Mk 7 OIL MIST DETECTOR

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

59812-K007

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LIST OF ILLUSTRATIONS

OIL MIST DETECTOR WARRANTIES

1. Carrier Fire & Security UK Ltd (Carrier) warrants, for a period of 3 years from the handover of the new vessel which is installed with Graviner Mk7 Oil Mist Detector (OMD) system to the system owner, and for a period of 2 years from the commissioning(*) date of a retro fitted Mk7 Oil Mist Detector (OMD) system, that any component forming part of the original OMD system manufactured by or supplied by Carrier shall be free from defects in workmanship or materials during normal usage (the "OMD System Warranty"). If any such component does not conform to this warranty Carrier will, at its sole discretion and its cost, either repair or replace such component. Installation of the repaired / replacement parts is not covered under the OMD System Warranty. Components replaced or repaired under the terms of the OMD System Warranty shall continue to have the benefit of the unexpired portion of the OMD System Warranty, unless that unexpired portion is less than 12 months, in which case the repaired / replacement parts shall have the benefit of a 12 month warranty against defects in workmanship or materials during normal usage starting on the date of delivery. OMD's supplied as spares shall be warranted in accordance with paragraph 2 below only.

2. Carrier warrants for a period of 12 months from delivery that individual OMD's supplied as spares shall be free from defects in workmanship or materials during normal usage.

3. Performance of Carrier's repair or replacement obligations shall constitute an entire discharge of Carrier's liability under the warranties set out in paragraphs 1 and 2 above ("Warranties").

4. The Warranties shall not apply to the following:
   a. defects reasonably judged by Carrier as being caused by the improper installation of the OMD's and/or OMD system;
   b. defects reasonably judged by Carrier as being caused by the failure to follow the recommendations contained in Carrier's product manuals and/or other documentation regarding the frequency of routine maintenance and testing of the OMD's and/or OMD system and/or the failure to have such routine maintenance performed;
   c. defects which are attributable to careless handling or storage, accident, improper use of the OMD's and/or OMD system, or incorrectly completed repairs or routine maintenance services;
   d. damages or losses occurring as a result of any act or omission which is wilfully unlawful or negligent;
   e. defects arising from the use of non-genuine Carrier parts or accessories, or the use of materials not approved for use by Carrier;
   f. any modifications to or installations performed on the OMD's and/or OMD system outside the scope of normal routine maintenance or running repairs without the express prior written approval of Carrier;
   g. deterioration, staining or corrosion of parts which will occur due to normal exposure and usage;
   h. alleged defects not materially affecting the quality or proper functioning of the OMD system.

5. In addition, the Warranties shall be limited as follows:
   a. Carrier shall be under no liability in respect of any defect in the OMD's and/or OMD System arising from any drawing, design or specification supplied by or at the request of the buyer or system owner (not being a drawing, design or specification of Carrier);
   b. Carrier shall be under no liability in respect of any defect or failure of the OMD's and/or OMD System to operate in accordance with specifications, illustrations, descriptions or other particulars due to their combination or use with any incompatible equipment or product.

6. The Warranties are conditional upon:
    a. the buyer or OMD system owner giving written notice to Carrier of the alleged defect, such notice to be given immediately when the buyer or OMD system owner discovers or ought to have discovered the defect;
    b. the buyer or OMD system owner affording Carrier a reasonable opportunity to inspect the OMD's and/or OMD system;
    c. the buyer or OMD system owner not altering or attempting to repair the OMD's and/or OMD system without the written consent of Carrier.

7. The Warranties can be transferred to any new owner of the OMD system provided Carrier is informed in writing within 30 days of the transfer. The OMD System Warranty cannot be transferred to another Carrier OMD system.
8. Save to the extent amended by the provisions set out above, Carrier's standard terms and conditions of sale shall apply.

* Commissioning is to be performed by a Carrier approved Service Provider.

OMD Service Life

Oil Mist Detectors (OMD's) are an integral part of critical safety systems designed to detect certain conditions that could lead to crankcase explosions on large Diesel engines. They are typically installed in harsh operating conditions - particularly with respect to temperature and vibration - and are expected to provide continuous service over extended periods. They are therefore subject to considerable wear and tear.

In order to ensure reliable performance, it is particularly important that OMD's are properly installed, operated and maintained in accordance with the manufacturer's instructions and guidelines. Given that they are components within key safety systems, as precautionary advice the manufacturer recommends the OMD system is overhauled during the routine 5year dry-dock by a trained and Authorised Graviner OMD Service Engineer and any faulty components are replaced at this time

1 DESCRIPTION

1.1 INTRODUCTION

High temperatures, in excess of 200ºC that occur on bearing surfaces under initial failure conditions, can lead to a rapid generation of oil vapour When the hot vapour contacts the relatively cooler atmosphere of the crankcase it condenses into a fine mist, with typical particle sizes of around 0.5 to 5 microns in diameter. When the density of these particles reaches between 30 to 50 mg/l (Milligrams per litre), depending upon the type of oil, an explosive condition exists.

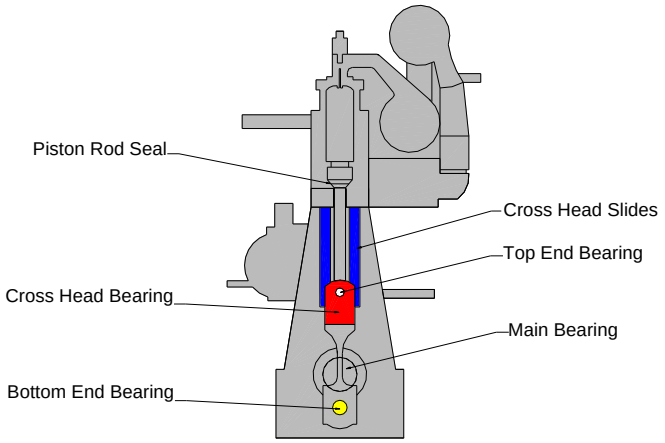


Figure 1 Areas of Failure – 2 Stroke Engine

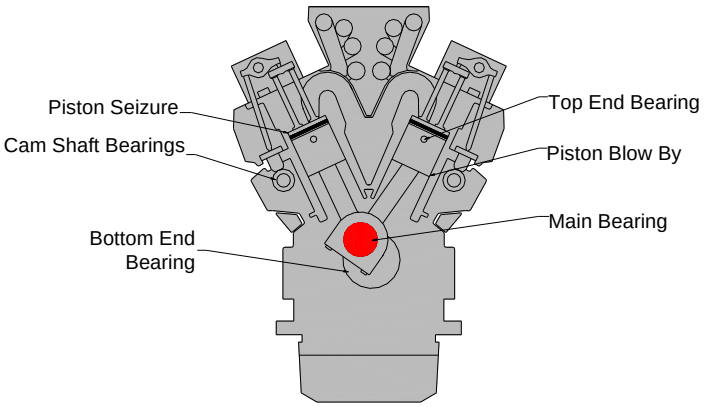


Figure 2 Areas of Failure – 4 Stroke Engine

A fire or explosion needs three constituents: fuel, oxygen and an ignition source. Remove one of these and no explosion will occur. Similarly, within the crankcase, the three constituents which could cause an explosion are air, oil mist and an ignition source, the “hot spot’. Using optical measuring techniques, oil mist density can be measured at levels as low as 0.05 mg/l and give early warning of a rise in oil mist density.

Oil Mist Detection (OMD) techniques have been used to monitor diesel engine crankcases for potential explosive conditions and early detection of bearing failures. The systems available rely mainly on analysing the optical density of oil mist samples drawn from the crankcase compartments, through pipes to the detector. While these systems proved successful in the past, engine design has improved

significantly over the years and oil mist detection techniques have improved substantially to maintain adequate protection.

The Graviner Mk 7 OMD provides the following benefits:

- Auto addressed system monitoring up to 10 detector heads per Control Unit
- Up to 10 Control Units per single system.
- Suitable for both 2 stroke and 4 stroke engines.
- Elimination of sample pipes - reduced installation costs.
- Engine mounted Control Unit.
- Remote Display Unit mounted in a safe area, typically the Engine Control Room (ECR).

Figure 3 Graviner Mk7 OMD Components

1.2 DESCRIPTION

The system comprises three main components (refer to Figure 3):

Detectors	1-53836-K269 (with base) 1-53836-K269-01 (Short sample pipe) 1-53836-K272 (replacement detector head)
Control Unit	1-53836-K270 (With Membrane) 1-53836-K276 (Without Membrane)
Remote Display Unit	1-53836-K271
And connecting cables	
Control Unit to Detector cable (Right Angle)	1-43682-K285-XX
Control Unit to Detector cable (Straight)	1-43682-K286-XX

The Graviner Mk7 OMD system can comprise up to 100 detectors directly mounted on the crankcases of up to 10 engines, allowing both main propulsion and auxiliary generators to be monitored at the same time.

Each detector communicates electronically over a serial data link via the engine mounted Control Unit with the Remote Display Unit designed to be mounted within the Engine Control Room. This eliminates the need to enter the machinery space in alarm conditions.

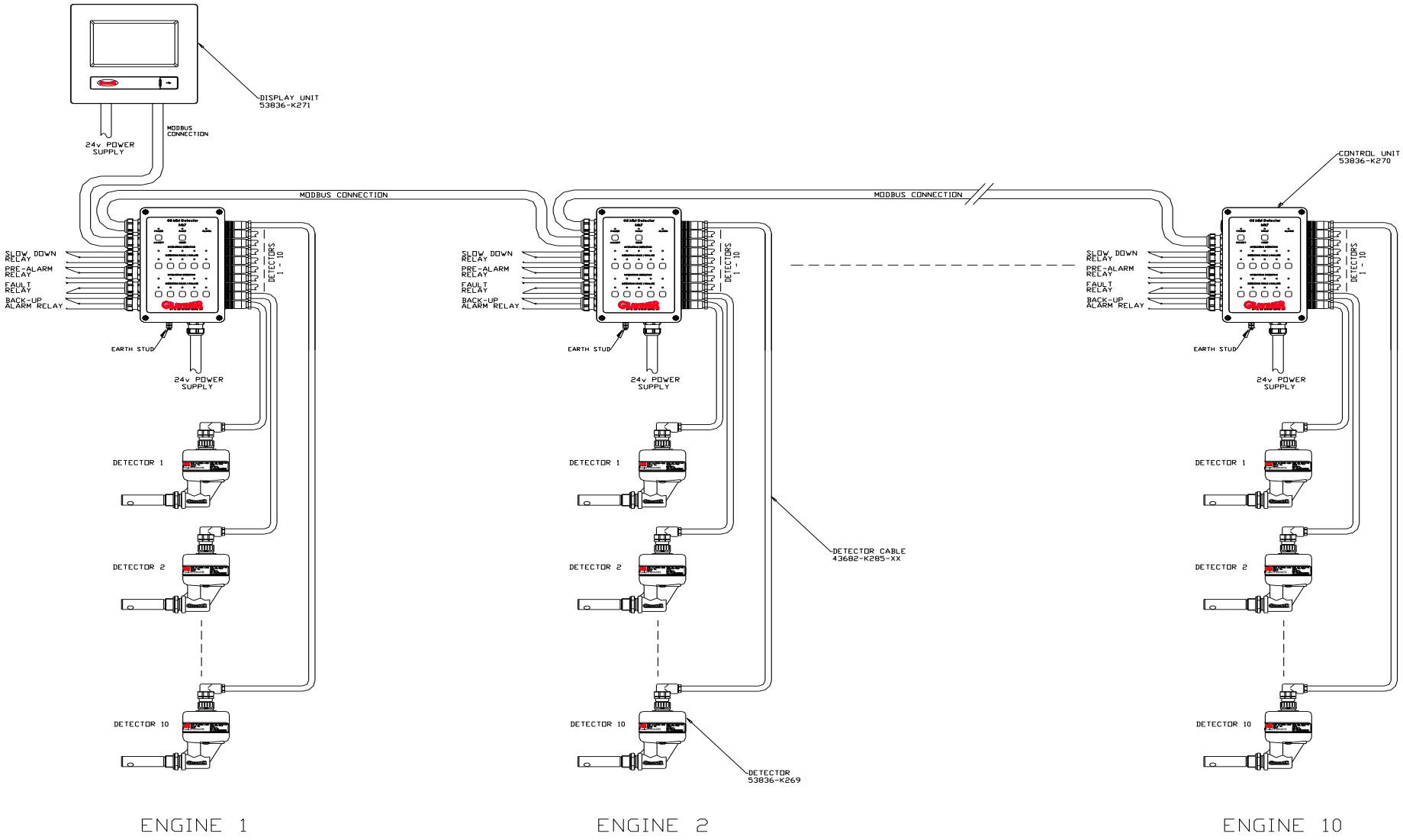


Figure 4 Typical System Configuration – With Membrane

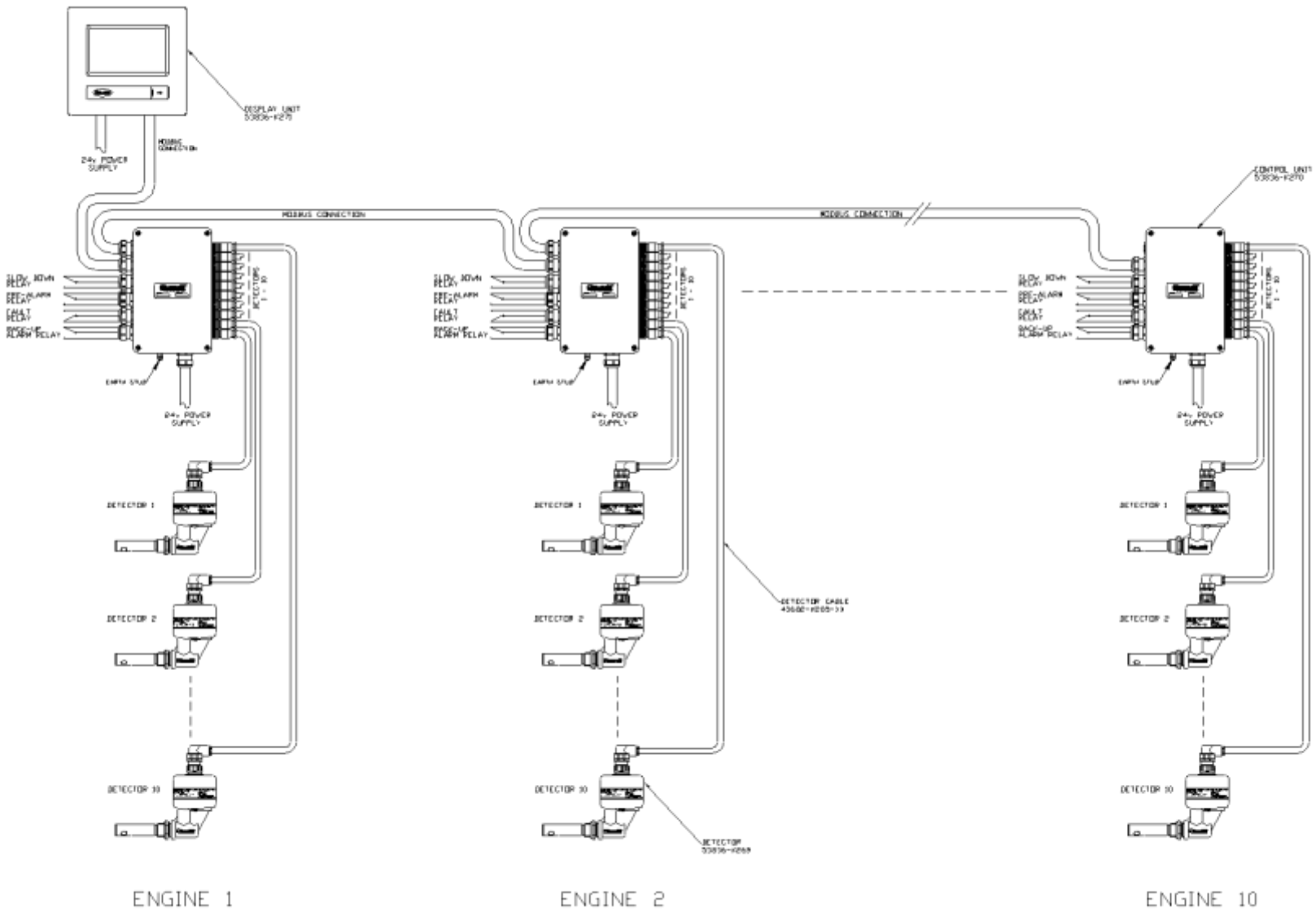


Figure 5 Typical System Configuration – Without Membrane

1.3 TECHNICAL SPECIFICATION

Detector

Mounting	¾ inch BSP	
Enclosure Rating	IP65	
Material	Sample Tube – Carbon Loaded PTFE	
	Detector – Black Du Pont Nylon 70G33L	
Indicators	Green	Detector On
	Red	Alarm
	Amber	Detector Fault
Power Consumption	1.5W	
Operating Temperature Rating	0 to 70°C	
Storage Temperature Rating	-20°C to 60°C	
Height	153mm	
Width	90mm	
Length	205mm	
Weight	0.5kg	

Control Unit

Enclosure Rating	IP65
Material	Aluminium
Max detector inputs	10
Output Relays	Volt-free change over contacts rated at 30Vdc 1A
	Relay contact minimum wetting current = 10mA
Pre-Alarm	1 set (de-energised during normal operation)
Fault Alarm	1 set (energised during normal operation)
Engine Slow/Shutdown Alarm	1 set (de-energised during normal operation)
Backup Alarm	1 set (de-energised during normal operation)

Alarm Ranges

Pre-Alarm	0.5mg/l to 1.2mg/l (adjustable) (Default 0.9mg/l)
Engine Slow/Shutdown Alarm	1.3mg/l to 2.4mg/l (adjustable) (Default 1.8mg/l)
Backup Alarm	3.0mg/l (fixed)
Operating Voltage	24Vdc (+30% -25%)
Power Consumption	3.9W
Operating Temperature Rating	0 to 70°C
Storage Temperature Rating	-20°C to 60°C

Dimensions

Height	186mm	(110mm mounting centres)
Width	318mm	(240mm mounting centres)
Depth	90mm	
Weight	2.8kg	

Remote Display Unit

Enclosure Rating	IP32	
Material	ABS (PA-765+)	
Max No. of detectors	100	
Max No. of engines monitored	10	
Power Supply	24Vdc (+30% -25%)	
Power Consumption	6.0W	
Operating Temp Rating	0 – 70°C	
Storage Temperature Rating	-20°C to 60°C	
Humidity level	95%	
Dimensions		
Height	225mm	(202mm mounting centres)
Width	240mm	(217mm mounting centres)
Depth	58mm	Bulkhead Mounted
	55mm	Panel Mounted
Weight	1.0kg	

1.4 SYSTEM OVERVIEW

The Graviner Mk7 OMD is an auto addressed oil mist detection system capable of monitoring up to 10 Control Units per system with each Control Unit having up to 10 detectors connected to it. This is achieved without external sample pipes and with minimum cabling. Each detector head monitors a single crank space and is a stand-alone device. On power up the detectors gather oil mist density data and convert it to a digital signal for transmission via the data lines in the detector cable to the Control Unit which is also mounted on the side of the engine. Alarm levels and alarm output requirements are all set from either the Remote Display Unit or a PC connected directly to the Control Unit.

The Remote Display Unit houses a 7.5" LCD Touch Screen display that shows the oil mist level for each engine and when required each detector, as well as the status of the system. In the event of an alarm, the display immediately shows the oil mist levels for the relevant engine. It also enables the individual readings of each detector on the engine to be displayed on demand and automatically under alarm conditions.

In the event of a detector fault, that detector can be isolated without affecting the function of the other detectors on the engine. The system will continue to operate while the faulty detector is replaced, repaired or maintenance is carried out.

The Mk7 detectors use optical sensing; (light scatter) as it's detection method and continually monitors the oil mist density in the crank space to which it is connected. In addition, the detector automatically performs self-checks for any internal faults. The Control Unit interrogates each detector in turn, identifying the position connected at the Control Unit, the oil mist density value and determines the status of the detector.

Each detector is fitted with 3 LED indicator lights:

Green	-	Power on
Red	-	Alarm
Amber	-	Fault

As all detectors operate independently, the loss of one detector through a fault does not affect the operation of the remaining system. Individual detectors, or engine groups, can be isolated from the system for maintenance while the rest of the system remains in operation.

The Control Unit can be supplied with or without a control membrane. The control membrane has LED indication for detectors connected, push buttons for isolation and de-isolation of detectors, as well as pushbuttons for Accepting and Resetting Alarms.

Alarm Philosophy

The system has 3 separate alarm levels as detailed below

1. Pre-Alarm - This indicates that the oil mist levels are increasing in a particular crank-space and that investigation should be undertaken. This alarm will not operate the slowdown/shutdown relays.
2. Engine Slow/Shutdown Alarm - When any detector reaches this threshold then the slowdown/shutdown relay will be operated if they are connected.
3. Back Up Alarm - In the event of a failure of either the Pre-Alarm or Engine Slow/Shutdown Alarm, then the Back Up Alarm will operate, but it will not operate the slowdown/shutdown relay. This is an additional functional precaution added by Carrier Fire & Security UK Ltd which can be connected in any way the customer requires. This is usually connected to a warning beacon or siren; however, the customer may choose to connect the relay to another device or to the engine slowdown or shutdown circuitry.

On receipt of either a Pre-Alarm or Engine Slow/Shutdown Alarm the engine should, unless connected to a slowdown/shutdown relay, be stopped if safe to do so and allowed to cool down so that the background oil mist levels reduce before entering the engine room.

When the oil mist levels have returned to normal then the Accept and Reset buttons can be operated from the Control Unit membrane if fitted or alternatively from the Remote Display Unit and the system will then return to normal operation.

Fault Diagnosis

When a system fault is received, the information on the display should be noted and then the appropriate Fault Finding procedure, detailed in section 5 Fault Finding of the manual, should be checked to enable the fault to be rectified.

When the faults have been rectified the Accept and Reset buttons can be operated and the system will return to normal

Event Log

All alarms, faults and events are recorded in an Event Log which is date and time stamped indicating the type of event which can be analysed at a later date. The Event Log is a rolling list and has a capacity of 1024 events.

SYSTEM CONTROLS AND DISPLAYS

The Remote Display Unit and PC software are menu driven and provides a logical route to all functions. It has three operating levels:

User
Engineer
Service

The User level is essentially for read only interrogation and does not allow any adjustments to be made to alarm settings or system configuration.

The Engineer level is password protected and allows access to most functions and the full range of programmable settings.

When selected, a prompt for a password will appear, enter 012345, when programming is completed, if required, the Password may be changed by an authorised person to prevent unauthorised access in the future. This process can be followed in section 2.9 of this manual.

The Service level is also password protected (different from the Engineer Menu) and allows access to all functions. This is only available to authorised Carrier personnel and authorised Service Providers.

2 INSTALLATION AND COMMISSIONING

2.1 CONTROL UNIT MOUNTING

The Control Unit 1-53836-K270 (1-53836-K270-01 Caterpillar only) or 1-53836-K276 is designed for on-engine mounting and it is recommended that the Control Unit is installed as near to the centre of the engine as possible to minimise detector cable lengths.

Mounting is via the four M6 locating holes in the box. Enough space must be left around the Control Unit to allow access to the cable glands and the routing of the cables and to facilitate easy access to all aspects of the Control Unit.

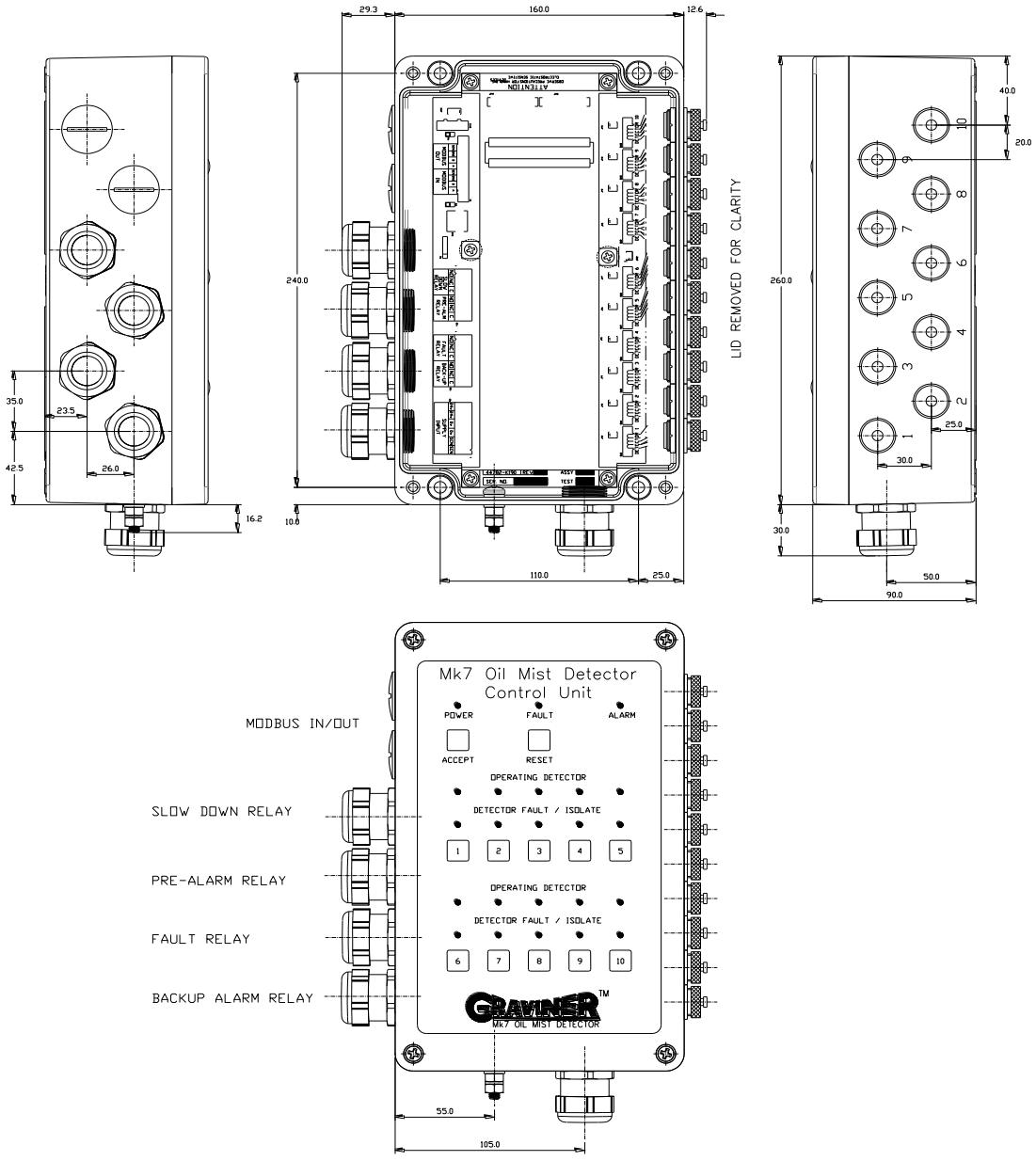


Figure 6 Control Unit 1-53836-K270 (With Membrane)

(Caterpillar 1-53836-K270-01)

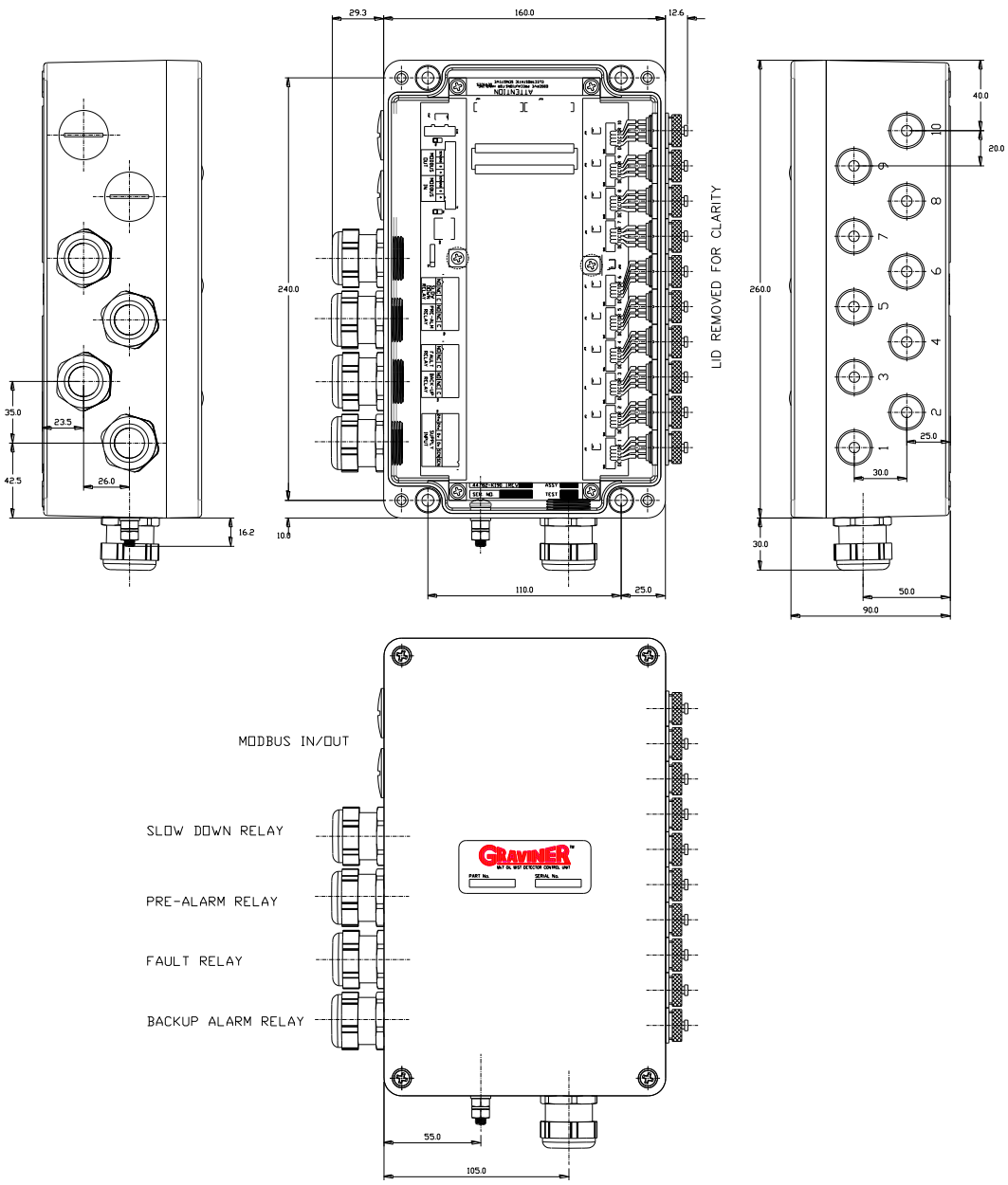


Figure 7 Control Unit 1-53836-K276 (Without Membrane)

2.2 CONTROL UNIT CABLING

24v DC Input supply

The Mk7 Control Unit should be powered from a floating 24v DC supply (+30% -25%) rated at 1.0Amp continuous rated, with 2.5Amp surge for 1.5ms.

PLEASE NOTE: - The Control unit(s) may not operate correctly if the external 24v power supply is referenced to the vessel earth and there is also a risk the input protection circuitry in the units could be damaged.

Cables should be segregated from high voltage cables and follow good installation practice.

Cable type-2 Cores + Earth, CSA 2.5mm^2 (50/0.25mm), flexible stranded bare copper conductors, low smoke halogen free insulation, cores laid up, braided screen, low smoke halogen free sheath – grey, outside diameter 9.8mm, operating temperature 0ºC + 80ºC.

Suggested cables

Lapp Kabel	CY cable 3 core 2.5mm^2
Prysmian	LSM-HF 3 core 2.5mm^2
Helkama	LKAM-HF 3 core 2.5mm^2

Refer Figure 8 for connector location.

Refer Figure 29 for wiring drawing.

Modbus

Cable type – Individually screened 2 pair data cable, 24AWG, low capacitance, low smoke halogen free. Outer diameter 7mm (max)

Cables should be segregated from high voltage cables and follow good installation practice

Approved cables:

FS Cables	2402PIFFH
Beldon	9729
Helkama	RFE-HF(i) 2x2x0.75
Jinro	60V RCOP(IS)

The above cable should be used to connect between the Control Units and either the ships Alarm Management System (AMS) or the Remote Display Unit.

Refer Figure 8 for connector location.

Refer Figure 29 for wiring drawing.

Please Note: The Control Unit Modbus data cable should NOT be connected with the power already applied to the unit.

With multiple Control Units connected to a Remote Display Unit the end of line jumpers indicated in Figure 8 should be fitted only in the last Control Unit connected.

Relay Outputs

The relay outputs are rated at 30v DC at 1amps.

2 Cores + Earth, CSA 2.5mm^2 (50/0.25mm), flexible stranded bare copper conductors, low smoke halogen free insulation, cores laid up, braided screen, low smoke halogen free sheath – grey, outside diameter 9.8mm, operating temperature 0^{o}C + 80^{o}C.

Cables should be segregated from high voltage cables and follow good installation practice

Approved cables:

Lapp Kabel	CY cable 3 core 2.5mm2
Prysmian	LSM-HF 3 core 2.5mm2
Helkama	LKAM-HF 3 core 2.5mm2

Refer Figure 8 for connector location.

Refer Figure 29 for wiring drawing.

USB Connection

A USB Type B connector is provided for connection to a PC.

Refer Figure 8 for connection location.

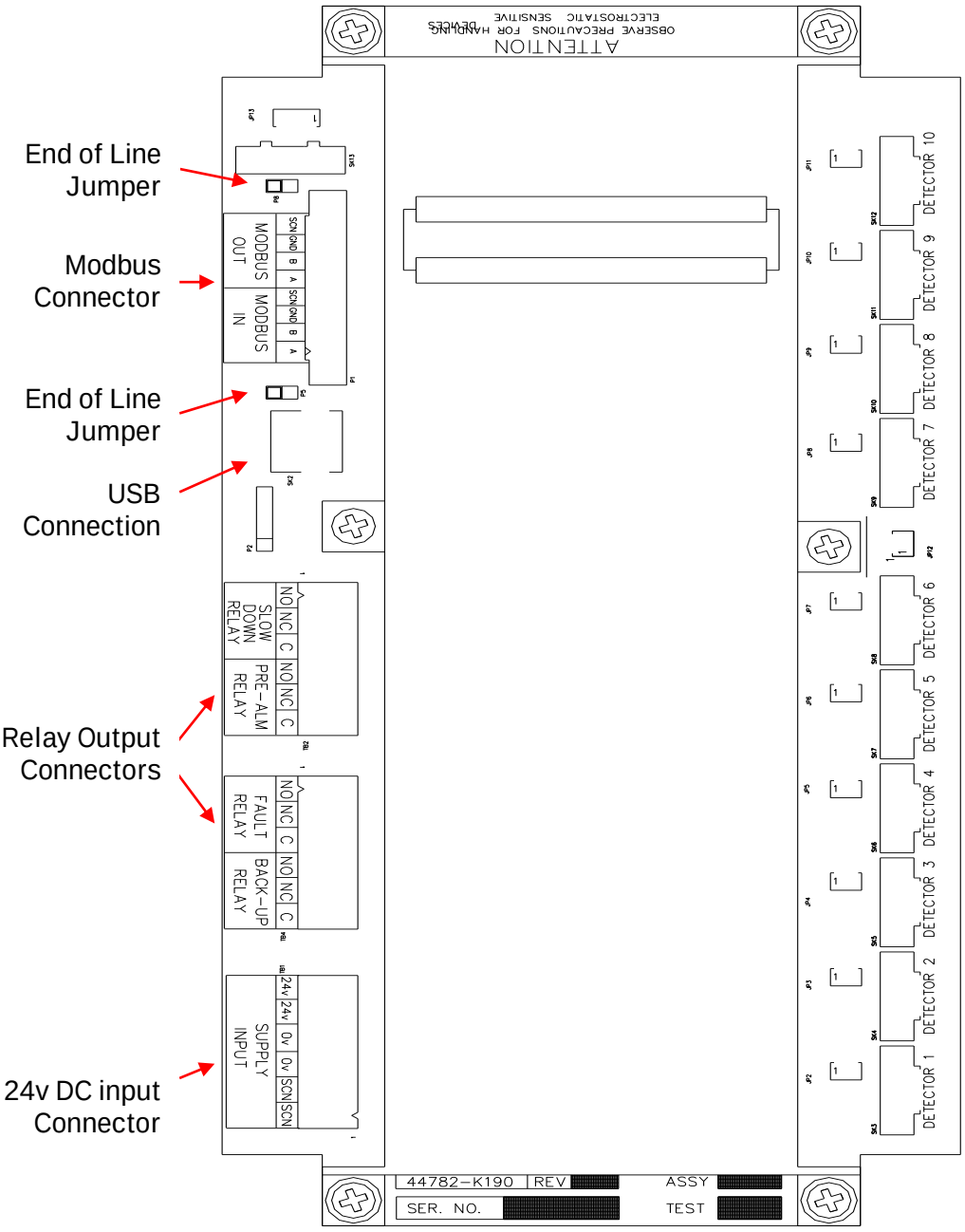


Figure 8 Control Unit PCB

2.3 DETECTOR MOUNTING

Each detector is mounted to an individual crankcase via a ¾ inch BSP threaded hole.

Ensure all detectors fitted to the engine are locked tightly in place by means of the lock nut supplied.

It is recommended that the detector be located at the upper part of the crankcase wall where it is not in the direct line of the oil throw. On smaller engines it is permissible to mount the detector on the crankcase door if desired or as installation dictates, subject to vibration levels.

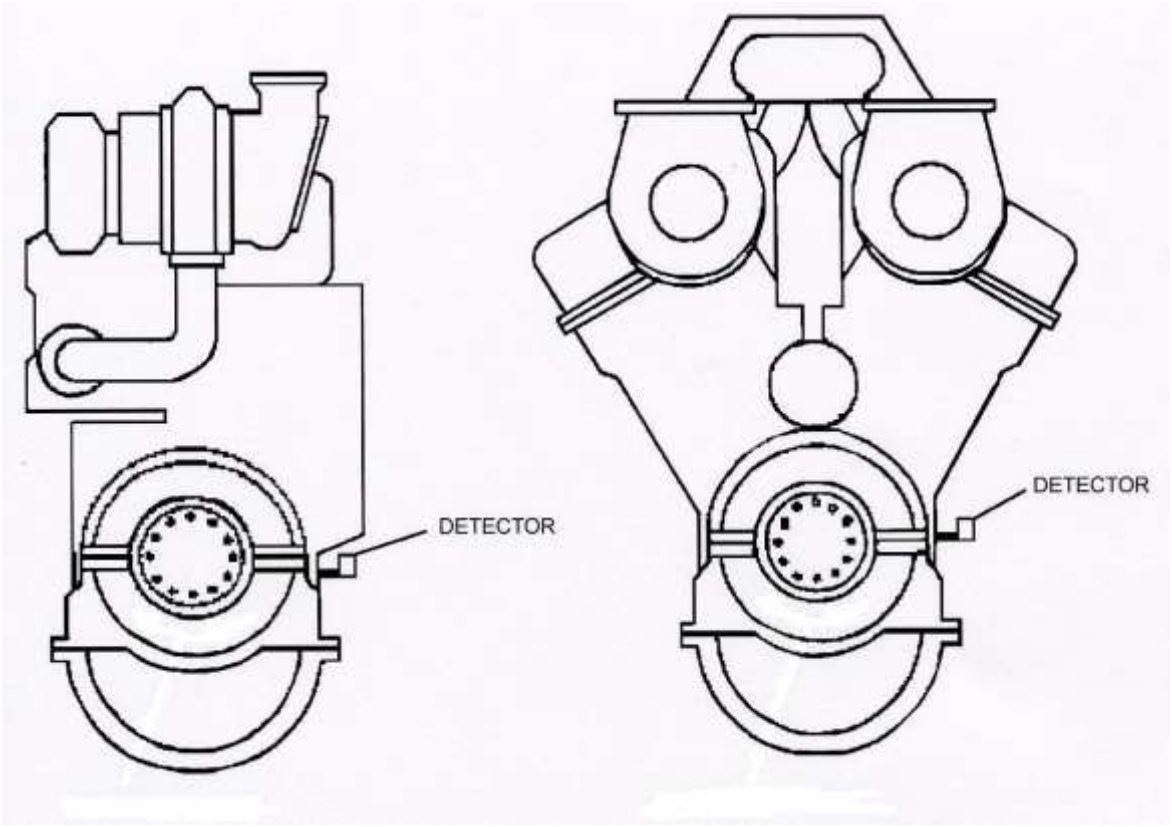


Figure 9 Ideal Mounting Position

The detector must be fitted at a maximum of plus or minus 20 degrees from the vertical. Horizontally the detector must be mounted level or with the detector body inclined towards the engine to ensure oil drainage. Refer to Figure 10, and Figure 11.

