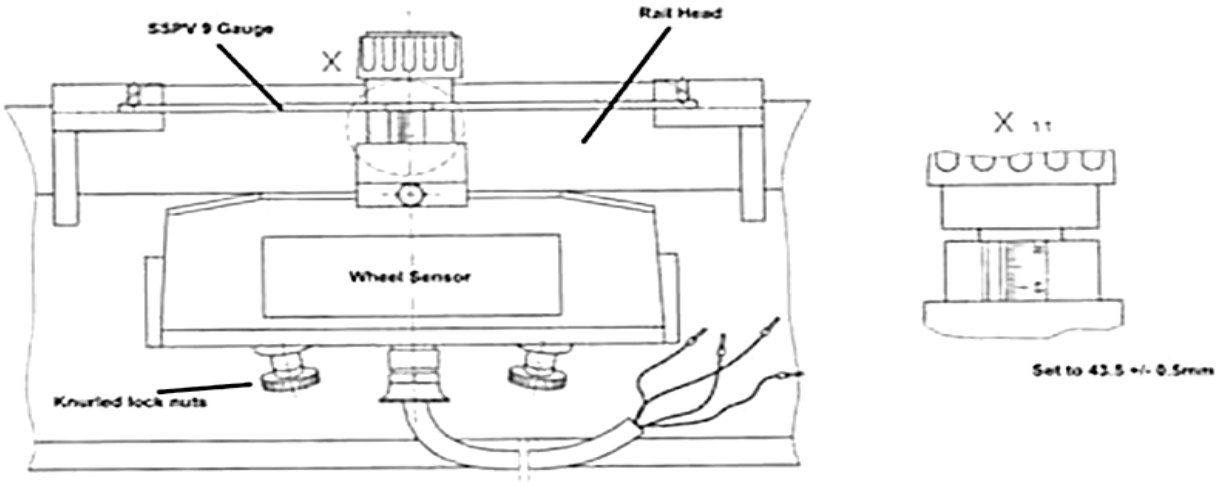
GETS FUS Wheel Sensor

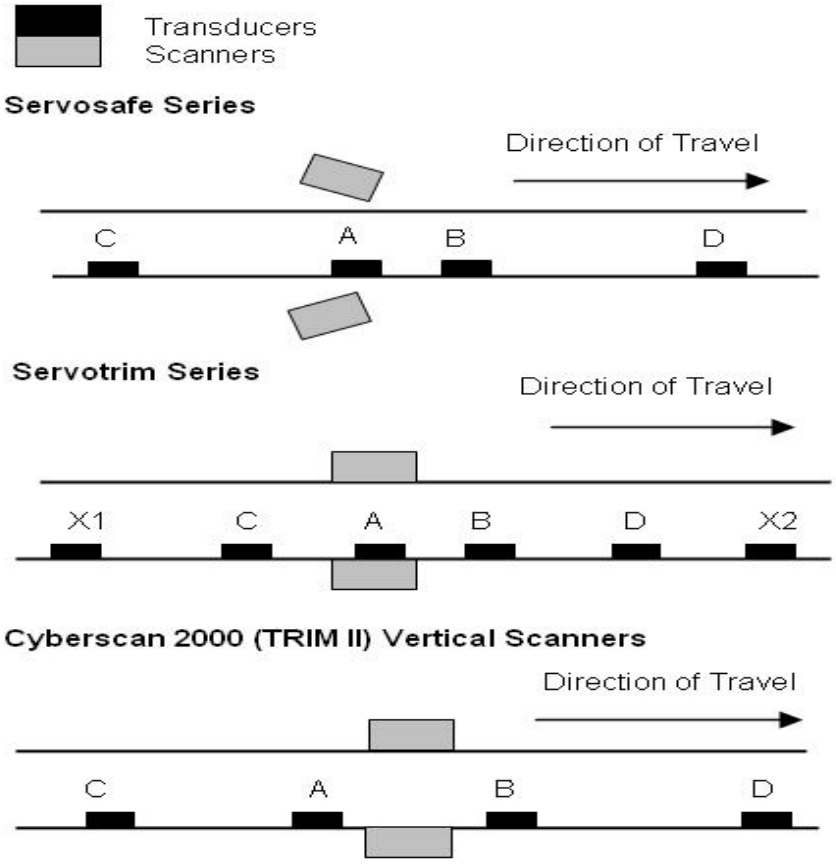


Generic Layout of Scanners and Transducers (Not to Scale)

Distances between each piece of equipment are detailed in NR/SMS/Test/087.

Note: Transducer D & X2 are fitted for bi-directional working only.

Note: Servosafe diagram shows ballast mounted scanners



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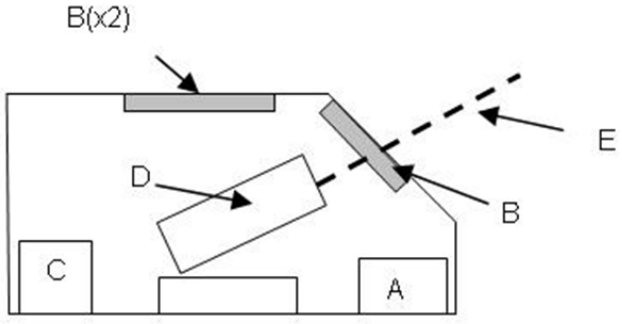
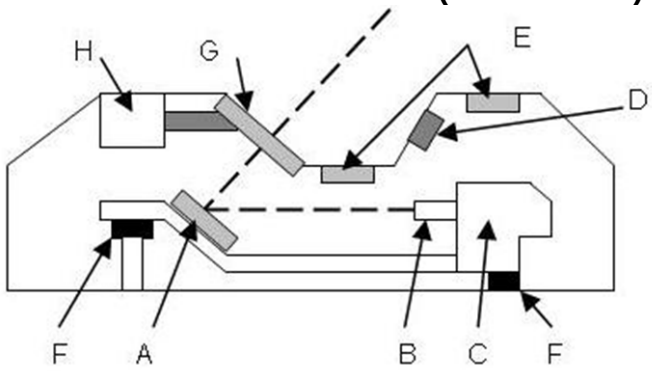
Generic Block Diagram of a Ballast Mounted Scanner (Not to Scale)



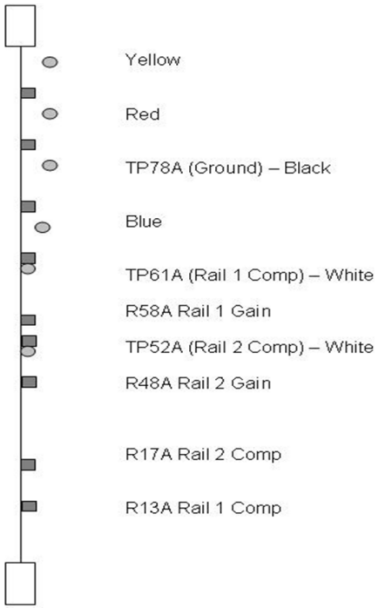
A: Shutter Assembly
B: Heaters
C: Junction Box
D: Sensor (on mounting plate)
E: Infra-red Radiation

Generic Block Diagram of a Rail Mounted Scanner (Not to Scale)



A: Mirror
B: Lens
C: Sensor
(Bolometer & pre-amp)
D: Thermostat
E: Heaters
F: Shock Absorber
G: Shutter & Integrity Heater
H: Shutter Motor
J: Infra-Red Radiation

Servotrim 9909: Position of Test Points & Potentiometers on Board 2 (I/O)



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Additional Equipment Required for Conducting Tasks & Tests (not exhaustive)

Servosafe 7788/7788R7789/8889 Series

a) Suitable Digital Multimeter and Frequency Meter Tape Measure (non metallic)

b) Chalk or Marking Crayon

c) Thermometer (alcohol or digital type, range 0° to 100°F) Function Simulator and Cable

d) Function Simulator Saddle (7788R only) Manuals and Drawings (as available) Servo Alignment Jig

e) Spirit level

f) Target Mirror (size as appropriate to the system) Telephone ‘ear piece’ (for system alarm levels)

g) Allen Keys:

- 1/2 & 3/4 inch (for Transducers)
  5/16 inch (for Scanners)
- 5/64 inch (for Knobs & Switches)

Servotrim 9909 and Cyberscan 2000 Series

a) Suitable Digital Multimeter Extended Socket Set

b) 10ft tape measure (non-metallic) Thermometer (1 per site) Torque wrench

c) Function Simulator and Cable Scanner Saddle

d) Servo Alignment Jig

e) Allen Keys:

- 1/2, 3/8 & 5/16 inch (for Transducers)

GETS FUS Series

a) Train simulator (GETS part No. 1001581-901) Heat Source (GETS part No. 1001603-901) Wheel Sensor Gauge SSPV9 & Test Box Alignment Matrix

b) Digital Thermometer

c) 19mm Socket Torque Wrench 10mm Spanner/Socket

d) Suitable cleaning Fluid for Lenses and Mirrors

End

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General

The System is divided into three subassemblies, which are briefly described below.

FÜES Sub Assembly	Description
Location Electronics	Contains the entire evaluation electronics for processing the measured data. It can be located in any building that is in close proximity to the railway line.
Measuring Sleeper	A hollow steel sleeper, into which the measuring sensors are integrated. The sensors measure the infra-red from the wheels and wheel bearings labelled: HOAL – Hot wheel bearing (Left) HOAR – Hot wheel bearing (Right) FBOA – Hot wheel There is only one hot wheel sensor as it is assumed that both wheels on an axle will be hot if the brakes remain on.
Wheel Sensors	They enable the system to measure the number of axles and speed of the train. They are labelled: RR – Advance sensor MK – Measuring sensor GR – Rear sensor (for bi-directional traffic).

