Mk 6 OIL MIST DETECTOR

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

1-59812-K001

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LIST OF ILLUSTRATIONS

REVISION HISTORY

Revision	Date	Details
1	June 08	Original.
2	July 08	Additional fault descriptions added.
3	July 09	Modified to reflect changes to terminations.
4	Oct 11	Removed Plug & Play part numbers.
5	July 13	Addition of Photos showing 2 screw Fan Connector.
6	May 16	Addition of Green Label Detector. Addition of Gas canister smoke test. Figure 20 & 21 Graviner MK6 OMD System wiring colours Part numbers prefix “1-“
7	Sept 17	Part number 1-21888-K073 added.
8	Jan 18	Part number 1-43682-K037 changed to 1-43682-K261.
9	Nov 20	UTC updated to Carrier
10	Nov 21	Manual re-written.

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 Mk6 Oil Mist Detector (OMD) system to the system owner, and for a period of 2 years from the commissioning(*) date of a retro fitted Mk6 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.

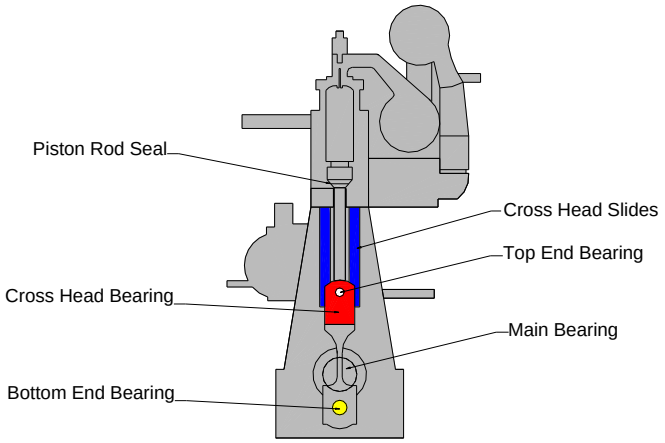


Figure 1 Areas of Failure – 2 Stroke Engine

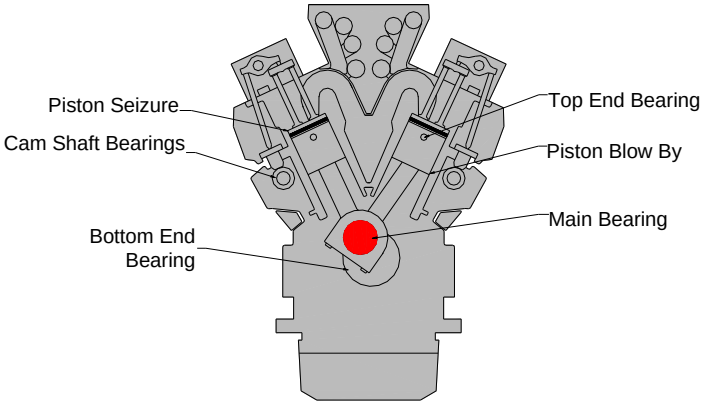


Figure 2 Areas of Failure – 4 Stroke Engine

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 6 OMD provides the following benefits:

- Multi engine capability, up to 8 engines on a single system
- Suitable for both 2 stroke and 4 stroke engines.
- Elimination of sample pipes - reduced installation costs.
- Significant reduction in scanning time - 1 .2 seconds for a system of 64 Detectors.
- Relocating system controls and display to the safety and comfort of control room.

Figure 3 Graviner Mk6 OMD Components

1.2 DESCRIPTION

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

Detectors	1-E3561-301 (with base) 1- E3561-301-01 (Short sample pipe) 1-D5622-001 (replacement detector head)
Control Panel	1-53836-K170 (Bulkhead Mounting) 1-53836-K206 (Flush Mounting)
Engine Junction Boxes	1-D4720-001-XX (20mm Power & Comms Connections) 1-53836-K224-XX (25mm Power & Comms Connections)
And connecting cables	
Junction Box to Detector cable (Straight)	1-43682-K108-XX
Junction Box to Detector cable (Right Angle)	1-43682-K109-XX

The Graviner Mk6 OMD system can comprise up to 64 detectors directly mounted on the crankcases of up to 8 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 Junction Box with the Control Panel designed to be mounted within the Engine Control Room. This eliminates the need to enter the machinery space in alarm conditions.