Please ensure that Detector 1 is connected to position 1 on the Control Unit, Detector 2 to position 2. Repeat for all Detectors fitted.

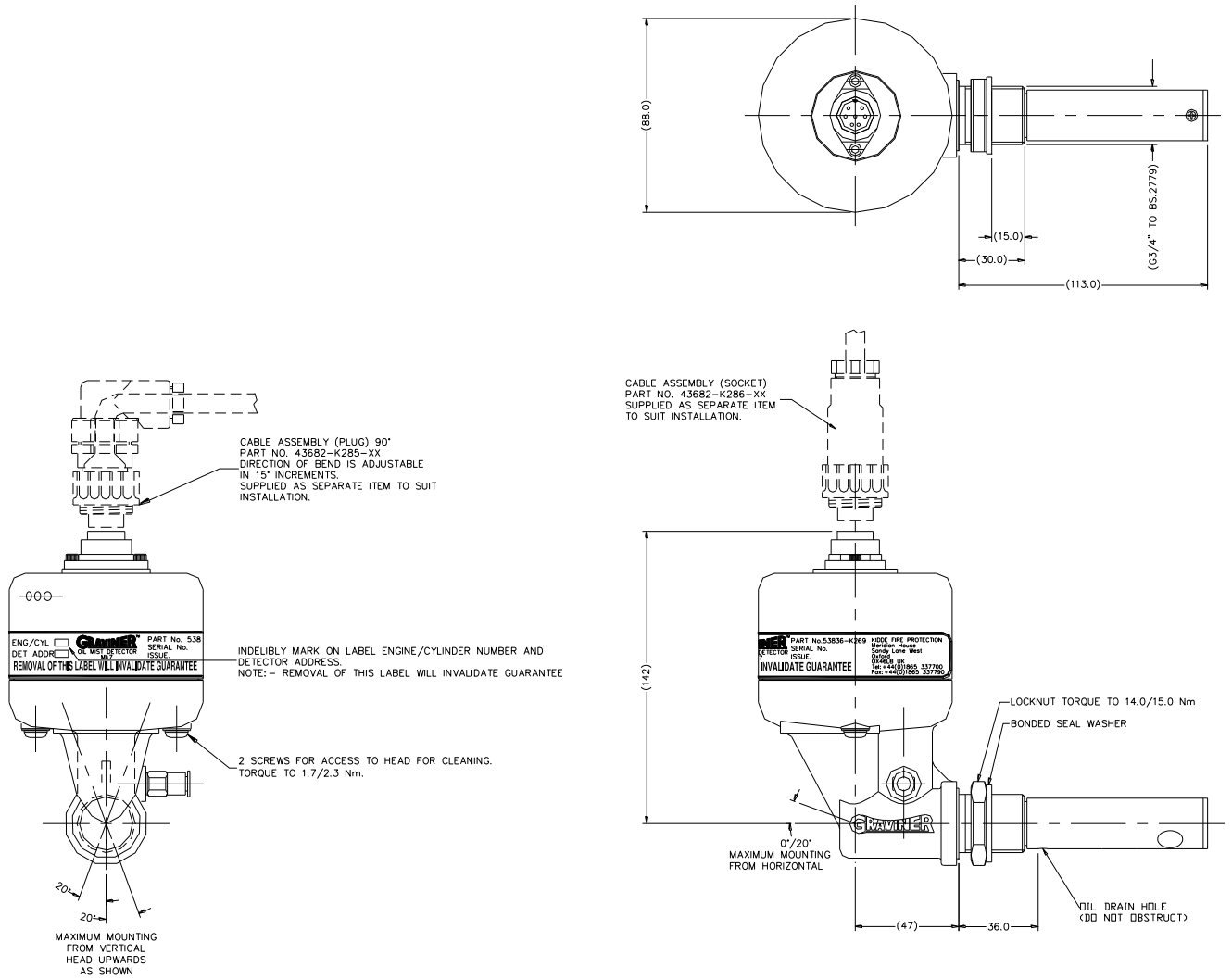


Figure 10 Detector Head Installation

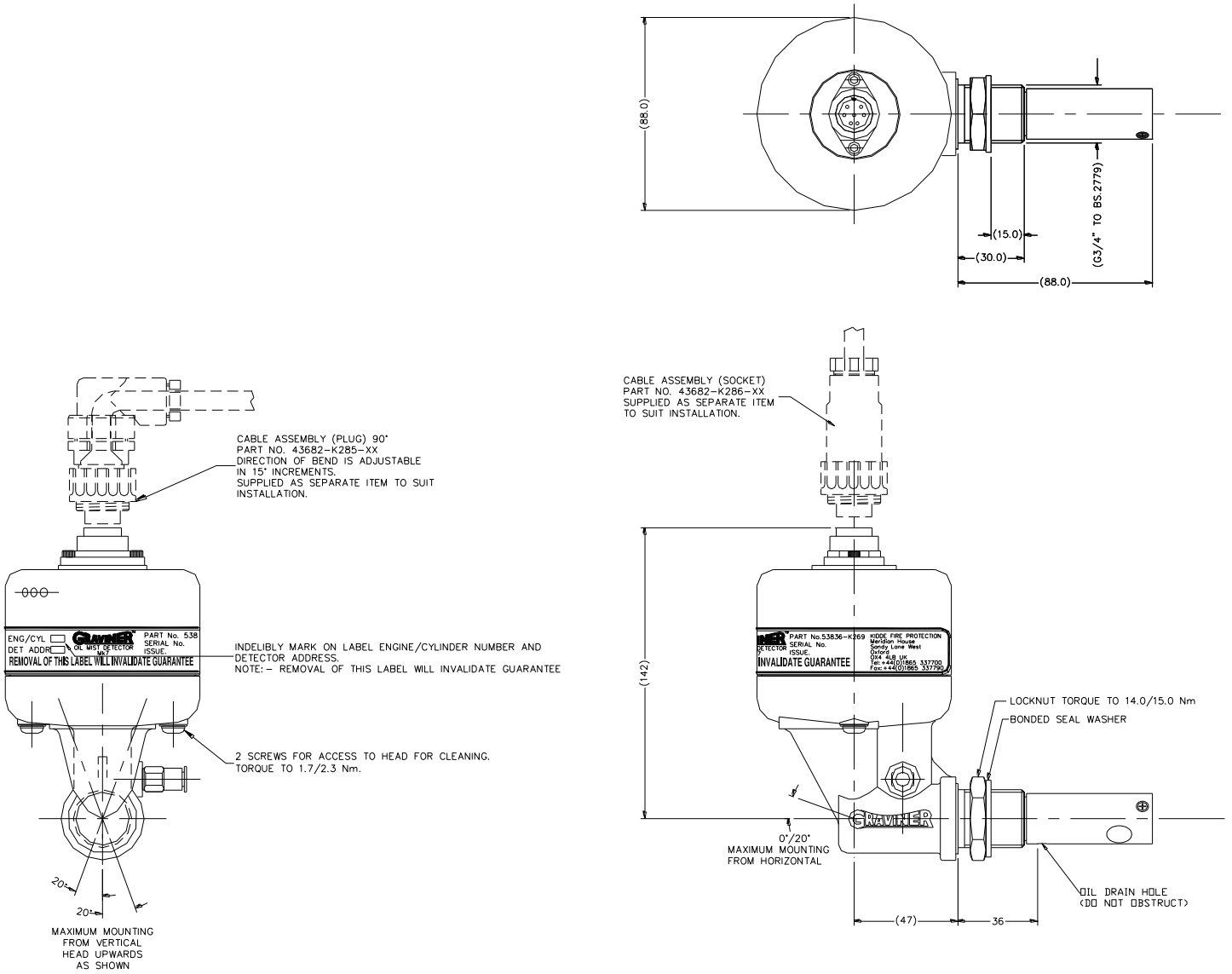


Figure 11 Detector Head Installation (Short Sample Pipe)

2.4 DETECTOR CABLES

Each detector must be connected to the Control Unit by way of a supplied detector cable.

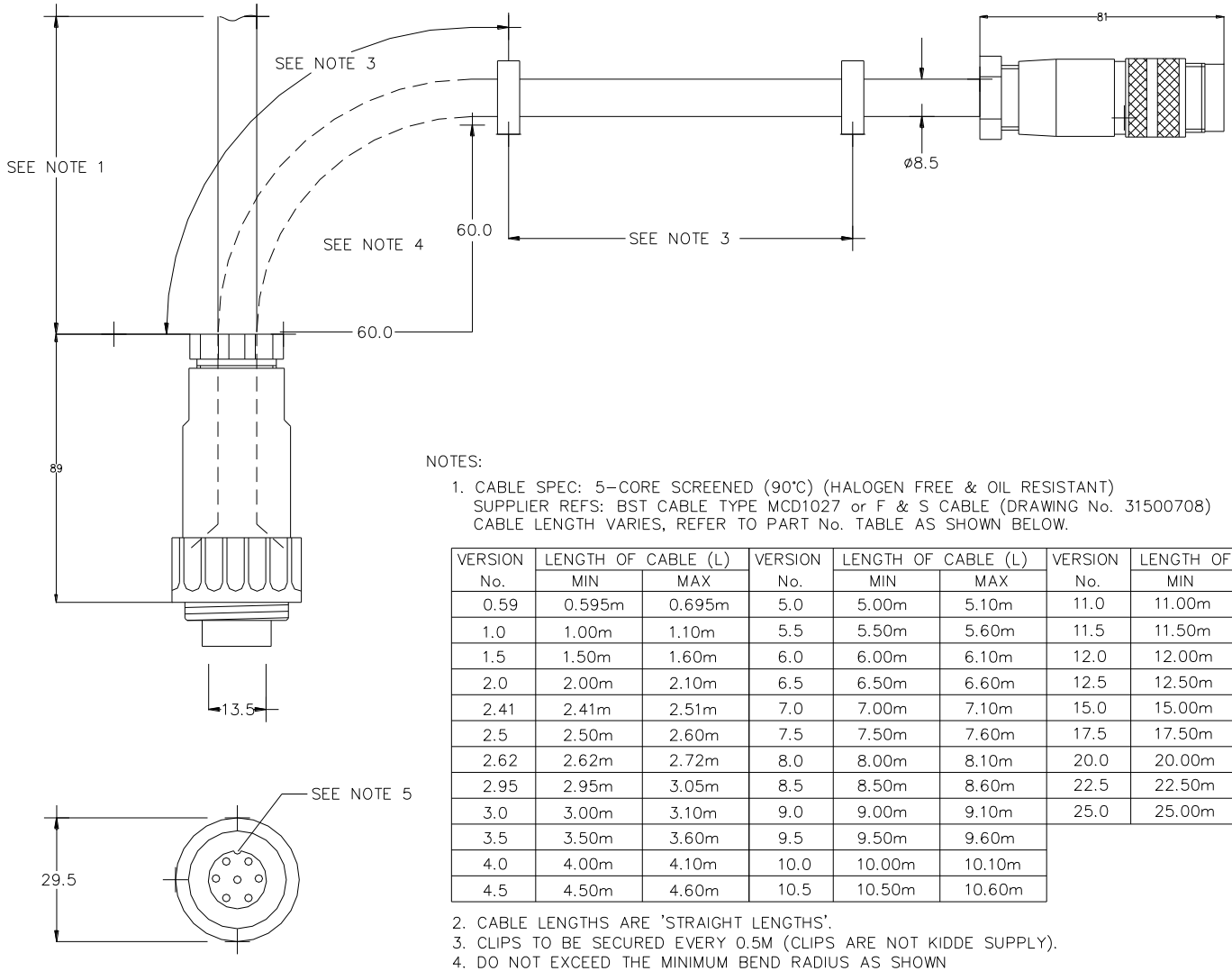
Refer Figure 12.

Ensure that the cables are run in a suitable cable tray and clipped at regular intervals to ensure they cannot be subjected to mechanical damage caused by vibration.

Figure 12 Detector Cable

Refer to section 6.6 for a list of available detector cables

All Detector connectors are pre-wired.



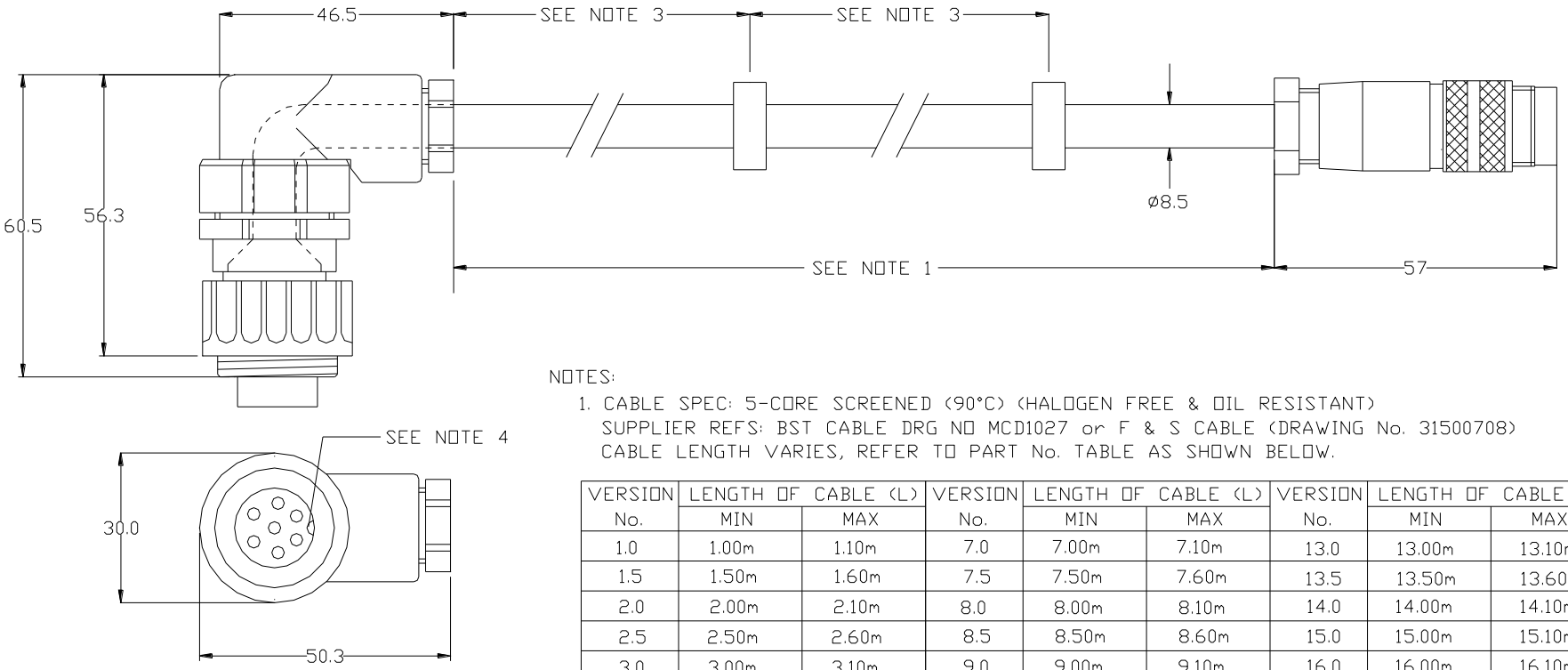
NOTES:

1. CABLE SPEC: 5–CORE SCREENED (90°C) (HALOGEN FREE & OIL RESISTANT)
   SUPPLIER REFS: BST CABLE TYPE MCD1027 or F & S CABLE (DRAWING No. 31500708)
   CABLE LENGTH VARIES, REFER TO PART No. TABLE AS SHOWN BELOW.

VERSION	LENGTH OF CABLE (L)		VERSION	LENGTH OF CABLE (L)		VERSION	LENGTH OF CABLE (L)	
No.	MIN	MAX	No.	MIN	MAX	No.	MIN	MAX
0.59	0.595m	0.695m	5.0	5.00m	5.10m	11.0	11.00m	11.10m
1.0	1.00m	1.10m	5.5	5.50m	5.60m	11.5	11.50m	11.60m
1.5	1.50m	1.60m	6.0	6.00m	6.10m	12.0	12.00m	12.10m
2.0	2.00m	2.10m	6.5	6.50m	6.60m	12.5	12.50m	12.60m
2.41	2.41m	2.51m	7.0	7.00m	7.10m	15.0	15.00m	15.10m
2.5	2.50m	2.60m	7.5	7.50m	7.60m	17.5	17.50m	17.60m
2.62	2.62m	2.72m	8.0	8.00m	8.10m	20.0	20.00m	20.10m
2.95	2.95m	3.05m	8.5	8.50m	8.60m	22.5	22.50m	22.60m
3.0	3.00m	3.10m	9.0	9.00m	9.10m	25.0	25.00m	25.10m
3.5	3.50m	3.60m	9.5	9.50m	9.60m			
4.0	4.00m	4.10m	10.0	10.00m	10.10m			
4.5	4.50m	4.60m	10.5	10.50m	10.60m			

2. CABLE LENGTHS ARE 'STRAIGHT LENGTHS'.
3. CLIPS TO BE SECURED EVERY 0.5M (CLIPS ARE NOT KIDDE SUPPLY).
4. DO NOT EXCEED THE MINIMUM BEND RADIUS AS SHOWN
5. NOTE ORIENTATION OF KEY–WAY.

Figure 13 Detector Cable Assembly (Straight Connector)



NOTES:

1. CABLE SPEC: 5-CORE SCREENED (90°C) (HALOGEN FREE & OIL RESISTANT)
   SUPPLIER REFS: BST CABLE DRG NO MCD1027 or F & S CABLE (DRAWING No. 31500708)
   CABLE LENGTH VARIES, REFER TO PART No. TABLE AS SHOWN BELOW.

VERSION	LENGTH OF CABLE (L)		VERSION	LENGTH OF CABLE (L)		VERSION	LENGTH OF CABLE (L)	
No.	MIN	MAX	No.	MIN	MAX	No.	MIN	MAX
1.0	1.00m	1.10m	7.0	7.00m	7.10m	13.0	13.00m	13.10m
1.5	1.50m	1.60m	7.5	7.50m	7.60m	13.5	13.50m	13.60m
2.0	2.00m	2.10m	8.0	8.00m	8.10m	14.0	14.00m	14.10m
2.5	2.50m	2.60m	8.5	8.50m	8.60m	15.0	15.00m	15.10m
3.0	3.00m	3.10m	9.0	9.00m	9.10m	16.0	16.00m	16.10m
3.5	3.50m	3.60m	9.5	9.50m	9.60m	17.0	17.00m	17.10m
4.0	4.00m	4.10m	10.0	10.00m	10.10m	17.5	17.50m	17.60m
4.5	4.50m	4.60m	10.5	10.50m	10.60m	20.0	20.00m	20.10m
5.0	5.00m	5.10m	11.0	11.00m	11.10m	22.5	22.50m	22.60m
5.5	5.50m	5.60m	11.5	11.50m	11.60m	23.0	23.00m	23.10m
6.0	6.00m	6.10m	12.0	12.00m	12.10m	25.0	25.00m	25.10m
6.5	6.50m	6.60m	12.5	12.50m	12.60m	27.5	27.50m	27.60m

2. CABLE LENGTHS ARE 'STRAIGHT LENGTHS'.
3. CLIPS TO BE SECURED EVERY 0.5M (CLIPS ARE NOT KIDDE SUPPLY).
4. NOTE ORIENTATION OF KEY-WAY.

Figure 14 Detector Cable Assembly (Right Angle Connector)

2.5 REMOTE DISPLAY UNIT

The Remote Display Unit part number 1-53836-K271 must be mounted in the Engine Control Room (ECR) or similar safe environment, do not mount in an Engine Room as it is not designed to be mounted in this type of environment. Additionally, Class Society rules state that any display must be mounted in a safe area away from the Engine Room.

For flush mounting details see below and Figure 15 and Figure 16.

For bulkhead mounting details see Figure 17.

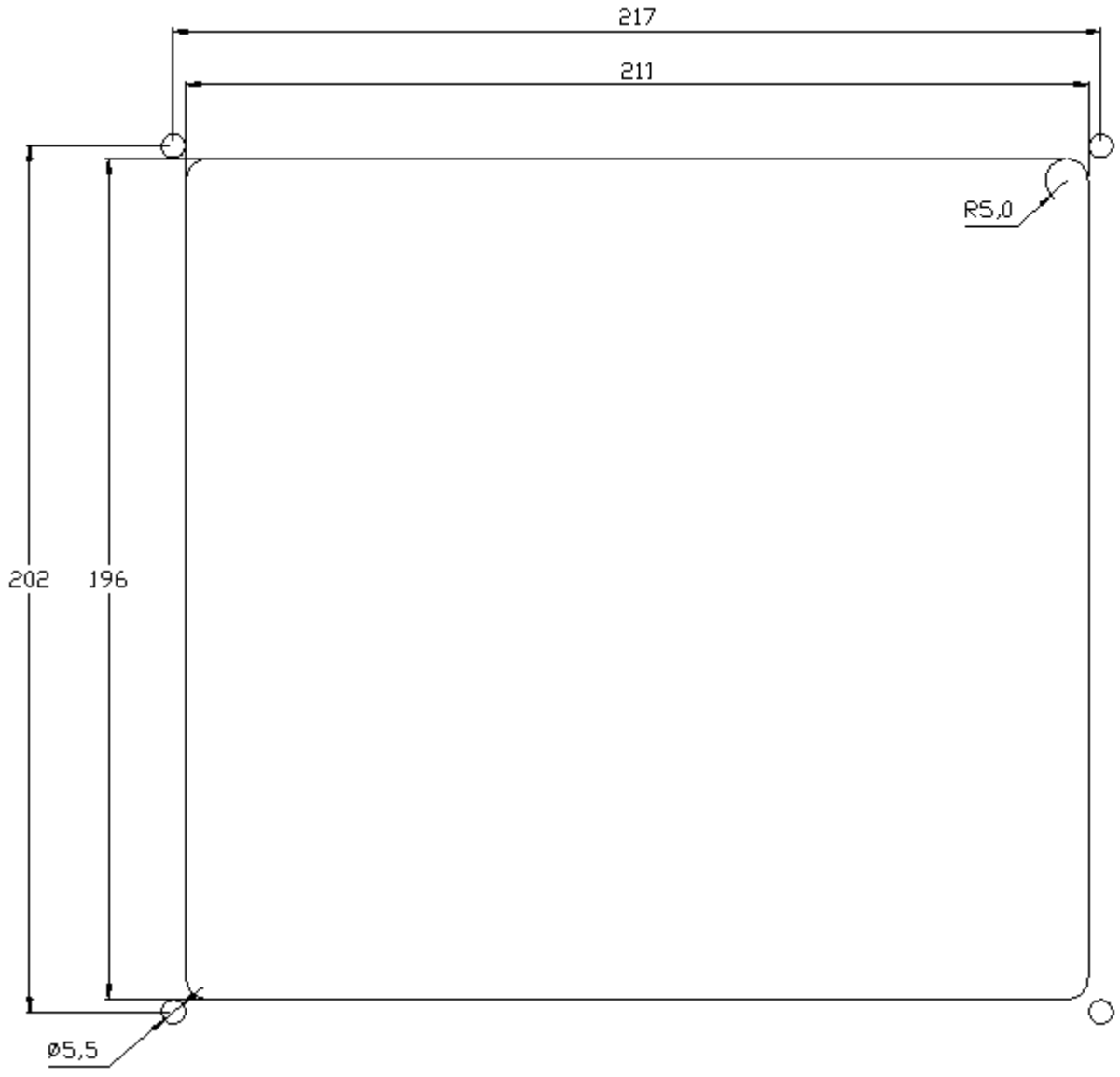


Figure 15 Flush Mounting Cut-out for Remote Display Unit

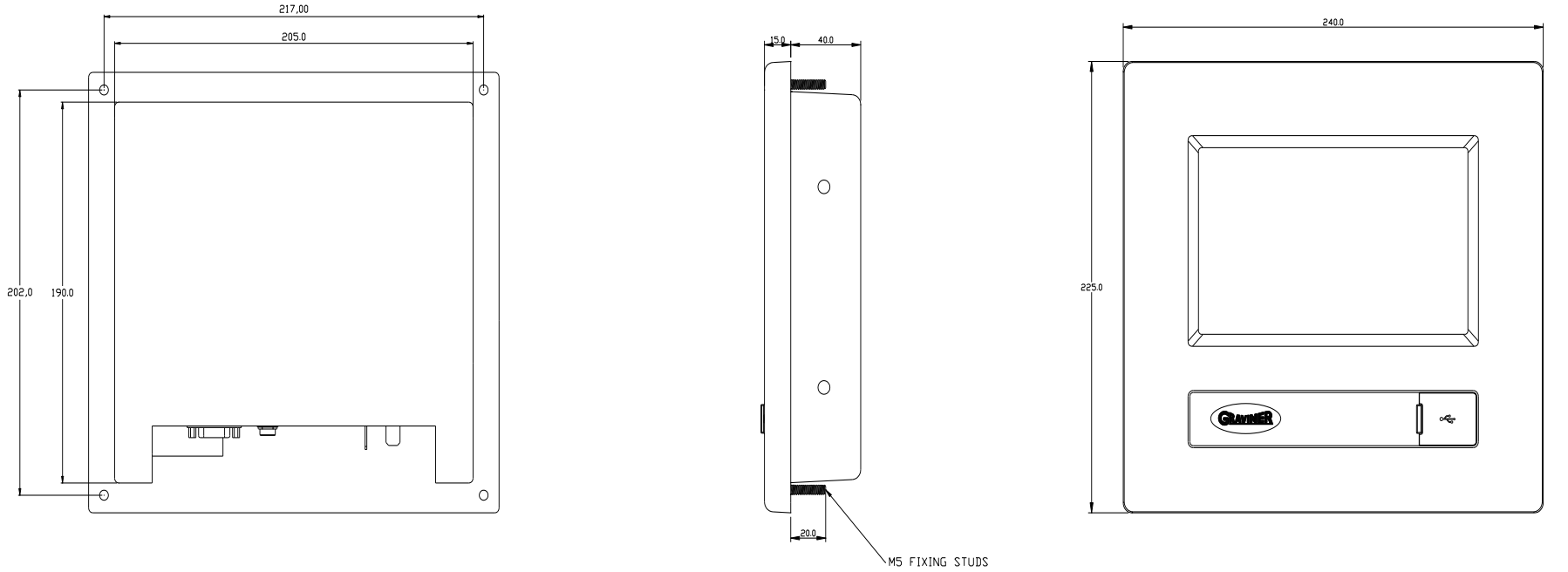


Figure 16 Flush Mounting for Remote Display Unit

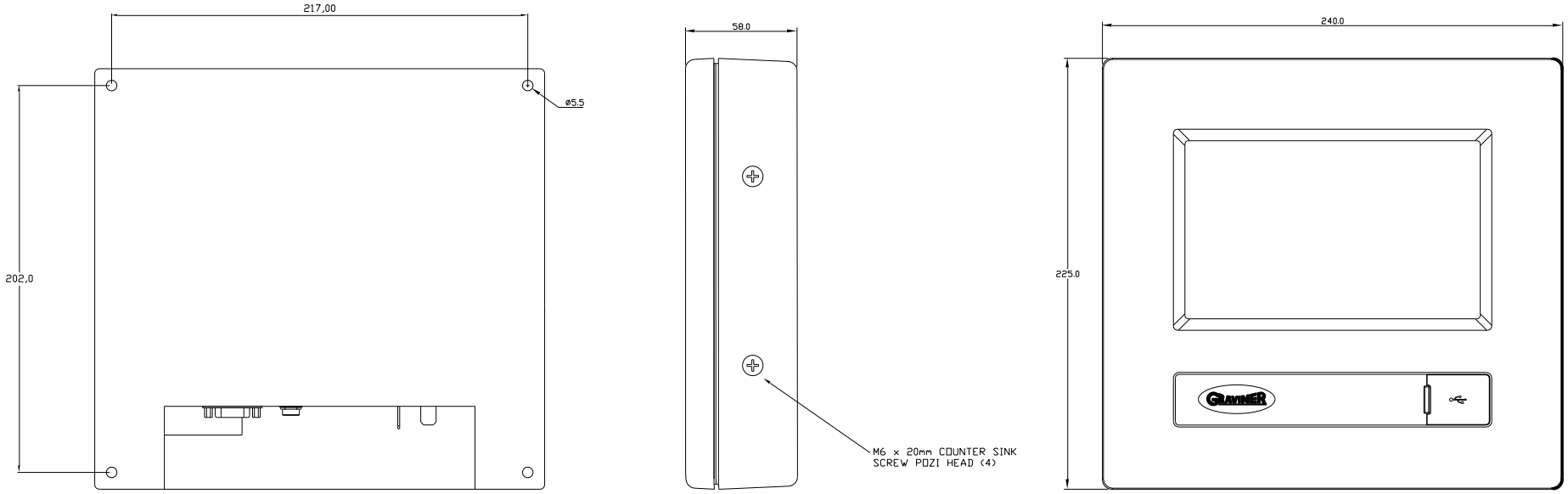


Figure 17 Bulkhead Mounting for Remote Display Unit

2.6 REMOTE DISPLAY UNIT CABLING

24v DC Input supply

The Mk7 Remote Display Unit should be powered from a floating 24v DC supply (+30% -25%) rated at 1.5 Amp continuous rated, with 2.5Amp surge for 1.5ms.

The external supply should be connected via a Hirschmann GM216 NJ power connector.

PLEASE NOTE: - The Remote Display Unit may not operate correctly if the external 24v power supply is referenced to the vessel earth. There is also a risk the input protection circuitry in the unit could be damaged.

Cable type – 2 Cores + Earth, CSA 1.5mm^2, fine stranded bare copper wires, braided screen, low smoke halogen free sheath, outside diameter 10mm (max), operating temperature 0ºC + 80ºC.

Cables should be segregated from high voltage cables and follow good installation practice

Suggested cables

Lapp Kabel	1.5mm2 Ölflex Classic 110CH - 10035068
Prysmian	LSM-HF 3 core 1.5mm2
Helkama	LKAM-HF 3 core 1.5mm2

The 24v DC connection to the Remote Display Unit may be made using the pre-terminated 5m cable, 1-43682-K296. The cable may be cut to length or extended depending on the distance between the Remote Display Unit and the 24v DC power source.

Alternatively, a single length of cable may be used between the 24v power supply and the Remote Display Unit. Using this method, the cable must be terminated in using a Hirschmann GM216 NJ power connector, 1-27400-K304.

Refer Figure 18 for 24vDC Socket wiring drawing.

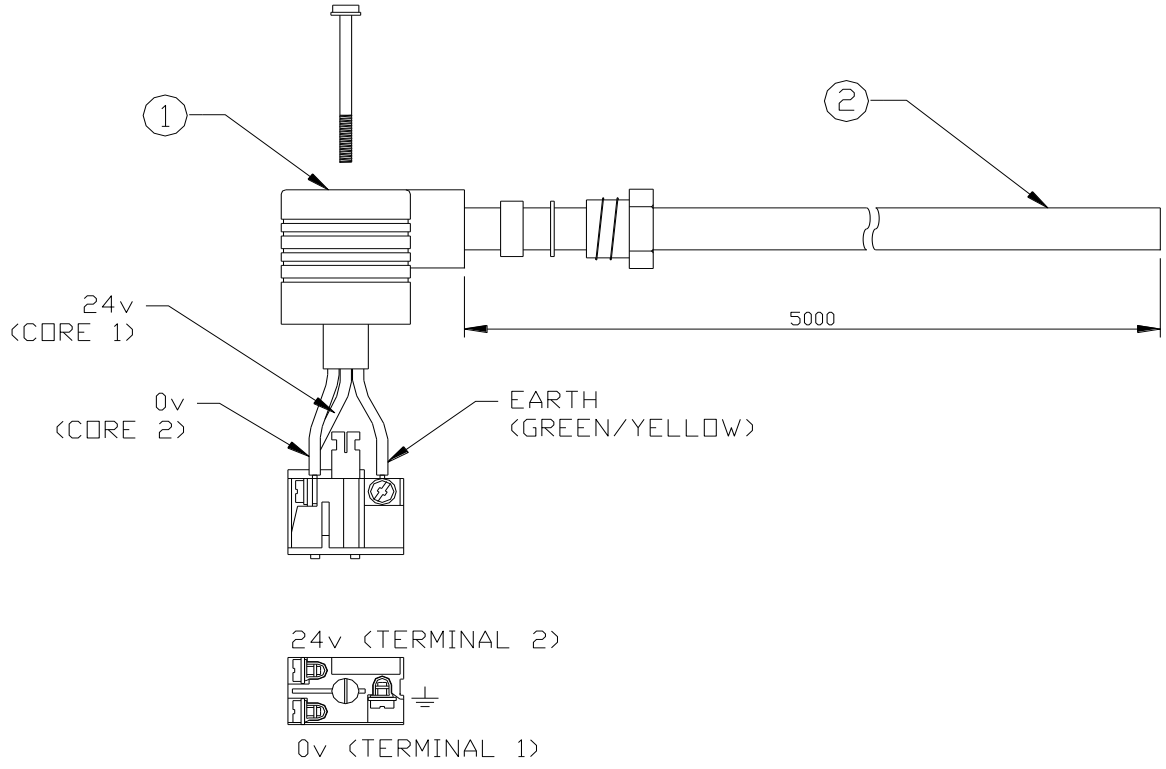


Figure 18 24v DC Socket Wiring Drawing

Refer Figure 20 for connection location.

Modbus

Cable type – Individually screened 2 pair data cable, 24AWG, low capacitance, low smoke halogen free. Outer diameter 7mm (max)

To prevent signal crosstalk OMD cables should be segregated from high voltage cables and follow good installation practice

Please Note: The Remote Display Unit Modbus data cable should NOT be connected when the power is applied to the unit.

Suggested cables:

FS Cables	2402PIFFH
Beldon	9729
Helkama	RFE-HF(i) 2x2x0.75
Jinro	60V RCOP(IS)

The above cable should be used to connect between the control unit and either the ships AMS system or the Remote Display Unit

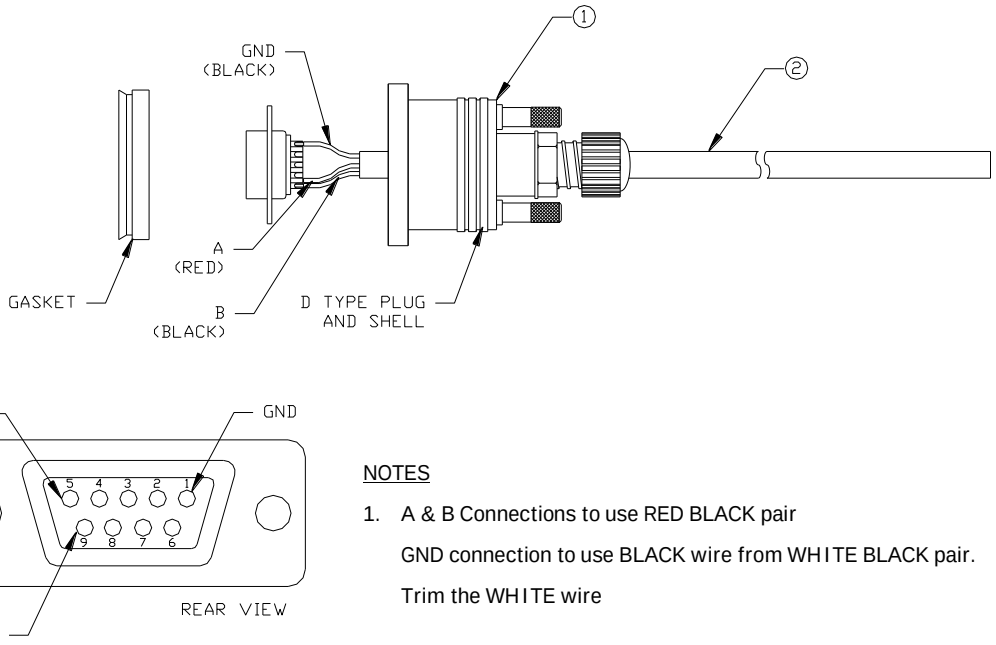
The Modbus connection to the Remote Display Unit may be made using the pre-terminated 5m cable, 1-43682-K297. The cable may be extended to provide the required length to the Control Unit.

Refer Figure 21, Figure 22 and Figure 23 for cable extension methods

Alternatively, a single length of cable may be used between the Control Unit and the Remote Display Unit. Using this method, the cable must be terminated in using a 9 pin D type connector + IP65 shell, 1-27400-K305.

Refer Figure 19 for Modbus Connector Wiring Drawing.

Refer Figure 20 for connector location.



NOTES

1. A & B Connections to use RED BLACK pair

   GND connection to use BLACK wire from WHITE BLACK pair.

   Trim the WHITE wire

Figure 19 Modbus Connector Wiring Drawing

Figure 20 Remote Display Unit 1-53836-K271

The use of RS485 based signalling allows the RDU and Control Unit to be located a large distance apart. The following drawings show the wiring pin out for 3 methods of connecting the extended Modbus cable.

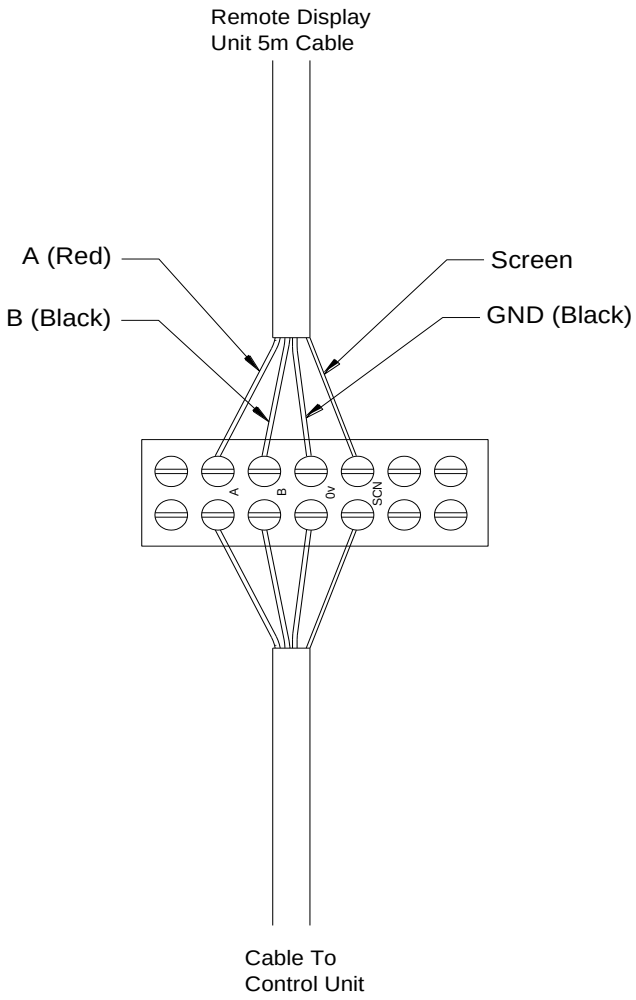


Figure 21 Terminal Block Connection

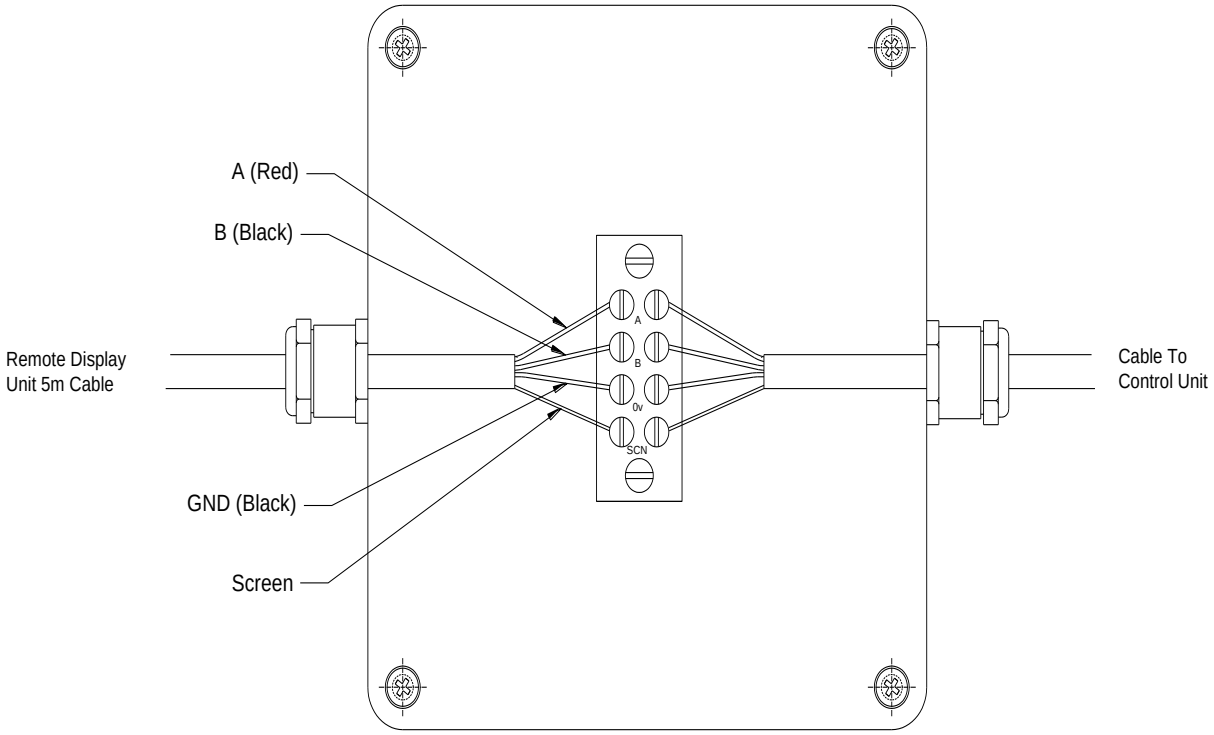


Figure 22 Junction Box Connection

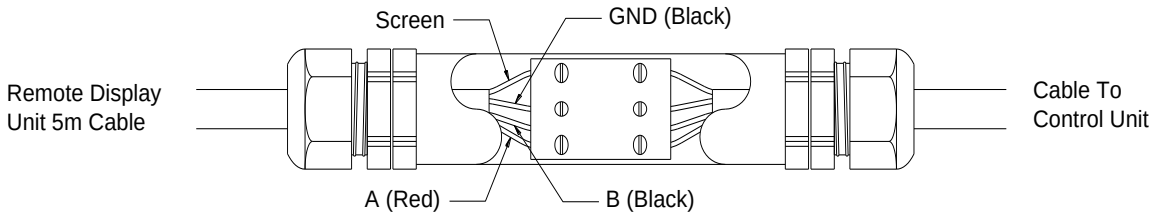


Figure 23 Inline Connector

2.7 CONNECTING THE SYSTEM

2.7.1 Input power

+24 V dc and 0 V dc power input cables for the Control Unit should be terminated onto Supply Input (terminal block TB1).