Table 1 - Sub Assemblies

Where there is a need to replace an IR sensor, an internal and external calibration of the sensor is required (See Appendix A).

Any problems or defects that cannot be rectified during maintenance shall be reported to your SM(S).

Certain tasks can be carried out by other teams or equipment specialists at a different time/frequency to routine maintenance.

You shall reach an understanding with the Signaller before any tasks are carried out that affects the normal operation of the equipment.

As some of the tasks require simulations of passing trains with excessive heat sources, it is advisable to disable the alarms during maintenance.

On completion of maintenance and reconnection, the last alarm on the system should be checked.

Tasks and tests are advised to be carried out under a possession or a no train period.

When navigating menus in the software check that all programs are exited correctly: if a “Quit” button is available then that is the desired option to close the program. If this is not an option then left click the dash in the top left corner of the program screen and select “Destroy”.

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SERVICE A

1. Equipment Room Cubicle Equipment

1.1 Check the security of the plugs and connections on the front and rear of the cubicle, including:

a) 240V supply connection.

b) UPS inputs and interface connections.

c) IR unit.

1.2 Check internal and external temperature sensors for damage and security.

1.3 Check that both voltage arresters (referred to as DEHN guards) show a green indicator. If a red indicator is shown, replace the DEHN guard.

1.4 Check the green LEDs on all six power supplies are illuminated. Investigate and rectify any that are extinguished. Any LED not illuminated might indicate a defective power supply or short circuit on the power supply output.

1.5 Check the following LEDs are correctly indicating with no trains present:

LWL Simplex Card:

One Green LED illuminated.
One Red LED extinguished.

Figure 1 - LWL Simplex Card

LWL Duplex Card:

Two Green LEDs illuminated.
Two Red LEDs extinguished.

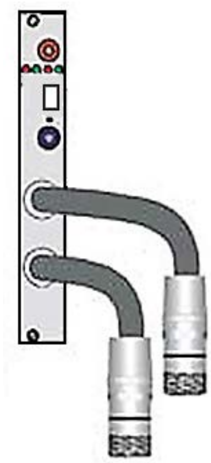

Figure 2 - LWL Duplex Card

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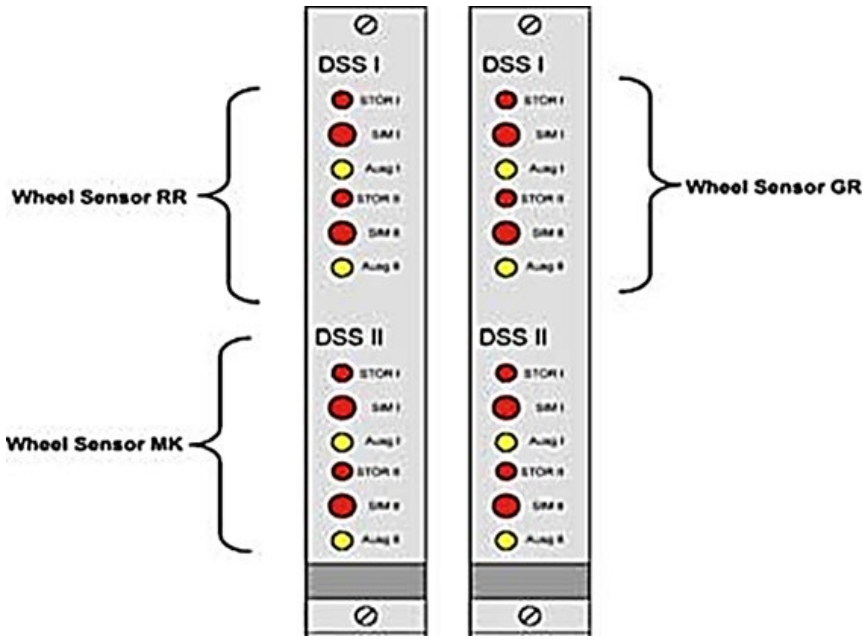

Figure 3 - Wheel Sensor Card

Wheel Sensor Card - All four LEDs are off for each wheel sensor.

NOTE: *If only one-wheel sensor is connected to a wheel sensor board e.g. GR board, the LEDs of the second wheel sensor indications permanently glow, indicating no equipment connected.*

Fibre Optic Interface Card (FOIC):

Green LED Illuminated.
Two yellow LEDs illuminated.
Red LED flashing.

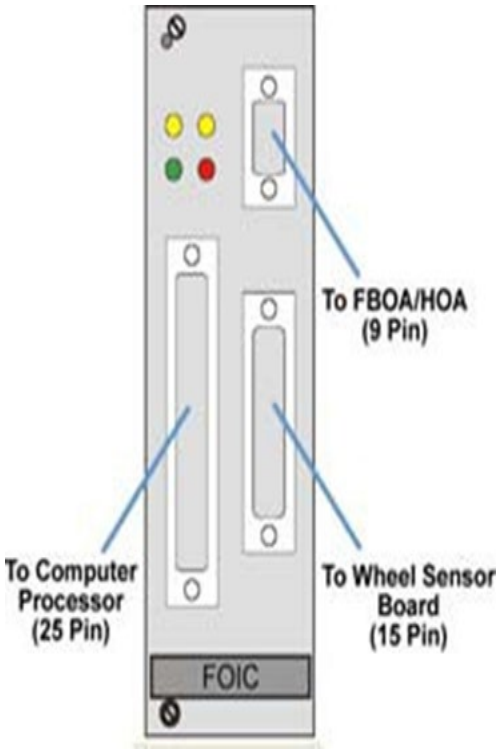

Figure 4 - Fibre Optic Interface Card

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1.6 Check operation of the IR unit by, either simulating a train by passing a metal object over a wheel sensor or observing the passage of a train and check the following LEDs are correctly lit:

Card	State	When
Wheel Sensor Ausg1	Illuminated	Throughout simulation
FOIC (Green)	Extinguished	Start of simulation
	Illuminated	End of simulation
FOIC (Yellow)	Illuminated	Start of simulation
	One flash	End of simulation

Table 2 – IR Unit LED Indications

1.7 Check the following UPS LEDs are indicating correctly:

LED	Colour	State
Line	Green	Illuminated
Battery	Orange	Extinguished

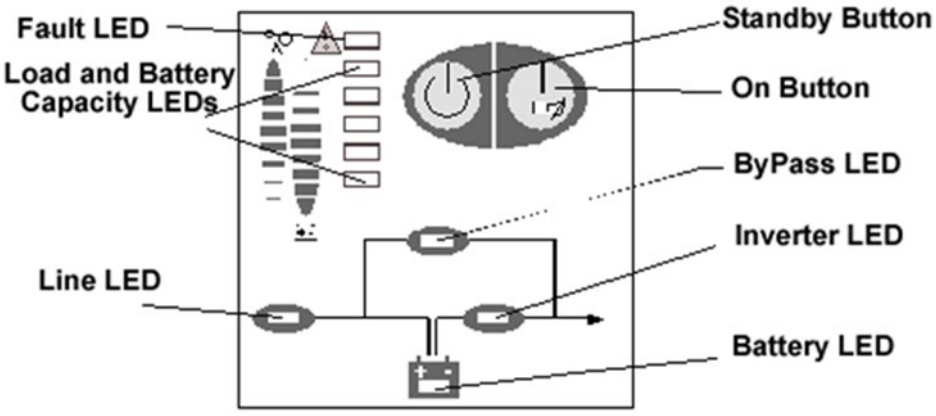

Figure 5 – UPS Module and Indications

1.8 Check that the monitor display is satisfactory, in particular look for:

a) Stable and bright of the display.

b) No visible distortion of the image or geometry settings.

c) Correct colouring i.e. no colours missing (Red, Blue or Green).

Inform your SM(S)if there are any problems.

1.9 Check that each fan is working correctly and if necessary clean the filters.

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1.10 Check the keyboard for correct operation. Where fitted, check the tracker ball for smooth operation and clean if necessary. Keyboard operation can be checked as part of using it for other checks. Problems with the keyboard or tracker ball shall be reported.

NOTE: *If the keyboard or mouse are found to be unresponsive, unplug and reinsert both the connectors in the rear of the PC. If the keyboard or mouse remain unresponsive after reconnection the PC should be powered down and back up after 1 minute, using the PC power switch.*

1.11 Log into the system using the USERNAME – "**rabo**" and the PASSWORD "**product**".

1.12 Open the CAN Tool menu (left click on the background and hold, and select "CAN TOOL"). Once the screen has loaded, left click to place it in the required position, before selecting any options, wait for "CAMMOD43" to be displayed in the status bar.

Check the correct operation of the following for each operational assembly (HOAL, HOAR and FBOA):

Reading	Check
Shutter	Operate shutter Open and Close.
VCC	23 V < shutter operating voltage < 25 V
I-Shutter	400 mA < current < 1000 mA
I-Heating	1500 mA < current < 2000mA
Mirror	Operate rotating mirror
I-Mirror	5 mA < current < 100 mA
Temp	Check temp of REB is correct using a digital thermometer
Nom Temp	Check outside temp is correct using a digital thermometer

Table 3 – Operational Checks

It is also important to check the components for free movement of mirrors, no damaged or obstruction to the shutter units and that there are no loose or damaged cables/connections.

1.13 Open the Utilities menu (Left click and hold, and select "Terminal". Once the screen has loaded, left click to place it in the required position). At the Terminal prompt: type: Menu -x (*Note: there is a space following the word Menu*).

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Figure 6 – Selection

Select option “b” to view the last train and then option “e” on the next window to view train.