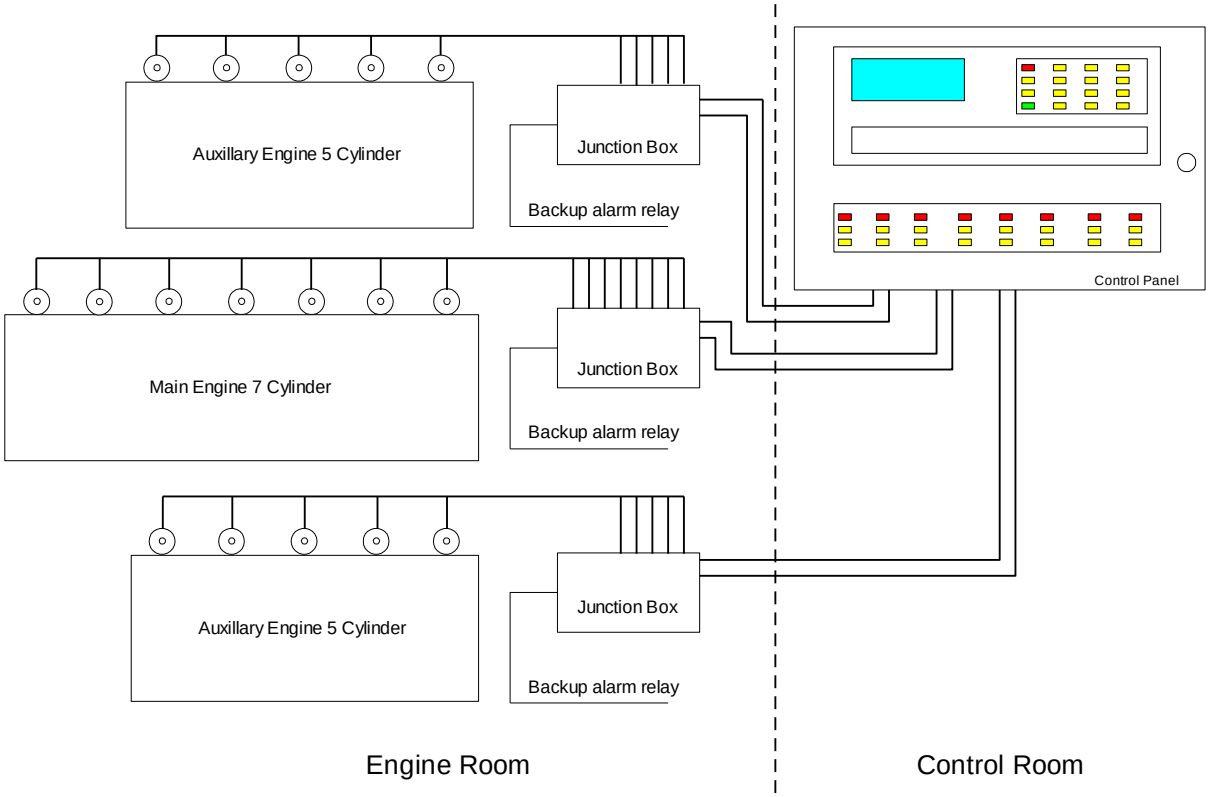


Figure 4 Typical System Configuration

1.3 TECHNICAL SPECIFICATION

Detector

Mounting	¾ inch BSP	
Enclosure Rating	IP65	
Address Switch	2 x 10 position (0 to 99)	
Material	Sample Tube – Carbon Loaded PTFE	
	Detector – Black Du Pont Nylon 70G33L	
Indicators	Green	Detector On
	Red	Alarm
	Amber	Detector Fault
Power Consumption	2.8W	
Operating Temperature Rating	0 to 70°C	
Storage Temperature Rating	-20°C to 60°C	
Height	175mm	
Width	90mm	
Length	205mm	
Weight	0.6kg	

Junction Box

Enclosure Rating	IP65	
Max detector inputs	14	
Fuse Rating	4A 20mm slow blow	
Back-up alarm relay	Volt-free change over contacts rated at 30Vdc 1A	
Power Consumption	100mW	
Temperature Rating	0 – 70°C	
Dimensions		
Height	186mm	(110mm mounting centres)
Width	318mm	(240mm mounting centres)
Depth	90mm	
Weight	2.7kg	