Cables should be segregated from high voltage cables and follow good installation practice

Note all terminations should be made using crimped wires.

For each of the power connections strip the power cable to the required length to connect to the terminals in the Control Unit. Then remove approximately 1cm of the outer sheath to expose the cable screen as shown below.

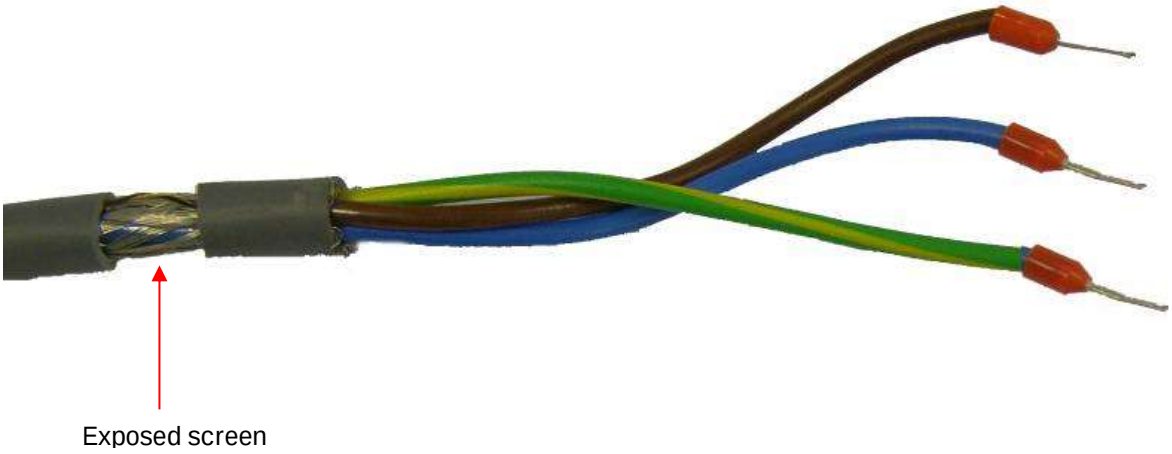


Figure 24 Power cable

Feed the cable into the Control Unit via a metal IP65 EMC gland supplied, ensuring that the metal prongs make a good contact with the exposed cable screen as shown below.

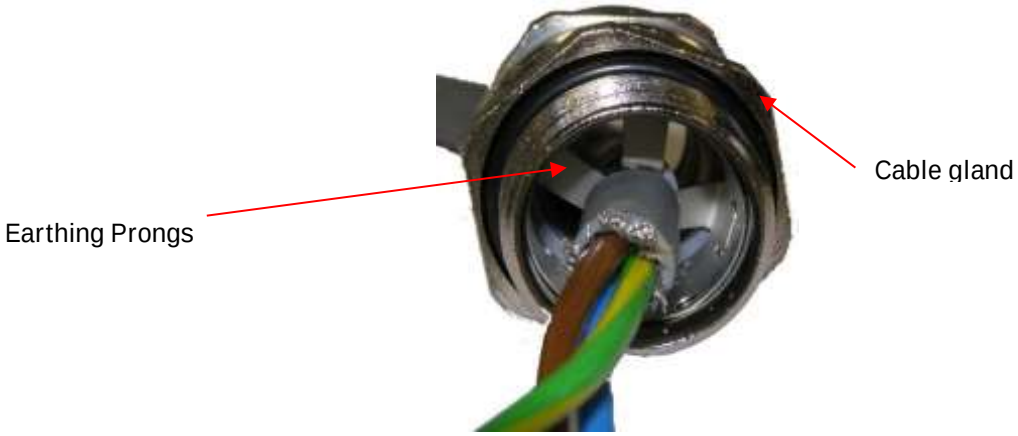


Figure 25 Power cable through EMC gland

Alternatively, both the earth and screen of the cable may be terminated in the screen terminal, SCN, provided in the SUPPLY INPUT terminal block.

Both the earth and the screen of the cable should be connected to earth at the 24v DC power supply.

2.7.2 Relay Cables

The connection to the Slowdown/Shutdown relay, Pre-Alarm relay, Backup Alarm relay and Fault relay at the Control Unit should be made using screened cable. For each of the relay connections strip the cable to the required length to connect to the terminals in the Control Unit. Then remove approximately 1cm of the outer sheath to expose the cable screen as shown below.

Cables should be segregated from high voltage cables and follow good installation practice

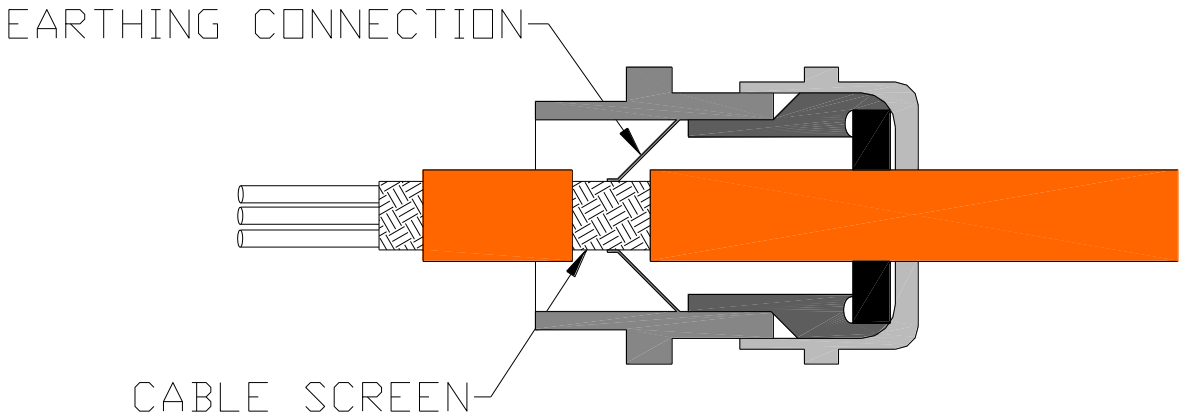


Figure 26 Control unit relay cable assembly

Feed the cable into the control unit via a metal IP65 EMC gland supplied, ensuring that the metal prongs make a good contact with the exposed cable screen as shown.

2.7.3 Control Unit to Detector Connections

At the Detector, screw the connector to the top of the Detector.

Figure 27 Detector cable assembly

At the Control Unit, screw the connector to the input required.

Note: Numbering indicates correct Detector installation position.

Figure 28 Control unit - Detector cable assembly

2.7.4 Modbus Cables

The Modbus connection between the Remote Display Unit and the first Control Unit should be made using a suitable cable, refer to section 2.6. For each of the Modbus connections strip the cable to the required length to connect to the terminals in the Control Unit, including the drain wires for the cable screens. The wires should be terminated into the MODBUS IN terminals.

Subsequent Control Units should be connected using the MODBUS OUT terminals to the MODBUS IN terminals. The end of line jumpers indicated in Figure 8 should be fitted only in the last Control Unit connected.

When connecting between the Remote Display Unit and the Control Unit the 24v power supply cable should be connected to the Remote Display Unit before connecting the Modbus cable.

A system wiring diagram is shown in Figure 29.

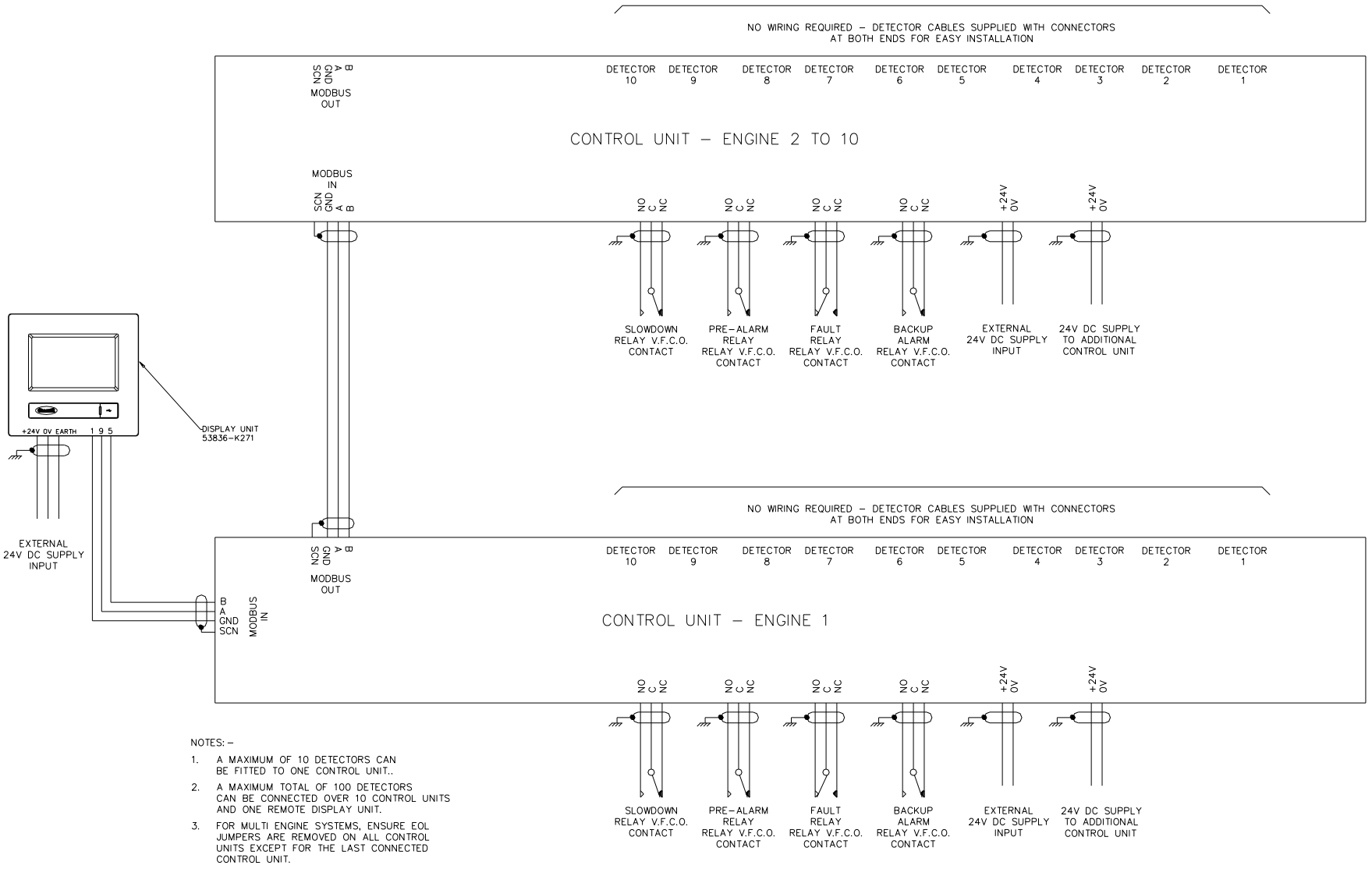


Figure 29 Wiring Drawing

2.8 SYSTEM CHECKS PRIOR TO SWITCHING ON

2.8.1 Ensure that the 24v DC input power supply cable is connected correctly at each Control Unit (if more than one installed).

2.8.2 Check the cable run of all Modbus Communication cables between all installed Control Units to each other and to the Remote Display Unit (if installed) or AMS to ensure that it is not damaged.

2.8.3 Ensure that the Modbus Communication (if required) is terminated correctly at each Control Unit (if more than one installed and/or Remote Display Unit installed or connected to AMS).

2.8.3.1 If more than one Control Unit is installed, please ensure the End of Line (EOL) jumpers are removed from all Control Units (refer Figure 8) except for the highest Modbus addressed Control Unit.

2.8.3.2 Make sure that the Modbus addresses are set as required, refer section 2.10 for procedure.

2.8.4 Ensure that the Backup Alarm, Pre-Alarm, Fault and Slowdown/Shutdown relays are connected correctly at each Control Unit (if more than one installed).

2.8.5 Ensure the detectors are connected to each Control Unit in the correct number sequence.

2.8.6 Ensure all unused Glands are removed from all Control Units and replaced by Blanking Plugs.

2.8.7 Ensure that the power supply and Modbus Communication cables are connected correctly at the Remote Display Unit (if installed).

2.8.8 Ensure that the input voltage at the Control Unit(s) and the Remote Display Unit (If installed) is a clean 24 V dc (+30%, - 25%)

2.8.9 When all the above have been checked and are satisfactory the system is ready to switch on.

2.8.10 Allow the engine to reach its' normal operating temperature before continuing to System Configuration and Commissioning.

Oil Mist alarm levels should be set to a level above the actual normal operating level displayed,

2.9 SYSTEM SETUP / CONFIGURATION – WITH A REMOTE DISPLAY UNIT

With all connections completed and checked, power up the Control Unit(s) and Remote Display Unit, the following power up screen will show for a few seconds on the Remote Display Unit.

If there is more than one Control Unit connected to the display the Modbus address needs to be set up via the USB connection on the Control Unit before it can talk to the Remote Display Unit. Please refer to section 2.10 for the Modbus address setup.

Figure 30 Remote Display Unit Splash Screen

After a few seconds the following will be seen on the Remote Display Unit, this shows one engine connected but may show up to ten engines.

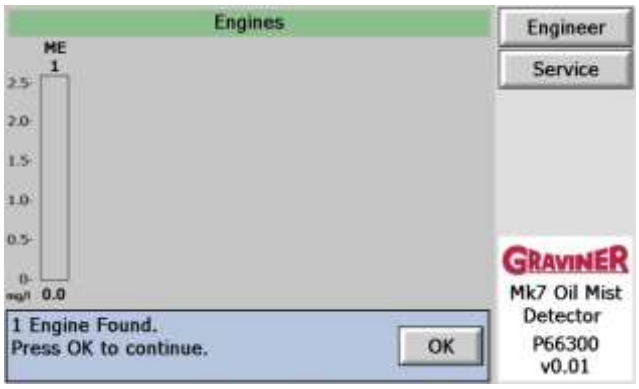


Figure 31 Detecting Engines

Press 'OK'

A bar graph should be displayed for each Control Unit connected to the Remote Display Unit.

Press the 'Engineer' button to log in as an Engineer.

Note – To setup Engine and Detectors and Save Logs, you must be logged in as an Engineer.

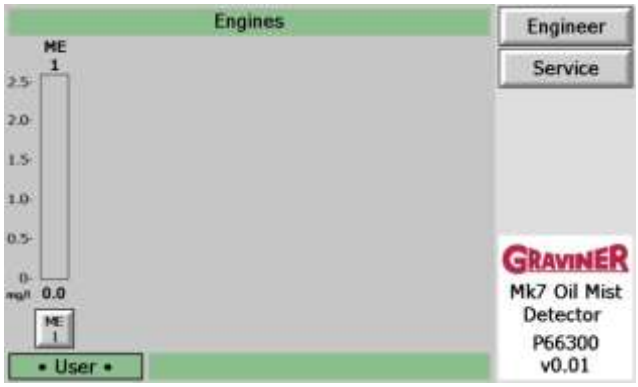


Figure 32 Engine Overview Screen – User Level

Enter password 012345.

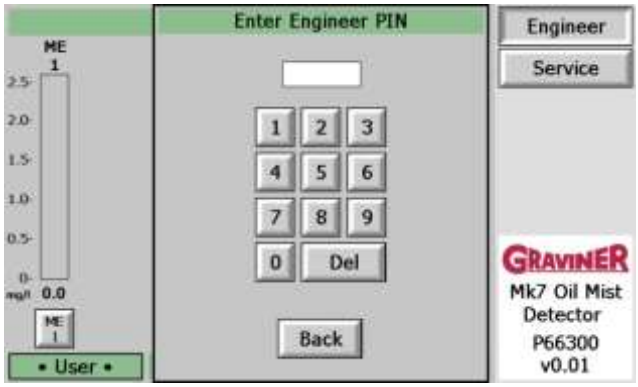


Figure 33 Engineers Login Screen

The current access level 'Engineer' will be displayed at the bottom left of the screen

Press 'Menu' Button to display the Engineers menu.

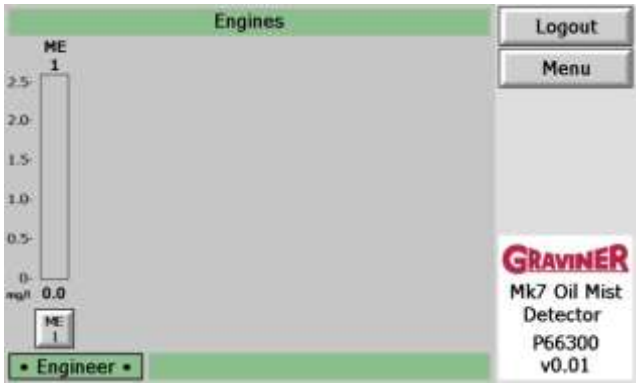


Figure 34 Engine Overview Screen – Engineer Level

To set or change Engine Names press ‘Engine Names’.

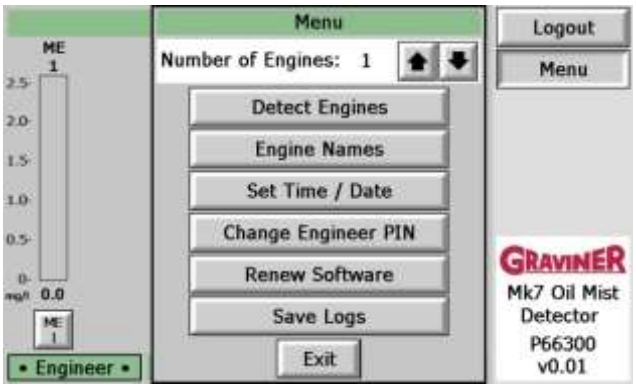


Figure 35 System Configuration Menu

Press the up and down arrows to cycle through possible Engine Names, this figure shows one engine connected but may show up to ten.

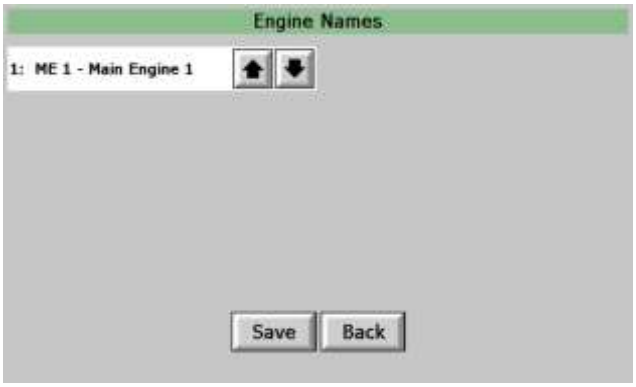


Figure 36 Engine Names Screen

Please see below for the full list of Engine Names.

Press ‘Save’ once your desired name is selected for each Engine.

Engine Name Selection List (supported by Control Unit Software versions to P66200-107 and lower)

Text label	Displayed on Icon as
Main Engine 1	ME 1
Main Engine 2	ME 2
Fuel Supply Unit	FSU
Generator 1	G/E 1
Generator 2	G/E 2
Generator 3	G/E 3
Generator 4	G/E 4
Generator 5	G/E 5
Generator 6	G/E 6
Generator 7	G/E 7
Generator 8	G/E 8
Generator 9	G/E 9
Generator 1	GEN 1
Generator 2	GEN 2
Generator 3	GEN 3
Generator 4	GEN 4
Generator 5	GEN 5
Generator 6	GEN 6
Generator 7	GEN 7
Generator 8	GEN 8
Generator 9	GEN 9

Text label	Displayed on Icon as
Auxiliary Engine 1	AUX 1
Auxiliary Engine 2	AUX 2
Auxiliary Engine 3	AUX 3
Auxiliary Engine 4	AUX 4
Auxiliary Engine 5	AUX 5
Auxiliary Engine 6	AUX 6
Auxiliary Engine 7	AUX 7
Auxiliary Engine 8	AUX 8
Auxiliary Engine 9	AUX 9
No name	

Engine Name Selection List (supported by Control Unit Software versions P66200-108 and above)

Text label	Displayed on Icon as
Main Engine 1	ME 1
Main Engine 2	ME 2
Main Engine 3	ME 3
Main Engine 4	ME 4
Main Engine 5	ME 5
Main Engine 6	ME 6
Main Engine 7	ME 7
Main Engine 8	ME 8
Main Engine 9	ME 9
Main Engine 10	ME 10
Main Engine Starboard	ME STB
Main Engine Port	ME PRT
Main Engine Forward	ME FWD
Main Engine Aft	ME AFT
Main Engine 1 Forward	ME1 FWD
Main Engine 1 Aft	ME1 AFT
Main Engine 2 Forward	ME2 FWD
Main Engine 2 Aft	ME2 AFT
Main Engine 3 Forward	ME3 FWD
Main Engine 3 Aft	ME3 AFT
Main Engine 4 Forward	ME4 FWD
Main Engine 4 Aft	ME4 AFT
Generator 1	G/E 1
Generator 2	G/E 2
Generator 3	G/E 3
Generator 4	G/E 4
Generator 5	G/E 5
Generator 6	G/E 6
Generator 7	G/E 7
Generator 8	G/E 8
Generator 9	G/E 9

Text label	Displayed on Icon as
Generator 1	GEN 1
Generator 2	GEN 2
Generator 3	GEN 3
Generator 4	GEN 4
Generator 5	GEN 5
Generator 6	GEN 6
Generator 7	GEN 7
Generator 8	GEN 8
Generator 9	GEN 9
Auxiliary Engine 1	AUX 1
Auxiliary Engine 2	AUX 2
Auxiliary Engine 3	AUX 3
Auxiliary Engine 4	AUX 4
Auxiliary Engine 5	AUX 5
Auxiliary Engine 6	AUX 6
Auxiliary Engine 7	AUX 7
Auxiliary Engine 8	AUX 8
Auxiliary Engine 9	AUX 9
Unit 1	UNI 1
Unit 2	UNI 2
Unit 3	UNI 3
Unit 4	UNI 4
Fuel Supply Unit 1	FSU 1
Fuel Supply Unit 2	FSU 2
Fuel Supply Unit 3	FSU 3
Fuel Supply Unit 4	FSU 4
No name	

Press 'OK'.

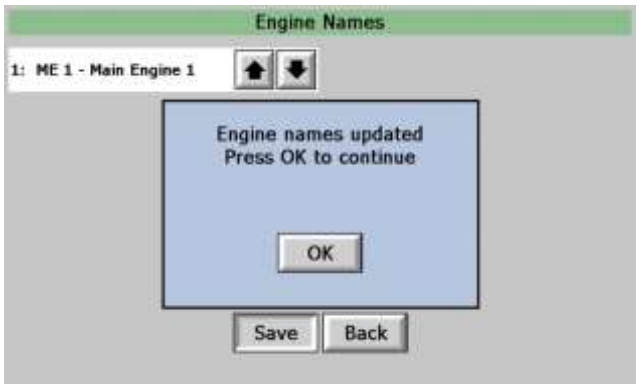


Figure 37 Engine Names Saved

The Display will return to the System Configuration Menu screen, Figure 35

To change the Time & Date press 'Set Time / Date on the System Configuration Menu, Figure 35

Use numeric keys to set the Time and Date. Press 'OK' when complete

Note – Time and Date must be entered even if the correct Time and Date is displayed.

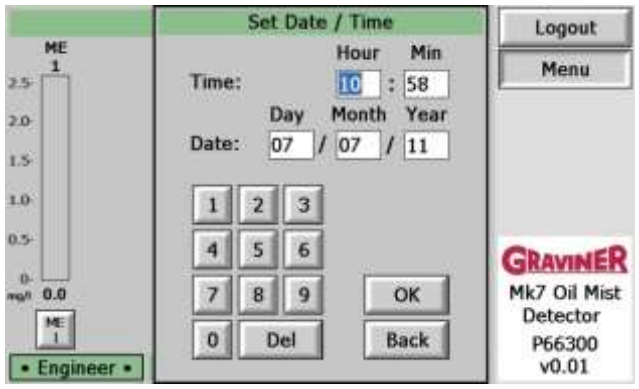


Figure 38 Set Time / Date Screen

Press 'OK',

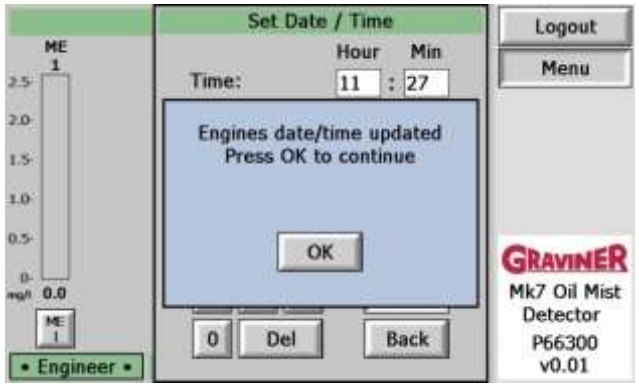


Figure 39 Save Time / Date

The Display will return to the System Configuration Menu screen, Figure 35

To change the Engineer PIN press 'Change Engineer PIN'.

Use numeric keys to enter a new 6-digit pin and then store in a safe place where only authorised users can access it

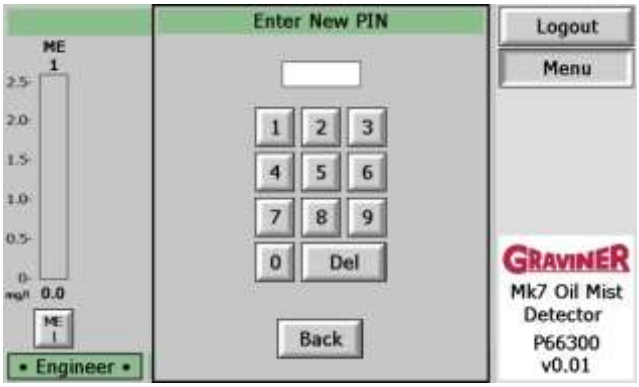


Figure 40 Engineers New Pin Screen

Use numeric keys to re-enter the new 6-digit pin.

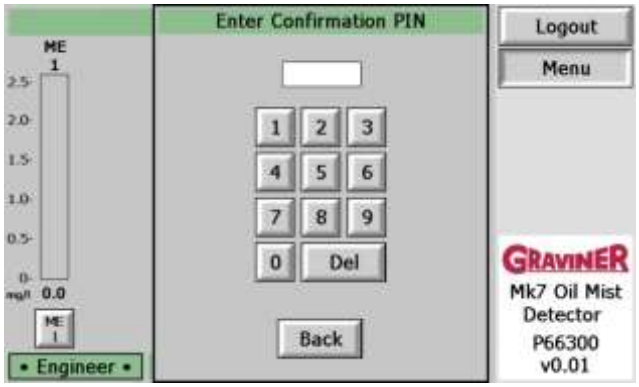


Figure 41 Engineers New Pin Confirmation Screen

Press 'OK'

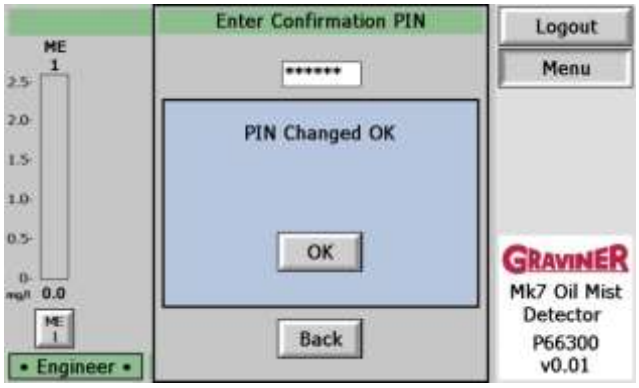


Figure 42 Save New Engineers Pin

The Display will return to the System Configuration Menu screen, Figure 35

Note: If the pin number is lost Engineer access can be gained using the default pin number, 012345.

To save the event Log press ‘Save Logs’

Figure 43 Saving Event Log Screen

Press ‘OK’

Figure 44 Event Log Saved

The Display will return to the System Configuration Menu screen, Figure 35

Note – Once the Logs are saved, only Carrier approved Service Providers can download them.

Press ‘Exit’ to return to Engines Overview screen, Figure 34

To setup the Detectors on each Engine, press the button under the mg/l display for the Engine being setup.

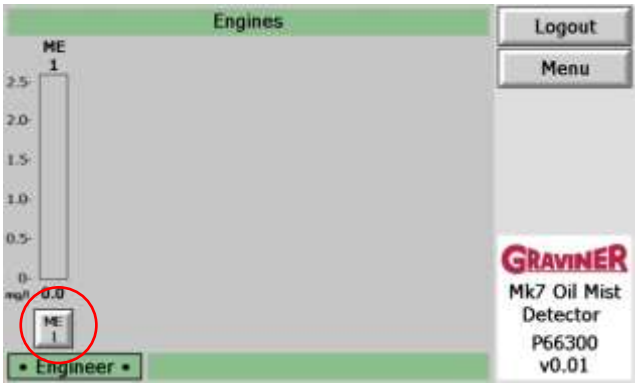


Figure 45 Engine Selection

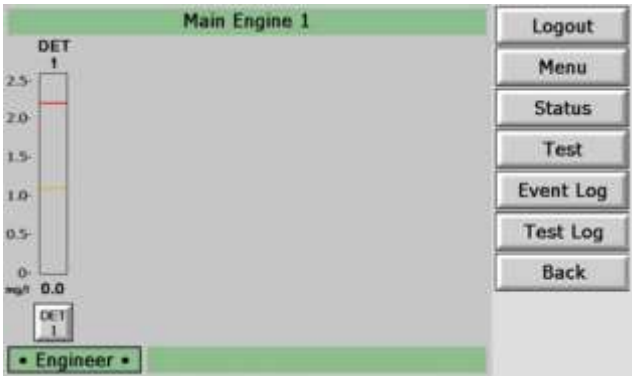


Figure 46 Engine Screen – Engineers Level

Press 'Menu' to display the Engine Menu.

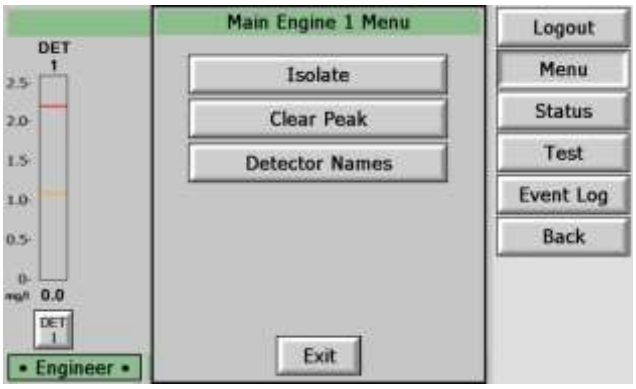


Figure 47 Engine Menu

To set or change Detector Names press 'Detector Names'.

Press the up and down arrows to scroll through possible Detector Names, this figure shows one detector connected but may show up to ten Detectors.

Please see below for the full list of Detector Names.

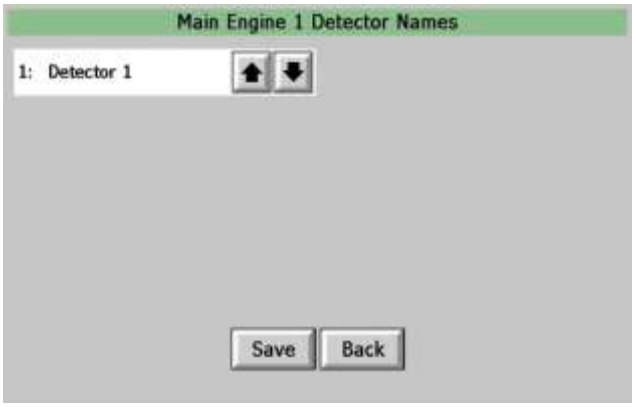


Figure 48 Detector Names Screen

Press 'Save' once your desired name is selected for each Detector.

Detector Name Selection List (supported by Control Unit Software versions P66200-107 and below)

Text label	Displayed on Icon as
Detector 1	DET 1
Detector 2	DET 2
Detector 3	DET 3
Detector 4	DET 4
Detector 5	DET 5
Detector 6	DET 6
Detector 7	DET 7
Detector 8	DET 8
Detector 9	DET 9
Detector 10	DET 10
Detector 11	DET 11
Detector 12	DET 12
Detector 13	DET 13
Detector 14	DET 14
Detector 15	DET 15
Detector 16	DET 16
Detector 17	DET 17
Detector 18	DET 18
Detector 19	DET 19
Detector 20	DET 20
Cylinder 1	CYL 1
Cylinder 2	CYL 2
Cylinder 3	CYL 3
Cylinder 4	CYL 4
Cylinder 5	CYL 5
Cylinder 6	CYL 6
Cylinder 7	CYL 7
Cylinder 8	CYL 8
Cylinder 9	CYL 9
Cylinder 10	CYL 10
Cylinder 11	CYL 11
Cylinder 12	CYL 12
Cylinder 13	CYL 13
Cylinder 14	CYL 14
Cylinder 15	CYL 15
Cylinder 16	CYL 16
Cylinder 17	CYL 17
Cylinder 18	CYL 18
Cylinder 19	CYL 19
Cylinder 20	CYL 20
Fuel Supply Unit 1	FSU 1
Fuel Supply Unit 2	FSU 2
Fuel Supply Unit 3	FSU 3
Fuel Supply Unit 4	FSU 4
Fuel Supply Unit 5	FSU 5
Chain Case	C/C
Gear Box	G BOX
Gear Box 1	GB 1
Transfer Box	T BOX
Thrust Bearing	THR BRG
Moment Compensator	MOM CPT

Detector Name Selection List (supported by Control Unit Software versions P66200-108 and above)

Text label	Displayed on Icon as
Detector 1	DET 1
Detector 2	DET 2
Detector 3	DET 3
Detector 4	DET 4
Detector 5	DET 5
Detector 6	DET 6
Detector 7	DET 7
Detector 8	DET 8
Detector 9	DET 9
Detector 10	DET 10
Detector 11	DET 11
Detector 12	DET 12
Detector 13	DET 13
Detector 14	DET 14
Detector 15	DET 15
Detector 16	DET 16
Detector 17	DET 17
Detector 18	DET 18
Detector 19	DET 19
Detector 20	DET 20
Cylinder 1	CYL 1
Cylinder 2	CYL 2
Cylinder 3	CYL 3
Cylinder 4	CYL 4
Cylinder 5	CYL 5
Cylinder 6	CYL 6
Cylinder 7	CYL 7
Cylinder 8	CYL 8
Cylinder 9	CYL 9
Cylinder 10	CYL 10
Cylinder 11	CYL 11
Cylinder 12	CYL 12
Cylinder 13	CYL 13

Text label	Displayed on Icon as
Cylinder 14	CYL 14
Cylinder 15	CYL 15
Cylinder 16	CYL 16
Cylinder 17	CYL 17
Cylinder 18	CYL 18
Cylinder 19	CYL 19
Cylinder 20	CYL 20
Fuel Supply Unit 1	FSU 1
Fuel Supply Unit 2	FSU 2
Fuel Supply Unit 3	FSU 3
Fuel Supply Unit 4	FSU 4
Fuel Supply Unit 5	FSU 5
Chain Case	C/C
Gear Box	G BOX
Gear Box 1	GB 1
Gear Box 2	GB 2
Gear Box 3	GB 3
Gear Box 4	GB 4
Gear Box 5	GB 5
Gear Box 6	GB 6
Transfer Box	T BOX
Thrust Bearing	THR BRG
Moment Compensator	MOM CPT
Hydraulic Power Station 1	HPS 1
Hydraulic Power Station 2	HPS 2
Hydraulic Power Station 3	HPS 3
Hydraulic Power Station 4	HPS 4
Fore Comp	F/C
Thrust Bearing	T/B
Chain Case Forward	C/C F
Chain Case Aft	C/C A

Press 'OK'. The display will return to the Engine Menu screen, Figure 47.

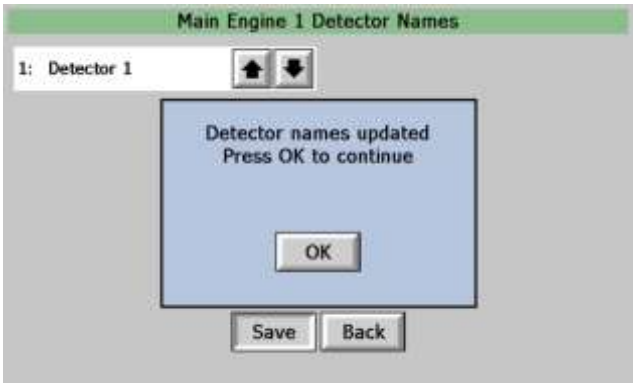


Figure 49 Detector Names Saved

Press 'Exit'. To return to the Engine Screen, Figure 46

To set the individual Detector parameters, press the button under the mg/l display for the required detector.

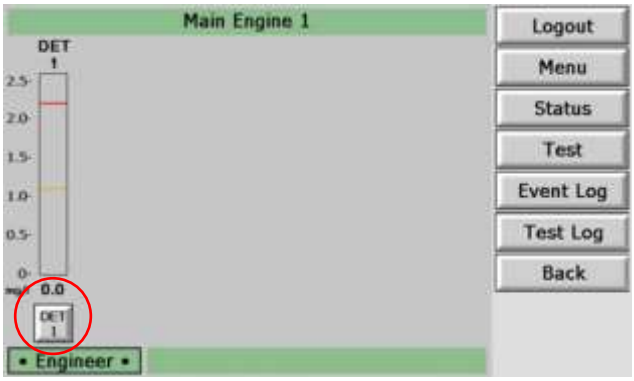


Figure 50 Detector Selection

Press 'Menu' to display the Detector Menu.