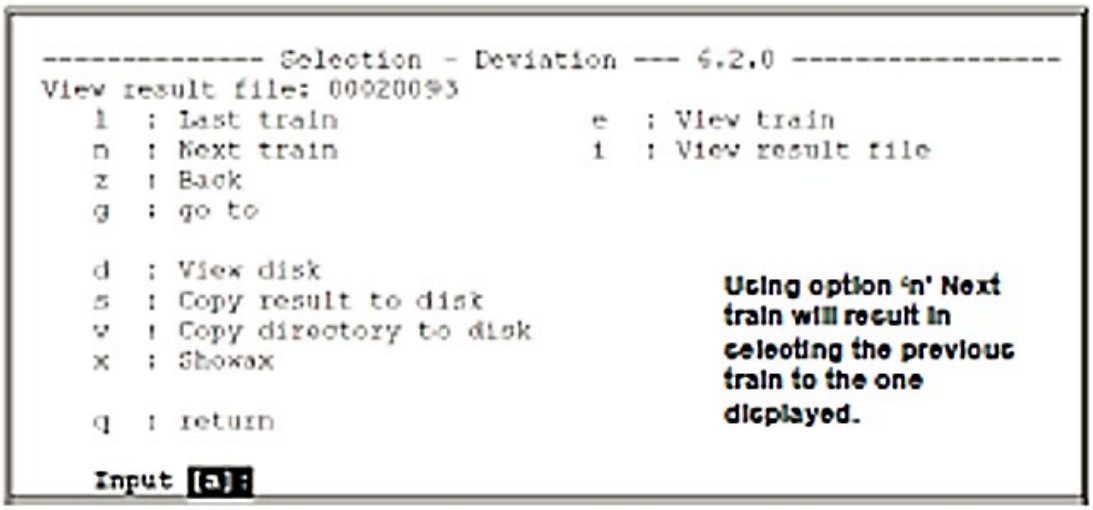

Figure 7 – Selection Deviation Menu

***NOTE**: the train number shown, the train history can be toggled using the options available and then selecting “e” to view a particular train. If the system has been rebooted: no train files are stored.*

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1.14 Check the deterioration of optical parts like the mirror and lenses by selecting a report of the last train and checking the Attenuation e.g.

```
Train number  :   00499
------------------------------------------------------------------------------
16.09.2006 21:42:01  System_name                    non-standard   axles: 110
speed   :   92 km/h      Ref1: +025     Mirror1: 015 015 015 015      RR: 110
Ambient : +007 °C        Ref2: +022     Mirror2: 001 001 001 001      MK: 110
Train end recognized     Ref3: +020     Mirror3: 000 000 002 000      GR: 110
------------------------------------------------------------------------------
Alarm     0061 3 04 0 +322 axle info:  +040 +025 +322 xxxx -094   warm alarm
Alarm     0062 3 04 0 +285 axle info   +034 +028 +285 xxxx -094   warm alarm
Info      Alarm telegrams: HOAL 0  HOAR 0  FBOA1 2 FBOA2 0
Info      FUES Softwarerelease 6.2.0
```

a) Mirror 1 = HOAL

b) Mirror 2 = HOAR

c) Mirror 3 = FBOA

The fourth and third figures, these values represent the deterioration of elements one through to four. The last value shown is the highest value for the four elements.

Values higher than 050 require the lens and mirror of the sensor shall be cleaned.

NOTE: *Reading above 050 result in the corresponding beam being ignored by the software as being unreliable, several unreliable beams result in the sensor being shut down.*

1.15 Clean all operational mirrors by opening the shutters using the CAN Tool (See clause 1.12 and figure 8).

It is recommended that a soft bristled brush and water are used to clean the mirrors as they rotate.

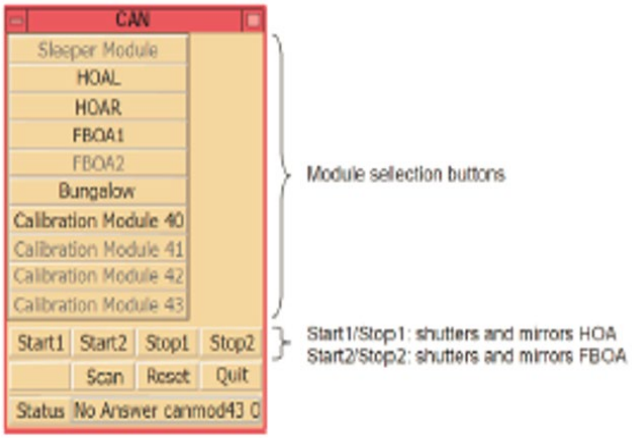

Figure 8 – CAN Tool Screen

1.16 Once the mirrors have been cleaned, it is necessary to observe the passage of 1 or 2 trains or train simulations (using the Train Simulator card) before the attenuation values are accurately represented on the newest train file.

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1.17 Check the 4 elements values for the FBOA are close together (<50 apart approximately) and that they are all between 200 and 300.

If the values are outside of this range, then a Triggerbox (See Clause 1.19) shall be carried out as corrective maintenance. Any values that are not consistent after a Triggerbox can indicate a failed sensor.

1.18 Check the EIT values in the righthand column are reasonably consistent.

NOTE: *These represent the temperature sensors at each HOA and FBOA unit. If they are high but falling, it can indicate that the system is cooling following an auto calibration. If one is consistently not in line with the other sensors or the ambient temperature it can indicate a shutter failure.*

1.19 The Triggerbox initiates an offset adjustment of the IR Sensors controlled by the software. The offset adjustment is performed if A/D values (digits) of the single detector elements are shifted by an amount which affects the evaluation of the measured temperature. The Triggerbox is only to be used if the values in clauses 1.16 and 1.17 are not met.

Open the CAN tool menu (Left click on the background and hold, select “CAN TOOL”). Once the screen has loaded, left click to place it into the required position. Before selecting any options, wait for “CANMOD43” to be displayed in the status bar. Select <Calibration Module 40>

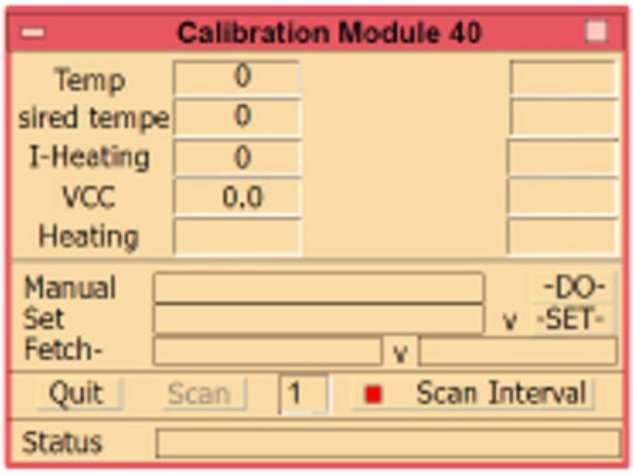

Figure 9 - Calibration Module 40 Screen

Click on the symbol “V” on the righthand side of the input box “Set” and a pulldown menu opens. Select <Heating50%> and click “Set” and perform the offset adjustment. The status bar displays “00007d” and a letter “H” appears in the Heating window for 8 seconds whilst this is taking place.

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1.20 If the Evaluation PC has not been rebooted as part of the maintenance visit then it shall be rebooted at this point. Open the Utilities Menu select “Terminal”. Once the screen has loaded at the terminal prompt type “presscad” to reboot the system and wipe the volatile memory. Check the system returns to the log in screen following the reboot and switch off the monitor using the rocker switch.

2. Wheel Sensor

2.1 Remove all fire risks and potential obstructions from or near the Sensors and Disconnection Box.

2.2 Visually check the tail cables to the disconnection box and Wheel sensor. Confirm they are secured and not damaged or deteriorated such that it might lead to a failure.

2.3 Clean the wheel sensors.

2.4 Check each Sensor and fixings for damage. Rectify where necessary.

2.5 Check cable protection for damage or wear. Rectify where necessary.

2.6 Check disconnection box for damage and stability.

3. Measuring Sleeper

NOTE: *If an IR sensor is replaced an internal and external calibration is required, See Appendix A.*

3.1 Remove all fire risks and potential obstructions from or near the sleeper.

3.2 Visually check the tail cables from the cess to the sleeper. confirm they are secure and not damaged or deteriorated such that it can lead to a failure.

3.3 Visually check the cable protection arrangements ensuring cables passing under the rails are not damaged, rectify as necessary.

3.4 Visually check the outside of the sleeper, including the shutter units and cable entries for damage.

3.5 Check the following PWay components:

a) Security of rail clips.

b) Damage to rail fixings.

c) Damage to the Rail.

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Report loose or damaged components and excessive track movement as corrective maintenance.

4. Signal Box RAD

4.1 Clean the monitor screen with a proprietary anti-static dry screen cleaner. Use cleaning products in accordance with the manufacturer's instructions.

4.2 Check that the monitor display is satisfactory, in particular look for:

a) Stable and brightness of the display.

b) No visible distortion of the image or geometry settings.

c) Correct colouring i.e. no colours missing (Red, Blue or Green).

Report if there are any problems.

4.3 Check the security of connections to computer and monitor.

SERVICE B

5. REB Cubicle

5.1 Using a meter measure, the DC output voltage of each power supply module. Check they are within the tolerances stated.