Control Panel

Enclosure Rating	IP32
Material	Steel
Max detector inputs	64
Max engines	8
Output Relays	Volt-free change over contacts rated at 30Vdc 1A
	Relay contact minimum wetting current = 10mA
Main Alarm	1 set (energised during normal operation)
Fault Alarm	1 set (energised during normal operation)
Engine Slow/Shutdown Alarm	8 sets, 1 set per engine (de-energised during normal operation)

Alarm Ranges

Deviation Alarm	0.05mg/l to 0.5mg/l (adjustable) (Default 0.3mg/l)
Average Alarm	0.3mg/l to 1.3mg/l (adjustable) (Default 0.7mg/l)
Backup Alarm	1.6mg/l (fixed)
Operating Voltage	24Vdc (+30% -25%)
Power Consumption	5.2W
Operating Temperature Rating	0 to 70°C
Storage Temperature Rating	-20°C to 60°C

Dimensions

Bulkhead Mounted

Height	313mm	(270mm mounting centres)
Width	500mm	(445mm mounting centres)
Depth	118mm	

Flush Mounted

Height	309mm
Width	559mm
Depth	118.5mm
Weight	8.7kg

1.4 SYSTEM OVERVIEW

The Graviner MK6 OMD retains the long-established differential measuring system unique to Carrier Fire & Security Limited, which enables high sensitivity to be used while maintaining the maximum false alarm rejection. It still uses optical sensing, but light scatter instead of obscuration. This enables very small Detectors to be used. These are rugged and designed to be engine mounted using standard oil mist detector ports. As they each have their own means of sample acquisition no sample pipes are required. Multiple internal light sources ensure that a single failure will not cause the loss of a Detector. Modular construction means that a faulty Detector can be replaced in a matter of minutes.

Each Detector continually monitors the oil mist density in the crankspace to which it is connected. In addition, it self-checks for any internal faults. The Control Panel interrogates each Detector in turn, notes its address, the oil mist density value and determines the health of the Detector.

For each engine the average oil mist density from each Detector is calculated and stored. Each Detector signal is then compared in turn with the stored average. A positive difference (the deviation) is then compared with a pre-set, but adjustable reference (the deviation alarm level) for that engine (or Detector). If it is greater than the reference a deviation alarm is indicated.

The stored average level is also compared with a pre-set reference (the average alarm level) and an average alarm is indicated if the reference is exceeded.

A full system of 64 Detectors over 8 engines has a maximum scan time of 1.2 seconds, but with alarm priorities that enable the system to respond if an alarm occurs.

The Control Panel separates the information according to engine groups.

The Control Panel incorporates a Liquid Crystal Display (LCD). The Main Display constantly displays the average oil mist density reading for each engine along with the average alarm level for each engine. It also enables the individual readings of each Detector on an engine and the average to be displayed on demand and automatically under alarm conditions.

In the interest of safety, all system controls and alarm displays are located on the Control Panel. However, to aid fault finding each Detector is fitted with 3 indicator lights:

Green	-	Power on
Red	-	Alarm
Amber	-	Fault

Each Detector also has access to its address set switches.

As all Detectors operate independently, the loss of one by either failure or the need to clean does not affect the operation of the rest of the system. Individual Detectors, or engine groups, can be isolated from the rest of the system for maintenance while the rest of the system remains in operation.

Alarm Philosophy

The system has 3 separate alarms as detailed below

1. Average Alarm - This indicates that the average oil mist levels within the engine are increasing and that an investigation should be undertaken. This alarm will operate the slowdown/shutdown and the common alarm relays.
2. Deviation Alarm - This indicates that the level of a detector has increased above the engine average level and that an investigation should be undertaken. This alarm will operate the slowdown/shutdown and the common alarm relays.
3. Back Up Alarm - In the event of a failure of either the Control Panel or Detector software, then the Back Up Alarm will operate the common alarm relay, 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 an Average Alarm or Deviation 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 Panel membrane 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.