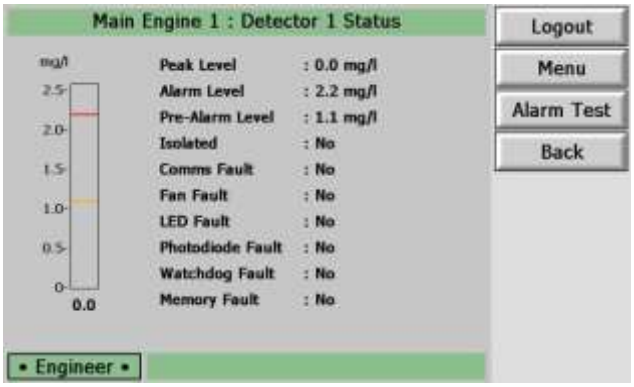


Figure 51 Detector Status Screen

Press the up and down arrows to select the desired Alarm and Pre-Alarm Levels.

Slow/Shutdown Alarm Limits	1.3 – 2.4mg/l, default 1.8mg/l
Pre-Alarm Limits	0.5 – 1.2mg/l, default 0.9mg/l

Press 'Save' once complete.

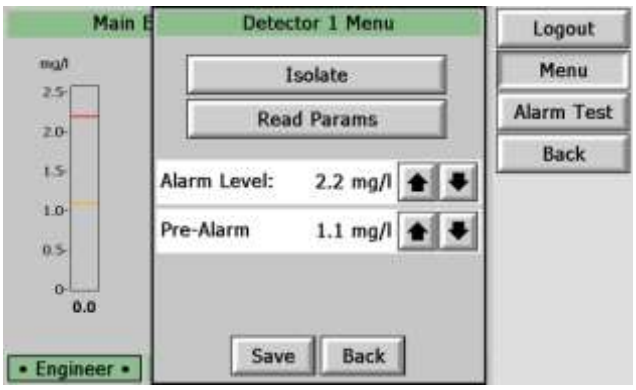


Figure 52 Detector Menu

Press 'OK'.

The display will return to the Detector Status Screen, Figure 51.

Press 'Back' to return to the detector Selection Screen, Figure 50.

Repeat setting Detector settings for the number of Detectors connected.

Figure 53 Alarm Levels Saved

Once Detectors on Engine 1 have been set, Press 'Back' to return to Engine Overview screen.

Repeat setting Engine Names & Detector settings for the number of Engines connected.

The OMD Mk7 System should now be setup.

2.10 CONTROL UNIT MODBUS ADDRESSING

When more than one Control Unit is connected on a system, the Modbus address must be set up in each Control Unit before the system will communicate correctly with a Remote Display Unit.

NOTE: – For multiple Control Units per system, each Control Unit must have its own Modbus address and they must be sequential**, i.e. 01. 02. 03 …..10**

All Control Units are configured with a Modbus address 01 (1st Control Unit) when shipped.

There are 2 methods to change the Modbus address, the first is via the Membrane (refer Section 2.10.1), the second is via the USB connection on the PCB (refer Section 2.10.2)

2.10.1 Setting the Modbus address via the Control Unit Membrane

To change the Modbus address via the front Membrane

a) With no Faults or Alarms on the Control Unit to be addressed, press the Accept button for a minimum 1sec. (Refer Figure 54)

b) Then press the Reset button for a minimum of 1sec. (Refer Figure 54)

NOTE: – The Reset button must be pressed within 5sec of pressing the Accept button

Press 'Accept' button for a minimum of 1sec Press 'Reset' button for a minimum of 1sec

Figure 54 Control Unit Membrane

a. The current Modbus address of the Control Unit will now be flashing (1sec on, 1sec off) (Refer Figure 55)

b. Press the numerical button required until the Green LED above the pressed button flashes. (i.e. For Modbus address 03, press No. 3 button (Refer Figure 56)

NOTE: – The numerical button must be pressed within 10sec of pressing the Reset button

Current Modbus address flashing

Press required numerical button for 1sec

Figure 55 Control Unit Membrane

c. The Green LED above the button pressed will now be flashing. The Control Unit will automatically store this new Modbus address.

d. When the address has been changed, the Control Unit returns to normal operation and indicates the number of detectors connected.

Repeat the above for the number of Control Units installed per system.

After the addresses have been changed, please ensure that both EOL jumpers are fitted to the last Control Unit only, all other Control Units need to have both the EOL jumpers removed.

Refer Figure 8 for EOL jumper positions.

NOTE: – The Control Units 24Vdc Power Supply needs to be removed for a period of 10sec and re-applied to ensure Modbus address changes are recognized on the Modbus network.

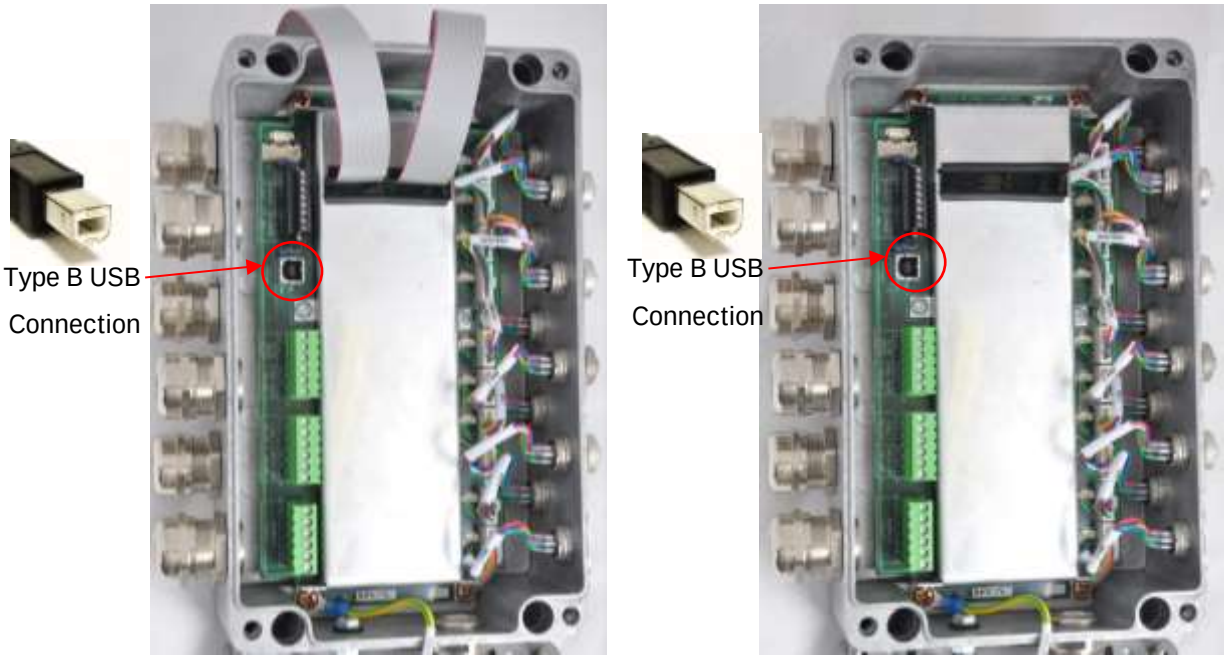
Once all Control Units have the correct Modbus addresses, the Remote Display Unit will need to be programmed to detect the required number of engines on the system (refer Section 2.10.3)

2.10.2 Setting the Modbus address via the USB connection.

To change the Modbus address via the USB connection on the PCB (Refer Figure 56)

a. Connect the 24Vdc power supply to the Control Unit to be changed.

b. Connect the USB-B end to the USB socket located on the PCB inside the Control Unit (refer Figure 56)



Control Unit – With Membrane

Control Unit – Without Membrane

Figure 56 Control Unit – USB Connector

c. Connect the other end of the USB Lead to a USB socket on your computer (refer Figure 57)

Figure 57 Computer Connection – Type A USB Connector

With the above cables connected, open the 'Mk7 Oil Mist Engine Manager' software on the computer. Version 103 and above of this software does NOT require a USB Dongle, previous versions require the USB Dongle supplied to be connected to the computer.

Click ‘Login’, then ‘Engineer’

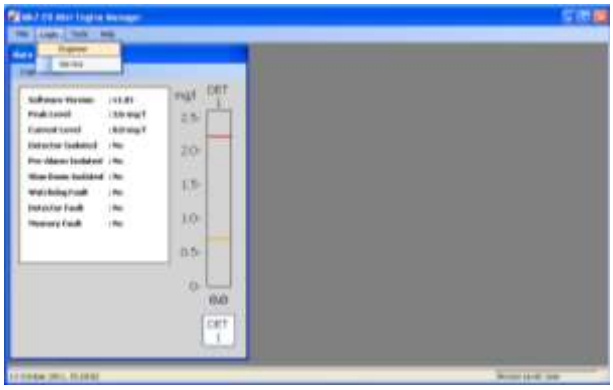


Figure 58 Engine Screen

Enter 012345 and press ‘Login’

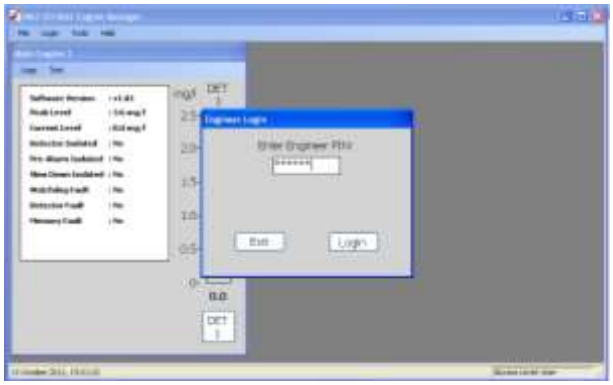


Figure 59 Engineers Login

Select the required Control Unit Address (this is the Modbus address)

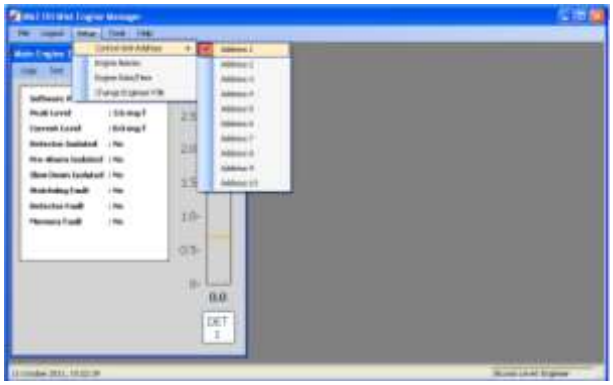


Figure 60 Select Modbus Address

Repeat the above for the number of Control Units installed per system.

After the addresses have been changed, please ensure that the EOL jumpers are fitted to the last Control Unit only, all other Control Units need to have both the EOL jumpers removed.

Refer Figure 8 for EOL jumper positions.

NOTE – The Control Units 24Vdc Power Supply needs to be removed for a period of 10sec and re-applied to ensure Modbus address changes are recognized on the Modbus network.

Once all Control Units have the correct Modbus addresses, the Remote Display Unit will need to be programmed to detect the required number of engines on the system (refer Section 2.10.3)

2.10.3 Configuring the number of engines on the Remote Display Unit

Once all Control Units have the correct Modbus addresses, the Remote Display Unit will need to be programmed to detect the required number of engines on the system.

Press the 'Engineer' button to log in as an Engineer.

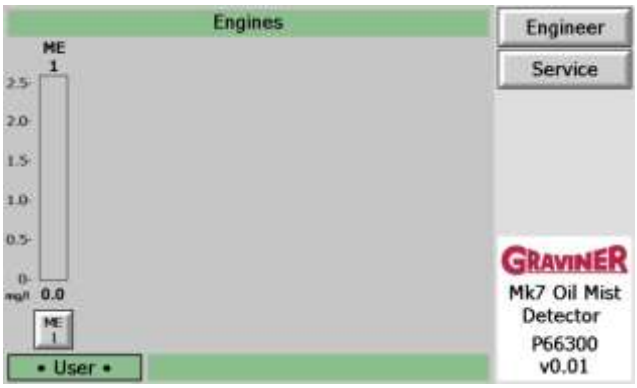


Figure 61 Engine Overview Screen – User Level

Enter password 012345.

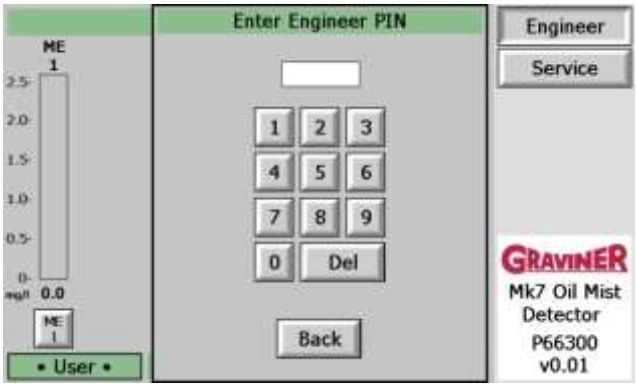


Figure 62 Engineers Login Screen

Press 'Menu' Button to display the Engineers menu.

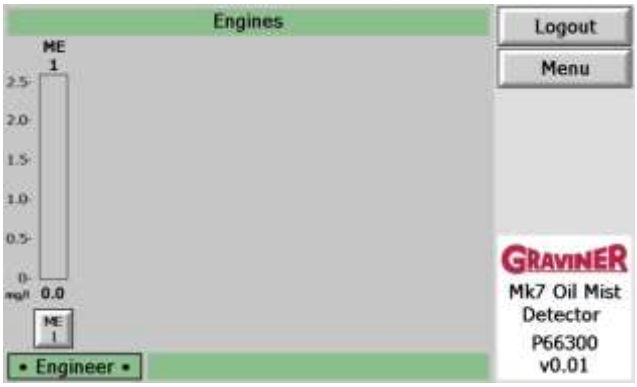


Figure 63 Engine Overview Screen – Engineer Level

Press the up and down arrows to select the number of Engines/Control units connected on the system.

Press 'Detect Engines'

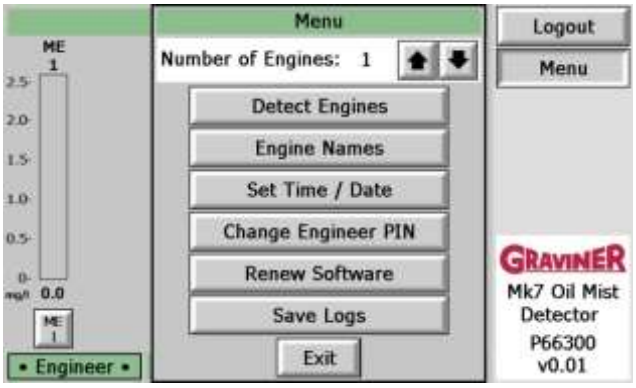


Figure 64 System Configuration Menu

After a few seconds the following will be seen on the Remote Display Unit, this shows one engine connected but may show up to ten.

Press 'OK'

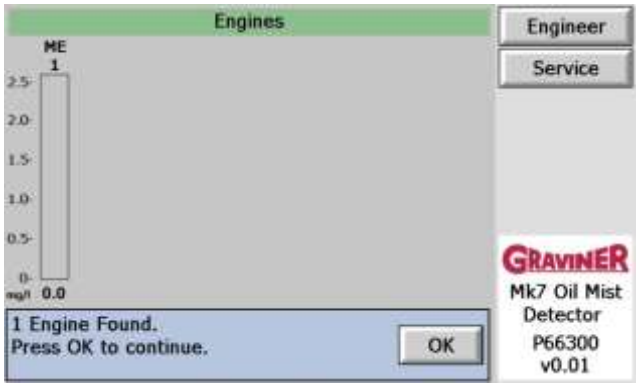


Figure 65 Detecting Engines

2.11 COMMISSIONING THE SYSTEM

Following the installation of the system the functionality should be checked to ensure that the system is operating correctly, and the required responses are produced by the AMS.

2.11.1 Visual Inspection

On each detector check that the green Power LED is on and the yellow Fault and red Alarm LED's are off.

On each Control Unit check that the green Power LED is on and that a green Operating Detector LED is on for each detector connected. All alarm and fault LED's should be off.

On the Remote Display Unit check that a bar graph is displayed for each of the Control Units connected and that the names are displayed correctly identifying each engine. Select each engine by pressing the button under the mg/l display for the Engine, check that the correct number of detectors are displayed and for each detector that the Pre-Alarm and Alarm levels indicated on the bar graphs are as expected. There should be no alarms, faults or isolations indicated.

2.11.2 Relay operation.

Each of the relay connections between the Control Unit(s) and the AMS should be tested and the required response observed.

The operation of the Fault and Pre-Alarm relays may be tested with User level access however Engineer Level access is required to test the operation of the slowdown/shutdown relay.

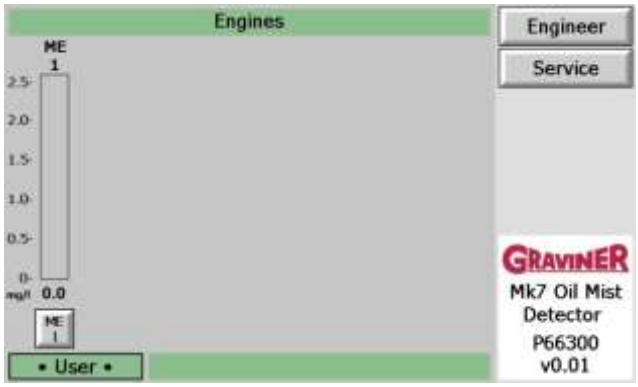


Figure 66 Engine Overview Screen – User Level

Enter password 012345.

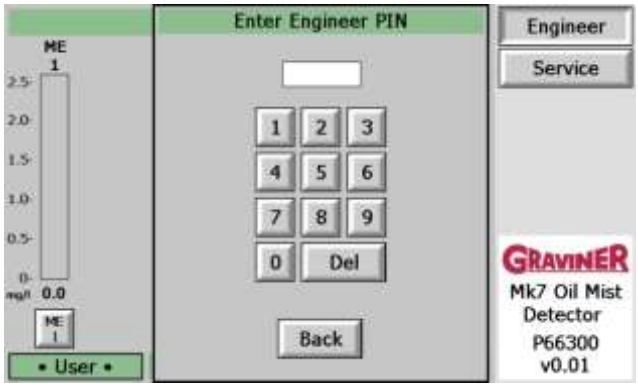


Figure 67 Engineers Login Screen

The current access level 'Engineer' will be displayed at the bottom left of the screen

Press 'Menu' Button to display the Engineers menu.

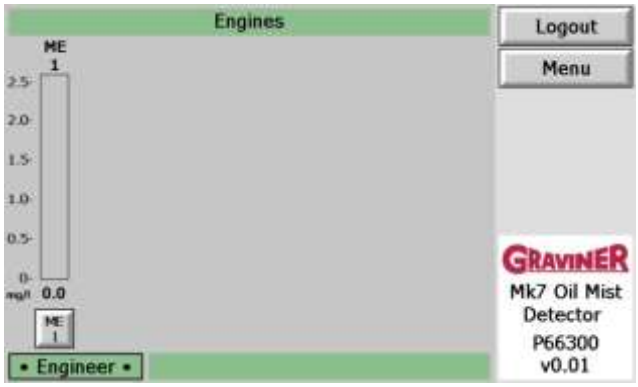


Figure 68 Engine Overview Screen – Engineer Level

Press the button under the mg/l display for the Engine to be tested

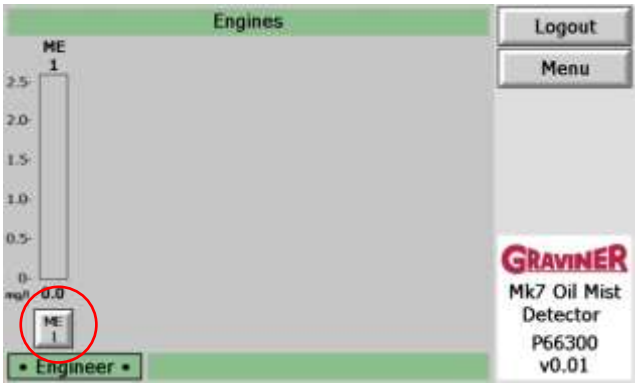


Figure 69 Engine Selection

Press the test button to bring up the Test Menu

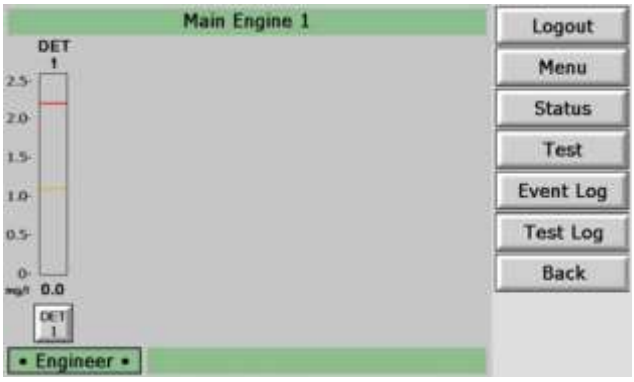


Figure 70 Engine Screen – Engineers Level

To test the Slowdown/Shutdown Relay, press the '1' button.

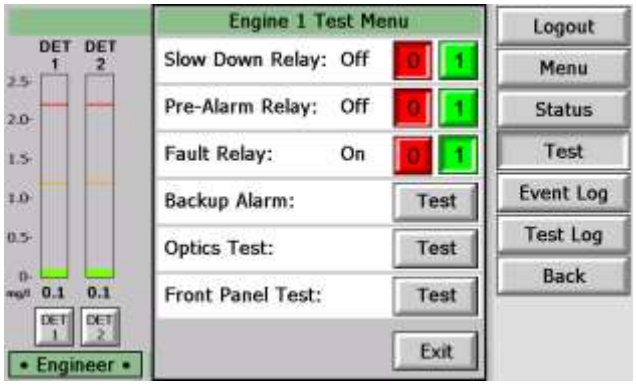


Figure 71 Test Menu – Engineers Level

Ensure that the correct engine slowdown/shutdown response is indicated by the AMS.

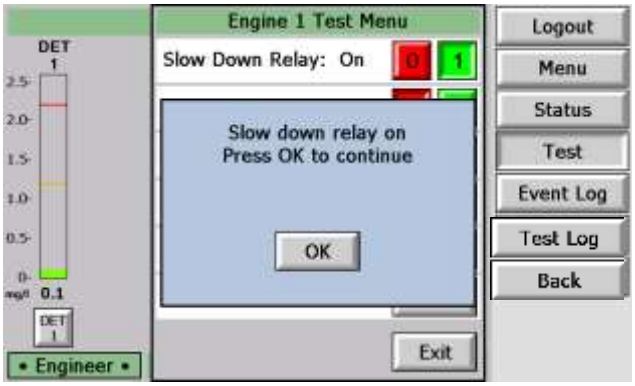


Figure 72 Slowdown Relay Test

Press 'OK'. You will be returned to Figure 71

To de-activate the Slowdown/Shutdown Relay press the '0' button

To test the Pre-Alarm Relay, press the '1' button.

Figure 73 Pre-Alarm Relay Test

Press 'OK'. You will be returned to Figure 71

Ensure that the correct engine response is indicated by the AMS.

To de-activate the Pre-Alarm Relay press the '0' button

To Test the Fault Relay, press the '0' button, the fault relay is normally energised

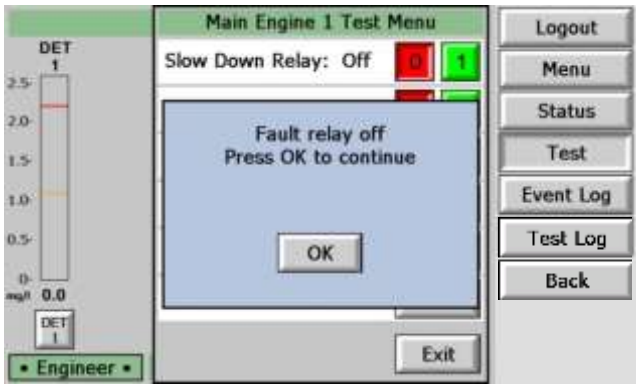


Figure 74 Fault Relay Test

Press 'OK'. You will be returned to Figure 71

Ensure that the correct engine response is indicated by the AMS.

To activate the Fault Relay press the '1' button

2.11.3 Backup Alarm Test

The Backup Alarm is a hard-wired link from each Detector installed on a Control Unit. This facility will allow any Detector which sees an oil mist level of 3.0mg/I or greater to produce a 'Back Up Alarm and operate the Backup Alarm Relay.

The integrity of the Backup Alarm signal between the Control Unit and the Detector a Backup Alarm Test should be performed.

To test the Backup Alarm, press the 'Test' button.

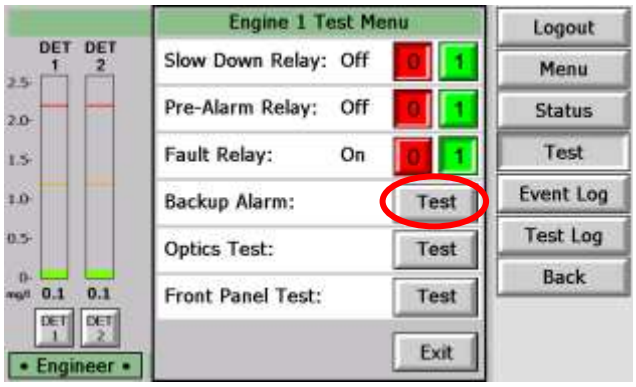


Figure 75 Test Menu – Engineers Level

After a short time the result of the test is displayed. No faults should be indicated.

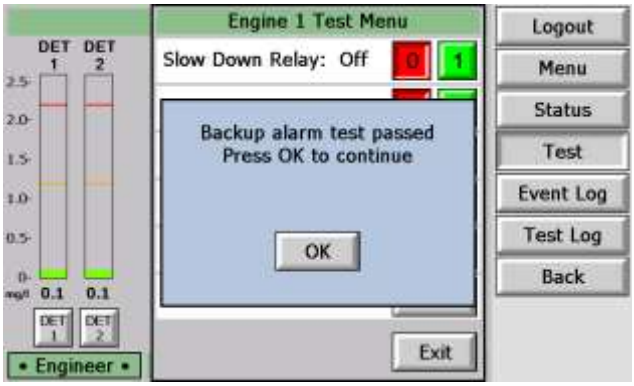


Figure 76 Test Menu – Backup Alarm OK screen

Press 'OK'. You will be returned to Figure 71

2.11.4 Detector Smoke Alarm Test

A smoke test should be performed on each detector to ensure that the correct response is obtained.

One of two methods may be used to conduct the Smoke Alarm Test.

Note: Isolation of the output relays (Pre-Alarm and Slowdown/Shutdown Relays) is required before commencing the smoke alarm test, see sections 4.1.2 and 4.1.3. If the Backup Alarm Relay is connected to the engine slowdown or shutdown system this should be disconnected.

Warning: Carrying out this test without isolation or disconnection of the output relays will cause the engine slowdown or shutdown system to operate.

Method 1 – Using a Wick

a. Cut a length of wick approximately 30 mm long. Assemble the smoke tester by pushing the wick into the wick holder fitted with the pipette bulb. Press the nylon pipe into the pipe connector (refer to Figure 77).

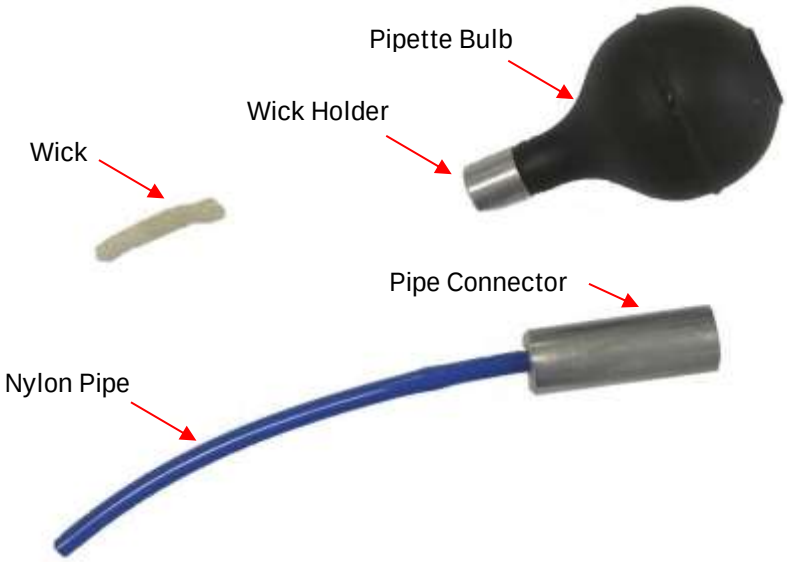


Figure 77 Smoke Tester

b. Push the nylon pipe of the smoke tester into the connector on the side of the detector base body (refer to Figure 78).

Figure 78 Smoke Test

c. Dip the wick into the bottle of smoke oil and reseal the bottle firmly

Note: Only a small quantity of oil is required.

d. Ignite the wick of the smoke tester and blow out the flame. Squeeze the pipette bulb to keep the wick smoking.

   Note: Care to be taken with this activity at all times.

e. While the wick is still smouldering, insert it into the pipe connector and squeeze the pipette bulb.

f. Observe the wick is still smouldering, insert nylon pipe into the pipe connector of the detector and squeeze the pipette bulb.

g. After tests are completed the Detector Peak Level readings should be erased. This can be done via the Engine Menu using Clear Peak. (refer Figure 106)

h. To release the pipe from the connector, press in the metal collar on the end of the connector at the same time as pulling the pipe out

i. Remove the nylon pipe from the pipe connector for stowage purposes.

j. The wick is reusable and can be left in the wick holder. Fully extinguish the wick after use at all times.

k. Refer to the Material Safety Data Sheet in the event of health or safety issues.

Method 2 - Using Artificial Smoke

It is important when using this method that only approved smoke canisters are used as other brands may deposit residue within the detector sample chamber affecting the performance.

Smoke canisters approved for use on the Graviner Mk7 Oil Mist Detection system are:

HSI Fire and Safety – SmokeCheck 25S

HIS Fire and Safety – PurCheck

When using this type of spray canister, it will inject smoke at a rate where the rise of oil mist is rapid and will pass through the alarm thresholds extremely quickly.

a. Push the nylon pipe of the smoke tester into the connector on the side of the detector base body (refer to Figure 78).

b. Using a can of artificial smoke, spray enough artificial smoke into the pipe connector to cause an alarm condition.

c. After tests are completed the Detector Peak Level readings should be erased. This can be done via the Engine Menu using Clear Peak. (refer Figure 106)

d. To release the pipe from the connector, press in the metal collar on the end of the connector at the same time as pulling the pipe out

e. Remove the nylon pipe from the pipe connector for stowage purposes.

f. Refer to the Material Safety Data Sheet in the event of health or safety issues.

   Method 2 is recommended in situations where the use of a naked flame would be hazardous.

3 OPERATION

Under normal operation the detector continuously monitors the oil mist level in the engine.

The Control Unit communicates with each connected detector to obtain the measured oil mist level and the detector status. The Control Unit determines if the measured oil mist level is above the alarm levels or if there is a fault condition and activates the appropriate relays.

The Remote Display Unit communicates with each Control Unit to obtain the oil mist levels for each detector, the system configuration data and the system status data. This information is then displayed in graphical form on a colour touch screen LCD. The touch screen allows the user to interact with the system.

3.1 SYSTEM POWER UP

On power up the system will perform a sequence of actions:

3.1.1 Detectors

The green power LED on each detector will be switched on indicating power is being supplied to the detector.

3.1.2 Control Unit – with membrane

The Control Unit software revision is indicated as four digits flashed two at a time on the detector LED's

e.g. revision 0112 would be shown as

Detector 10 Operating LED (0) and Detector 1 Fault / Isolated LED (1)
Detector 1 Operating LED (1) and Detector 2 Fault / Isolated LED (2)

The Control Unit ModBus address is shown by the Detector Fault / Isolated LED's (1 – 10)

The Control Unit switches on all the membrane LED's providing visual confirmation that all the LED's are functioning correctly. Each LED will then be switched on individually in sequence.

Following this sequence, the Power LED shall be on together with a Detector Operating LED for each connected detector.

3.1.3 Remote Display Unit

During the Remote Display Unit software initialization, the Graviner 'splash screen' will be displayed.

Figure 79 Remote Display Unit Splash Screen

After a few seconds the following will be seen on the Remote Display Unit, this shows one engine connected but may show up to ten engines.

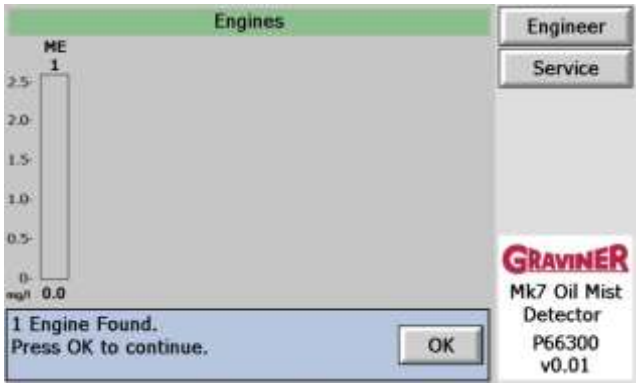


Figure 80 Detecting Engines

The display should indicate the correct number of engines have been found and a bar graph displayed for each.

The number shown in the bottom right of the display indicates the Remote Display Unit software number and version.

Press 'OK'

3.1.4 Engine Overview

During normal operation the Remote Display Unit will display the Engine Overview screen showing a bar graph for each engine.

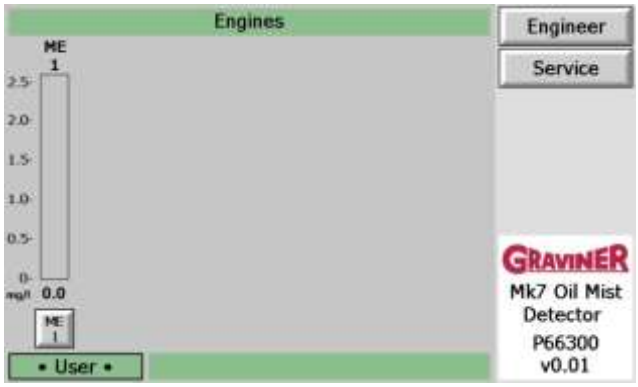


Figure 81 Engine Overview Screen – User Level

The name of the engine is shown above the bar graph and in the button below the bar graph.

The level displayed on the bar graph and numerically below the bar graph indicates the highest oil mist level being measured by one of the detectors on that engine at that moment in time. The indicated level will change real time as the oil mist level in the engine changes.

Colour coding of the bar graph indicates the alarm state of the engine:

Green	–	No alarm condition
Orange	–	Pre-Alarm
Red	–	Slowdown/Shutdown Alarm

A fault on an engine is indicated by a blue engine button

An isolation on the engine is indicated by the numerical level being replaced by ISO.

3.2 ACCESS LEVELS

There are three access levels available, each allowing access to various options within the system.

3.2.1 User Level

At power up the system defaults to User level access, allowing access to view system information. No changes can be made to the system configuration at User level.

3.2.2 Engineer Level

A 6-digit pin is required to access the Engineer Level.

To enter the Engineer Level, press the Engineer button.

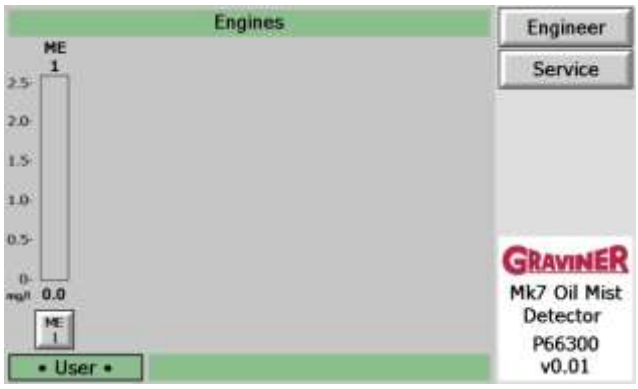


Figure 82 Engine Overview Screen – User Level

Enter password 012345.

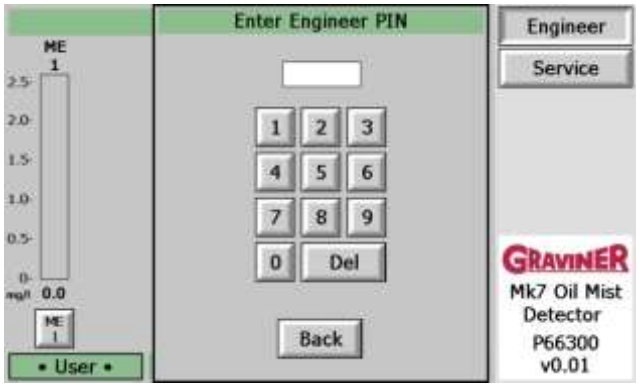


Figure 83 Engineers Login Screen

The current access level 'Engineer' will be displayed at the bottom left of the screen

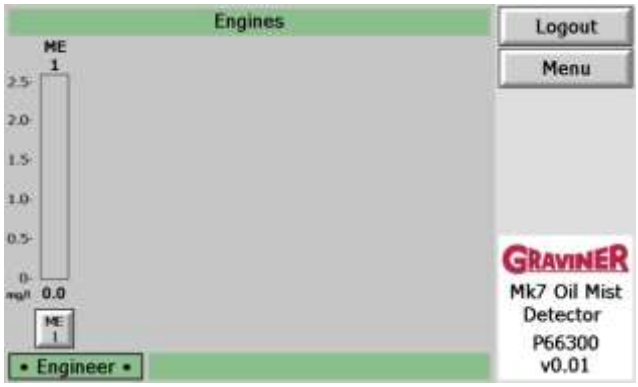


Figure 84 Engine Overview Screen – Engineer Level

3.2.3 Service Level

A 6-digit pin is required to access the Service Level.

Service level access is reserved for Carrier approved Service Engineers.

3.3 ENGINE SCREEN – USER

Information on a single engine can be accessed by pressing the required engine button under the bar graph.

The engine screen displays a bar graph for each detector, up to 10 detectors.

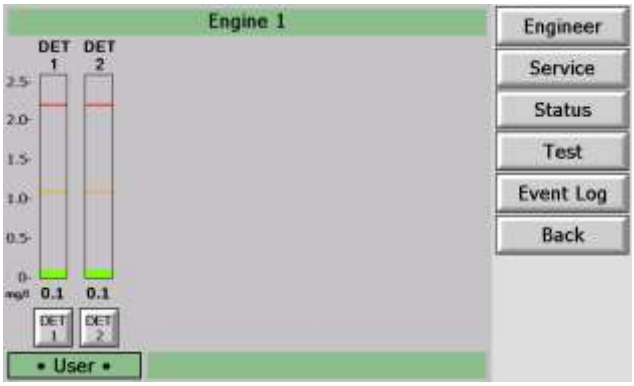


Figure 85 Engine Screen – User

The name of the detector is shown above the bar graph and in the button below the bar graph.

The level displayed on the bar graph and numerically below the bar graph indicates the oil mist level being measured by the detectors at that moment in time. The indicated level will change real time as the oil mist level in the cylinder changes.

Colour coding of the bar graph indicates the alarm state of the detector:

Green	–	No alarm condition
Orange	–	Pre-Alarm
Red	–	Slowdown/Shutdown Alarm

A fault on a detector is indicated by a blue detector button

An isolated detector is indicated by the numerical level being replaced by ISO.

Orange and red lines on the bar graph show the Pre-Alarm and Slowdown/Shutdown Alarm levels configured for that detector.

Additional buttons on the right-hand side allow further user interaction with that engine.

3.4 ENGINE STATUS INFORMATION

To access the Engine status information, press the Status button

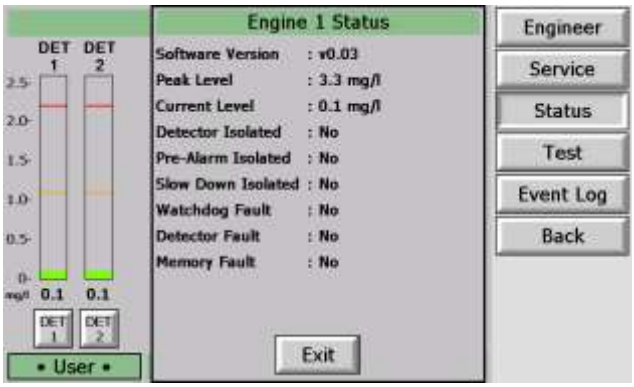


Figure 86 Engine Status Screen

The status screen shows:

Software Version	The version number of the software in the Control Unit.
Peak Level	The highest oil mist level indicated by a detector on that engine since the peak level was reset.
Current Level	The current highest oil mist level indicated by a detector on that engine.
Detector Isolated	Indicates Yes if any detector on the engine is isolated.
Pre-Alarm Isolated	Indicates Yes is the Pre-Alarm Relay is isolated.