Power Supply Modules	Voltages
+ 12 V Measuring Head	+12 V ± 0.5 V
- 12 V Measuring Head	+12 V ± 0.5 V
+ 12 V Peltier Cooler CAN (Controller Area Network)	+12 V ± 0.5 V
- 12 V CAN (Controller Area Network)	+12 V ± 0.5 V*
+ 24 V CAN (Controller Area Network) Shutter & Heater Unit	Min + 24 V Max + 27 V
+ 5 V CAN (Controller Area Network)	Min 5V Max 5.6V

*Internal wiring provides a positive voltage on the output

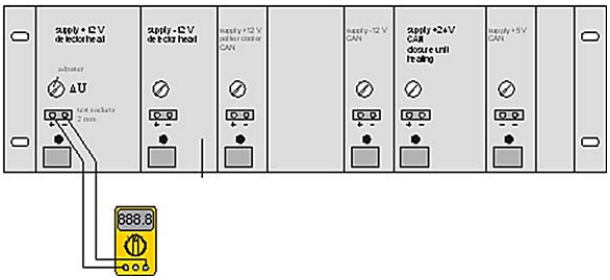

Figure 10 - Method for taking voltage readings on the power supply modules.

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5.2 Check the capacity of the battery back-up by the following method:

a) Disconnect the UPS from the AC input supply by setting the rocker switch of the automatic circuit breaker in the rear of the cubicle to “AUS” (OFF).

b) Check the “Battery” LED turns on to indicate power supply from the batteries. Table 5 lists the indications.

c) Check that the remaining battery capacity is greater than 50%.

d) Return the power to the UPS by setting the rocker switch of the automatic circuit breaker to “EIS (ON)”.

LED Illuminated	Battery Capacity
5th	95% to 100%
4th	75% to 95%
3rd	55% to 75%
2nd	35% to 55%
1st	1% to 35%

Table 4 - Battery Capacity

6. Wheel Sensors

6.1 Measure the rail wear by calculating the distance from the top of the wheel sensor to the highest point of the rail head >37mm.

If this < 37mm the wheel sensor requires to be lowered (using the upper fixing holes) to achieve a minimum of 37mm. If one-wheel sensor has to be lowered, the others are likely to require lowering as well.

6.2 Check security of each sensor ensuring sensor head is parallel to the rail head. Torque rail fixings to 50Nm.

6.3 Examine the inside the disconnection box, check the following:

a) Condition of seal (check for moisture in box).

b) Condition of internal wiring.

c) Condition of connections.

6.4 Remove foreign objects and clean as necessary.

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6.5 Use the SSPV 9 test plate and test unit to check for the correct switching gap. Where necessary use the adjustment tool to achieve the correct setting. Details of this test are provided in Appendix C.

7. Measuring Sleeper

7.1 Remove shutter units and put to one side. Do not remove the earth cable and other connecting cables.

7.2 Check the rubber end stops of the shutter unit are not ruptured or worn out at the limit stop. Replace the buffers as necessary.

7.3 Clean the shutter unit as follows:

a) Remove any dirt from the top surface of the shutter segments with brush or cloth.

b) Remove any dirt on the inner surface (reference heater) with a soft brush.

7.4 Clean the inner surface of the shutter unit with a damp cloth.

7.5 Use the CAN tool menu to open and close the shutter and check for smooth operation. Damaged or defective shutters require to be replaced.

7.6 Check the mirror for:

a) Damage;

b) Chipping;

c) Scratches;

d) Security of fixings.

Replace the mirror if chipped, damaged, or heavily scratched. If the mirror fixings are loose check the mirror alignment with the alignment matrix (See Appendix B).

7.7 Pre-clean the mirror surface with a soft brush to remove loose dirt.

7.8 Using the CAN tool menu and switch on the rotating mirrors. If the mirror is not rotating or rotating slowly, it requires to be replaced.

7.9 Soak a smooth lint-free cloth or cleaning paper for optical devices with ethanol (or equivalent cleaning fluid) and remove the dirt by moving from the middle to the edge without using any force. Follow manufactures instructions when using the cleaning fluid.

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7.10 Switch off the rotating mirror.

7.11 Check the shock absorbers for signs of rupture or wear. Check their operation by applying pressure to the housing. The movement should be minimal and when released return to the previous position without any noticeable oscillations. Where necessary, replace the shock absorbers.

7.12 Check the security of the shock absorbers to the housing.

7.13 Check the security of the CAN modules and connections.

7.14 Check the wiring and connections for damage.

7.15 Clean the Hot Axle (HOA) IR sensors using the following method:

a) Check the IR sensors for scratches and damage.

b) Without removing the IR sensor, clean the lens with a soft brush.

c) Soak a smooth lint-free cloth or cleaning paper for optical devices with ethanol (or equivalent cleaning fluid) and remove the dirt by moving from the middle to the edge without using any force. Follow manufactures instructions when using the cleaning fluid.

7.16 Clean the Hot Wheel (FBOA) IR sensor using the following method:

a) Remove the four fastening screws of the Sensor.

b) Separate the upper parts of the clamping cradle and remove the IR sensor.

c) Check the IR sensors for scratches and damage.

d) Clean the lens with a soft brush.

e) Soak a smooth lint-free cloth or cleaning paper for optical devices with ethanol (or equivalent cleaning fluid) and remove the dirt by moving from the middle to the edge without using any force; Follow manufactures instructions when using the cleaning fluid.

f) Re-install the sensor into the cradle.

g) Replace the upper parts of the cradle ensuring the cradle makes direct contact with the cooling jacket.

h) Fasten the four screws hand tight.

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7.17 Check the security of the IR sensor fixings. If they appear loose check the sensor alignment with the alignment matrix (see Appendix B).

7.18 Check the security of the IR connectors. They should be screwed together tightly to prevent moisture entering the connector.

7.19 Reassemble the shutter units and cover plate ensuring no objects have fallen into the housing. Also check the connecting cables of the shutter units are not clamped nor obstructing the mirror or sensor path. Torque the cover plate fixings to 70Nm.

7.20 For each of the IR sensors re-calibrate the system following lens and mirror cleaning by:

a) Disconnect the FOIC 15-pin connector to the wheel sensor board. This is to prevent passing trains disrupting the calibration.

b) Use the CAN tool menu to select ‘calibrate after cleaning mirrors.

c) Re-connect the 15-pin connector from the FOIC.

8. Measuring Sleeper Functions Test

8.1 Carry out NR/SMS/PartB/Test/087 (HABD GETS FÜES FunctionS Test).

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APPENDIX A - Calibration

A calibration shall be carried out following the replaced or modified components of the optical system (e.g. IR sensor) or shutter heating unit.

The calibration is performed in 2 steps:

1. Internal calibration
2. External calibration

The internal calibration uses the shutter heaters to measure the amount of attenuation in the mirror and lens surfaces and also any drift in the sensors themselves.

The external calibration uses a heat source to optimize and verify the internal calibration. The calibration should be carried in a no train period.

The measuring heads shall have been operating for at least two hours before a calibration takes place.

1. Internal Calibration

1.1 Check that the lens and mirror are cleaned.

1.2 Check that the measuring heads and mirrors are correctly aligned (See Appendix B).

1.3 Select “Super Calibration” on the computer terminal (via terminal viewer).

1.4 Select the sensor to be calibrated. (It may be possible to select both HOAL and HOAR to be calibrated at the same time, if required).

1.5 Select “Internal Calibration”.

1.6 After starting the calibration procedure, the temperature values appear on the screen.

1.7 After a successful calibration select ‘Yes’ to use the new characteristic curve.

1.8 Repeat this for all the sensors that have been replaced or modified.

1.9 Perform one train or two train simulation (as necessary) for the acceptance of the new characteristic curves.

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2. External Calibration

Check the 'Temperature Output' of the 'evaluation' submenu within the FÜES Configuration is set to 'absolute'. If it is currently set to 'relative', change the setting and re-boot the system to activate it.

2.1 Select external calibration for selected sensor.

HOAL

2.2 Set the heat source to 60OC. Once the temperature is reached, place the heat source on the HOAL sensor.

2.3 Perform a train simulation (wait 10 seconds after the simulation).

2.4 Set the heat source to 100 OC. Once the temperature is reached, place the heat source on the HOA sensor.

2.5 Perform a train simulation (wait 10 seconds after the simulation).

2.6 Select 'Calculate Characteristic Curve'.

2.7 Following a successful calibration select 'Yes' to use the new characteristic curve.

2.8 Perform one train or two train simulations (as necessary) for the acceptance of the new characteristic curves.

HOAR

2.9 Repeat steps 2.2 to 2.8 with the heat source on the HOAR sensor.

FBOA

2.10 Perform steps 2.3 to 2.8 using the following heat source temperatures.

a) 200°C

b) 300°C

c) 400°C

Note that the Heat source is to be placed on its end for the FBOA Calibration.

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APPENDIX B - Adjust Sensor Alignment

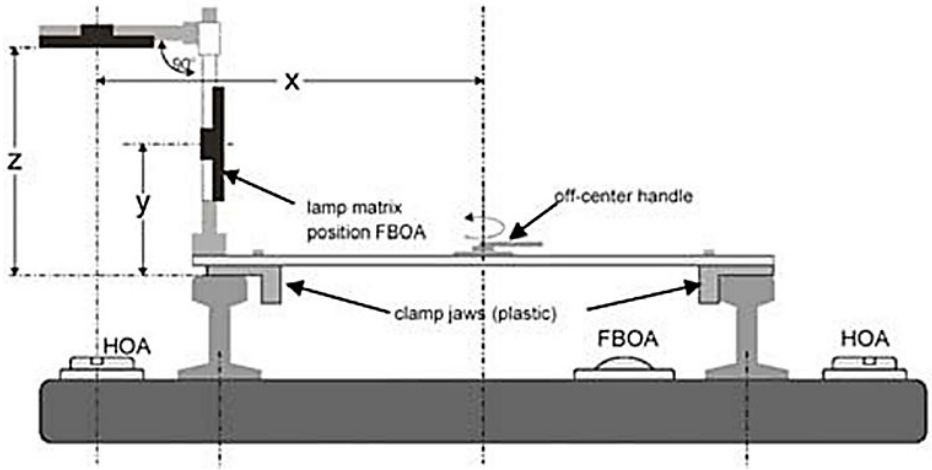

Figure 11 – Sensor alignment

	X	Y	Z
Dimensions (mm)	878 ± 5	267 ± 10	500 ± 10

Table 5 - Dimensions

1. Switch on the alignment matrix system

2. Set the switch HOA/FBOA at the front panel of the control device to HOA or FBOA depending on the sensor being tested.

3. Open the shutter from the CAN Tool Menu (Start 1 for HOA and Start 2 for FBOA).

HOAL

4. Pre-select Channel ‘0’ (Element 1 of the sensor on HOAL) with the push-button at the front panel of the control device.