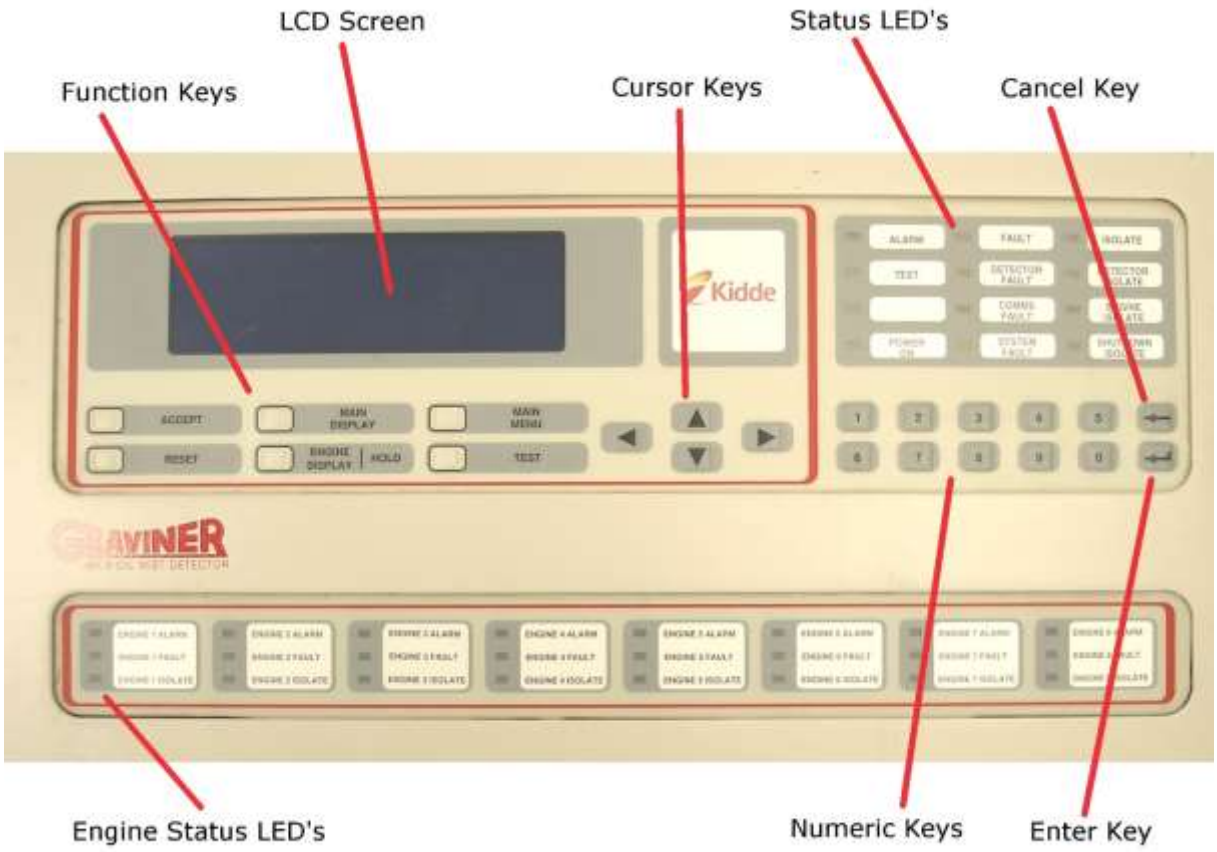
When the faults have been rectified the Accept and Reset buttons can be operated and the system will return to normal

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 256 events.

SYSTEM CONTROLS AND DISPLAYS

User interaction with the OMD Mk6 system is performed via the Control Panel. User input is performed via the membrane keypad and system indication is provided via the LCD screen and the indicating LED's.



Membrane Keypad

Function Keys

Key	Function
Accept	Acknowledge faults and alarms on the system. Silences the buzzer
Reset	Clears faults and alarms on the system. Faults and alarms must be accepted before the reset key will operate. Following reset the fault or alarm indication will be reactivated if the initial cause has not been corrected.
Main Display	Reverts the LCD to the main screen.
Engine Display | Hold	Changes the LCD screen to show details of an individual engine. If the screen is automatically scrolling through multiple alarms pressing the key will hold the screen and prevent scrolling.
Main Menu	Displays the main menu on the LCD allowing access to User, Engineer or Service level menus.
Test	Displays the User level test menu.

Cursor Keys

Key	Function
▲	Move the LCD cursor up.
▼	Move the LCD cursor down.
◀	Move the LCD cursor left.
▶	Move the LCD cursor right.