Slow Down Isolated	Indicates Yes if the Slowdown/Shutdown Relay is isolated.
Watchdog Fault	Indicates Yes if a Control Unit software failure has caused the Control Unit to be automatically reset.
Detector Fault	Indicates Yes if a fault has occurred on any detector on the engine.
Memory Fault	Indicates Yes if a fault has been detected in the Control Unit memory

3.5 TEST MENU

Although the Control Unit and detectors perform continuous automatic checks a suit of tests are provided to allow manual testing of the system functionality to be performed.

To access the Test Menu, press the Test button

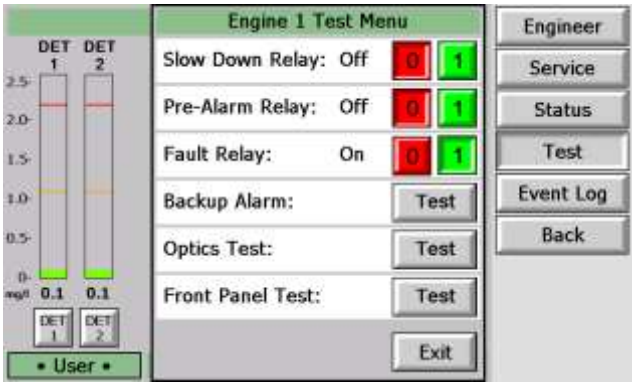


Figure 87 Test Menu – User

Slow Down Relay	This test is not available at User level
Pre-Alarm Relay	Pressing button '1' activates the relay, button '0' de-activates the relay.
Fault Relay	Pressing button '1' activates the relay, button '0' de-activates the relay. The Fault relay is normally activated and is deactivated to indicate a fault condition.
Backup Alarm	The Control Unit checks the integrity of the Backup Alarm connection between the Control Unit and the detectors. At the end of the test the display with either show that the test has been passed or indicate the detector(s) that failed.
Optics Test	Each detector performs an optics test to check for oil contamination within the detector sample chamber. At the end of the test the display will either show that the test has been passed or indicate the detector(s) that failed.
Front Panel Test	All of the LED's on the Control Unit membrane are switched on for a short period and then switch on and off one at a time in sequence. This allows a visual check to be made of the membrane indications.

3.6 EVENT LOG

The Event Log enables the user to interrogate the past 1024 events and can be accessed via the menus below. The Event Log is a rolling buffer and when the events exceed 1024 then the oldest event is dropped off the Event Log.

To access the Event Log from Figure 85, press 'Event Log' button.

Use the Up and Down arrows to scroll through the events in this screen.

Figure 88 Event Log – All Events

The events log may be filtered to show events occurring on a particular date.

Press 'By Date' tab to view event log by date.

Figure 89 Event Log Date Selection

Use the Up and Down arrows to scroll through the events in this screen.

Figure 90 Event Log by Date

Note: - If there are no Events matching your search then this screen will be blank.

The events log may be filtered to show the occurrence of a particular event type.

Press 'By Event' tab to view event log by Event.

Use the Up and Down arrows to select the event to search.

Press 'Search' to view event log by selected event.

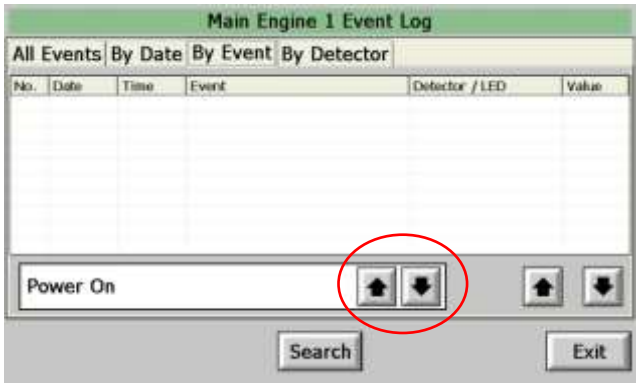


Figure 91 Event Type Selection

Use the Up and Down arrows to scroll through the events in this screen.

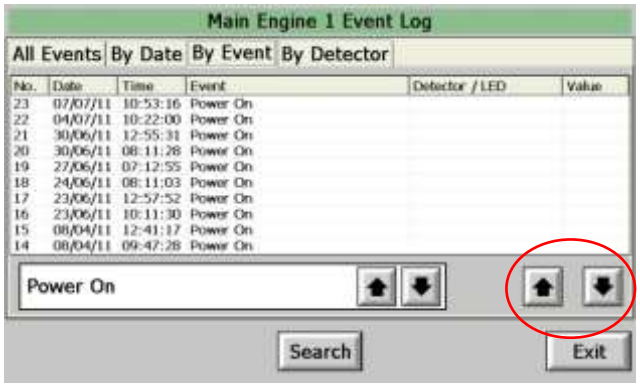


Figure 92 Event Log by Event

Press 'By Detector' tab to view event log by Detector.

Use the Up and Down arrows to select the Detector to search.

Press 'Search' to view event log by selected Detector.

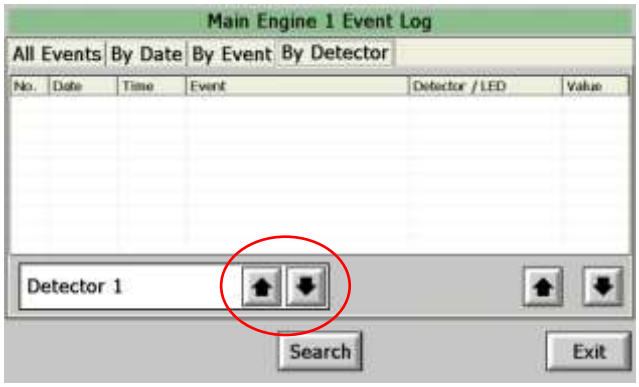


Figure 93 Detector Selection

Use the Up and Down arrows to scroll through the events in this screen.

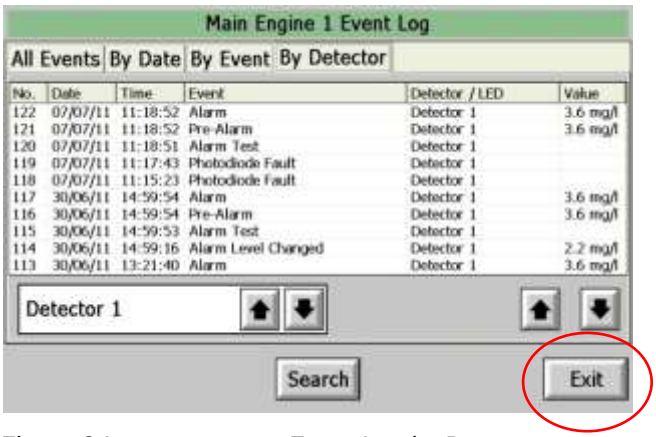


Figure 94 Event Log by Detector

Press 'Exit' to return to Engine screen, Figure 85.

3.7 DETECTOR SCREEN – USER

In addition to information relating to the engine information can also be displayed for the individual detectors.

Status information on a single engine can be accessed by pressing the required detector button under the bar graph.

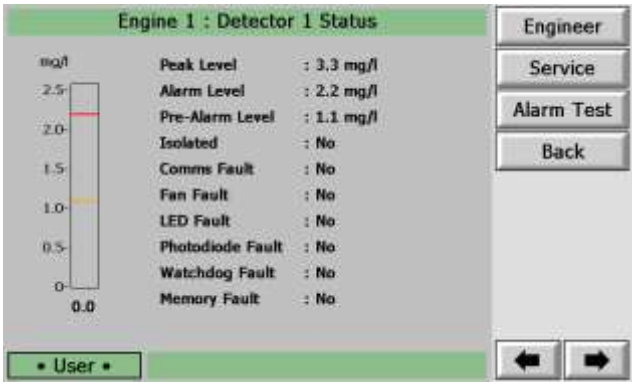


Figure 95 Detector Status Screen - User

The status screen shows:

Peak Level	The highest oil mist level indicated by the detector since the peak level was reset.
Alarm Level	The slowdown/shutdown alarm level set for the detector.
Pre-Alarm Level	The pre-alarm level set for the detector.
Isolated	Indicates Yes if the detector is isolated.
Comms Fault	Indicates Yes if the detector is not communicating with the Control Unit.
Fan Fault	Indicates Yes if the fan has failed on the detector.
LED Fault	Indicates Yes if there is oil contamination in the sample chamber.
Photodiode Fault	Indicates Yes if light is failing to reach the measuring photodiode
Watchdog Fault	Indicates Yes if a detector software failure has caused the detector to be automatically reset.
Memory Fault	Indicates Yes if a fault has been detected in the Control Unit memory

3.8 ALARM TEST

The Alarm Test allows an alarm condition to be simulated on the detector. The indications on the detector, Control Unit and Remote Display Unit will be as per a slowdown/shutdown alarm however the slowdown/shutdown alarm will not be activated, allowing the test to be performed without shutting down the engine.

Press the Alarm Test button

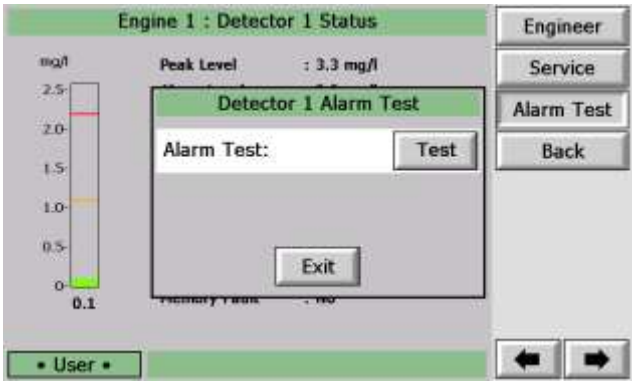


Figure 96 Detector Alarm Test

Press the Test button

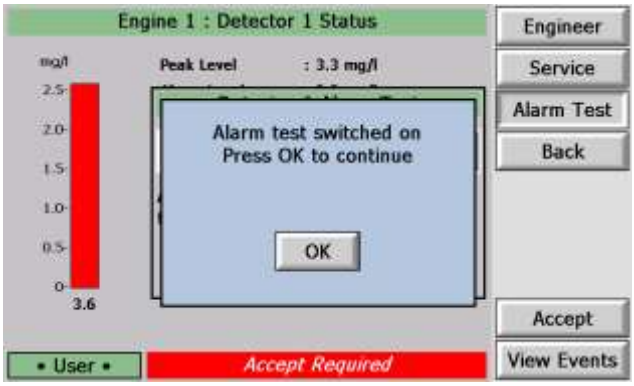


Figure 97 Detector Alarm Test Activated

The screen will revert to the engine overview screen showing the engine in alarm, it is not necessary to press OK as shown on the above screen.

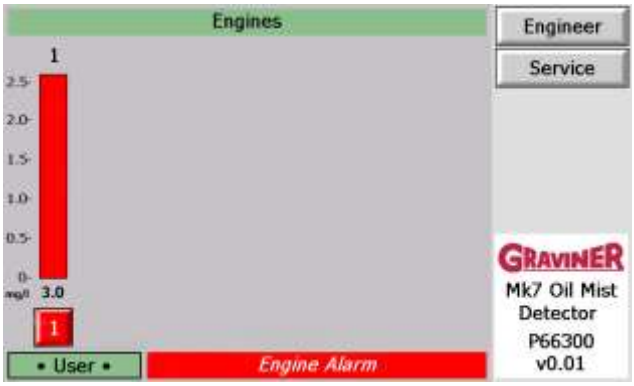


Figure 98 Engine Alarm – User

To reset the alarm, press the engine button under the bar graph.

Figure 99 Detector Alarm – User

Press the Accept button

Figure 100 Accept Ok

OK Accept

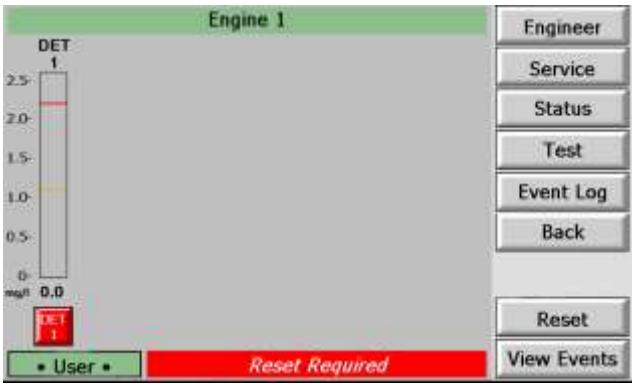


Figure 101 Detector Alarm Reset

Press the Reset button

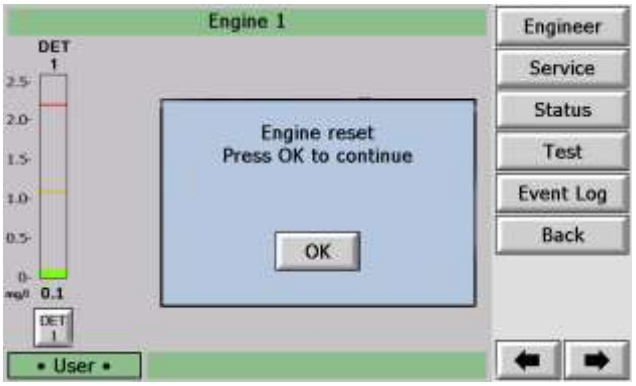


Figure 102 Detector Reset

3.9 ENGINEERS ACCESS

While interrogation and testing of the system is available at the User access level changes to the system configuration requires logging in to the Engineers access level, see section 3.2.2.

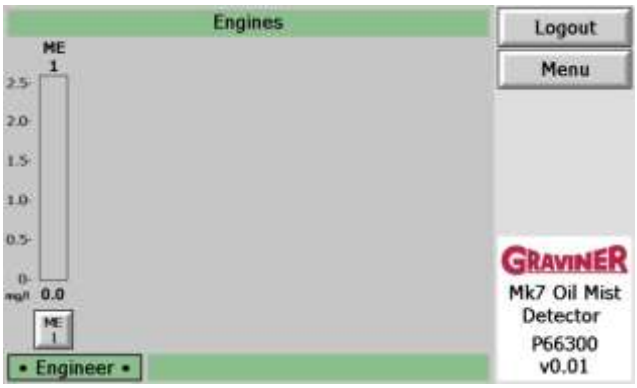


Figure 103 Engine Overview Screen – Engineer Level

Logout — Returns to User level access. The system will automatically revert to User level access after approximately 5 minutes if no buttons are press.

3.10 SYSTEM CONFIGURATION MENU

Pressing the Menu button accesses the System Configuration Menu.

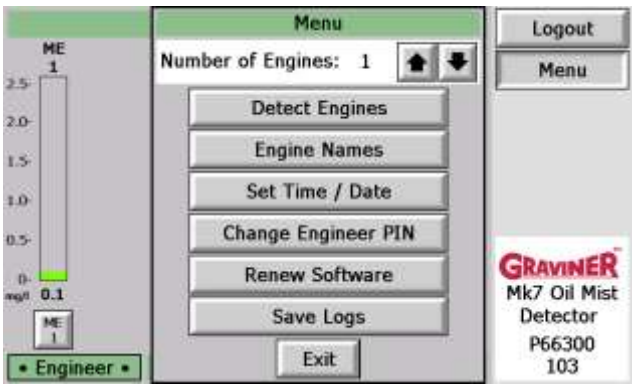


Figure 104 System Configuration Menu

Number of Engines	The number of engines connected to the Remote Display Unit is automatically detected on power up however this can be altered manually if necessary. Use the up and down arrows to set the required value.
Detect Engines	Manually requests the Remote Display Unit to check the number of engines connected.
Set Time / Date	See Figure 38 and Figure 39.
Change Engineer PIN	See Figure 40 to Figure 42
Renew Software	Allows the Remote Display Software to be updated if necessary.
Save Logs	Allows the event logs and system test logs from all connected Control Units to be saved on the Remote Display Unit. The saved logs may be downloaded to a PC using the Oil Mist Manager Software.

3.11 ENGINE SCREEN – ENGINEERS

Pressing the engine button below the bar graph accesses the Engine Screen

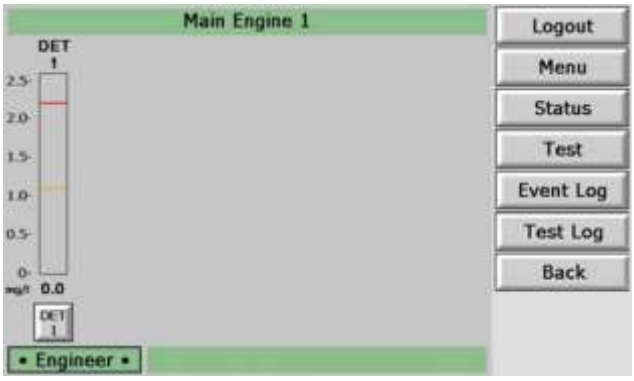


Figure 105 Engine Screen – Engineers Level

Logout	Returns to User level access. The system will automatically revert to User level access after approximately 5 minutes if no buttons are press.
Menu	Accesses the Engine Menu, see section 3.12
Status	Accesses the Engine Status Information, see section 3.4
Test	Accesses the Test Menu, see section 3.5. The function of the Slowdown/Shutdown Relay maybe tested in Engineer Level.
Event Log	Accesses the Control Unit Event Log, see section 3.6
Test Log	Accesses the Control Unit Test Log, see section 5.3
Back	Returns to the Engine Overview Screen

3.12 ENGINE MENU

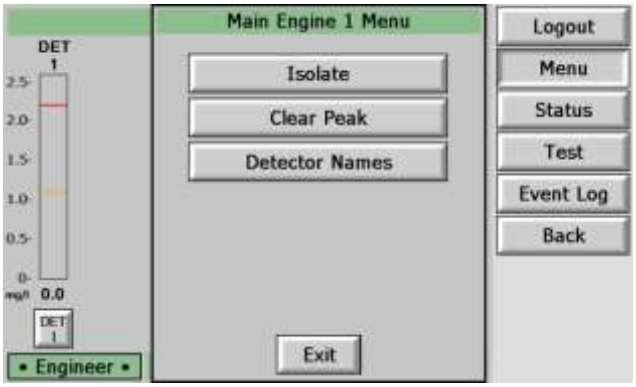


Figure 106 Engine Menu

Isolate	Allows isolation of All Detectors, Pre-Alarm Relay and Slowdown/Shutdown Relay, see section 4.1
Clear Peak	Clears all detector peak readings
Detector Names	Assigns names to identify each detector on the engine, see Figure 48
Exit	Returns to the Engine Screen

3.13 DETECTOR MENU

Pressing the detector button below the bar graph accesses the Detector Status Screen, see section 3.7

Press 'Menu' to display the Detector Menu.

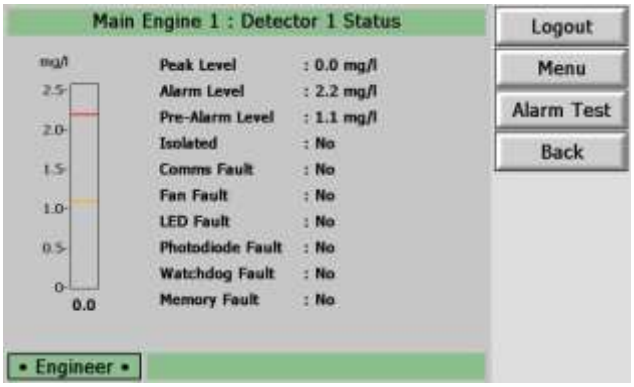


Figure 107 Detector Status Screen

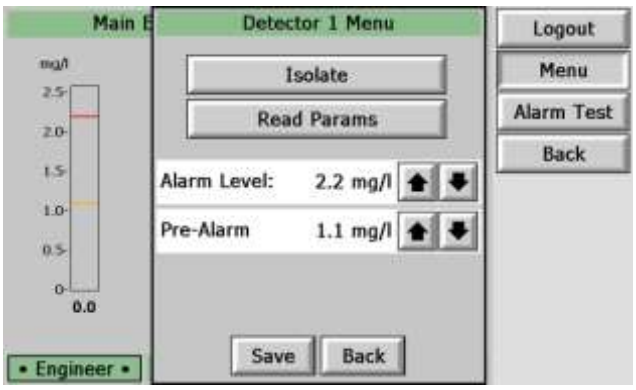


Figure 108 Detector Menu

Isolate	Allows isolation of the detector, see section 4.2
Read Params	Displays the internal parameters of the detector, see section 4.5
Alarm Level	Sets the Slowdown/Shutdown Alarm level for the detector, see Figure 51
Pre-Alarm	Sets the Pre-Alarm level for the detector, see Figure 51
Save	Save the Alarm and Pre-Alarm levels to the Control Unit
Back	Returns to the Detector Status Screen.

3.14 PRE-ALARM OPERATION

If the oil mist level measured by a detector rises above the set pre-alarm level pre-alarm condition will be initiated. This is indicated by:

Detector	Alarm LED flashing
Control Unit	Activation of the Pre-Alarm Relay
Control Unit with membrane	Alarm indicator flashing
	Operating Detector indicator flashing for the detector in pre-alarm.
Remote Display Unit	Displays the Engine Overview Screen with the engine in pre-alarm displayed in orange.

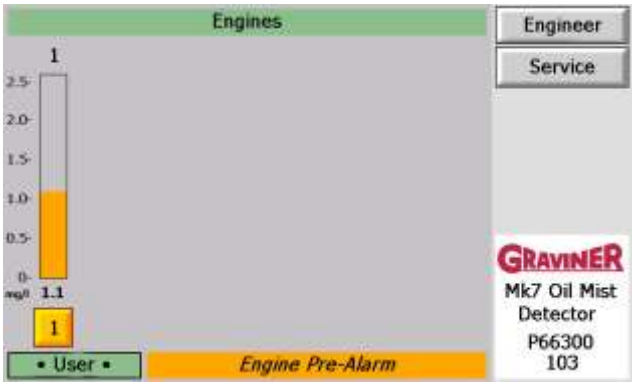


Figure 109 Engine Overview Screen – Pre-Alarm

Press the button under the bar graph to display the Engine Screen. The detector in pre-alarm is displayed in orange.

Figure 110 Engine Screen – Pre-Alarm, Accept

Press Accept

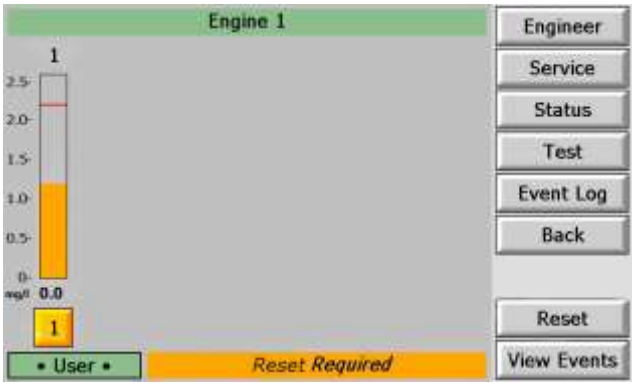


Figure 111 Engine Screen – Pre-Alarm, Accept

Prior to resetting the Engine, it is recommended that any additional events which may have occurred are examined. A list of events can be shown by pressing the View Events button.

The alarm may be reset once the oil mist level falls below the pre-alarm level. The system will return to the Engine Screen.

3.15 SLOWDOWN/SHUTDOWN ALARM OPERATION

If the oil mist level measured by a detector rises above the set slowdown/shutdown alarm level an slowdown/shutdown alarm condition will be initiated. This is indicated by:

Detector	Alarm LED on constant
Control Unit	Activation of the Pre-Alarm and Slowdown/Shutdown Relay
Control Unit with membrane	Alarm indicator on constant
	Operating Detector indicator flashing for the detector in alarm.
Remote Display Unit	Displays the Engine Overview Screen with the engine in alarm displayed in red.

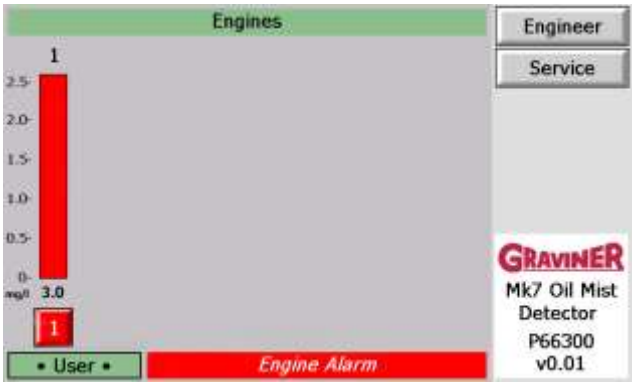


Figure 112 Engine Overview Screen – Alarm

Press the button under the bar graph to display the Engine Screen. The detector in alarm is displayed in red.

Figure 113 Engine Screen – Pre-Alarm, Accept

Press Accept

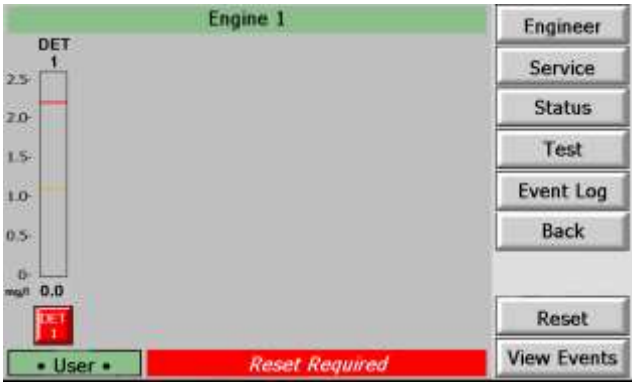


Figure 114 Engine Screen – Pre-Alarm, Accept

Prior to resetting the Engine, it is recommended that any additional events which may have occurred are examined. A list of events can be shown by pressing the View Events button.

The alarm may be reset once the oil mist level falls below the pre-alarm level. The system will return to the Engine Screen.

3.16 BACKUP ALARM

The Backup Alarm is a hard-wired link from each Detector installed on the system and operates independent of the system software. This facility will allow any Detector which sees an oil mist level of 3.0mg/I or greater to produce a 'Backup Alarm. This will result in the operation of the Backup Alarm Relay in the Control Unit; the Backup Alarm will also override any Detector or Detectors that are isolated.

Whilst any Detectors are in a Backup Alarm condition the Accept key is inoperative until the oil mist level drops below 3.0mg/l.

It is possible for a healthy Detector to produce a Backup alarm if the level of oil rises very rapidly.

NOTE - The Backup Alarm will not operate the Slowdown/Shutdown Relay

3.17 RELAY OPERATION

Communication of alarm and fault conditions between the OMD Mk7 system and the ship's Alarm Management System (AMS) is via a series of volt free contact relays. Individual relays are provided for Pre-Alarm, Slowdown/Shutdown Alarm, Backup Alarm and Fault. For each output connections are provided to the relay common, normally open and normally closed contacts providing the flexibility to meet the interface requirements of the AMS.

The actions of the relays are detailed below:

Pre-Alarm Relay	Activated when the oil mist level of a detector rises above the configured pre-alarm level.
Slowdown/Shutdown Alarm Relay	Activated when the oil mist level of a detector rises above the configured slowdown/shutdown alarm level.
Backup Alarm Relay	Activated when oil mist level of a detector rises above 3mg/l for a period of 5sec or more. Operation of the Backup Alarm Relay is software independent and cannot be reset until the oil mist level falls below 3mg/l.
Fault Relay	The Fault Relay is normally activated and de-activated when a fault occurs on the Control Unit or Detectors. In the event power is lost to the Control Unit the relay is de-activated ensuring a fault is indicated to the AMS.

A graphical representation of the relay operation is shown below:

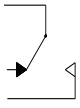
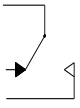
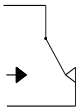
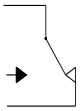
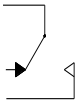
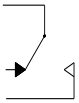
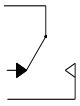
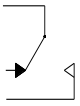
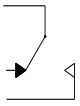
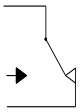
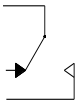
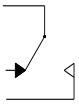
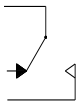
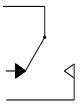
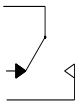
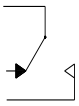
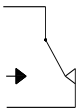
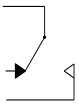
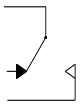
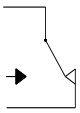
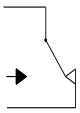
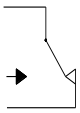
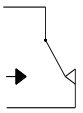
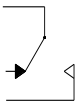
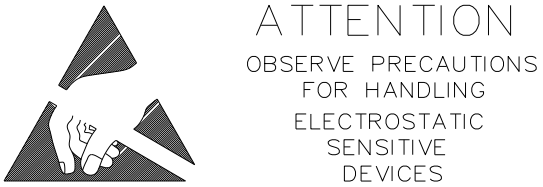
Relay Description	Unit off	Unit on	Pre-Alarm	Slowdown/ Shutdown	Backup Alarm	Fault
Pre-Alarm						
Engine Slow/Shutdown Alarm						
Backup-alarm						
Fault						

Figure 115 Relay Function Modes

4 **Maintenance**

Warning: Do not work on the system unless the power is switched off or isolated.



Caution: Ensure that anti-static handling procedures are observed applied when working on the system, i.e. Anti- Static Wrist Straps

Warning: The Guarantee label around the Detector Head is fitted to ensure that the Detector head is not tampered with. Any attempt to remove or disassemble the head will void the warrantee and may affect the detector calibration settings requiring the Detector Head to be replaced.

Prior to conducting maintenance on the OMD system it is recommended to isolate the Pre-Alarm and Slowdown/Shutdown Relays and the detectors being maintained. In addition, if the detector head is to be removed from the base the detector cable should be detached from the detector.

Isolating the relays will ensure that an alarm condition, which may occur during maintenance, is not transmitted to the AMS.

Isolating the detector will ensure that faults or alarm, which may occur during maintenance, are not indicated on the Control Unit or Remote Display Unit.

Disconnecting the detector cable from the detector will ensure that light entering the sample chamber does not result in a backup alarm being initiated.

4.1 ENGINE ISOLATIONS

To perform isolations on an engine it is necessary log in to Engineering access level.

To access the Engine Isolation Menu press the Isolate button on the Engine Menu, see section 3.12

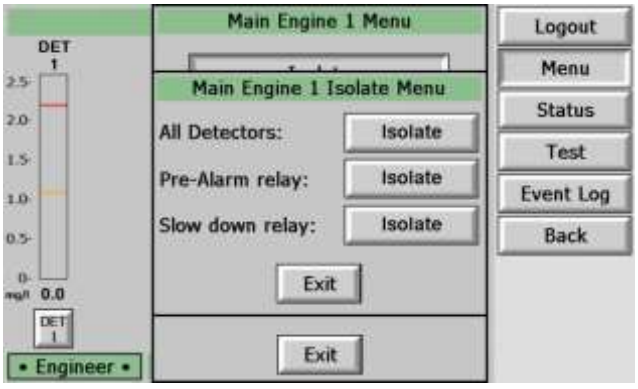


Figure 116 Engine Isolation Menu

All Detectors	Isolates/De-isolates all detectors connected to the Control Unit.
Pre-Alarm relay	Isolates/De-isolates the Control Unit Pre-Alarm Relay.
Slow down relay	Isolates/De-isolates the Control Unit Slowdown/Shutdown Alarm Relay.

4.1.1 Isolating all detectors

Press the All Detectors: Isolate button

Press 'Yes' to isolate All Detectors.

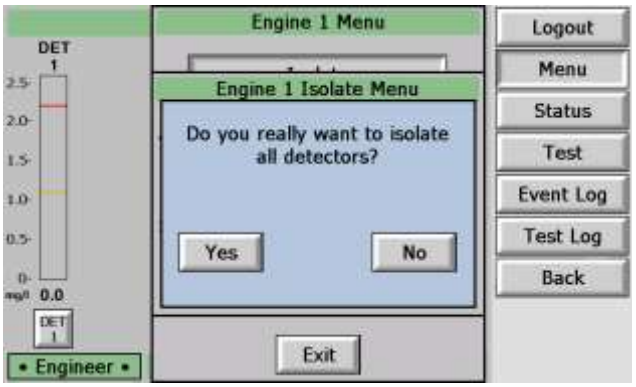


Figure 117 Isolate All Detectors

Press 'OK'

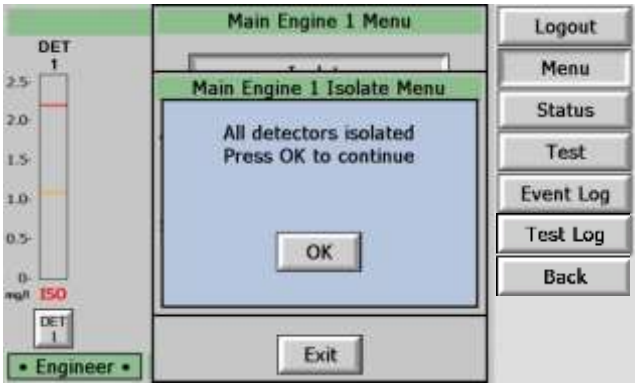


Figure 118 Isolate All Detectors - OK

To de-isolate all detectors press the 'De-Isolate' button.

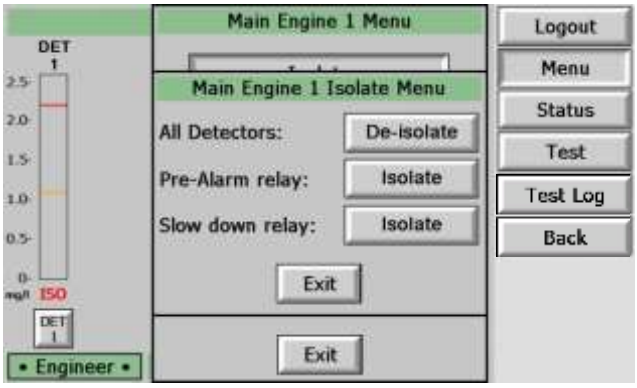


Figure 119 De-isolate All Detectors

Press ‘Yes’

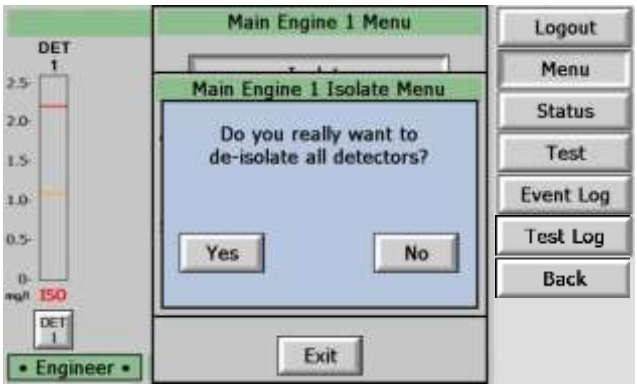


Figure 120 De-isolate All Detectors - Yes

4.1.2 Isolate the Pre-Alarm Relay

Press the Pre-Alarm relay: Isolate button

Press ‘Yes’ to isolate the Pre-Alarm Relay.

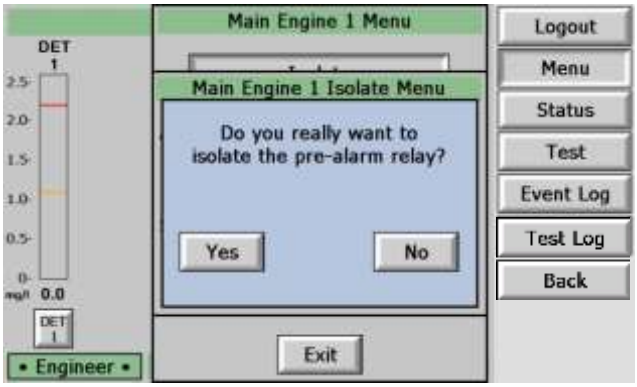


Figure 121 Isolate Pre-Alarm Relay

Press ‘OK’

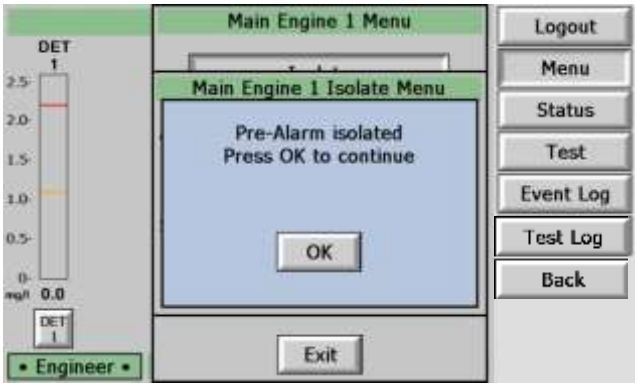


Figure 122 Isolate Pre-Alarm Relay - Ok

To De-Isolate the Pre-Alarm relay, press the ‘De-Isolate’ button.

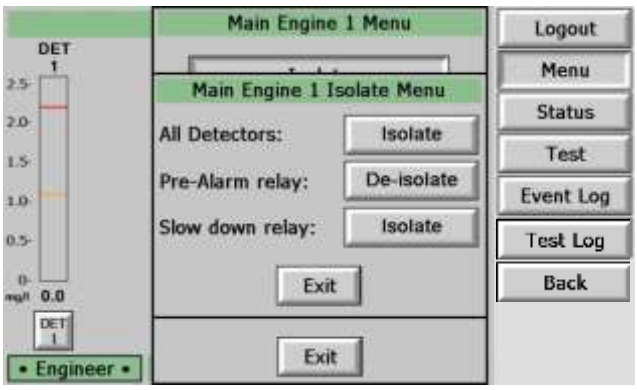


Figure 123 De-isolate Pre-Alarm Relay

Press 'Yes'

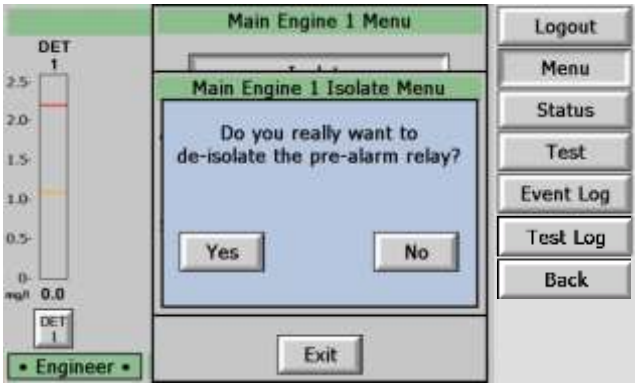


Figure 124 De-isolate Pre-Alarm Relay - Yes

Press 'OK'

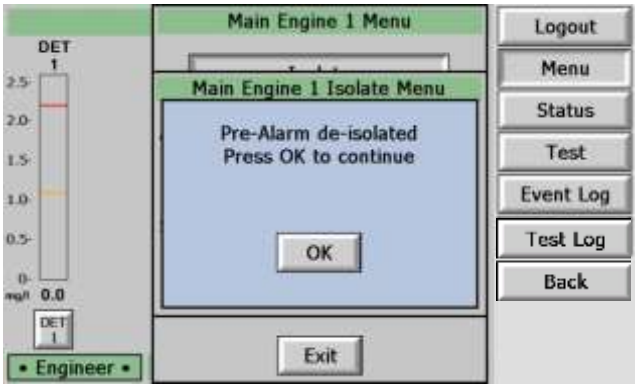


Figure 125 De-isolate Pre-Alarm Relay - Ok

4.1.3 Isolate the Slowdown/Shutdown Alarm Relay

Press the Slow down relay: Isolate button

Press 'Yes' to isolate the Slowdown/Shutdown Alarm Relay.