5. Start the measurement procedure by pressing ‘Start’ on the control device. This causes the LEDs on the top side of the matrix to light up one after the other. Wait until a flashing LED shows the position of maximum sensitivity.

6. Repeat step 5 for the remaining Channels 1, 2 and 3.

7. The position of the elements 0, 1, 2 and 3 should be evenly distributed. Where necessary undertake any corrective actions and re-test.

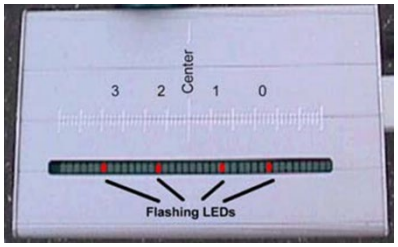

Figure 12 – Element Positions

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HOAR

8. Pre-select channel ‘5’ (element 1 of the sensor on HOAR) with the push button on the front panel of the control device.

9. Start the measurement procedure and wait until a flashing LED shows the position of maximum sensitivity.

10. Repeat step 8 for the remaining channels (6, 7 & 8).

FBOA

11. Set the HOA/FBOA switch on the front panel of the control device to FBOA (check the ‘remote electronic finger’ is moved to the FBOA position).

12. Pre-select channel ‘0’ (element 1 of the senor on FBOA) with the push button on the front panel of the control device.

13. Start the measurement procedure and wait until a flashing LED shows the position of maximum sensitivity.

14. Repeat steps 12 and 13 for the remaining channels (1, 2 & 3).

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APPENDIX C - Check/Adjust Wheel Sensor

NOTE: *Watch the 'Battery' LED of the test for battery condition. If the LED illuminates, the battery needs charging.*

1. Open the cover of the corresponding signal cable disconnection box and disconnect the wheel sensor from the Trackside Apparatus Case electronics.

2. Connect the cables of the wheel sensor with those of the same colour of the test instrument.

3. Set the SSPV 9 gauge to a switching gap of 43.5mm +/- 0.5mm. 43mm to 45mm can be used to achieve the correct switching gap.

4. Place the slip gauge onto the middle of the wheel sensor with its pedestal.

5. Screw off the knurled lock nuts of the adjustment screws (one for each system of the wheel sensor).

6. Attach the adjustment tool with the threaded joint without pushing the adjuster out of the alignment retention. Push the adjustment tool upwards. DO NOT use force to turn the adjustment screws as you might damage the adjustment retention or the adjustment tool.

7. Using the adjustment tool, turn the adjustment screws to the right until the function LED is lit. Then turn the screws to the left until the LED just turns off. At this point the measuring systems of the wheel sensor are aligned to their reference value 6.45 V +- 0.05V. (Clockwise turn – switch gap increases. Counter clockwise – switch gap decreases).

8. Screw the knurled nuts hand-tight.

9. Disconnect the test instrument from the disconnection box and reconnect the wheel sensor to the Trackside Apparatus Case electronics.

10. Close and secure the cover of the disconnection box.

END

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NR/L3/SIG/10663 Signal Maintenance Specifications		
NR/SMS/PartE/HO12		
HABD Equipment: Phoenix MB		
Issue No. 3	Issue Date: 03/03/18	Compliance Date:31/05/18

Includes:	Phoenix MB
Excludes:	All other types of Hot Axle Box Detector

The Signaller shall be informed before maintenance is carried out. Agreement with the Signaller shall be reached before any tasks are carried out that will affect the normal operation of the equipment.

Normally a possession of the equipment or a no train period would be required.

Sub-Assemblies

The system is divided into three sub-assemblies, see table1.

SST Phoenix MB Sub	Description
The Electronics Cabinet	Contains the Modem, UPS, Service Monitor & Keyboard, Heater, PC, Passive Board, Active Board and Power Supplies. The PC contains a Windows Operating System with programs for processing measured data and on-site calibration etc.
Measuring Sleeper (incorporating the sensors)	A hollow steel sleeper where the measuring sensors are housed. The sensors measure the infra-red heat from the wheels and wheel bearings. There are three sensors namely:- HBD1: Hot Box Detector 1 HBD2: Hot Box Detector 2 HWD1: Hot Wheel Detector 1
Rail Contacts	Detect the passage of a wheel due to changes in the current flow through their coils. A system may comprise of up to three wheel sensors namely:- RC1: System initiated, sensor shutters open, time stamp (t0). RC2: Starts the measurement of axles, speed calculation, time stamp (t1) RC4 – For bi-directional moves

Table 1 – Sub-Assembly Descriptions

All sensors are integrated into the measuring sleeper. They are precisely positioned at the time of installation with the fitment of the sensor frame. If the frame is not disturbed a sensor can be replaced in a few minutes without distorting the optical geometry.

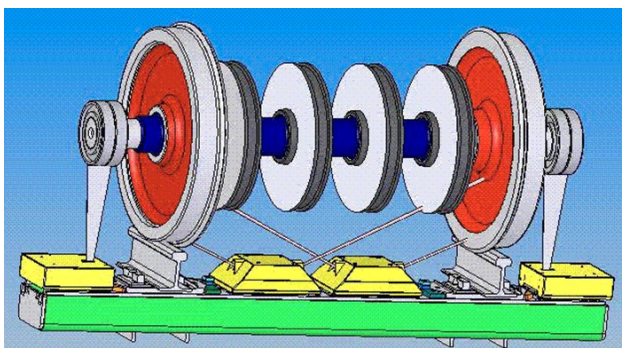

Fig 1: A line drawing of the trackside Phoenix MB equipment

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SERVICE A

1. Rail Contacts

1.1 Remove obstructions and fire risks.

1.2 Check each rail contact and fixings for damage, security and alignment.

1.3 Visually check the tail cables of each rail contact for damage and deterioration at vulnerable and exposed positions.

1.4 Check that each rail contact and bracket is clear of the ballast.

2. Sleeper Mounted Sensors (Hot Axle Box and Hot Wheel Detectors)

2.1 Remove obstructions and fire risks from around the sensors and measuring sleeper.

2.2 Examine all sensors checking for physical damage, effectiveness of the rubber dampers and security of the sensor and associated lid. Apply pressure to the sensor housing and check the effectiveness of the shock absorbers.

The movement shall be smooth and minimal returning to its previous position without any noticeable misalignment.

2.3 Examine the measuring sleeper for physical damage, misalignment or signs of voiding.

2.4 Check on each sensor that the cover heater is working if the ambient temperature is below 5°C.

2.5 Check that all sensors are clear of the ballast.

2.6 Remove any debris from the sensor openings.

2.7 Clean the sensor covers.

2.8 Visually check the tail cables of each sensor for damage and deterioration at vulnerable and exposed positions e.g. under rails, entry and exit from troughing route etc.

2.9 Visually check the cable protection arrangements between the measuring sleeper and the electronic cabinet.

3. The Electronics Cabinet

3.1 Check that all fans within the cabinet are operational.

3.2 Check the status of the UPS indications.

3.3 Using the SCT program check that the status information for all system components are showing green on the Technicians' Monitor (i.e. rail contacts, sensors, etc).

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If the “V Factor” of HBD1, HBD2 or HWD1 is less than 60, clean the optical components as per Service B.

4. Signal Box Office End Equipment

4.1 Check with the signaller that the SB equipment is working correctly, i.e. keyboard, monitor, printer and PC.

SERVICE B

5. Sleeper Mounted Sensors

To undertake the following tests pass a metal object over rail contact 1 twice in the normal train direction.

This will open the sensor shutters and start the mirrors rotating for a period of 60 seconds.

After 60 seconds the shutters will close and the above will have to be repeated if the work is not complete within that time.

5.1 Using a torch check the sensor mirrors for damage. E.G. cracks or scratches.

5.2 Using only the approved cleaning kit clean the rotating mirror on each sensor.

Permanent irreversible damage can result if any other unapproved cleaning products are used. Use a one-wipe motion.
Do not reapply dirty cleaning materials as they will damage the mirror.

6. The Electronics Cabinet

6.1 Clean the fan filters in the door and roof of the electronics cabinet.

6.2 Check the output voltage from the PSU. This voltage shall be 26.5v (minimum 23.0v, maximum 27.0v).

6.3 Check the keyboard, tracker ball and monitor for correct operation.

6.4 Using the SCT program check the status of the rail contacts, hot box detectors, hot wheel detector and SCT components.

6.5 Check a sample of recent train logs from the screen view for the correct train data and no alarms.

6.6 Test the operation of the UPS by disconnecting the supply to the electronics cabinet:

a) The monitor should automatically switch off and the UPS should take the load.

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b) The HABD equipment should remain operational with no alarms reported to the signaller.

c) A buzzer will sound twice approximately every 8 seconds.

d) The status of the battery will be displayed on the UPS LED panel showing the battery voltage level in discharge condition.

e) Leave the supply disconnected for 10 minutes to observe the battery discharge rate.

f) If the buzzer signal changes from sounding twice every 8 seconds to once a second before the 10 minutes has elapsed the batteries are exhausted and require replacing.