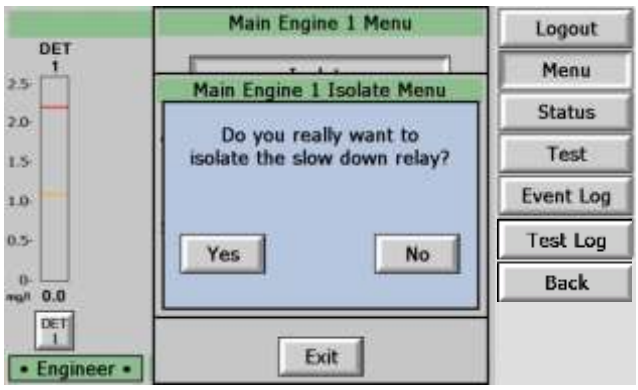


Figure 126 Isolate Slowdown/Shutdown Alarm Relay

Press 'OK'

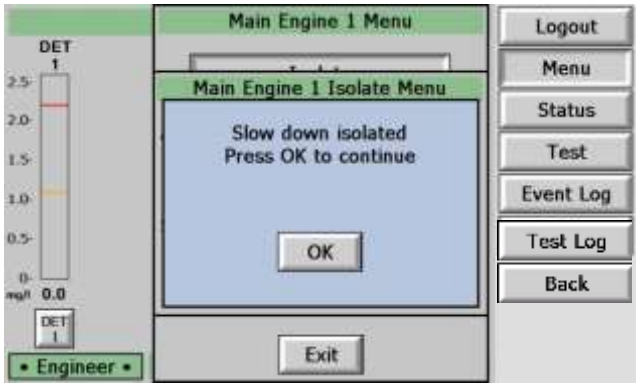


Figure 127 Isolate Slowdown/Shutdown Alarm Relay - Ok

To De-Isolate the Slowdown/Shutdown Alarm relay, press the 'De-Isolate' button.

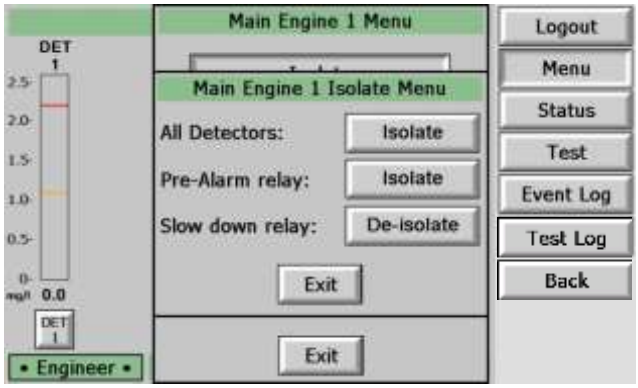


Figure 128 De-isolate Slowdown/Shutdown Alarm Relay

Press 'Yes'

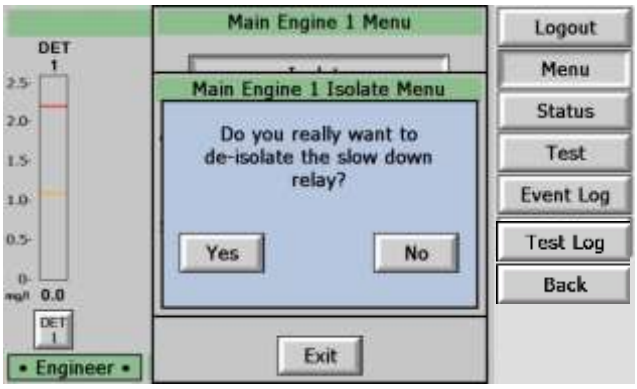


Figure 129 De-isolate Slowdown/Shutdown Alarm Relay - Yes

Press 'OK'

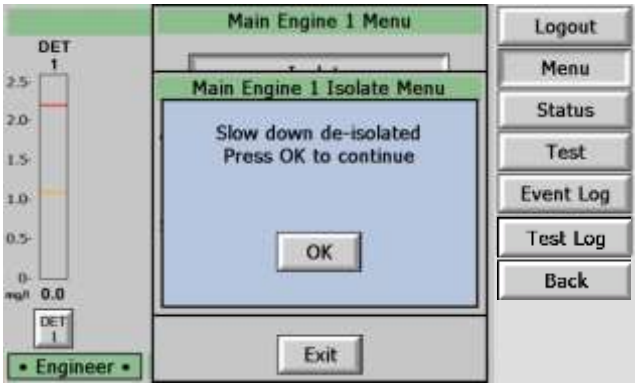


Figure 130 De-isolate Pre-Alarm Relay - Ok

4.2 DETECTOR ISOLATIONS

4.2.1 Detector Isolations via the remote display unit

In addition to isolating all detectors on an engine, individual detectors maybe isolated. To perform isolations on individual detectors it is necessary log in to Engineering access level.

To isolate a detector, press the Isolate button on the Detector Menu, see section 3.13

Press 'Yes'

Figure 131 Isolate Detector

Press 'OK'

Figure 132 Isolate Detector - Ok

To De-Isolate the selected Detector, press 'De-Isolate'

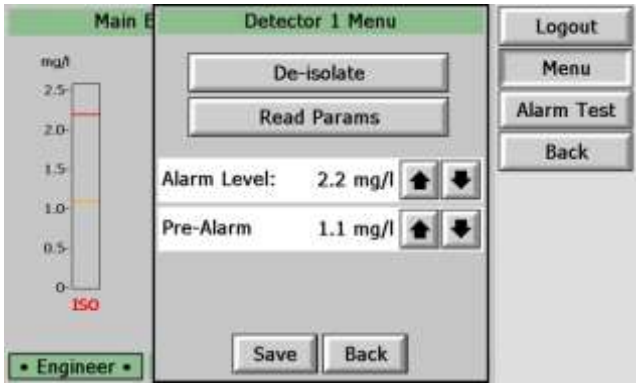


Figure 133 De-isolate Detector

Press 'Yes'

Figure 134 De-isolate Detector - Yes

Press 'OK'

Figure 135 De-isolate Detector - Ok

4.2.2 Detector Isolations via the Control Unit

For a Control Unit with membrane individual detectors can also be isolated at the Control Unit.

To isolate a Detector at the Control Unit fitted with a Membrane, press the Detector number button for 2 seconds until the relevant Detector Fault / Isolate indicator is steady. (Refer Figure 136)

Figure 136 Control Unit Membrane

Repeat the above to de-isolate a Detector.

4.3 SYSTEM MONITORING

The OMD Mk7 provides access to a range of system parameters that can be used to monitor system operation and can also give an early indication of changes in the engine.

Engine Status, see section 3.4.

Provides an indication of engine faults and isolations as well as the peak oil mist levels measured on the engine.

Detector Screen, see section 3.7.

Provides an indication of detector alarm levels, faults and isolations as well as the peak oil mist levels measured on the detector.

Detector Parameter Readings, see section 4.5.

Monitoring changes in the contamination level for each detector can be used to determine the optimal cleaning intervals for a particular engine, allowing detectors to be cleaned before a fault is indicated.

Changes in the rate of detector contamination may also indicate changes in the engine oil, e.g. increasing contaminants or particulates in the oil

Test Log, see section 5.3.

Regular examination of the System Test Log can highlight changes in the engine operation, increases in oil mist reading, temperature or vibration may be symptoms of a potential engine issue.

Event Log, see section 3.6.

Examination of the event log could identify any underlying ongoing faults on the system, e.g. power supply variations, memory errors etc.

4.4 ROUTINE MAINTENANCE SCHEDULE

This maintenance schedule is a guide only as every engine is different in its usage, oil, temperature, scrubber performance etc.

Maintenance check sheets are provided in Appendix 2.

WEEKLY:

1. Record current contamination level for each detector head, see section 4.5. See attached spreadsheet example in Appendix 1.

Note: - the detector cleaning interval will be unique to each engine and dependent upon many factors such as the way the vessel engine is operated, the engine temperature, the condition of the engine oil and the engine service intervals.

Tracking the changes in contamination value over a period of time will allow an engine specific detector cleaning program to be formulated.

MONTHLY:

(TEST PROCEDURE SHOULD BE DONE WITH NO LOAD ON THE ENGINE).

Perform Smoke Test at each Detector using the push-in smoke test connector and Graviner Smoke Test kit, see section 2.11.4

TWICE PER YEAR:

(TEST PROCEDURE SHOULD BE DONE WITH NO LOAD ON THE ENGINE).

Perform a visual inspection

1. Externally inspect all Mk7 Control Unit(s) in the OMD system taking note of the condition of all Glands, External Wiring and LED indications displayed.
2. Highlight any holes that are either NOT or incorrectly blanked off as these will affect the IP65 and EMC rating.

3. Internally inspect all Mk7 Control Unit(s) in the OMD system.
4. All Detectors installed on the engine(s) plus any Detector Heads which are considered as usable spares by the vessel (external view), document the status of the LEDs on each Detector.
5. The Remote Display Unit is showing the correct number of Engines and Detectors on each Engine.
6. All other enclosures (external view) and wiring used to connect the OMD relay contacts to the vessel Alarm Monitoring & Engine Shutdown systems.
7. Document the software versions of all system components.

As part of this work document any concerns with: -

a. Corrosion.
b. Evidence of burnt components.
c. Poor quality wiring or incorrectly specified cabling used for power and data communication.
d. Missing or incorrect EMC glands.
e. Missing or incorrect screening & earthing.
f. Missing blanking plugs or caps.
g. Ensure all terminal block connector screws are tight

8. Inspect the contents of the Mk7 Event log.

   It is important to understand the contents of the Mk7 Event log to diagnose and remove the reason for any fault messages.

Figure 137 Event Log – All Events

Please photograph and document the Remote Display Unit screens from the Event Log.

9. Check the Status of each Detector prior to any cleaning taking place.

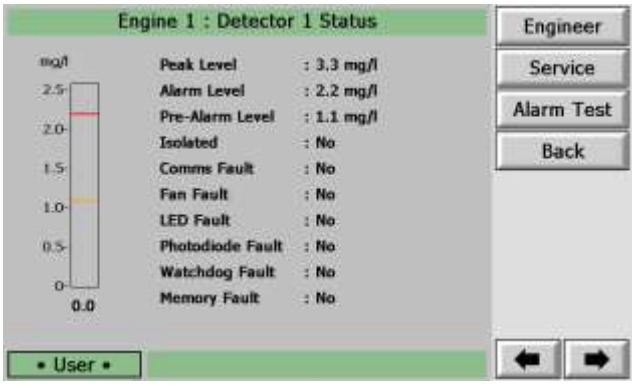


Figure 138 Detector Status Screen - User

Access the Detector Status Screen for each Detector.

Ensure: The Alarm and Pre-Alarm level settings are correct,

The Detector is NOT Isolated,

There are NO active Faults shown.

If any Faults are indicated, please take appropriate actions to clear the indication(s).

10. Carry out Parameter readings of each Mk7 Detector prior to any cleaning taking place. See section 4.5.

    This will show the current status of the selected Detector. Note the readings for each Detector.

    See section 4.6 for proper Detector Head removal, cleaning and refitting. Ensure Detector Heads & Detector base O-Ring seals are properly fitted with Molykote O-Ring Lubricant.

    Clean each Detector twice using the recommended cleaning buds and fluid and repeat the Parameter Reading process.

    Again, note the readings for each Detector

    Compare the Current Contamination Value with the Original Contamination Value after the Detector has been cleaned. Any Detector NOT recovering to within 20% of the Original Contamination Value after cleaning should be replaced as it is at the end of its Service Life.

11. Prior to refitting the detector head inspect the detector base. Document any concerns with:

    Water droplets in the detector –may indicate a leak in the water cooling lines or a problem with the lube oil separator, particularly if the engine has not been in use for some time.

Figure 139 Water Droplets in the base.

Emulsified oil (foam in the detector base) – may indicate cylinder or liner cooling water leaks or a problem with the lube oil separator. If allowed to build up over time the inlet and outlet of the detector may become blocked preventing the measurement of oil mist.

Figure 140 Emulsified oil in the detector base

Fuel in the lube oil (a green colour in the lube oil) – may indicate a problem with the fuel oil heaters or leaking valves.

Figure 141 Fuel in the lube oil

Metal particles – may indicate wear due to high vibration levels.

12. Verify all vital and non-vital alarm actions at Mk7 Control Unit function correctly.

    Using the Test Menu, see section 3.5, check the correct operation of the Slow Down Relay, Pre-Alarm Relay and Fault Relay.

ANNUAL:

A Graviner Authorised Service Engineer should perform a complete system inspection.

1. Record serial numbers and software revisions

a. Record the Remote Display Unit serial number (found on the rear of the unit)

b. For each Control Unit record the type, membrane or non-membrane, and serial number (found on the inside of the lid)

c. Record the Remote Display Unit software version (found on the engine over-view screen)

d. For each Control Unit record the software version (found on the Remote Display Unit engine status screen)

2. Verify all Graviner Mk7 System Functions.
3. Review and record Event log and System Test Log history
4. Clean Detector heads and Detector base Assemblies and renew base O-Rings.
5. Clean the Detector Base and sample pipe by blowing through with Clean Air at a working pressure of up to 90 PSI to remove any potential blockages as shown in the image below.

Figure 142 Detector Base Cleaning

6. Verify cable terminations and earthing.
7. Test all vital and non-vital alarm functions
8. Review C/E contamination level trending report
9. Upgrade software to current versions
10. Upgrade Detector heads or hardware if required
11. Load current manual on Control room computer
12. Instruct crew on Mk7 procedures & System operation.

4.5 READING DETECTOR PARAMETERS

Several unique parameters are programmed into each detector during the production process access to which can be useful during maintenance and fault finding.

To read the parameters on a detector it is necessary log in to Engineering access level, see section 3.2.2.

To access the detector parameters, press the Read Params button on the Detector Menu, see section 3.13

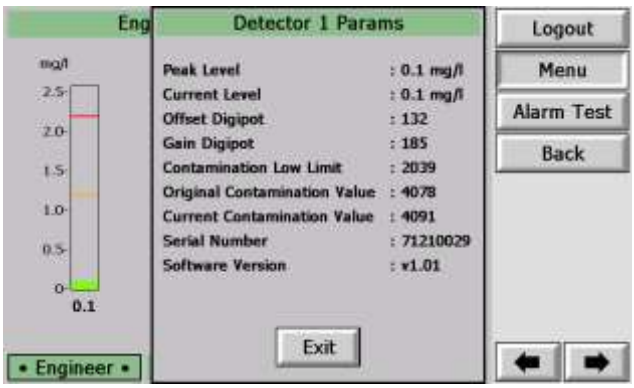


Figure 143 Detector Parameters

Peak Level	The highest oil mist level indicated by the detector since the peak level was reset.
Current Level	The current oil mist level indicated by the detector.
Offset Digipot	Value set during the production of the detector. The value is specific to the detector.
Gain Digipot	Value set during the production of the detector. The value is specific to the detector.
Contamination Low Limit	This represents the lowest value for the contamination value before a fault is indicated. Value set during the production of the detector. The value is specific to the detector.
Original Contamination Value	This represents the contamination value measured when the detector was produced, i.e. when the detector sample chamber was free of oil.
Current Contamination Value	The represents the current contamination value measured by the detector.
Serial Number	Shows the serial number of the detector.
Software Version	Shows the version of the software programmed into the detector.

4.6 DETECTOR CLEANING

The Graviner OMD Detector is made of 2 assemblies, the Detector Head and the Detector Base. The Detector Head is attached to the Detector Base with 2 Allen bolts.

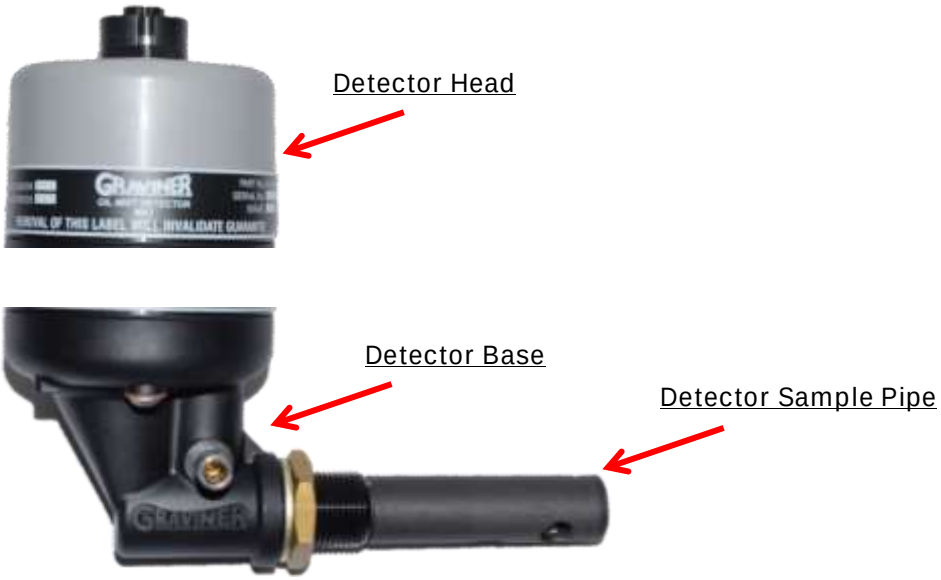


Figure 144 Detector Assembly

The oil mist detection chamber in each Detector Head must be inspected at regular intervals and cleaned to remove any build-up of oil splash or carbon deposits created by the operation of the engine.

The OMD system will automatically warn the Users when the detection optics become partially obscured and must be cleaned. Establishing a cleaning and maintenance regime to minimise any Fault message warnings of this type and maximise the service life of each Detector Head is recommended, see section 4.3.

WARNING - Do NOT remove the Detector from the base whilst the engine is in operation.

This action should be carried out whilst the engine is stopped to avoid the possibility of hot oil coming out of the Detector Base.

Please Note

Graviner Detector Heads should only be cleaned with the recommended cleaning fluid and cleaning buds.

Many cleaning fluids have been evaluated by Graviner but only the Electrolube ASC fluid is recommended by Graviner as our tests have shown it offers the best cleaning ability and leaves no residue on the glass chamber.

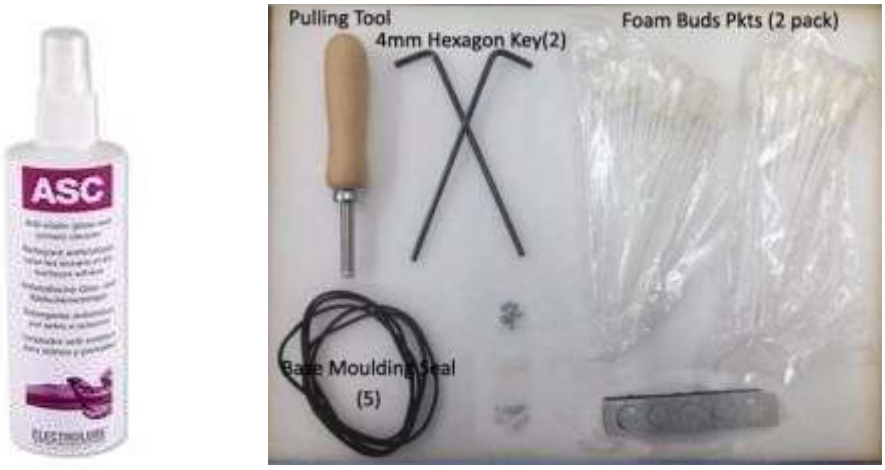


Figure 145 Cleaning Kit

Note: - Do not use any third-party electronic contact cleaners, isopropyl alcohols, flux removers, any harsh chemical cleaners, etc., as these will affect the Detector performance.

Only use the official Graviner Cleaning products, see 6.4.2.

To clean a detector: -

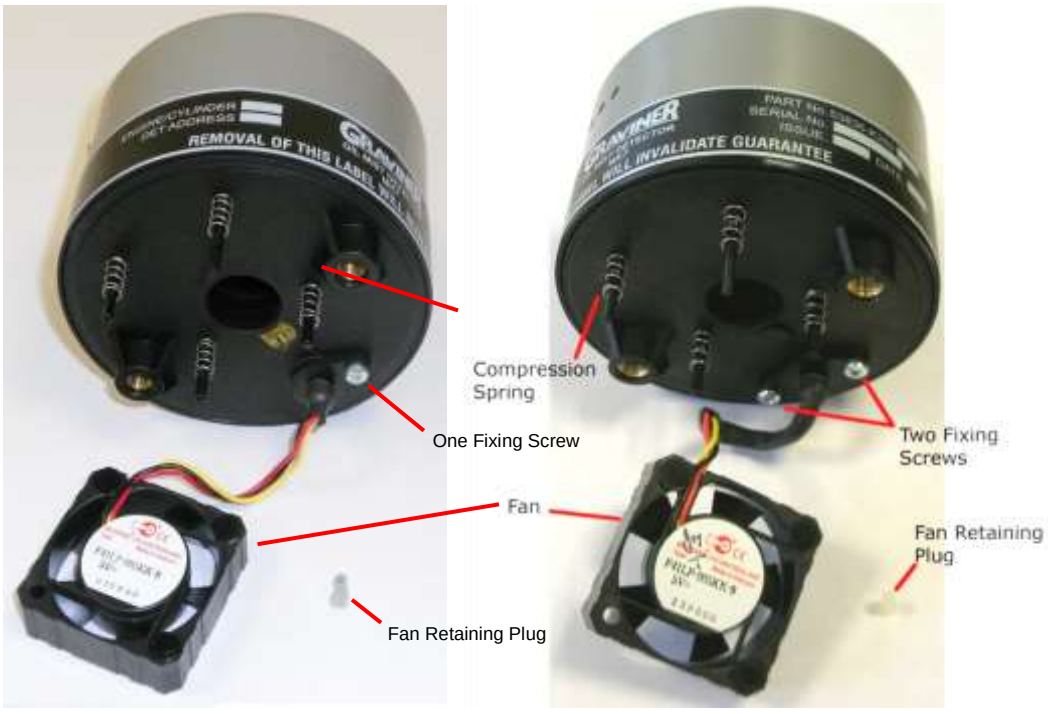
1. With the detector isolated disconnect the cable connector fitted to the top of the Detector Head.
2. Using a 4mm hexagonal key, loosen the two fixing screws in the Detector Base. The screws are self-retaining.
3. Remove and invert the top part of the Detector Head so the Fan is visible.
4. Wipe off any excess oil from the surface of the base and fan.
5. Examine the Detector Base unit seal and replace if damaged or perished or not seated firmly in its channel.

CAUTION: - Do NOT press the fan label, handle only the fan outer housing.

6. Using the Pulling Tool (see below), slowly remove the Fan Retaining Plug by capturing the shoulder and pulling. Carefully remove the Fan from its mountings.

Figure 146 Pulling Tool

BEWARE: - Please take extreme care NOT to lose any of the Compression Springs or the Fan Retaining Plug.



7. Examine the 4 Compression Springs and the Fan Retaining Plug; replace any damaged items. Spares for these items are included in the Service Kit, see 6.4.2.
8. Ensure the fan is free running and not clogged by oil residues.
9. If fan damage is suspected the fan should be replaced, see section 5.2.6.

10. Using the following images on this page as a guide, apply the Graviner recommended glass cleaning fluid to a foam bud and wipe carefully around the inside of the oil mist detection opening in the Detector Head.

(Note: Do not use any electronic contact cleaners, isopropyl alcohols, flux removers, any harsh chemical cleaners, etc., as these will affect the Detector performance.)

Figure 147 Sample Chamber Cleaning

11. Ensure that the glass ring around the side of the Detector Head and the small aperture shown in the image above are thoroughly cleaned with the foam cleaning buds.
12. To ensure thorough cleaning Graviner recommend that steps 10 and 11 are repeated with cleaning fluid applied to another foam bud.
13. Examine the Detector base body and sample tube and wipe clean where necessary.
14. Reassemble the Fan to the Detector Head using the Fan Retaining Plug.

CAUTION: Do not press the centre label of the fan, only handle the fan by the outer housing.

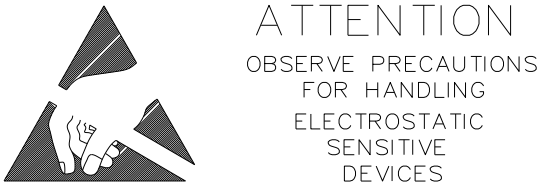
15. Reattach the Detector head to base and re-tighten the fixing screws. Attach the cable to the Detector Head.
16. De-Isolate the Detector.

4.7 DECOMMISSIONING

All the components of the Graviner Mk7 OMD system must be disposed of as electrical/electronic equipment waste. i.e. using waste disposal methods in accordance with current local waste disposal regulations.

5 Fault Finding

Warning: Do not work on the system unless the power is switched off or isolated.



Caution: Ensure that anti-static handling procedures are observed applied when working on the system, i.e. Anti- Static Wrist Straps

Prior to conducting fault diagnostics on the OMD system it is recommended to isolate the Pre-Alarm and Slowdown/Shutdown Relays and the detectors being examined see sections 4.1 and 4.2. In addition, if the detector head is to be removed from the base the detector cable should be detached from the detector.

5.1 FAULT INDICATIONS

In the event of a fault occurring on the system an indication of the fault will be provided.

5.1.1 Detector Faults

In the case of a fault with a detector the indications are:

Detector	Fault LED on constant
Control Unit	Activation of the Fault Relay
Control Unit with membrane	Fault indicator on flashing
	Detector Fault / Isolate indicator flashing for the detector in alarm. Flash rate = 1sec on 1sec off for communication fault, 0.5sec on 0.5sec off for all other faults.
Remote Display Unit	Displays the Engine Overview Screen with the engine name button, under the bar graph, of the engine in fault displayed in blue.

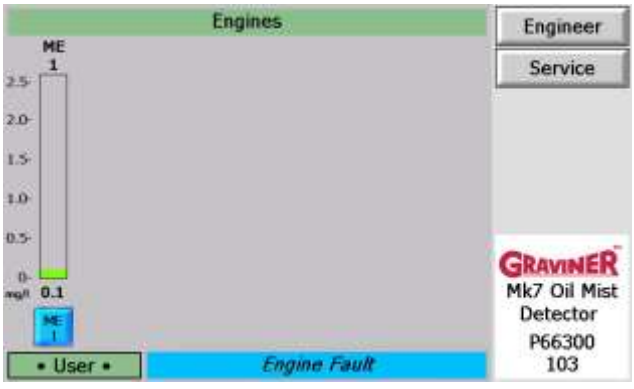


Figure 148 Engine Overview Screen – Fault

Further details on the type of fault indicated can be obtained by either:

1. Examining the detector status, see section 3.7
2. Examining the event-log, see section 3.6

5.1.2 Control Unit Faults

In the case of a fault with a Control Unit the indications are:

Detector	No fault indication.
Control Unit	Activation of the Fault Relay
Control Unit with membrane	Fault indicator on flashing
Remote Display Unit	Displays the Engine Overview Screen with the engine name button, under the bar graph, of the engine in fault displayed in blue.

Further details on the type of fault indicated can be obtained by either:

1. Examining the engine status, see section 3.4
2. Examining the event-log, see section 3.6

5.1.3 Remote Display Unit Communication Faults

In the case of a communications fault between the Remote Display Unit and a Control Unit the indications are:

Detector	No fault indication.
Control Unit	No fault indication
Remote Display Unit	Displays the Engine Overview Screen with a cross in the engine bar graph, of the engine.

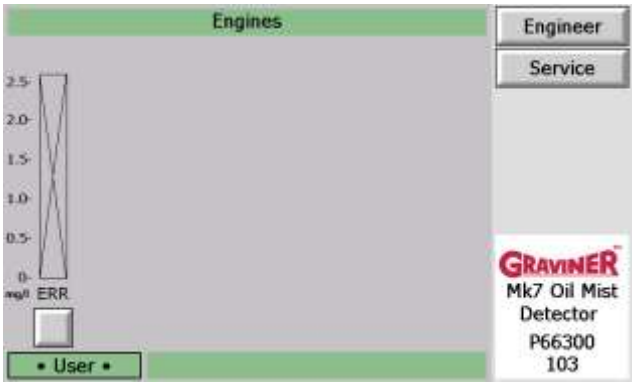


Figure 149 Remote Display Unit Communication Fault

5.1.4 Fault List

A list of the fault messages that may be viewed in the Event Log are detailed below.

Event Log Message	Description
Backup Alarm Test	Following a Backup Alarm Test the Control Unit failed to detect the activation of the backup alarm signal from a detector. The event message will identify which detector has failed.
Communications Fault	Communications failure between the Control Unit and a Detector. The event message will identify which detector has failed.
Contamination Low Fault	Oil contamination within the sample chamber has reduced the light levels below an acceptable limit. The event message will identify which detector has failed.
Control Unit Error	A fault occurred when accessing the Control Unit memory, either the Flash Memory, the Random Access Memory (RAM) or the Real Time Clock Memory (RTC).
Controller Watchdog	A Control Unit software error resulted in an automatic restart of the software.
Fan Fault	A detector fan has stopped rotating. The event message will identify which detector has failed.
Gain Digipot Read Fault	A fault has been detected when accessing the gain digipot in a detector. The detector oil mist levels may not be accurate. The event message will identify which detector has failed.
Offset Digipot Read Fault	A fault has been detected when accessing the offset digipot in a detector. The detector oil mist levels may not be accurate. The event message will identify which detector has failed.
Photodiode Fault	Oil contamination within the sample chamber has reduced the light levels reaching the measurement photodiode below an acceptable limit. The event message will identify which detector has failed.
Warning Memory Limit Met	The number of writes to the Control Unit Flash Memory has reached the manufacturers guaranteed number of writes, 100,000 erase cycles.
Watchdog Fault	A detector software error resulted in an automatic restart of the software. The event message will identify which detector has failed.

A list of the fault that are not listed in the Event Log are detailed below.

Fault	Description
Remote Display time and date incorrect	When setting the date and time via the Remote Display Unit the displayed date and time are incorrect. The Remote Display Unit uses a Lithium battery to maintain the internal real time clock, when the battery reaches its end of life the time and date are no longer maintained.
Control Unit time and date incorrect	When examining the Event Log the time and date of events is incorrect. The Control Unit uses a Lithium battery to maintain the internal real time clock, when the battery reaches its end of life the time and date are no longer maintained.
Remote Display Unit not communicating with the Control Units	The engine bar graph is displayed with a cross rather than an oil mist level. The Remote Display Unit is unable to communicate with the Control Unit.
Remote Display Unit remains on the initial screen.	On power up the Remote Display Unit only shows the Graviner splash screen.
Remote Display Unit displays a software exception message	A software failure has caused an error to occur in the Remote Display operating system resulting in an exception error.

5.2 FAULT DIAGNOSTICS AND REMEDIES

5.2.1 Backup Alarm Test Failure

A Backup Alarm Test is performed manually via the Test Menu, see section 3.5, or automatically during the daily system check at 16:00hrs. If a failure occurs during the test a Backup Alarm Test fault is indicated, see section 5.1.2

An inspection of the engine event log, see section 3.6, will list the event:

Backup Alarm Test Detector *X* Failed

5.2.1.1 Single Detector in fault

Having established which detector is in fault it is necessary to establish the cause of the fault using the following steps.

1. Swap the detector with a known working detector.
2. Reset the Control Unit.
3. Perform a Backup Alarm Test via the Test Menu, see 2.11.3

   If the fault indication remains at the original position return the swapped detectors to the initial positions go to item 4

   If the fault indication moves to the new position of the detector, the detector has failed and should be replaced.
4. Swap the detector cable with a known working cable at the Control Unit.
5. Reset the Control Unit.
6. Perform a Backup Alarm Test via the Test Menu, see 2.11.3

   If the fault indication remains at the original position return the swapped cables to the initial positions go to item 7

If the fault indication moves to the new position of the cable, the cable has failed and should be replaced.

7. Open the Control Unit lid
8. Swap the detector harness connecting to the PCB with an adjacent harness. There is a push bar at the side of the connector to release it, taking care not to damage the connection wires or the connector pins/connections.
9. Reset the Control Unit.
10. Perform a Backup Alarm Test via the Test Menu, see 2.11.3

    If the fault indication remains at the original position the Control Unit PCB has failed and should be replaced.

    If the fault indication moves to the new position of the cable, the cable has failed and should be replaced.

5.2.1.2 All Detectors in fault

If all the detectors connected to the Control Unit are shown with a Backup Alarm Test fault the Control Unit PCB has failed and should be replaced.

5.2.2 Communications Fault

Under normal operating conditions the Control Unit polls each of the detectors one at a time with the detector responding each time. If when the Control Unit polls a detector it fails to get a response or the response is corrupted the Control Unit will indicate a communications fault, see section 5.1.1.

To identify which detector is at fault, from the Engine Overview Screen, Figure 148, select the required engine.

Figure 150 Engine Screen – Detector Fault

Select the faulty detector to access the Detector Status Screen.

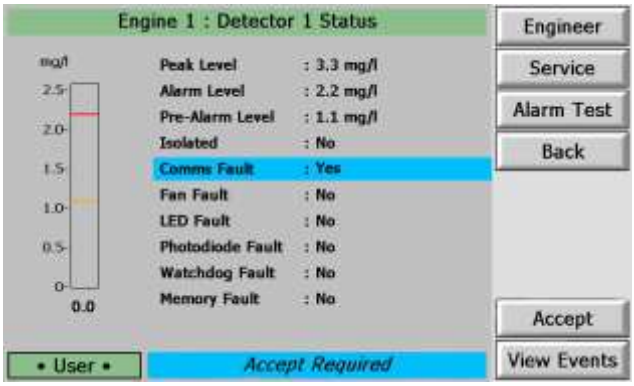


Figure 151 Detector Status Screen – Communications Fault

Identify the fault being indicated, in this case a communications fault.

Alternatively, an inspection of the engine event log, see section 3.6, will list the event:

Communications Fault Detector *X*

5.2.2.1 Single Detector in fault

Having established which detector is in fault it is necessary to establish the cause of the fault using the following steps.

11. Swap the detector with a known working detector.
12. Reset the Control Unit.
13. Wait for the communications fault to be indicated again.

    If the fault indication remains at the original position return the swapped detectors to the initial positions go to item 4

    If the fault indication moves to the new position of the detector, the detector has failed and should be replaced.

14. Swap the detector cable with a known working cable at the Control Unit.
15. Reset the Control Unit.
16. Wait for the communications fault to be indicated again.

    If the fault indication remains at the original position return the swapped cables to the initial positions go to item 7

    If the fault indication moves to the new position of the cable, the cable has failed and should be replaced.

17. Open the Control Unit lid
18. Swap the detector harness connecting to the PCB with an adjacent harness. There is a push bar at the side of the connector to release it, taking care not to damage the connection wires or the connector pins/connections.
19. Reset the Control Unit.
20. Wait for the communications fault to be indicated again.

    If the fault indication remains at the original position the Control Unit PCB has failed and should be replaced.

    If the fault indication moves to the new position of the cable, the cable has failed and should be replaced.

5.2.2.2 All Detectors in fault

If all the detectors connected to the Control Unit are shown in communication fault complete the following steps to identify the cause of the fault.

1. Check the status LED's on the detectors.

   If the detector power LED's are all off, go to item 2.

   If the detector power LED's are on replace the Control Unit PCB.

2. Remove the power from the Control Unit.
3. Disconnect the detector cable from all the detectors.
4. After 2 minutes apply the power to the Control Unit.
5. Reconnect each detector one at a time, as each detector is connected check that the detector power LED in on.

   If the detector power LED is off the detector has failed and should be replaced.

6. Once the failed detector has been disconnected / replaced remove the power from the Control Unit.
7. After 2 minutes apply the power to the Control Unit.
8. Continue reconnecting the remaining detectors as above until all detectors are reconnected to the Control Unit.

5.2.3 Contamination Low Fault

As part of the oil mist measurement process light is passed across the sample chamber to illuminate the oil mist particles in the sampled air. Over time condensing oil can build up on the sample chamber walls causing the light in the sample chamber to be reduced. The OMD Mk7 Detector constantly monitors the level of light passing through the sample chamber and produces a fault indication if the light level drops below a predetermined limit set as part of the detector production process.

If the light level in the sample chamber falls below the allowed limit the detector will communicate the fault to the Control Unit. The Control Unit will then indicate a contamination low fault, see section 5.1.1.

To identify which detector is at fault, from the Engine Overview Screen, Figure 148, select the required engine.

Figure 152 Engine Screen – Detector Fault

Select the faulty detector to access the Detector Status Screen.

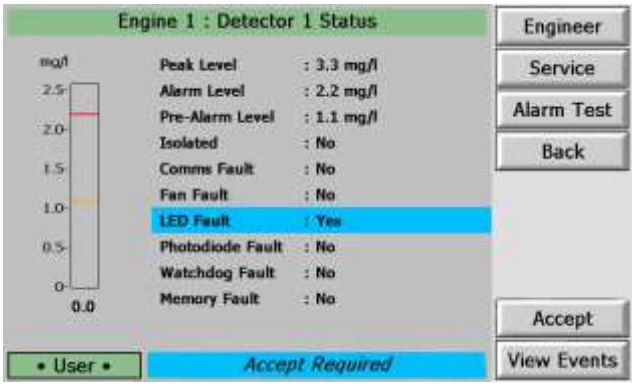


Figure 153 Detector Status Screen – LED Fault

Identify the fault being indicated, in this case an LED fault.

Alternatively, an inspection of the engine event log, see section 3.6, will list the event:

Contamination Low Fault Detector *X*

Having established which detector is in fault it is necessary to establish the cause of the fault using the following steps.

1. Read the parameters of the Mk7 Detector prior to any cleaning taking place. See section 4.5.

   This will show the current status of the selected Detector.

2. See section 4.6 for proper Detector Head removal, cleaning and refitting. Ensure Detector Heads & Detector base O-Ring seals are properly fitted with Molykote O-Ring Lubricant.

3. Clean the Detector twice using the recommended cleaning buds and fluid and repeat the Parameter Reading process.

4. Compare the Current Contamination Value with the Original Contamination Value after the Detector has been cleaned. If the Detector is NOT within 20% of the Original Contamination Value after cleaning it should be replaced as it is at the end of its Service Life.

5.2.4 Control Unit Error

The Control Unit continually checks the data held in memory to ensure that it has not been corrupted. If an error in the data is identified a Control Unit Error fault will be indicated.

To identify the type of fault on the Control Unit access the Engine Status Screen, see section 3.4.

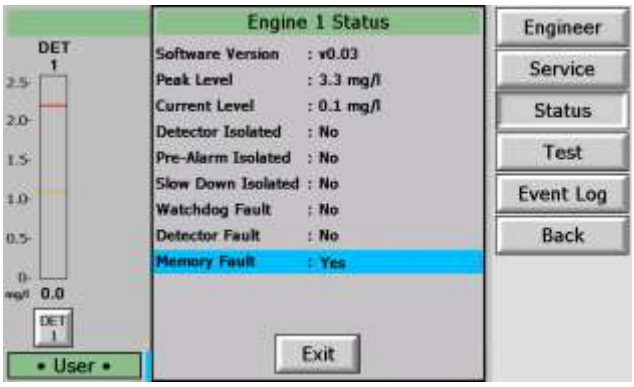


Figure 154 Engine Status Screen – Memory Fault

Identify the fault being indicated, in this case a Control Unit Memory fault.

Alternatively, an inspection of the engine event log, see section 3.6, will show one of the below events:

Control Unit Error	Engine *X*	RAM
Control Unit Error	Engine *X*	RTC
Control Unit Error	Engine *X*	Flash

Having established which Control Unit is in fault the following steps should be followed.

1. Power down the Control Unit.
2. Power up the Control Unit.
3. Check if the memory fault reoccurs.

   If the memory fault does not reoccur no further action is required.

   If the memory fault reoccurs the Control Unit PCB has failed and should be replaced.

5.2.5 Controller Watchdog

The Control Unit continually checks the operation of the software on the PCB to ensure that it has not been corrupted or locked up. If an error in the software operation occurs an automatic reset will be performed to restart the Control Unit operation. If the software has been successfully restarted the performance of an automatic reset is indicated as a Controller Watchdog.

5.2.5.1 Control Unit software restarted

To identify the type of fault on the Control Unit access the Engine Status Screen, see section 3.4.

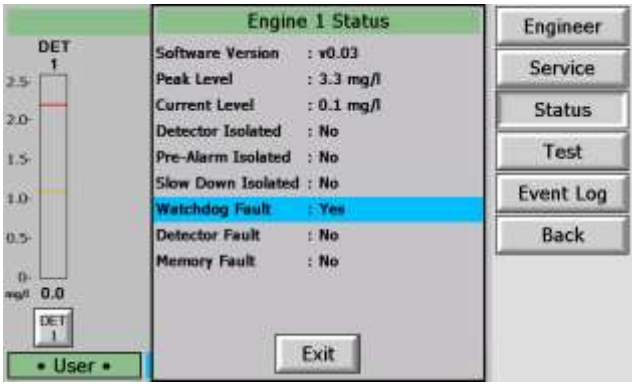


Figure 155 Engine Status Screen – Watchdog Fault

Identify the fault being indicated, in this case a Control Unit Watchdog fault.

Alternatively, an inspection of the engine event log, see section 3.6, will list the event:

Controller Watchdog Engine *X*

Having established which Control Unit is in fault the following steps should be followed.

1. Examine the Event Log to establish the frequency at which the Controller Watchdog is occurring.

   If multiple Controller Watchdogs are recorded in the event log go to item 2

   If a single Controller Watchdog is recorded in the event log Accept and Reset the Control Unit to clear the fault. No further action is required.

2. Examine the Control Unit System Test Log, see section 5.3. Check the Control Unit power supply voltage on each record. The average power supply voltage should be within the specified Control Unit operating voltage, see section 1.3. The peak to peak voltage variation should be less than 1.2v.

   If the voltages recorded in the System Test Log are not within the specification go to item 3

   If the voltages recorded in the System Test Log are within the specification the Control Unit PCB should be replaced.

3. Examine the power supply cable to the Control Unit ensuring that:

   a. Screened cable has been used

   b. The cable screen is connected to the SCN terminal of Supply Input terminal block.

   If the cable is fitted correctly the power supply used for the Control Unit should be examined and if necessary changed.

   If the cable is not fitted correctly, change the cable connections to conform with this installation manual, see section 2.7.1.

5.2.5.2 Control Unit software not restarted

If the software fails to restart the following indications will be observed:

Detector	The fault LED will be on for all detectors.
Control Unit	Activation of the Fault Relay
Control Unit with membrane	Fault indicator on constant
Remote Display Unit	The display will show a loss of communication with the Control Unit, see Figure 149

The Control Unit PCB has failed and should be replaced.

5.2.6 Fan Fault

The fan fitted to the detector head is required to draw the air from the engine into the detector sample chamber. The detector continuously monitors the operation of the fan and communicates a fault to the Control Unit if the fan stops rotating.

To identify which detector is at fault, from the Engine Overview Screen, Figure 148, select the required engine.

Figure 156 Engine Screen – Detector Fault

Select the faulty detector to access the Detector Status Screen.

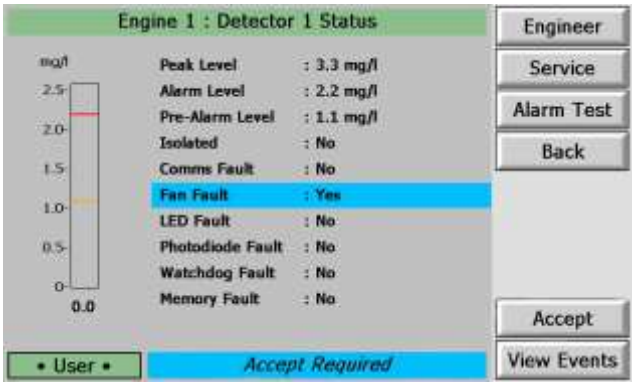


Figure 157 Detector Status Screen – Fan Fault

Identify the fault being indicated, in this case a Fan fault.

Alternatively, an inspection of the engine event log, see section 3.6, will list the event:

Fan Fault Detector *X*

Having established which detector is in fault the following steps should be followed.

1. Using a 4mm hexagon key, unscrew 2 off screws from the underside of the Detector head. The screws are self-retaining.

Figure 158 Detector Head Removal

2. Remove and invert the top part of the Detector head. Examine the base moulding seal and replace if damaged or perished, see Figure 159.

Screw Removal

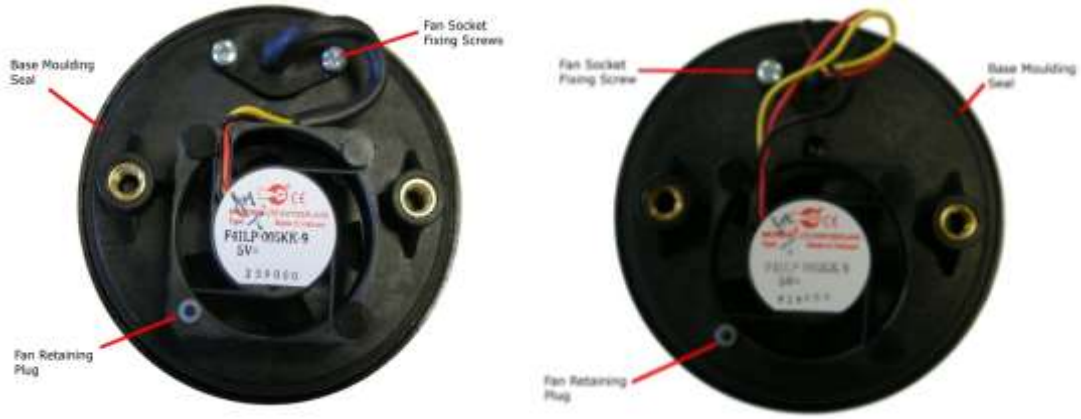


Figure 159 Base Moulding Seal

Caution: Do not press the fan, only handle the outer housing.

3. Using the Pulling Tool, Figure 160, remove the Fan Retaining Plug by capturing the shoulder and pulling. Carefully remove the Fan from its mountings, Figure 161.

Figure 160 Pulling Tool

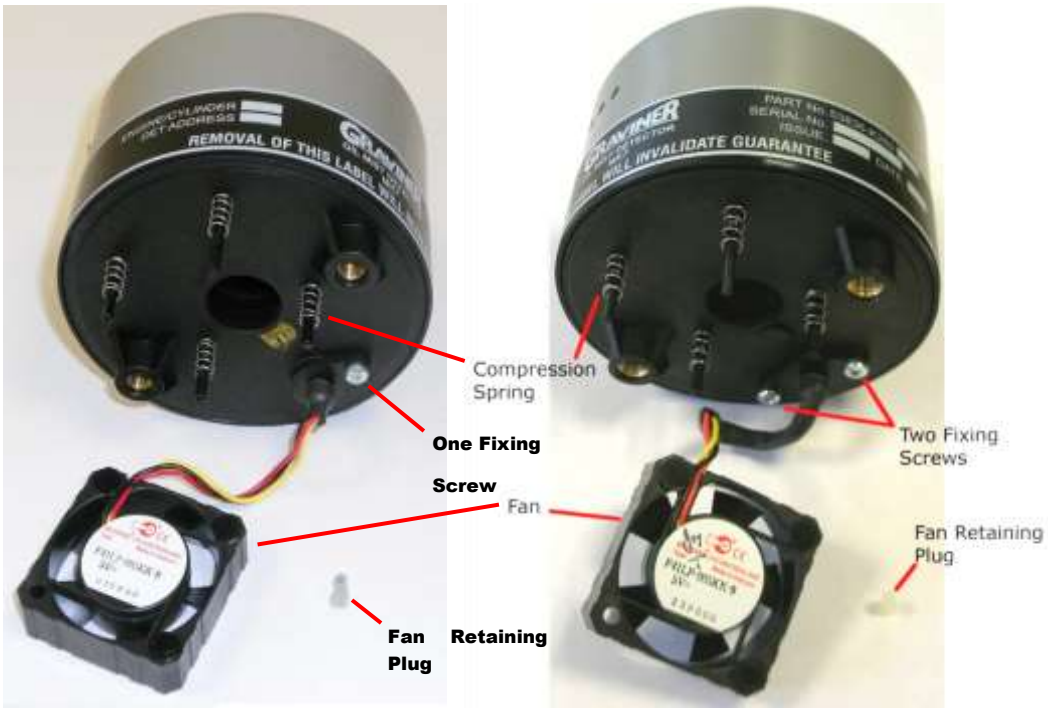


Figure 161 Fan Removal

4. Examine the 4 off compression springs and the fan retainer plug; replace any bent or damaged items from the spares.
5. Remove the fixing screw holding the fan socket to the mounting plate and unplug the fan from the detector head.
6. Discard the failed fan and fit a replacement fan in reverse order of disassembly.
7. Reconnect the detector head to the base and to the Control Unit, ensure that the fault does not reoccur.

5.2.7 Gain Digipot Read Fault

The gain digipot is a component within a detector used to ensure the correct calibration of the detector. The digipot value is set during the production of the detector and cannot be changed. The detector constantly monitors the digipot value to ensure that it has not been corrupted and communicates the fault to the Control Unit If an error in the value is identified a Gain Digipot Read Fault will be indicated.

To identify which detector is at fault, from the Engine Overview Screen, Figure 148, select the required engine.

Figure 162 Engine Screen – Detector Fault

Select the faulty detector to access the Detector Status Screen.

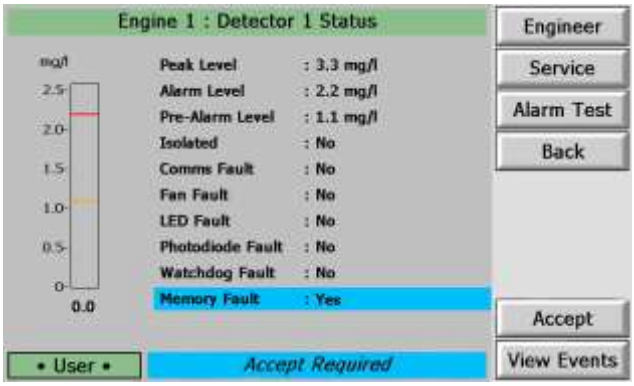


Figure 163 Detector Status Screen – Memory Fault

Identify the fault being indicated, in this case a Memory fault.

Alternatively an inspection of the engine event log, see section 3.6, will list the event:

Gain Digipot Read Fault Detector *X*

Having established which detector is in fault the following steps should be followed.

1. Disconnect the detector cable from the detector, to remove the power from the detector.
2. Reconnect the detector.
3. Accept and Reset the fault.
4. Check if the memory fault reoccurs.

   If the memory fault does not reoccur no further action is required.

   If the memory fault reoccurs the detector has failed and should be replaced.

5.2.8 Offset Digipot Read Fault

The offset digipot is a component within a detector used to ensure the correct calibration of the detector. The digipot value is set during the production of the detector and cannot be changed. The detector constantly monitors the digipot value to ensure that it has not been corrupted and communicates the fault to the Control Unit If an error in the value is identified an Offset Digipot Read Fault will be indicated.

To identify which detector is at fault, from the Engine Overview Screen, Figure 148, select the required engine.

Figure 164 Engine Screen – Detector Fault

Select the faulty detector to access the Detector Status Screen.

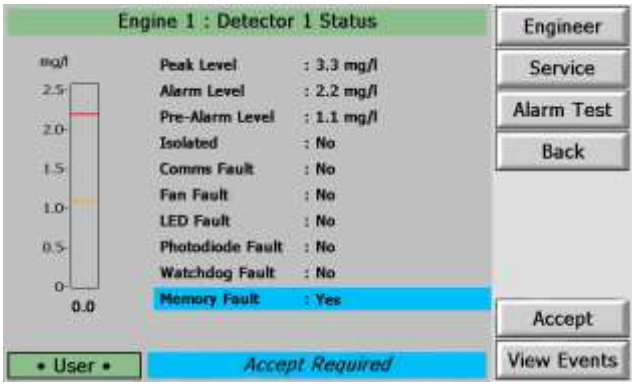


Figure 165 Detector Status Screen – Memory Fault

Identify the fault being indicated, in this case a Memory fault.

Alternatively, an inspection of the engine event log, see section 3.6, will list the event:

Offset Digipot Read Fault Detector X

Having established which detector is in fault the following steps should be followed.

5. Disconnect the detector cable from the detector, to remove the power from the detector.
6. Reconnect the detector.
7. Accept and Reset the fault.
8. Check if the memory fault reoccurs.

   If the memory fault does not reoccur no further action is required.

   If the memory fault reoccurs the detector has failed and should be replaced.

5.2.9 Photodiode Fault

As part of the oil mist measurement process light scattered from the oil mist particles in the sample chamber is measured by a photodiode. Over time condensing oil can build up on glass in front of the photodiode causing the light reaching the photodiode to be reduced. The OMD Mk7 Detector monitors the level of light reaching the photodiode and produces a fault indication if the light level drops below a predetermined limit.

Testing of the photodiode is performed automatically as part of the system test performed at 16:00hrs or maybe performed manually via the Optics Test in the Test Menu, see 3.5.

If the light level reaching the photodiode falls below the allowed limit the detector will communicate the fault to the Control Unit. The Control Unit will then indicate a photodiode fault, see section 5.1.1.

To identify which detector is at fault, from the Engine Overview Screen, Figure 148, select the required engine.

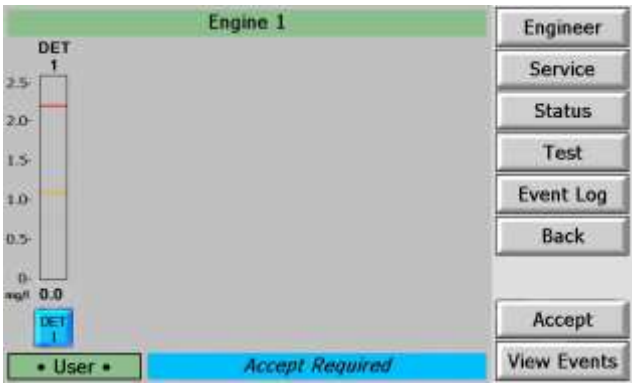


Figure 166 Engine Screen – Detector Fault

Select the faulty detector to access the Detector Status Screen.

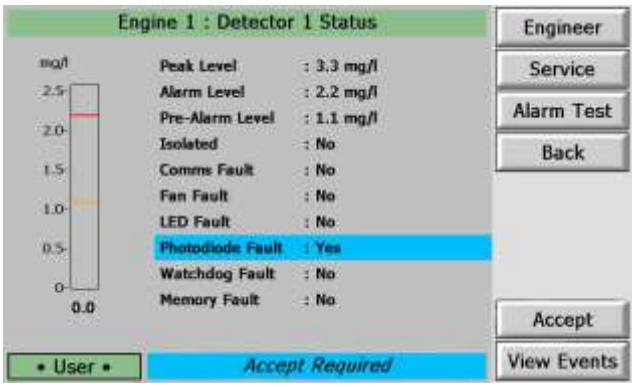


Figure 167 Detector Status Screen – Photodiode Fault

Identify the fault being indicated, in this case a Photodiode fault.

Alternatively, an inspection of the engine event log, see section 3.6, will list the event:

Photodiode Fault Detector X

Having established which detector is in fault it is necessary to establish the cause of the fault using the following steps.

1. See section 4.6 for proper Detector Head removal, cleaning and refitting. Ensure Detector Heads & Detector base O-Ring seals are properly fitted with Molykote O-Ring Lubricant.
2. Clean the Detector twice using the recommended cleaning buds and fluid.
3. Connect the detector to the Control Unit.
4. Perform an Optics Test via the Test Menu, see 3.5.
5. Check if the Photodiode Fault reoccurs.

   If the photodiode fault does not reoccur no further action is required.

   If the photodiode fault reoccurs the detector has failed and should be replaced.

5.2.10 Warning Memory Limit Met

The manufacture of the memory used to store the event log and the system test log specifies a number of memory erase cycles for the unit. To prevent a potential loss of data in the Control Unit a count of the number of erase cycles performed is maintained in the Control Unit. When the specified limit is reached, a fault indication is provided by the Control Unit.

Due to the memory capacity with normal operation of the system it is expected that memory will last over 20 years before the memory limit is met.

Note the system configuration data is not stored in this memory and is not affected by potential loss of data when the memory limit is reached.

To identify the type of fault on the Control Unit access the Engine Status Screen, see section 3.4.

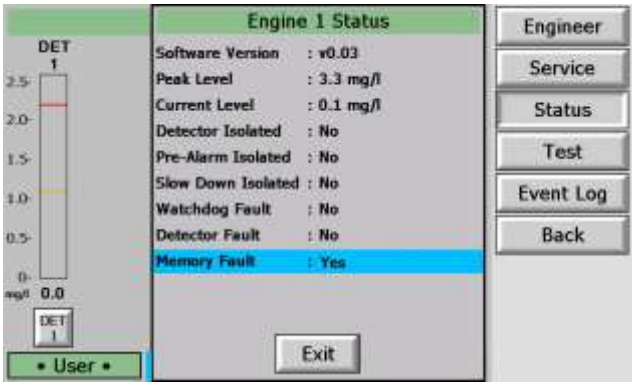


Figure 168 Engine Status Screen – Memory Fault

Identify the fault being indicated, in this case a Control Unit Memory fault.

Alternatively, an inspection of the engine event log, see section 3.6, will show one of the below events:

Warning Memory Limit Met Engine *X*

Having established which Control Unit is in fault and that the Warning Memory Limit Met fault has occurred the Control Unit PCB should be replaced.

5.2.11 Watchdog Fault

The detector continually checks the operation of the detector software to ensure that it has not been corrupted or locked up. If an error in the software operation occurs an automatic reset will be performed to restart the detector operation. If the software has been successfully restarted the performance of an automatic reset is indicated as a Watchdog Fault.

5.2.11.1 Detector software restarted

To identify which detector is at fault, from the Engine Overview Screen, Figure 148, select the required engine.

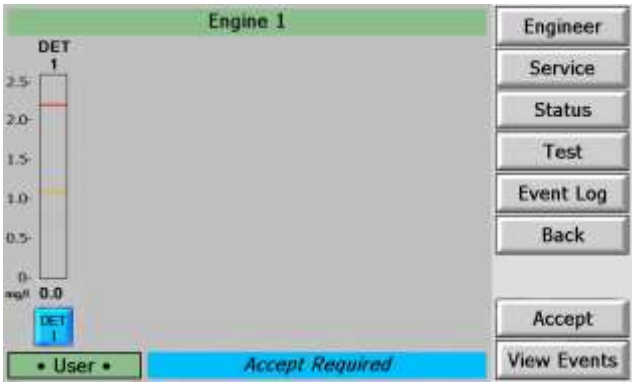


Figure 169 Engine Screen – Detector Fault

Select the faulty detector to access the Detector Status Screen.

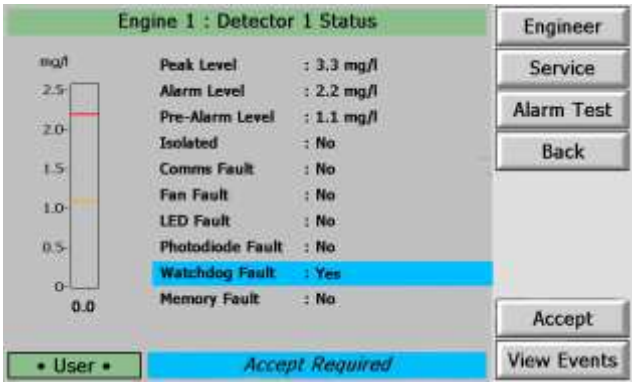


Figure 170 Detector Status Screen – Watchdog Fault

Identify the fault being indicated, in this case a Watchdog fault.

Alternatively an inspection of the engine event log, see section 3.6, will list the event:

Watchdog Fault Detector *X*

Having established which detector is in fault the following steps should be followed.

1. Examine the Event Log to establish the frequency at which the Watchdog is occurring.

   If multiple Watchdogs are recorded in the event log the detector should be replaced.

   If a single Watchdog is recorded in the event log Accept and Reset the Control Unit to clear the fault. No further action is required.

5.2.12 Remote Display Unit Time and Date Incorrect.

Changing the time and date maintained in the Remote Display Unit is performed at Engineer access level via the Set Time / Date Screen, see Figure 38. When accessing the Time / Date screen the current date and time will be displayed. If the battery used to maintain the real time clock reaches its end of life, the correct time and date are no longer maintained, and the display will show an incorrect time and date. A typical display is shown below.

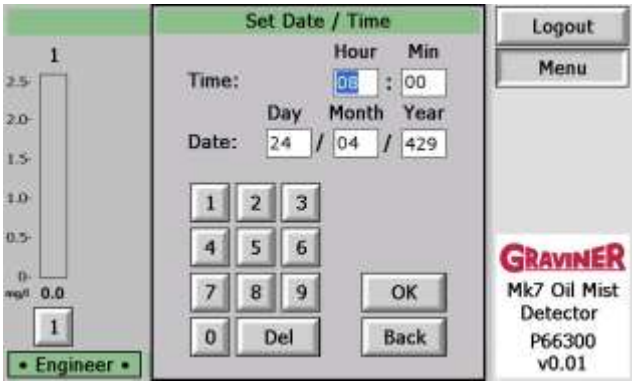


Figure 171 RTC Battery Failure

The RDU uses a standard CR1220 3v Lithium Coin Battery (12.5mm diameter)

Figure 172 CR1220 Battery

To ensure reliability and battery life we recommend the use of a quality brand.

Note: To maintain the warranty for the Control Unit changing of the battery should be performed by an approved Service Engineer.

The OMD Mk7 system can function independently of the RDU allowing the RDU to be disconnected whilst the rest of the OMD system remains in operation. In this case the Modbus connector should be removed BEFORE removing the 24V input to the RDU.

The procedure to replace the battery is as follows:

1. Remove the RDU from its mounting position, disconnect the Modbus connector followed by the 24V power connector from the base of the unit.
2. Place the RDU face down and remove the six screws which locate the rear cover.

   In the case of a bulkhead mounted RDU the backbox must be removed first by removing the 4 screws on the side. Please be mindful of the captive nuts within a bulkhead mounted RDU as these may slide out during disassembly.
3. The RDU should be turned face up after removing the screws prior to removing the front cover, this will prevent the captive nuts from falling out of their holders.
4. Care should also be taken not to pull the connecting cables when lifting the RDU cover. The easiest way is to lift the lid and flip it down.
5. Check that the blue plug in board is seated correctly and fitted firmly in its socket.

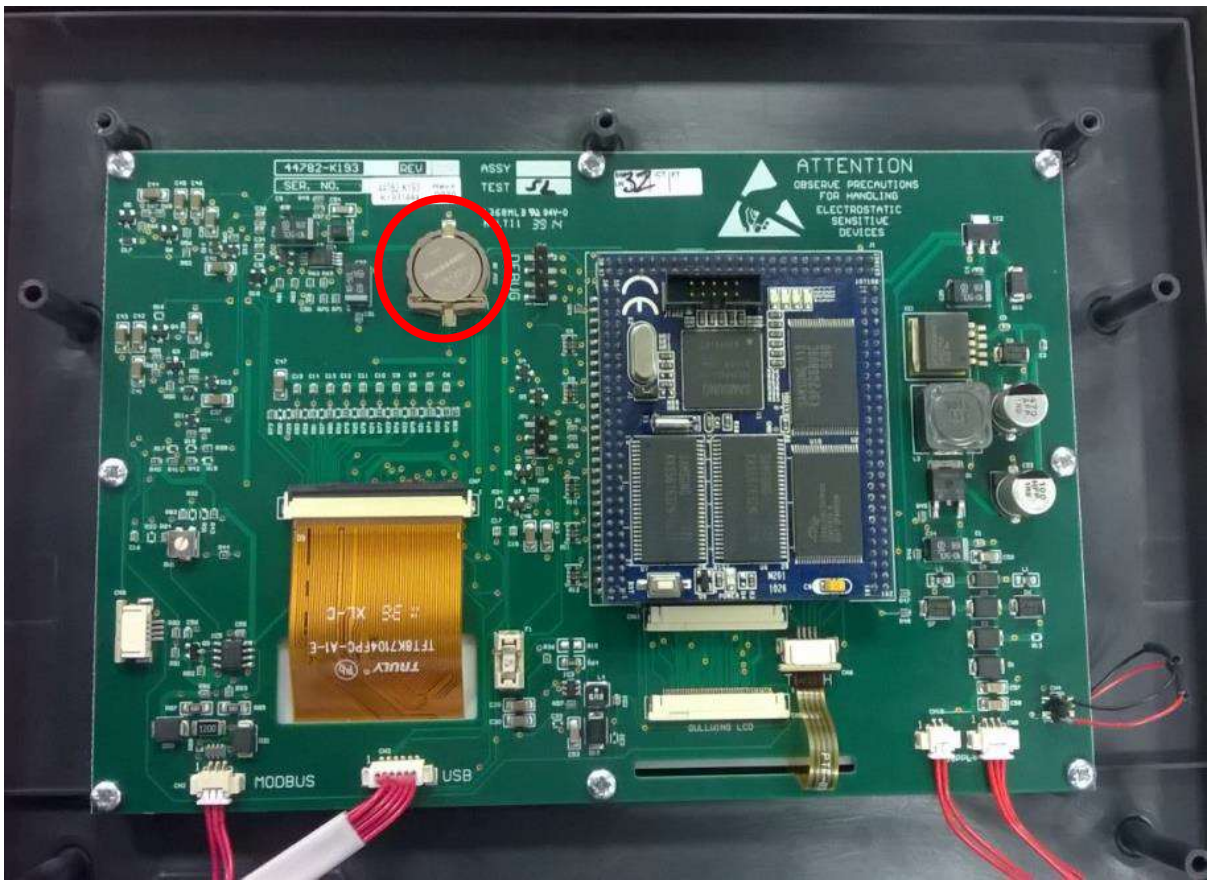


Figure 173 Real Time Clock Battery Location

6. Note the orientation the existing battery, see Figure 174 (the positive terminal is facing outwards)

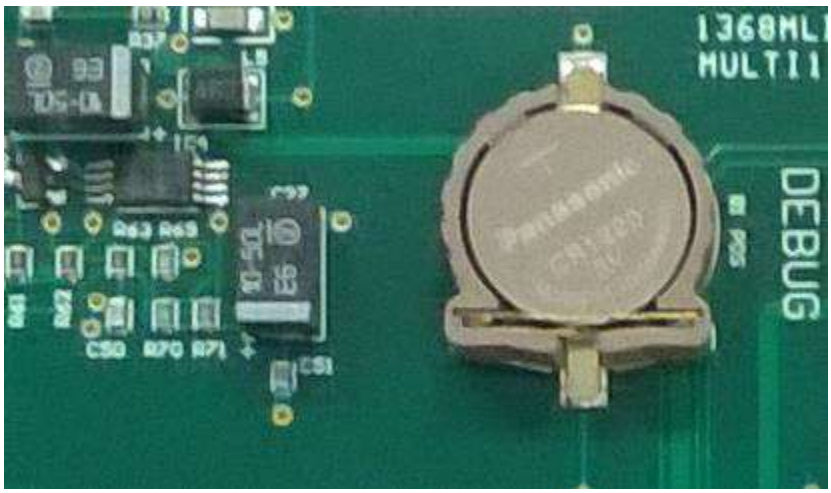


Figure 174 RTC Battery Orientation

7. Using a suitable tool remove and replace the battery, ensuring that the new cell is latched firmly in position.
8. Re-attach the casing(s), taking care not to over tighten the fixing screws and reconnect the 24V power connections FOLLOWED by the Modbus connector.
9. Set the correct time and date via the Time / Date Screen, see Figure 38 and Figure 39.

5.2.13 Control Unit Time and Date Incorrect.

When viewing a Control Unit Event Log each event is time stamped with the time and date the event occurred. The time and date are obtained from the Control Unit real time clock. If the battery used to maintain the real time clock reaches its end of life, the correct time and date are no longer maintained, and the time and date shown in the event log will be incorrect. A typical event log is shown below.

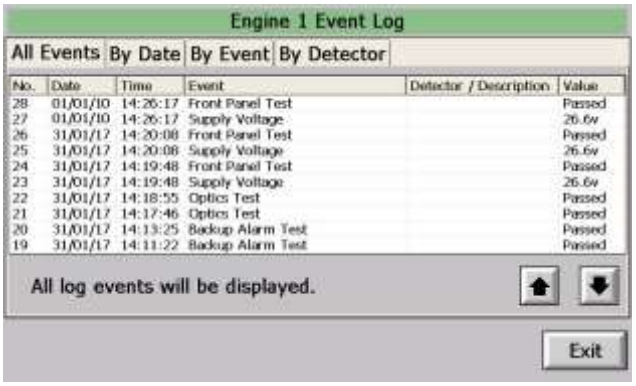


Figure 175 Control Unit RTC Battery Failure

Note that the date has changed to 01/01/10.

Note: To maintain the warranty for the Control Unit changing of the battery should be performed by an approved Service Engineer.

The Control Unit uses a standard CR1220 3v Lithium Coin Battery (12.5mm diameter) see Figure 172.

To ensure reliability and battery life we recommend the use of a quality brand.

To replace the battery:

1. Follow the procedure to replace the Control Unit PCB, see section 6.1.1.
2. Remove the two middle screws fixing the metal can over the PCB.

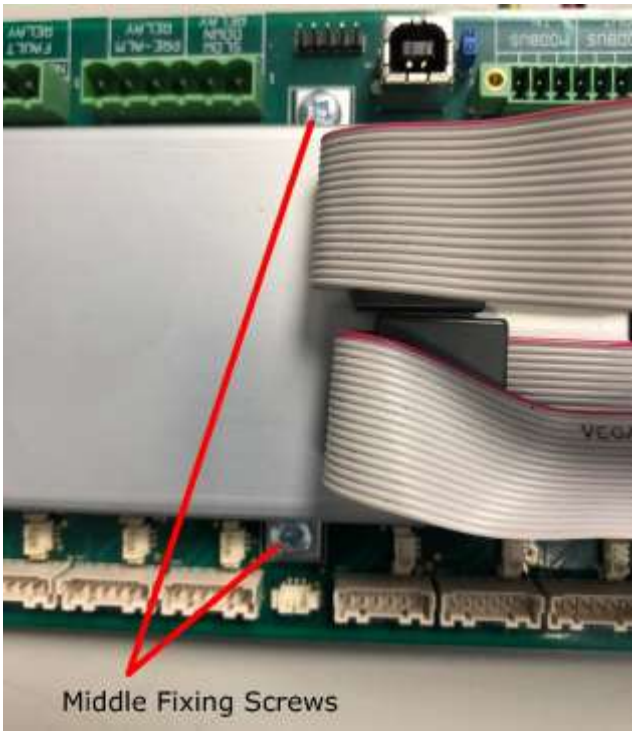


Figure 176 Control Unit Middle Fixing Screws

3. Tilt the metal can taking care not to detach the ribbon cables from the PCB.
4. Note the orientation the existing battery, see Figure 177 (the positive terminal is facing outwards)

Figure 177 Control Unit Battery Orientation

5. Using a suitable tool remove and replace the battery, ensuring that the new cell is latched firmly in position.
6. Reattach the metal can with the two middle screws and metal pillars.

7. Replace the PCB in the Control Unit enclosure.

5.2.14 Remote Display Unit not communicating with the Control Units

In the event of a communications failure between the Remote Display Unit and the Control Unit(s) the bar graph for the engine will be displayed with a cross through it.

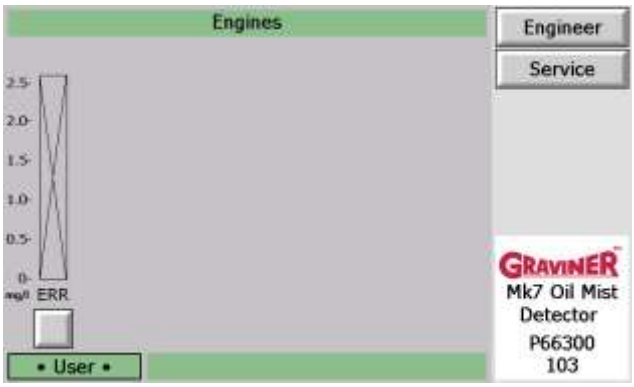


Figure 178 Remote Display Unit Communication Fault

In the event of a communications failure the following steps should be followed:

1. Check the Modbus connections in each Control Unit, ensuring that in each case all four connections are made to the terminals, A, B, GND and SCN.

   If the connections are correctly made go to item 2.

   If the connections are incorrect reconnect the cable correctly or if necessary, replace the cable.

2. Check the Modbus connections in the junction box if one has been used to extend the cable from the Remote Display Unit. Ensure all four connections are made between the two joined cables A, B, GND and SCN.

   If the connections are correctly made go to item 3.

   If the connections are incorrect reconnect the cable correctly or if necessary, replace the cable.

3. Check that screened cable has been used for both the Modbus and Power Supply connections to the Remote Display Unit.

   If the cables are correctly made go to item 4.

   If the cables are incorrect replace the cable with an approved cable, see section 2.6.

4. Check that screened cable has been used for both the Modbus and Power Supply connections to the Control Unit.

   If the cables are correctly made go to item 5.

   If the cables are incorrect replace the cable with an approved cable, see section 2.2

5. Check that the end of line jumpers are installed only in the last Control Unit, see Figure 8.

   If the end of line jumpers are correctly configured, go to item 6

   If the jumper links are installed in more than one Control Unit remove the links from all except the last one.

   If no jumper links are installed in the Control Unit place jumper links across the end of line pins in the last Control Unit.

6. Check that the Modbus address is correct in each Control Unit. The Modbus address can be checked by observing the Control Unit LED's during power up, see section 3.1.

   In the case of Control Units without a membrane fitted an approved service engineer will be required to check the Modbus address and to change the address.

   If the Modbus addresses are correct, go to item 7.

If the Modbus addresses are incorrect set them to the correct values, see section 2.10.1

7. Observe the number of Control Units failing to communicate with the Remote Display Unit.

   If the system has multiple Control Units fitted with some units communicating correctly replace the Control Unit PCB in the non-communicating Control Units, see section 6.1.1.

   If the system has multiple Control Units with communication failure indicated on all units replace the Remote Display Unit, see section 6.2.1.

   For systems with one Control Unit connected to a Remote Display Unit it is not possible to determine which unit should be replaced. If a spare Control Unit PCB or Remote Display Unit is available these can be swapped with the existing units to determine which to replace.

   If spares are not available, it may be necessary to obtain replacements for both the Control Unit PCB and Remote Display Unit.

5.2.15 Remote Display Unit remains on the initial screen.

At power up the Remote Display Unit will initially display the Graviner splash screen, see Figure 79 while the operational software is configured. A failure of the software will cause the power up sequence to freeze and the display to remain showing the Graviner splash screen.

In this case:

1. Open the Plastic flap at the front of the Remote Display Unit
2. To the right of the USB socket is the RDU reset button.

Figure 179 Remote Display Reset

3. Using a small probe or opened paper clip push the reset button

   If the Remote Display Unit operates correctly no further action is required.

   If the display remains showing the Graviner splash screen the Remote Display Unit should be replaced.

5.2.16 Remote Display Unit displays a software exception message.

A software failure in Remote Display Unit operating system may cause an exception message to be displayed on the screen and the software to halt.

Figure 180 Remote Display Exception Error

In this case:

1. Open the Plastic flap at the front of the Remote Display Unit
2. To the right of the USB socket is the RDU reset button.
3. Using a small probe or opened paper clip push the reset button

If the Remote Display Unit operates correctly no further action is required.

If the display remains showing the Graviner splash screen the Remote Display Unit should be replaced.

5.3 SYSTEM TEST LOG.

Access to the System Test Log requires Engineer Level access.

As part of the daily system checks performed by each Control Unit at 16:00hrs a record is maintained of data from the Control Unit and from each detector. The recorded data consists of:

Control Unit Data

Average Power Supply Voltage

Peak to peak supply voltage variation

Detector Data

Peak oil mist reading

Peak detector internal temperature

Peak detector vibration in the X, Y and Z directions

From the Engine Screen, see section 3.11, press the Test Log button.

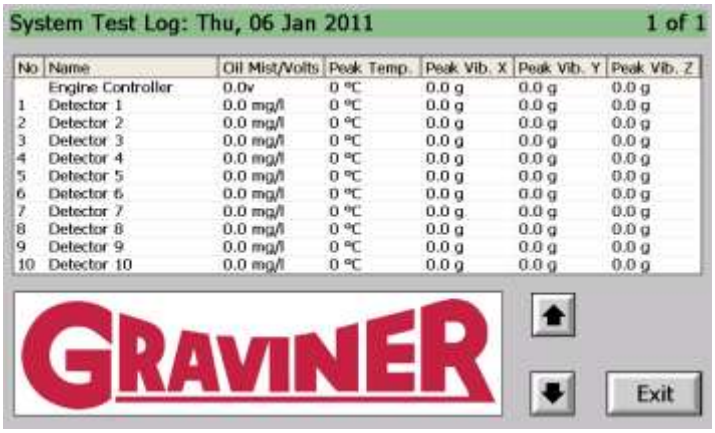


Figure 181 Test Log Screen

One page of the System Test Log shows 1 days recorded data; the date of the recording being displayed at the top of the screen.

Use the up and down arrows to scroll through the log. The System Test Log is a rolling buffer that can hold up to 1 year's records. When the records exceed 365 days then the oldest event is dropped off the System Test Log.

Regular examination of the System Test Log can highlight changes in the engine operation, increases in oil mist reading, temperature or vibration may be symptoms of a potential engine issue.

6 SPARE PARTS

6.1 CONTROL UNIT

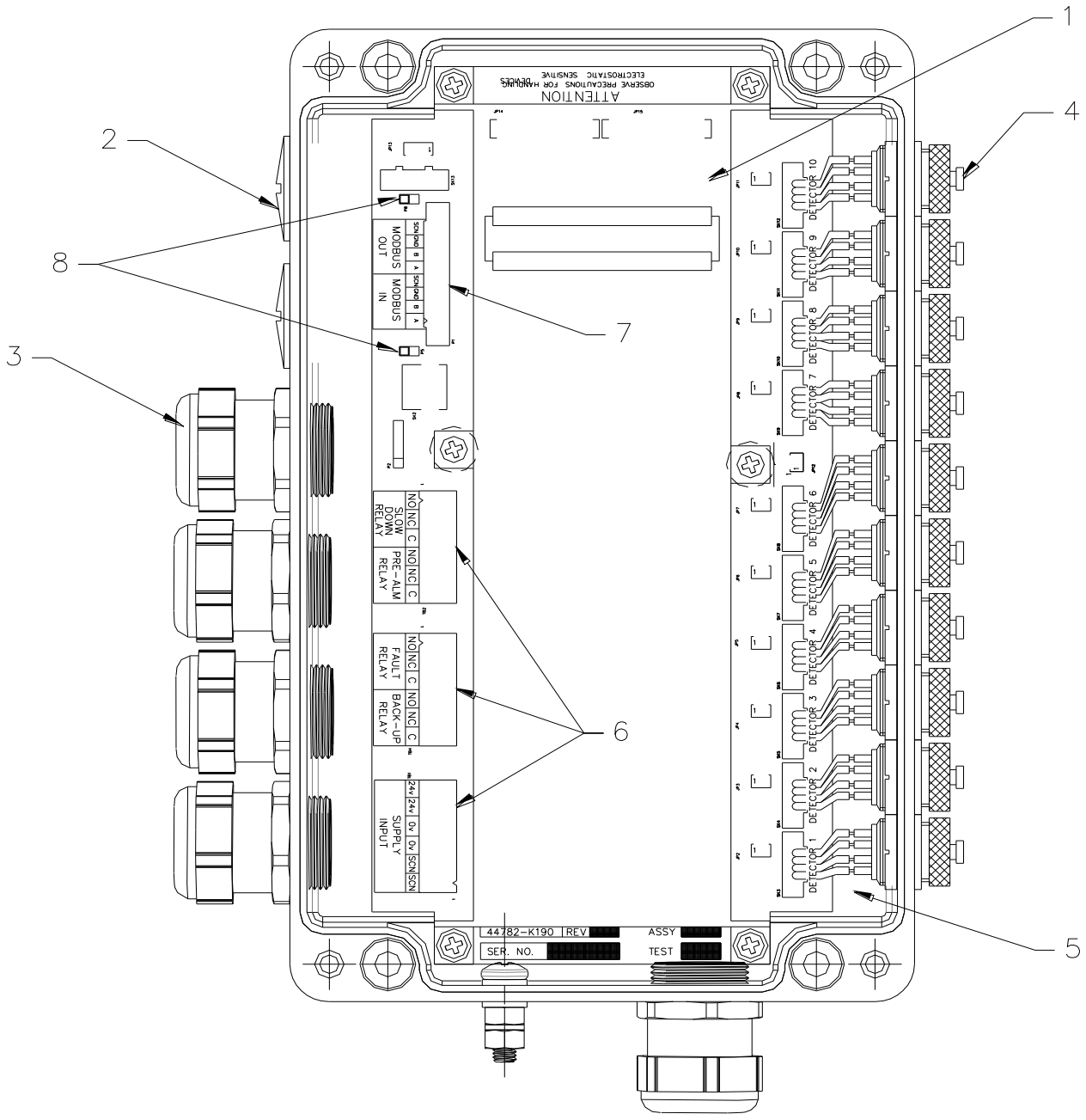


Figure 182 Control Unit Spares

Control Unit Spares		
Item	Description	Part No.
	Control Unit with Membrane	1-53836-K270
	Control Unit with Membrane (Caterpillar)	1-53836-K270-01
	Control Unit without Membrane	1-53836-K276
1.	Printed Circuit Board c/w Ribbon Cables	1-43782-K172-00
1.	Printed Circuit Board w/out Ribbon Cables	1-43782-K172-01
1.	Printed Circuit Board c/w Ribbon Cables (Caterpillar)	1-43782-K172-02
2.	25mm Blanking Plug	1-22540-K029
3.	25mm Metal Gland	1-22540-K028
	Detector Harness Kit	1-53569-K003
5.	6 Way Detector Connection – Qty 1	
	Wrench Tool – Qty 1	
	Control Unit Connector Kit	1-53569-K004
6.	Relay & Power Plugs – Qty 3	
7.	Modbus Plug – Qty 1	
8.	EOL Jumpers – Qty 2	

6.1.1 Control Unit PCB Replacement

Note: The Modbus data cable to the Remote Display Unit should NOT be connected to or disconnected from the Control Unit with the power applied to the Control Unit or the Remote Display Unit.