6.7 Check the deterioration of the optical parts such as the mirror, lens and optical module by carrying out NR/SMS/Test 212 – HABD Phoenix MB Accuracy Test.

6.8 If any of the recorded values recorded in step 6.7 was found outside the tolerance of its "Nominal Value" shown in the table below then a full calibration shall be carried out as defined in NR/SMS/Test211 - HABD Phoenix MB Full Calibration Test.

Sensor	Nominal Value (Low)	Nominal Value (High)
HDB 1	70°C ± 3°C	120°C ± 5°C
HDB 2	70°C ± 3°C	120°C ± 5°C
HWB 1	300°C ± 10°C	400°C ± 20°C
HWB 2	300°C ± 10°C	400°C ± 20°C

Table 2 – Nominal Values

6.9 Return to the overlay screen and check the status of the system components.

6.10 Contact the signaller and check that there are no outstanding alarms on the system and the HABD site appears to be working correctly.

Where practicable:

6.11 Observe the passage of a train over the site.

PERIODIC TASKS

7. Filters

7.1 Change all fan filters within the electronics cabinet.

END

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Includes:	FUES EPOS - Hot Axle Box Detector system
Excludes:	All other types of HABD system

GENERAL

The Signaller shall be informed before maintenance work on the system is started and after it is completed.

When maintenance is completed the maintenance mode shall be reset.

SERVICE B

1. Login

1.1 Switch on the monitor. The FUES-EPOS operating system login window is displayed.

1.2 Select user “rabo” and enter the password.

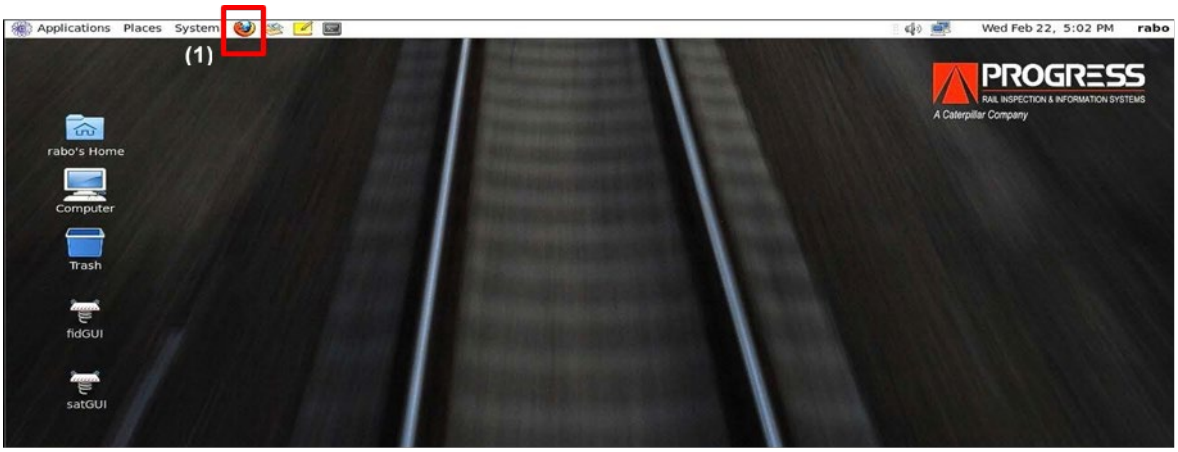

Figure 1 - FUES-EPOS system desktop (example)

1.3 Start the web browser by using the browser icon shown in the red box in Figure 1. The FUES-EPOS user interface login window opens See Figure 2. This page has been defined as the web browser home page.

Figure 2 - FUES-EPOS user interface login window

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1.4 Enter the name and password. The FUES-EPOS user interface home page opens Figure 3.

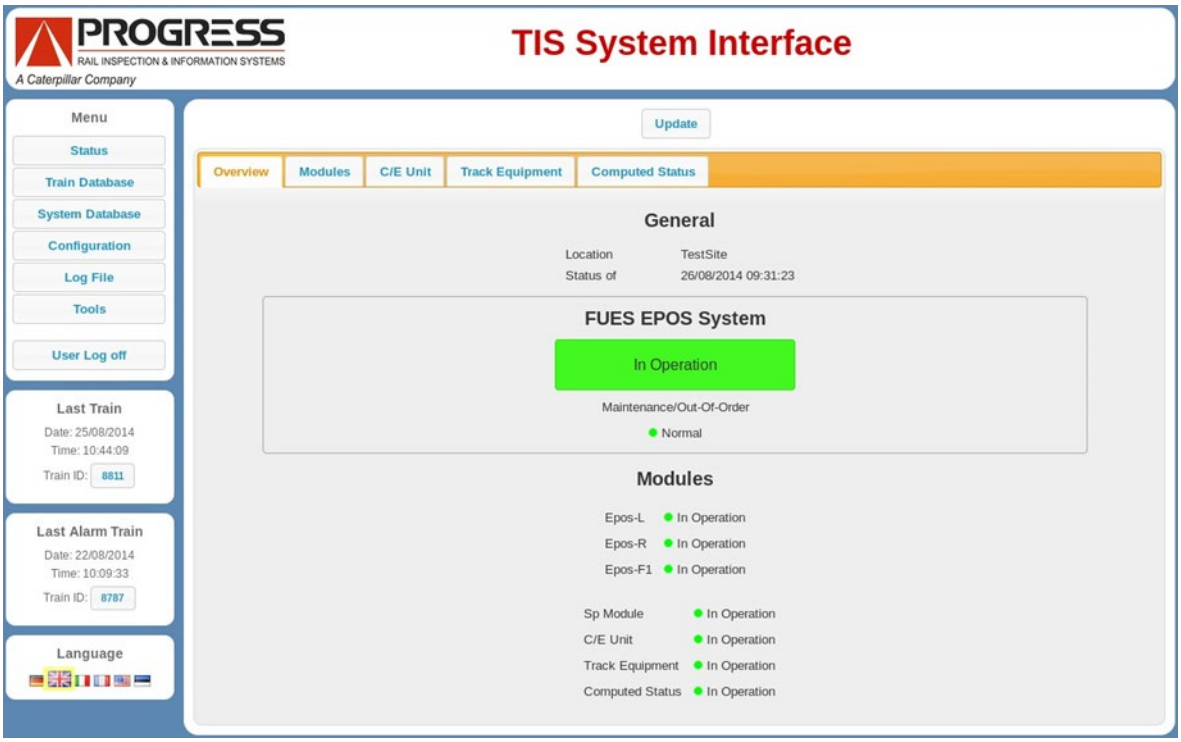

Figure 3 - FUES-EPOS user interface home page

2. Activating the “Maintenance Mode”

2.1 "Maintenance Mode” shall be activated before beginning the annual maintenance or repair works, to suppress alarm and fault messages during these works.

The FUES-EPOS system then sends a corresponding telegram to the remote announcement system.

When this operating mode is selected, the system performs all the standard functions. However, no telegrams (alarm telegram, malfunction telegram or information telegram) are sent to the remote announcement system.

2.2 To activate the “Maintenance Mode” proceed as follows:

a) Log in to the FUES-EPOS GUI.

b) Click on menu item “Configuration” See Figure 4.

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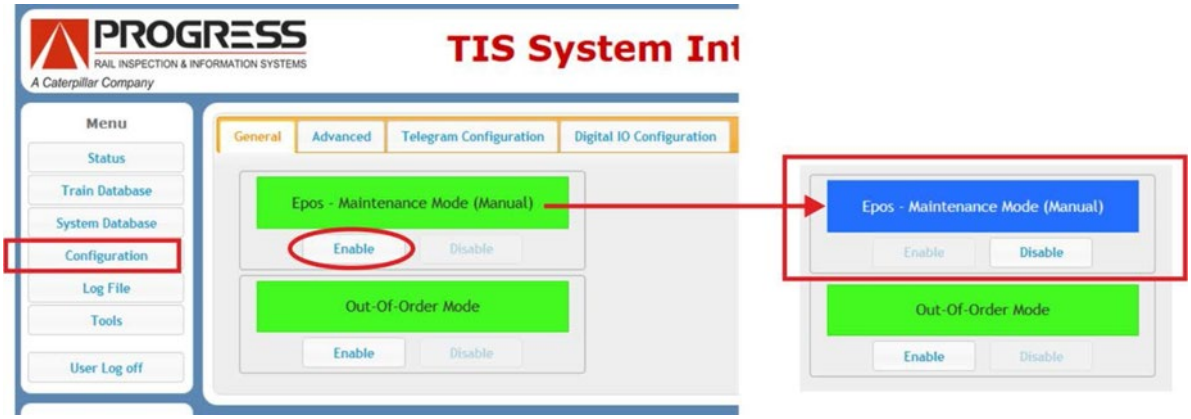

Figure 4 - Maintenance mode in FUES-EPOS GUI

2.3 Click on the “Enable Maintenance Mode” button in the “General” tab.

The activation will be displayed in the System Status display (see “Status” menu item - “General” tab) See Figure 5.