1. Prior to powering down the Mk7 OMD system use the Remote Display Unit to read and make note of the parameters below.

   These values will need to be re-entered into any replacement Control Unit PCB, using the Remote Display Unit during commissioning.

   a. The Modbus address of the Control Unit.

      Note the Factory default Modbus address = 1.

   b. The number of Detectors connected to each Control Unit,

   c. The Pre-Alarm and Slowdown Alarm levels for each detector.

      Pre-Alarm level: adjustable between 0.5 - 1.2mg/l

      (Factory Default level of 0.9mg/l).

      Engine Slow/Shutdown Alarm level: adjustable between 1.3 - 2.4mg/l

      (Factory Default level of 1.8mg/l.

   d. The positions of the End of Line jumpers on each Control Unit.

      Note: End of Line jumpers are ONLY installed on the last Control Unit connected to the Modbus in any Mk7 OMD multi-engine system or to Control Unit 1 for a single engine system

2. Power down the system.

3. Remove the 4 screws from the lid and lift the Control Unit lid off.

   The metal lid is connected to a PCB fixing point by a short earth wire (see below). The Membrane Keypad is also connected to the Control Unit PCB by two ribbon cables.

Figure 183 Control Unit Earth Wire

4. If the Mk7 Control Unit has a keypad membrane, prior to removing the ribbon connectors from the lid, the sticky pads holding the ferrites to the lid must be eased off.

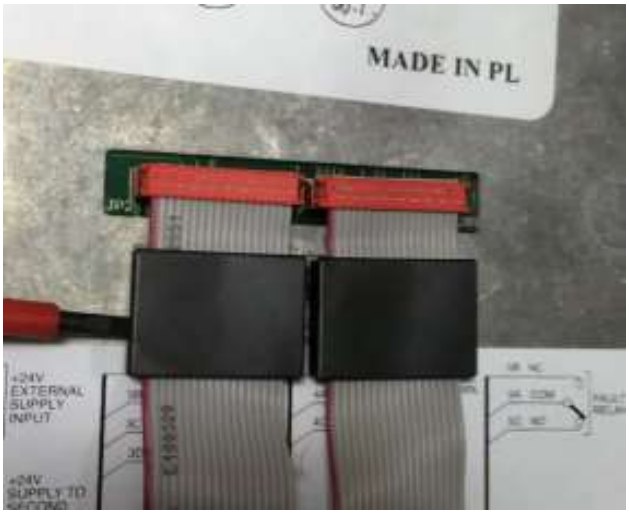


Figure 184 Ribbon Connector Ferrites

5. Disconnect the ribbon cables from the Control Unit lid taking care not to damage the pins and contacts. The ribbon cables are removed from the lid connectors not the PCB. There is no requirement to remove the metal can from the PCB.

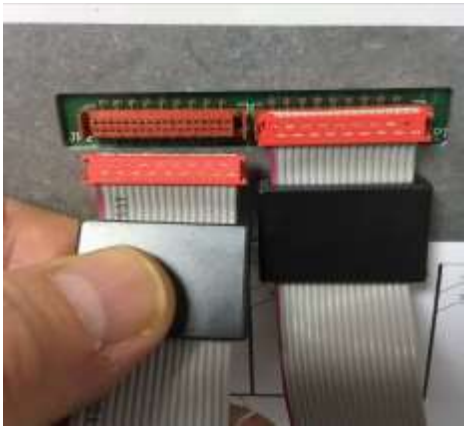


Figure 185 Ribbon Cable Removal

6. Remove the top half of the terminal blocks for the Power Supply Input, Fault Relay/Back-up relay, Slowdown Alarm/Pre-Alarm relay and Modbus In/Out connectors by unscrewing the screws at each end of the connector and easing the connectors apart, taking care not to damage the connection wires or the connector pins/connections.

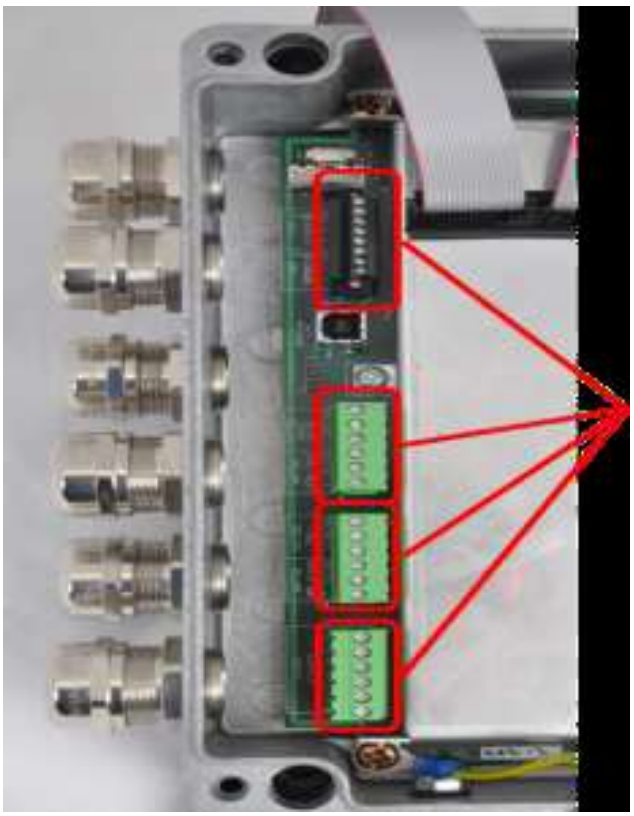


Figure 186 Control Unit Terminal Blocks

7. Disconnect the detector connectors (1 through to 10) – There is a push bar at the side of the connector to release it, taking care not to damage the connection wires or the connector pins/connections.
8. Remove the 4 screws at the corners of the Control Unit PCB.
9. Do NOT remove the 2 screws in the middle of the PCB as this will loosen the center standoffs. The replacement PCB will already have the middle screws and standoffs fitted.
10. Remove the PCB.
11. Fit the replacement PCB in reverse order to the above, ensuring stand-offs are in place and the ground wire is secure under the bottom left PCB screw, contacting the PCB.
12. Ensure the terminal block connections and detector connections are securely re-made and Modbus end of line jumper links are in the correct positions.
13. After replacing the PCB power up the unit and check that the correct number of detectors are indicated.
14. If required set the correct Modbus address, see section 2.10

    In the case of Control Units without a membrane fitted an approved service engineer will be required to change the Modbus address.

Figure 187 Control Unit – With Membrane

15. The Pre-Alarm and Slowdown Alarm values for each detector are reset to their original values see Figure 52.

6.1.2 CONTROL UNIT MEMBRANE

A new Control Unit Lid will be supplied fitted with the Membrane.

1. Unscrew the 4 screws to remove the Control Unit Lid
2. Disconnect the ribbon cables from the Control Unit lid taking care not to damage the pins and contacts. The ribbon cables are removed from the lid connectors not the PCB. There is no requirement to remove the metal can from the PCB.

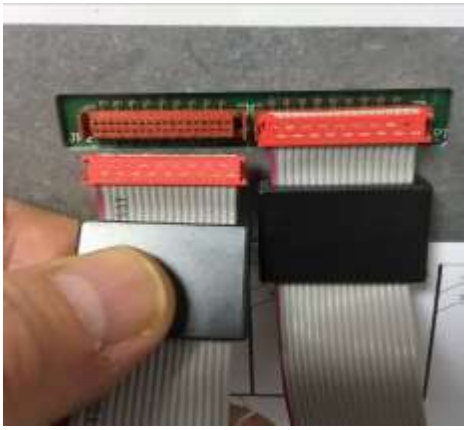


Figure 188 Ribbon Cable Removal

3. Fit new lid in reverse

6.1.3 Control Unit (Pre-Alarm, Slowdown/Shutdown and Backup Alarm or Fault Relay Cable Replacement (Supplied by Others)

1. Switch off the system.
2. Remove the Control Unit Lid by removing the 4 screws
3. Disconnect the damaged relay cable from the Control Unit.
4. Disconnect the damaged relay cable from the monitoring equipment.
5. Connect the replacement relay cable to the Control Unit ensuring it is screwed in place.
6. Connect the replacement relay cable to the monitoring equipment.
7. Switch the system on and allow it to initialise.

6.2 REMOTE DISPLAY UNIT

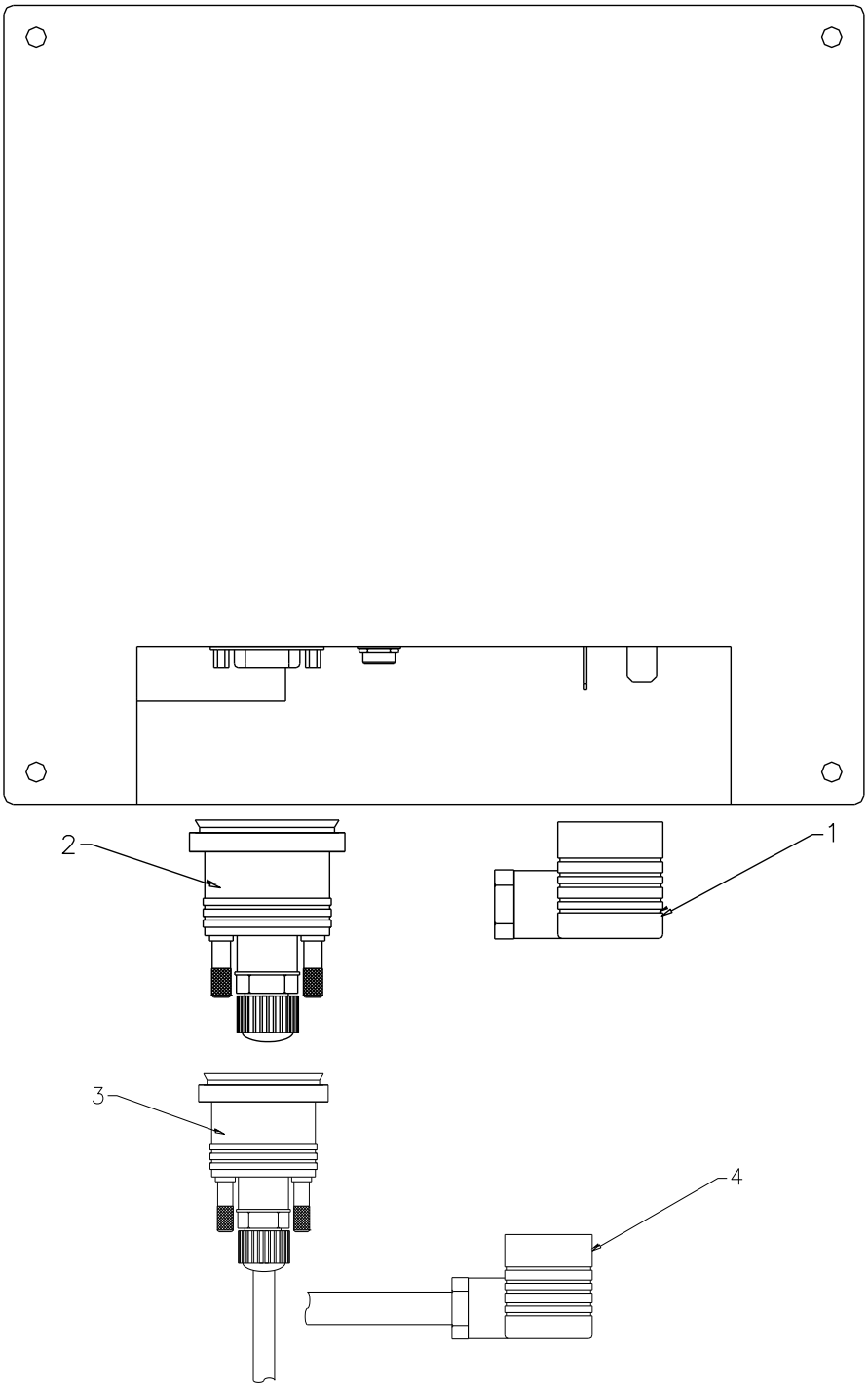


Figure 189 Display Unit Spares

Remote Display Unit Spares		
Item	Description	Part No.
	Remote Display Unit	1-53836-K271
1.	24VDC Power Socket (no Cable)	1-27400-K304
2.	Modbus Connector (no Cable)	1-27400-K305
3.	Modbus Connector c/w 5m Cable	1-43682-K297
4.	24VDC Power Socket c/w 5m Cable	1-43682-K296

6.2.1 Remote Display Unit Replacement

The OMD Mk7 system can function independently of the Remote Display Unit allowing the Remote Display Unit to be disconnected whilst the rest of the OMD system remains in operation. In this case the Modbus connector should be removed BEFORE removing the 24V input to the Remote Display Unit.

The procedure to replace the battery is as follows: -

1. Remove the Remote Display Unit from its mounting position,
2. Disconnect the Modbus connector from the base of the unit.
3. Disconnect the 24V power connector from the base of the unit.
4. Replace the Remote Display Unit.
5. Connect the 24V power connector from the base of the unit.
6. Connect the Modbus connector from the base of the unit.
7. Fix the Remote Display Unit to its mounting position.

6.2.2 Communications Cable Replacement (Supplied by Others)

1. Switch off the system.
2. Disconnect the damaged communications cable from the Control Unit.
3. Disconnect the damaged communications cable from the Remote Display Unit or AMS.
4. Connect the replacement communications cable to the Control Unit ensuring it is screwed in place.
5. The replacement communications cable must be connected to the terminals in the Control Unit and the Remote Display Unit or AMS.
6. Switch the system on and allow it to initialise.

6.3 DETECTOR

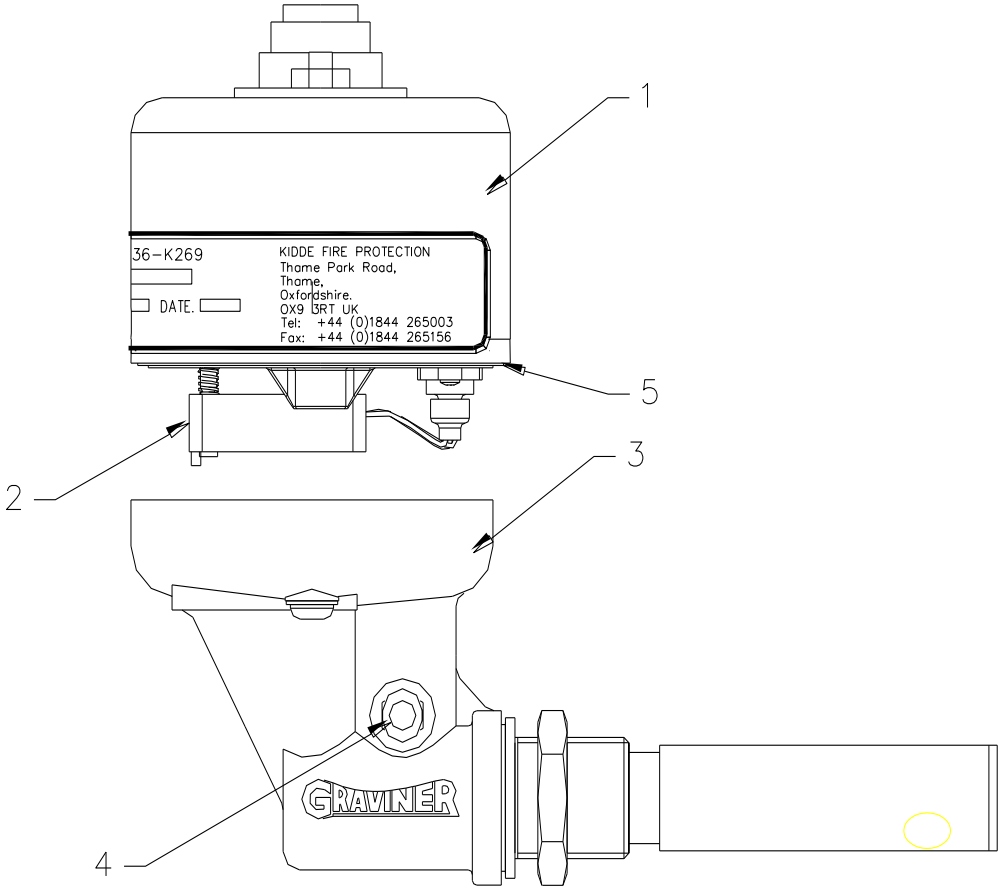


Figure 190 Detector Spares

Detector Spares		
Item	Description	Part No.
	Detector Complete	1-53836-K269
	Detector Complete (Short Sample Pipe)	1-53836-K269-01
1	Detector Head Replacement Assembly	1-53836-K272
2	Fan Assembly (1 Screw) Fan Assembly (2 Screw)	1-D5622-005-02 1-53569-K005
3	Base Unit sub-Assembly Base Unit sub Assembly (Short Sample Pipe)	1-D5622-101 1-D5822-102
4	Connector Push In	1-21888-K073
5	Base Moulding O Ring Seal	1-C1513-802

6.3.1 Detector Head replacement

WARNING - Do NOT remove the Detector from the base whilst the engine is in operation.

This action should be carried out whilst the engine is stopped to avoid the possibility of hot oil coming out of the Detector Base.

1. Switch off the system (if safe to do so) or isolate the Detector
2. Remove the cable connector fitted to the top of the Detector
3. Using a 4mm hexagonal key, loosen the two fixing screws in the assembly base.

Figure 191 Base Fixing Screw Removal

4. Lift the Detector head from the base.
5. Fit the new Detector head onto its base and tighten up the fixing screws. Re-fit the cable to the Detector head.
6. If the system was switched off, switch back on and allow the system to initialise.
7. If isolated, then de-isolate the Detector, Press OK on the Remote Display Unit, display will then return to normal

6.3.2 Replacing the Detector Base

WARNING - Do NOT remove the Detector from the base whilst the engine is in operation.

This action should be carried out whilst the engine is stopped to avoid the possibility of hot oil coming out of the Detector Base.

1. Remove the detector head from the base.
2. Release the locking nut on the detector base.
3. Rotate the detector base to unscrew the base from the mounting hole.
4. Screw the replacement detector base into the mounting hole with the sealing washer against the surface of the engine.
5. Tighten the locking nut against the engine surface.
6. Attach the detector head to the base.

6.3.3 Detector Cable Replacement

1. Isolate the Detector with the damaged cable.
2. Remove the cable connector on top of the Detector.
3. Identify the cable to be removed at the Control Unit
4. Unscrew the cable connector at the Detector and discard the damaged cable.
5. Connect the replacement cable to the connector on the Control Unit ensuring it is screwed in place.
6. Connect the cable connector to the Detector
7. De-isolate the Detector

6.4 SPARES KITS

6.4.1 Commissioning Kit

Commissioning Kit D9221-026 consists of:			
Description	Part No.	Qty	Category
Cleaning Wipes	1-A7311-001	2	Consumables
Smoke Test Oil -30 ml	1-D9221-028	1 Bottle	Consumables
Wick - 150 mm	1-17100-H06	3	Consumables
Smoke Tester	1-D9221-029	1	Tools
Materials Safety Data Sheet	-	2	Information

6.4.2 Service Kit

Service Kit D9221-027 consists of:			
Description	Part No	Qty	Category
Fan Retainer	1-B3741-902	5	Spares
Compression Spring	1-B3721-006	5	Spares
Base Moulding Seal	1-C1513-802	5	Spares
Fan Connector Seal (1 Screw)	1-C1413-801	5	Spares
Fan Connector Seal (2 Screw)	1-35134-K037	5	Spares
M3 Screw	1-21833-H01	5	Spares
Glass Cleaner 250ml	1-A7311-002	1	Consumables
Foam Buds Pkts	1-B6910-217	2	Consumables
4mm Hexagon Key	1-B6910-219	2	Tools
Pulling Tool	1-D9131-002	1	Tools
Materials Safety Data Sheet	-	2	Information

6.5 RECOMMENDED OPERATIONAL SPARES

Recommended Operational Spares			
Description	Part No.	Qty	
Commissioning Kit	1-D9221-026	1	
Service Kit	1-D9221-027	1	
OMD Mk7 Detector Head	1-53836-K272	1	
For systems with more than 10 detectors, it is recommended that additional detector head assemblies (1-53836-K272) are supplied.			

6.6 COMPLETE SPARE PARTS LIST

Description	Part No.	
Control Unit with Membrane for 10 detectors	1-53836-K270	
Control Unit with Membrane for 10 detectors	1-53836-K270-01	Caterpillar only
Control Unit without Membrane for 10 detectors	1-53836-K276	
Touch Screen Display Unit	1-53836-K271	
Detector Complete	1-53836-K269	
Detector Complete (Short Sample pipe)	1-53836-K269-01	
Oil Mist Manager Software	1-53836-K279	

Cable Assemblies

90º Connector		
Description	Part No.	Length
1.0m Cable with 90° Connector	1-43682-K285-1.0	1.0 Metres
1.5m Cable with 90° Connector	1-43682-K285-1.5	1.5 Metres
2.0m Cable with 90° Connector	1-43682-K285-2.0	2.0 Metres
2.5m Cable with 90° Connector	1-43682-K285-2.5	2.5 Metres
3.0m Cable with 90° Connector	1-43682-K285-3.0	3.0 Metres
3.5m Cable with 90° Connector (Discontinued)	1-43682-K285-3.5	3.5 Metres
4.0m Cable with 90° Connector	1-43682-K285-4.0	4.0 Metres
4.5m Cable with 90° Connector (Discontinued)	1-43682-K285-4.5	4.5 Metres
5.0m Cable with 90° Connector	1-43682-K285-5.0	5.0 Metres
5.5m Cable with 90° Connector (Discontinued)	1-43682-K285-5.5	5.5 Metres
6.0m Cable with 90° Connector	1-43682-K285-6.0	6.0 Metres
6.5m Cable with 90° Connector (Discontinued)	1-43682-K285-6.5	6.5 Metres
7.0m Cable with 90° Connector	1-43682-K285-7.0	7.0 Metres
7.5m Cable with 90° Connector (Discontinued)	1-43682-K285-7.5	7.5 Metres
8.0m Cable with 90° Connector	1-43682-K285-8.0	8.0 Metres
8.5m Cable with 90° Connector (Discontinued)	1-43682-K285-8.5	8.5 Metres
9.0m Cable with 90° Connector	1-43682-K285-9.0	9.0 Metres
9.5m Cable with 90° Connector (Discontinued)	1-43682-K285-9.5	9.5 Metres
10.0m Cable with 90° Connector	1-43682-K285-10.0	10.0 Metres
10.5m Cable with 90° Connector (Discontinued)	1-43682-K285-10.5	10.5 Metres
11.0m Cable with 90° Connector	1-43682-K285-11.0	11.0 Metres
11.5m Cable with 90° Connector (Discontinued)	1-43682-K285-11.5	11.5 Metres
12.0m Cable with 90° Connector	1-43682-K285-12.0	12.0 Metres
12.5m Cable with 90° Connector (Discontinued)	1-43682-K285-12.5	12.5 Metres
13.0m Cable with 90° Connector	1-43682-K285-13.0	13.0 Metres
13.5m Cable with 90° Connector (Discontinued)	1-43682-K285-13.5	13.5 Metres
14.0m Cable with 90° Connector (Discontinued)	1-43682-K285-14.0	14.0 Metres
15.0m Cable with 90° Connector	1-43682-K285-15.0	15.0 Metres
16.0m Cable with 90° Connector (Discontinued)	1-43682-K285-16.0	16.0 Metres
17.0m Cable with 90° Connector (Discontinued)	1-43682-K285-17.0	17.0 Metres
17.5m Cable with 90° Connector	1-43682-K285-17.5	17.5 Metres
20.0m Cable with 90° Connector	1-43682-K285-20.0	20.0 Metres
22.5m Cable with 90° Connector	1-43682-K285-22.5	22.5 Metres
23.0m Cable with 90° Connector (Discontinued)	1-43682-K285-23.0	23.0 Metres
25.0m Cable with 90° Connector	1-43682-K285-25.0	25.0 Metres
27.5m Cable with 90° Connector (Discontinued)	1-43682-K285-27.5	27.5 Metres

All cable lengths specified are the nominal lengths, tolerance +/-0.1m.

Cable Assemblies

Straight Connector		
Description	Part No.	Length
1.0m Cable with Straight Connector	1-43682-K286-1.0	1.0 Metres
1.5m Cable with Straight Connector	1-43682-K286-1.5	1.5 Metres
2.0m Cable with Straight Connector	1-43682-K286-2.0	2.0 Metres
2.5m Cable with Straight Connector	1-43682-K286-2.5	2.5 Metres
3.0m Cable with Straight Connector	1-43682-K286-3.0	3.0 Metres
3.5m Cable with Straight Connector (Discontinued)	1-43682-K286-3.5	3.5 Metres
4.0m Cable with Straight Connector	1-43682-K286-4.0	4.0 Metres
4.5m Cable with Straight Connector (Discontinued)	1-43682-K286-4.5	4.5 Metres
5.0m Cable with Straight Connector	1-43682-K286-5.0	5.0 Metres
5.5m Cable with Straight Connector (Discontinued)	1-43682-K286-5.5	5.5 Metres
6.0m Cable with Straight Connector	1-43682-K286-6.0	6.0 Metres
6.5m Cable with Straight Connector (Discontinued)	1-43682-K286-6.5	6.5 Metres
7.0m Cable with Straight Connector	1-43682-K286-7.0	7.0 Metres
7.5m Cable with Straight Connector (Discontinued)	1-43682-K286-7.5	7.5 Metres
8.0m Cable with Straight Connector	1-43682-K286-8.0	8.0 Metres
8.5m Cable with Straight Connector (Discontinued)	1-43682-K286-8.5	8.5 Metres
9.0m Cable with Straight Connector	1-43682-K286-9.0	9.0 Metres
9.5m Cable with Straight Connector (Discontinued)	1-43682-K286-9.5	9.5 Metres
10.0m Cable with Straight Connector	1-43682-K286-10.0	10.0 Metres
10.5m Cable with Straight Connector (Discontinued)	1-43682-K286-10.5	10.5 Metres
11.0m Cable with Straight Connector	1-43682-K286-11.0	11.0 Metres
11.5m Cable with Straight Connector (Discontinued)	1-43682-K286-11.5	11.5 Metres
12.0m Cable with Straight Connector	1-43682-K286-12.0	12.0 Metres
12.5m Cable with Straight Connector (Discontinued)	1-43682-K286-12.5	12.5 Metres
15.0m Cable with Straight Connector	1-43682-K286-15.0	15.0 Metres
17.5m Cable with Straight Connector	1-43682-K286-17.5	17.5 Metres
20.0m Cable with Straight Connector	1-43682-K286-20.0	20.0 Metres
22.5m Cable with Straight Connector	1-43682-K286-22.5	22.5 Metres
25.0m Cable with Straight Connector	1-43682-K286-25.0	25.0 Metres

All cable lengths specified are the nominal lengths, tolerance +/-0.1m.

Description	Part No.	
Spare Parts		
Cotton Wick (1 hank = 10 meters)	1-17100-H06	No longer sold separately
Connector Push in	1-21888-K073	Replaces 1-B5465-307
25mm Metal Gland	1-22540-K028	
25mm Blanking Plug	1-22540-K029	
24VDC Power Socket (no Cable)	1-27400-K304	
Modbus Connector (no Cable)	1-27400-K305	
Mk5 - Mk7 Retrofit Plate	1-35100-K274	
24VDC Power Socket comes with 5m Cable	1-43682-K296	
Modbus Connector comes with 5m Cable	1-43682-K297	
Printed Circuit Board comes with Ribbon Cables	1-43782-K172-00	
Printed Circuit Board without Ribbon Cables	1-43782-K172-01	
Detector Harness Kit	1-53569-K003	
Incl 1 x 6 Way Detector Connection		
Incl 1 x Wrench Tool		
Control Unit Connector Kit	1-53569-K004	
Incl 3 x Relay & Power Plugs		
Incl 1 x Modbus Plug		
Incl 2 x EOL Jumpers		
Micronel Fan Assy 2 screw type	1-53569-K005	
Incl 1 x Fan Connector Seal (2 screw)		
Mk7 Detector Head Replacement Assembly	1-53836-K272	
Incl 1 x 1-53569-K005		
Incl 1 x 1-C1513-802		
Cleaning Wipes	1-A7311-001	
Glass Cleaner 250ml	1-A7311-002	
Compression spring	1-B3721-006	
Fan Retainer	1-B3741-902	
Foam Buds Pkts	1-B6910-217	
4mm Hex Key	1-B6910-219	No longer sold separately
Base Moulding O Ring Seal	1-C1513-802	
Micronel Fan Assy 1 screw type	1-D5622-005-02	
Incl 1 x Fan Connector Seal (1 screw)		
Base unit sub assy	1-D5622-101	
Incl 1 x 1-21888-K073		
Base unit sub assy – Short Sample Pipe	1-D5622-102	
Incl 1 x 1-21888-K073		
Pulling tool	1-D9131-002	
Commissioning Kit	1-D9221-026	
Service Kit	1-D9221-027	
Smoke Oil	1-D9221-028	
Smoke tester	1-D9221-029	

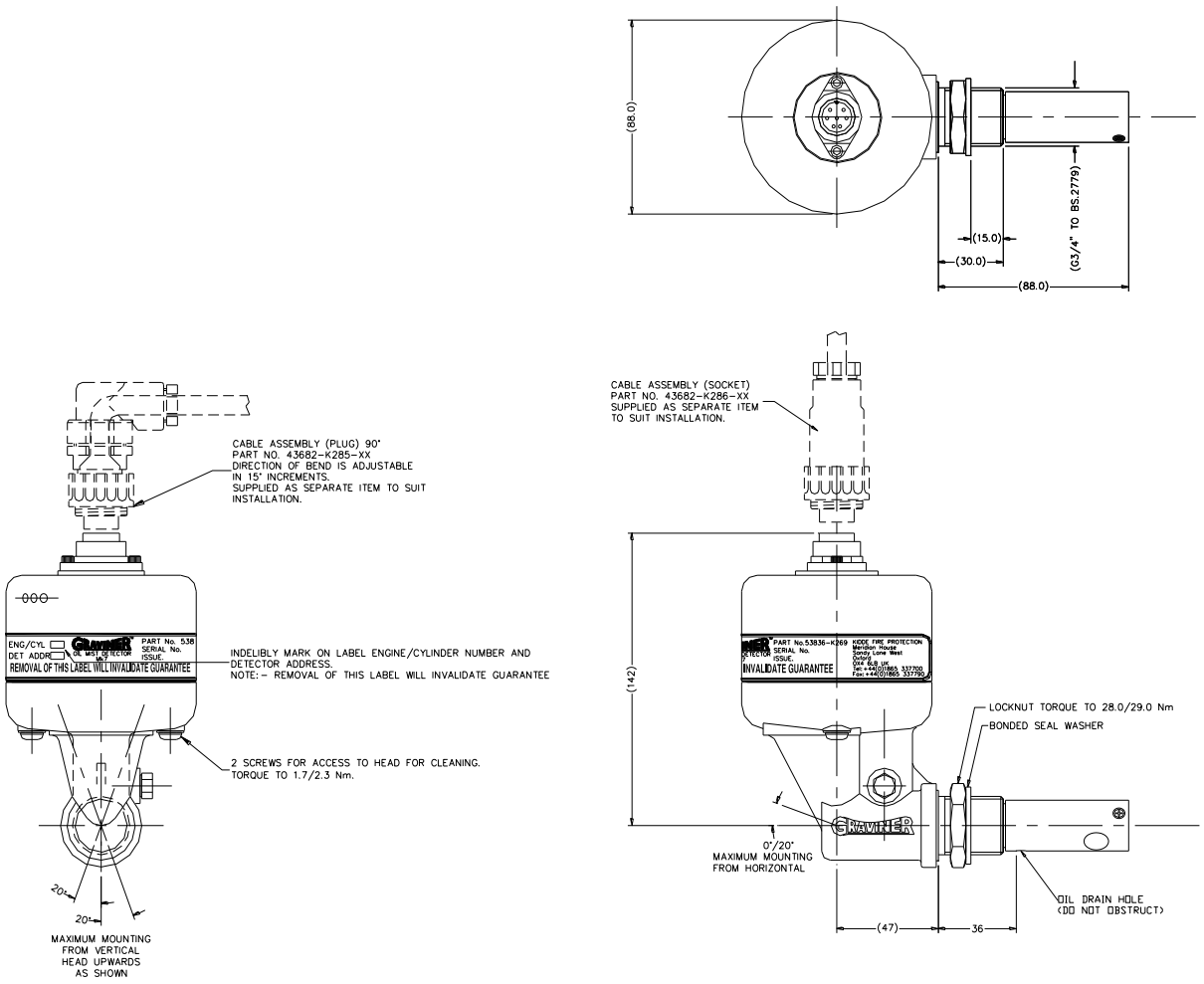


Figure 192 Caterpillar Detector with Short Sample Pipe, 1-53836-K269-03

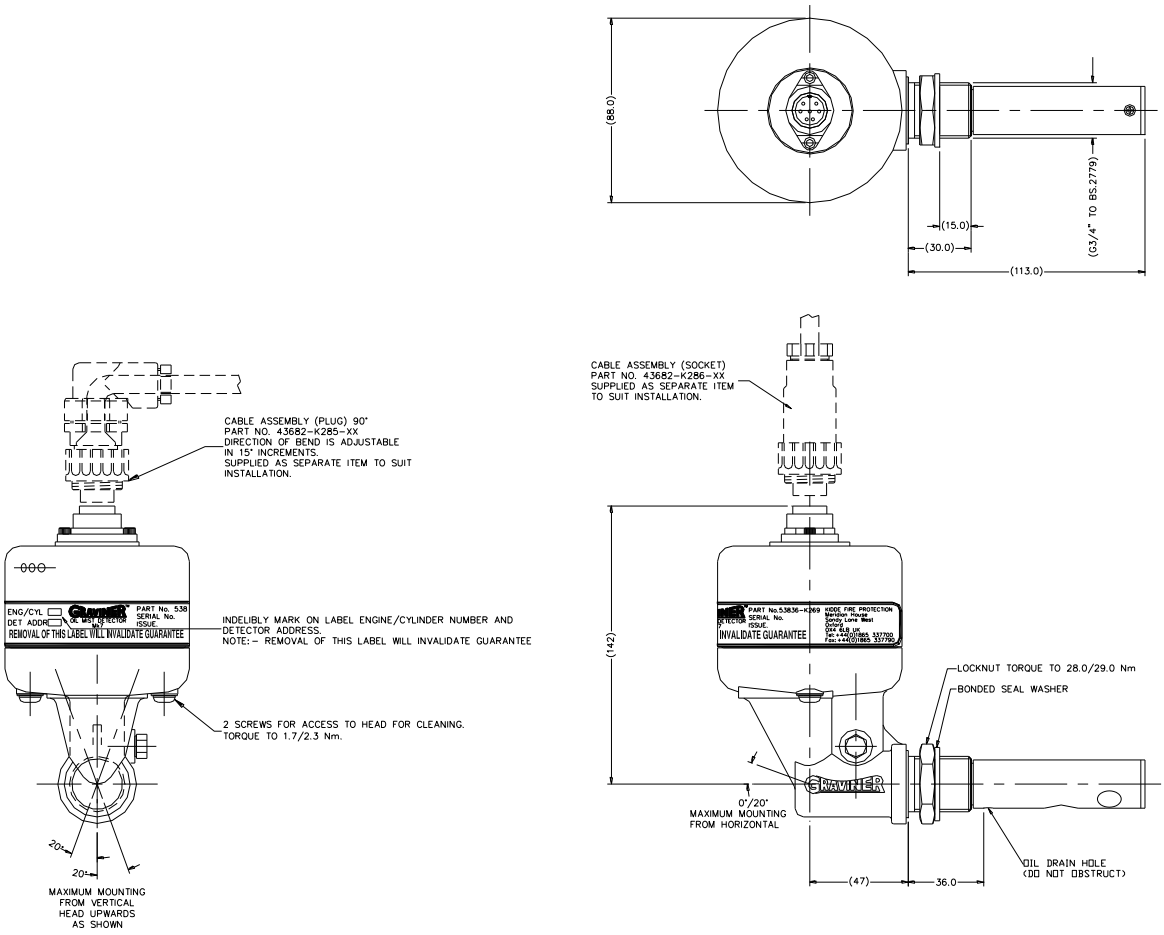


Figure 193 Caterpillar Detector with Standard Sample Pipe, 1-53836-K269-02

Cable Assemblies

90º Connector		
Description	Part No.	Length
0.50m Cable with 90° Connector	1-43682-K298-0.50	0.50 Metres
0.59m Cable with 90° Connector	1-43682-K298-0.59	0.59 Metres
0.65m Cable with 90° Connector	1-43682-K298-0.65	0.65 Metres
0.70m Cable with 90° Connector	1-43682-K298-0.70	0.70 Metres
0.78m Cable with 90° Connector	1-43682-K298-0.78	0.78 Metres
0.81m Cable with 90° Connector	1-43682-K298-0.81	0.81 Metres
0.90m Cable with 90° Connector	1-43682-K298-0.90	0.90 Metres
0.95m Cable with 90° Connector	1-43682-K298-0.95	0.95 Metres
1.05m Cable with 90° Connector	1-43682-K298-1.05	1.05 Metres
1.08m Cable with 90° Connector	1-43682-K298-1.08	1.08 Metres
1.11m Cable with 90° Connector	1-43682-K298-1.11	1.11 Metres
1.15m Cable with 90° Connector	1-43682-K298-1.15	1.15 Metres
1.39m Cable with 90° Connector	1-43682-K298-1.39	1.39 Metres
1.40m Cable with 90° Connector	1-43682-K298-1.40	1.40 Metres
1.43m Cable with 90° Connector	1-43682-K298-1.43	1.43 Metres
1.60m Cable with 90° Connector	1-43682-K298-1.60	1.60 Metres
1.68m Cable with 90° Connector	1-43682-K298-1.68	1.68 Metres
1.72m Cable with 90° Connector	1-43682-K298-1.72	1.72 Metres

All cable lengths specified are the minimum lengths, tolerance -0, +0.1m.

Appendix 1

GRAVINER Mk7 OIL MIST DETECTOR SYSTEM WEEKLY CONTAMINATION READINGS

Engine

Detector Name										
Original Contamination Value										
Contamination Low Limit										
Date	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value

EXAMPLE SHEET

Engine: Generator 1

Detector Name	Det. 1	Det. 2	Det. 3	Det. 4						
Original Contamination Value	3948	3004	3564	2754						
Contamination Low Limit	1974	1502	1782	1377						
Date	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value	Current Contamination Value
15/06/20	3881	2970	3363	2701						
22/06/20	3652	2506	3153	2875						
29/06/20	3777	2049	2497	2267						
06/07/20	3026	1703	2118	1994						
06/07/20 After Cleaning	3547	2165	3378	2599						

Detector 2 is not withing 20% of the original contamination value after cleaning and should be replaced.

Appendix 2

Twice Yearly Maintenance

See Section 4.3 for further details

External Inspection Performed	☐
Internal Inspection Performed	☐
Detector status LED's documented	☐
Correct number of engines and detectors displayed on the Remote Display Unit	☐
System component software versions documented	☐
Event Logs inspected and recorded	☐
Faults diagnosed and corrected	☐
Detectors cleaned, status and parameter readings checked	☐
Detectors bases checked	☐
Alarm and Fault relay functions checked	☐

Annual Maintenance

See Section 4.3 for further details

System component serial numbers and software versions recorded	☐
System functions verified	☐
Event Logs and System Test Logs inspected and recorded	☐
Detectors cleaned, status and parameter readings checked	☐
Detector bases inspected and cleaned	☐
Cable terminations and earthing checked	☐
Alarm and Fault relay functions checked	☐
Contamination level trending report reviewed	☐
Software upgraded to latest version, if applicable	☐
Hardware upgraded to latest version, if applicable	☐
Current manual is available	☐
Instruction provided to the crew	☐