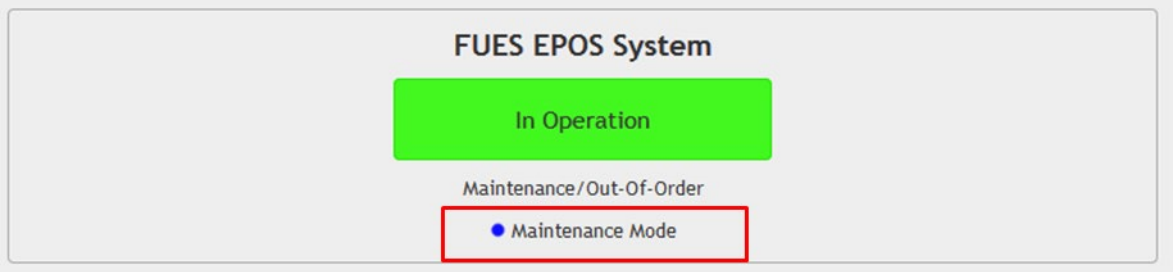

Figure 5 - Display of Operating mode “Maintenance Mode” in the System Status display

3. UPS

The UPS batteries have a limited service life, which is specified as 3 to 5 years by the manufacturer. Since the service life depends on the ambient and operating conditions, the UPS bypass time must be checked annually.

3.1 Carry out the following:

a) Disconnect the supply voltage for the FUES-EPOS system (230 V AC – supply in the distribution station).

The UPS therefore switches to battery operation. The FUES-EPOS system remains in operation without interruption. The switching operation is displayed on the UPS operating and display panel:

NOTE: *The display changes from charging mode*  *to battery mode*  *.*

b) Wait for the configured bypass time (the standard setting is 10 minutes).

c) Observe the “Charge Level” on the control and display panel.

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3.2 Reconnect the supply voltage for the FUES-EPOS system (230 V AC – supply in the distribution station).

4. Control and Evaluation Unit

Residual current circuit breaker (RCD)

4.1 Check the function of the residual current circuit breaker by carrying out the following:

a) Press the power button on the uppers side of the DE computer.

The DE computer will be shut down safely (duration approx. 1 min.). Wait until the blue light on the power button disappears.

NOTE: *For double system shut down both DE's.*

NOTE: *Damage to the evaluation computer, the sudden power shutdown by the RCD can damage the hard disc of the evaluation computer!*

b) Press the "QF1" test button of the residual current circuit breaker (see position (2) in Figure 6).

(1) Residual current circuit breaker.
(2) Test button.

Figure 6 - Residual current circuit breaker test button

The FUES-EPOS system reacts as follows:

c) The residual current circuit breaker and all other circuit breakers tilt to the "OFF" position (switch position at the bottom).

d) The UPS switches off, with the exception of the 230V input terminals and the batteries inside the UPS all components of the cabinet are voltage free now.

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4.2 Move the rocker switches back to the "ON" position.

a) The control and evaluation computer boots automatically.

b) Hold the “ON / / ” button on the UPS system down until you hear a beep.

c) The UPS system is starting, the display then shows the battery status and supplies the load connected with reliable power.

If the display is lit, fix all warnings and restart the UPS system.

d) The FUES-EPOS system is now ready for operation.

Temperature sensors

4.3 Because the external temperature has a direct influence on alarm evaluation, the plausibility of the external temperature measured value shall be checked.

To do this, perform the following steps:

a) Change to the "System Database" menu in the user interface.

The chronological sequence of the ambient temperature measurement can be inspected here See Figure 8.

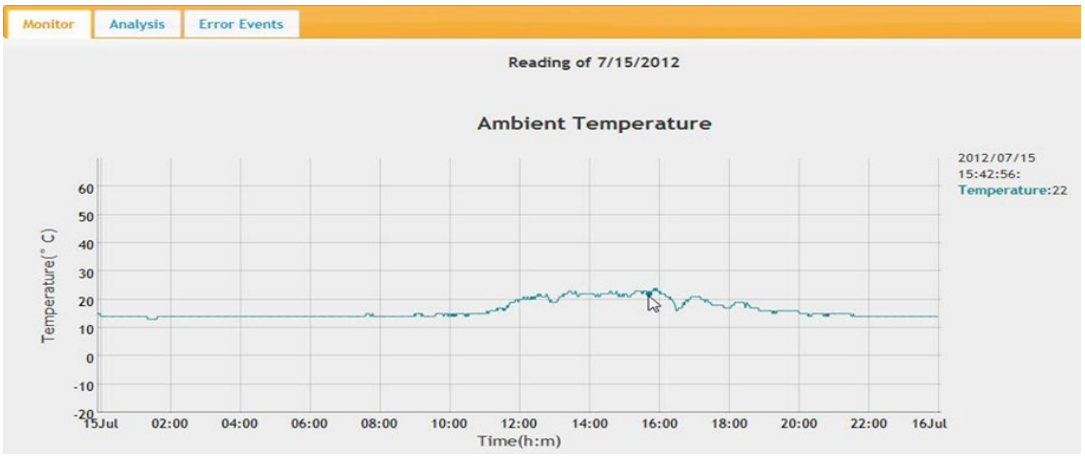

Figure 7 - Chronological sequence of the ambient temperature

b) Compare the current measured value of the ambient temperature using a thermometer.

c) In addition, the chronological sequence of the ambient temperature can be used for the evaluation.

NOTE: *If the measured value is not plausible, a precise analysis of all ambient temperature measurement components must be made.*

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5. Measuring sleeper

5.1 Visually check the measuring sleeper for the following:

a) Check track equipment carriers for visible damage.

b) No loose or missing screws visible.

c) Check cable hoses for damage.

d) Check cable entry points for secure clamping, tighten up screws if necessary.

6. Maintenance of EPOS Unit

Damping elements (HBD only)

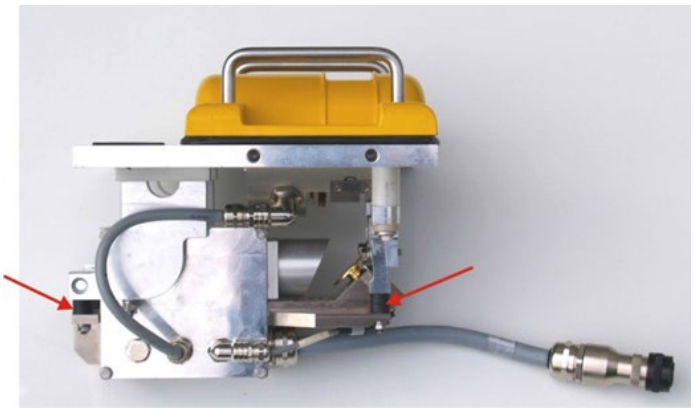

Figure 8 - HBD EPOS-Unit damping elements

6.1 Check the condition of the HBD EPOS-Unit damping elements on crack formation and other damages. See arrows in Figure 9.

Rotating mirror (HBD only)

Do not switch on the rotating mirror.

6.2 Soak a cleaning paper for optical devices or a lint-free cloth with ethyl alcohol (e.g. 2-propanol, ethanol), allow it to act on the mirror surfaces for a short time, then gently remove the dirt.

NOTE: *Pressure should not be applied to mirror, to avoid damaging the rotating mirror motor shaft. A bent motor shaft affects the measuring geometry.*

6.3 Check the rotating mirror surface. Is the mirror oxidized or badly scratched?

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Detector lenses

6.4 Soak a cleaning paper for optical devices or a lint-free cloth with ethyl alcohol, then remove the dirt by making a circular motion, starting from the centre of the objective lens and moving towards the edges.

NOTE: *The lenses could get scratched, so exert the minimum pressure when cleaning.*

Shutters

6.5 Pre-clean the inner surface of each shutter (surface heating) with a soft brush.

NOTE: *Do not use any cleaning agents that contain alcohol. Otherwise the black paint of the heating surface or the vulcanization of the temperature sensor could be damaged.*

6.6 Clean the inner surface of the shutters using a damp cloth. Use a detergent containing soap to remove stubborn dirt.

6.7 Carry out the following checks:

a) Are the rubber mounts (end stops) of the shutter segment cracked or worn? See Figure 10.

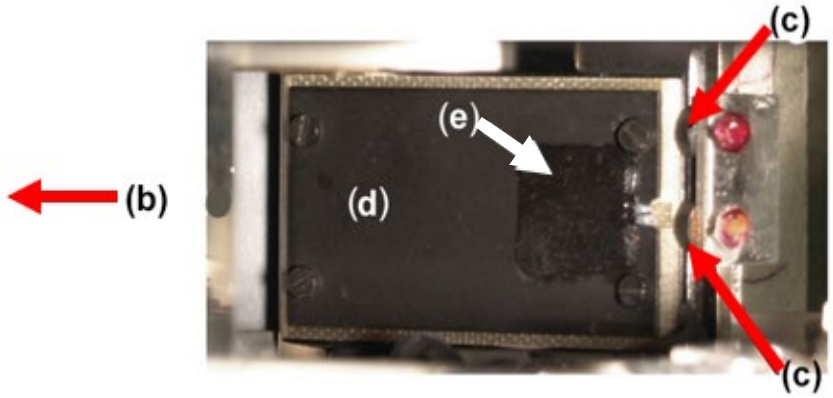

Figure 9 - Shutter – view reference heating surface

b) Rubber mount end stop position open (not visible).

c) Rubber mount end stop position closed.

d) Reference heating surface for internal calibration.

e) Pt100 temperature sensor.

6.8 Confirm the black surface of the reference heating surface Figure 10 item (d) is undamaged, any damage shall be reported to your SM(S).

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7. Functional test - EPOS-Units

7.1 After cleaning the optical components, the EPOS-Units shall be adjusted to the changed optical properties.

7.2 Carry out NR/SMS/PartB/Test/180 (EPOS - Manual Post Calibration Test) on each of the EPOS Units.

7.3 Carry out NR/SMS/PartB/Test/182 (EPOS - Verification of Measurement Accuracy

7.4 The measuring accuracy of the IR sensors shall be verified after calibration.

7.5 During this check, the measurement accuracy of at least one temperature for each measuring point shall be checked using the calibration heating device.

7.6 If during verification of the measured values, these are shown to be outside the nominal range, an external and internal calibration followed by a verification shall be performed for the measured measuring point in question.

8. Final Check

8.1 Log in to the FUES-EPOS GUI.

8.2 Check the system status in the "Status" menu. See Figure 11.

8.3 After completion of the maintenance work, check no further system faults are be present.

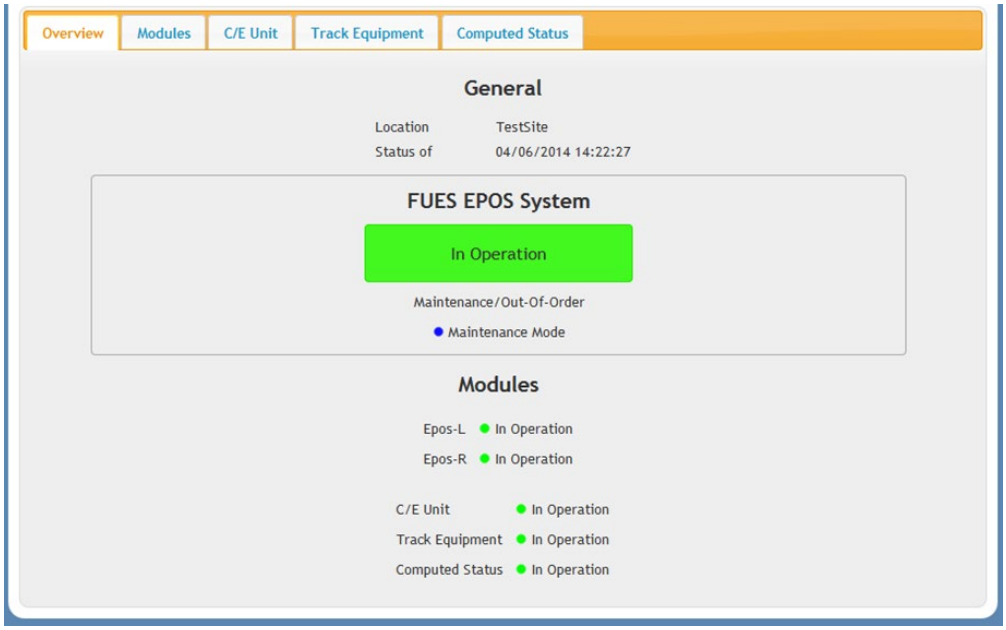

Figure 10 - System Status – Overview

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9. Deactivating the “Maintenance Mode”

9.1 After completion of the maintenance work the “Maintenance Mode” shall be deactivated, otherwise the transmission of alarm and fault messages are permanently suppressed!

9.2 To deactivate the “Maintenance Mode” proceed as follows.

a) Log in to the FUES-EPOS GUI.

b) Click on menu item “Configuration” See Figure 12.

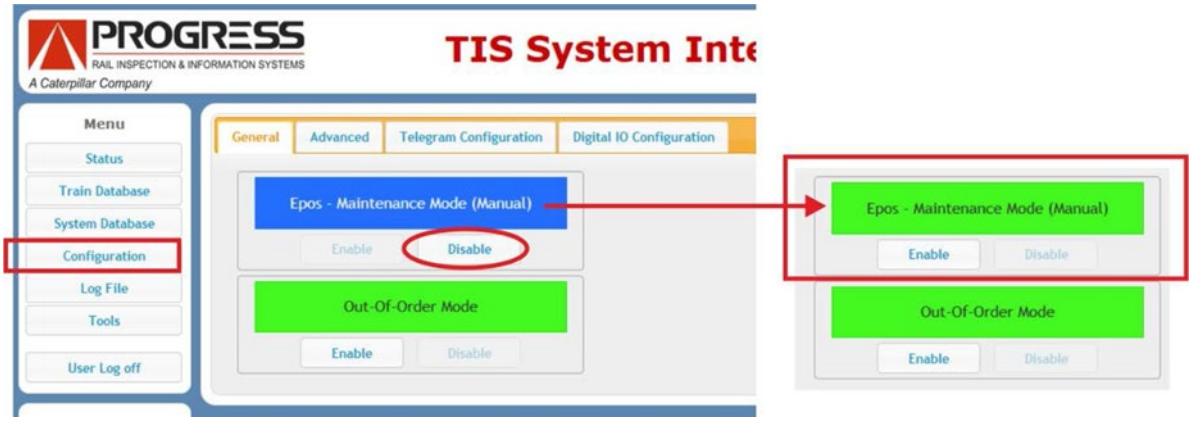

Figure 11 - Maintenance mode in FUES-EPOS GUI

9.3 Click on the “Disable Maintenance Mode” button in the “General” tab.

The deactivation of the “Maintenance Mode” into “Normal” operation will be displayed in the System Status display see Figure 13.

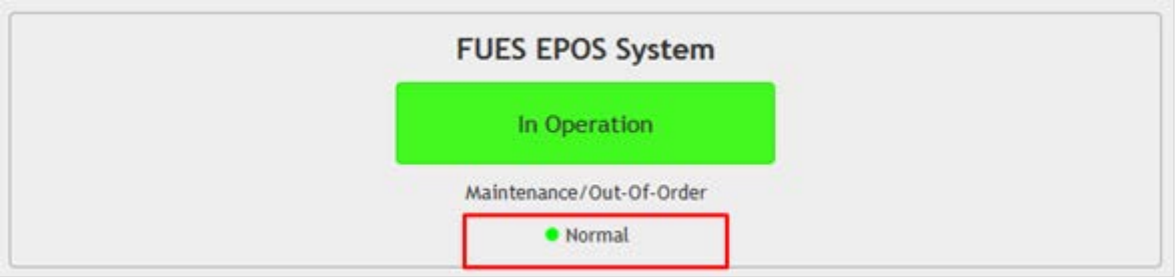

Figure 12 - Display of Operating mode “Normal” in the System Status display

END

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Includes:	RSR123 Wheel Sensor as part of an EPOS HABD System ONLY
Excludes:	All other uses of the RSR123 Wheel Sensor and all other type of Sensor

SERVICE B

1. Remote Occupancy Detection Test

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

NOTE: *This can be verified by looking at the 'Timeline' within the Train database of the Mozilla GUI.*

1.2 Where the timeline does not prove the successful passage of an on-track vehicle, a work order shall be raised to carry out NR/SMS/PartB/Test/181 – EPOS - Wheel Sensor Occupancy Detection Capability Test, for each of the sensors which have not been traversed.

2. Wheel Sensor Height Check

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

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

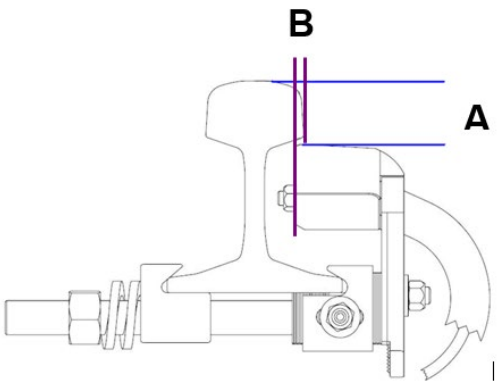

Figure 1 – Maintenance Measurements

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

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

3. Mechanical and visual check of Wheel Sensor RSR123

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

3.2 Check the area around the wheel sensor (within 2m) are free of items such as:

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

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

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

4. Head Sensor Security

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

a) Figure 3 Allen Screws to 25Nm

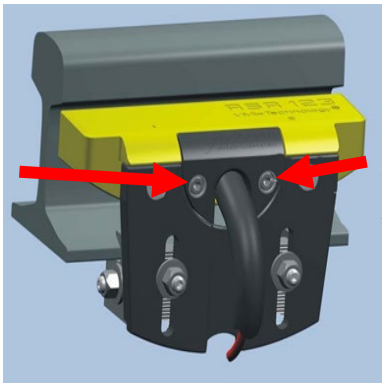

Figure 2 - Allen Screws

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

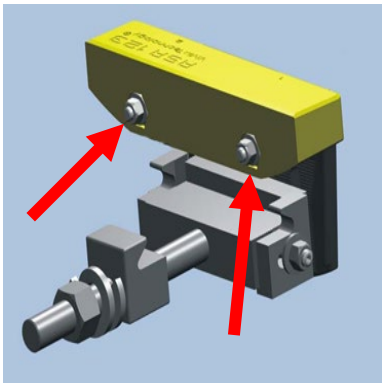

Figure 3 - M10 Nuts

c) Figure 5 M12 nuts to 40Nm.

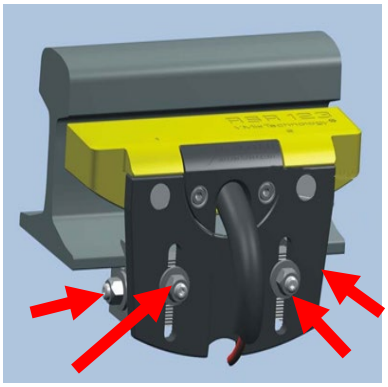

Figure 4 - M12 Nuts

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

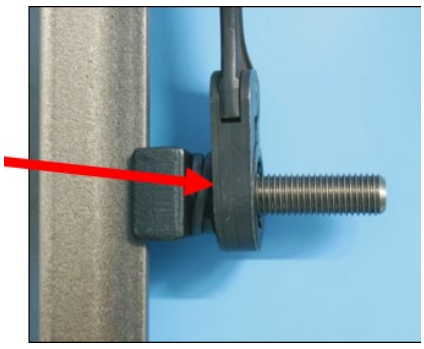

Figure 5 – Rail Claw Nut

4.2 The spring washer shall be replaced every time it is removed. Previously used/fitted Rail claw spring washers shall not be reused.

END

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