Numeric Keys

Key	Function
0-9	Enter numeric values 0-9.

Key	Function
Cancel	Cancel the last key entry or step back to the previous menu
Enter	Confirm the required function or select a menu option

LED Indications

Status LED's

LED	Colour	Function
Alarm	Red	Indicates there is an alarm on the system
Test	Yellow	Indicates a test is being performed on the system

Power On	Green	On when power is applied to the system.
Fault	Yellow	Indicates a fault on the system
Detector Fault	Yellow	Indicates there is a fault on a detector
Comms Fault	Yellow	Indicates a failure to communicate with one or more detector
System Fault	Yellow	Indicates a fault with the Control Panel or a Control Panel Software failure.
Isolate	Yellow	Indicates there is an isolation on the system.
Detector Isolate	Yellow	Indicates one or more detectors is isolated.
Engine Isolate	Yellow	Indicates all of the detectors on one or more engines are all isolated.
Shutdown Isolate	Yellow	Indicates one or more shutdown relays are isolated.

Engine Status LED's

LED	Colour	Function
Alarm	Red	Indicates there is an alarm on that engine
Fault	Yellow	Indicates fault on that engine
Isolate	Yellow	Indicates there is an isolation on that engine

The Control Panel is 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 2.8 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 PANEL MOUNTING

The Control Panel is designed for either bulkhead, 1-53836-K170 or flush, 1-53836-K206, mounting and must be installed in a control room or similar safe environment, not in the engine room.

For bulkhead mounting fix the panel to a rigid structure using the four M6 mounting flanges at the rear of the unit.

For flush mounting a bezel, part number 1-35100-K187 can be supplied (refer to Figure 7).

The position of the Control Panel must be sited for optimum visibility of the display. Enough space must be left around the Control Panel to allow the fitting and routing of the cables, and to facilitate easy access to all aspects of the Control Pane. A minimum of 500mm must be allowed at the front of the Control Panel to allow the door to be opened.

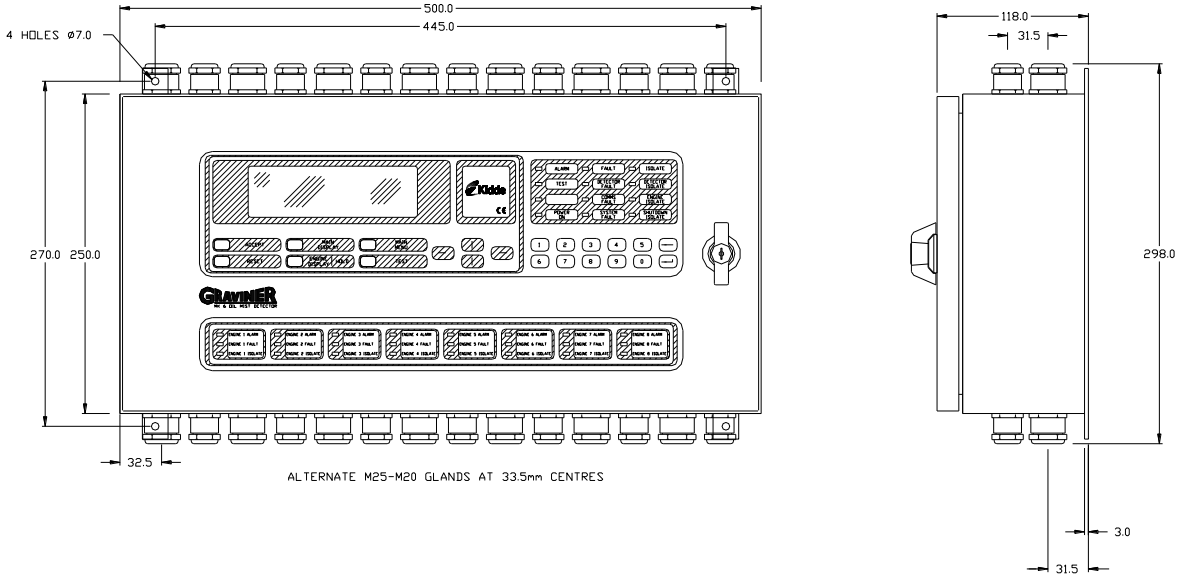
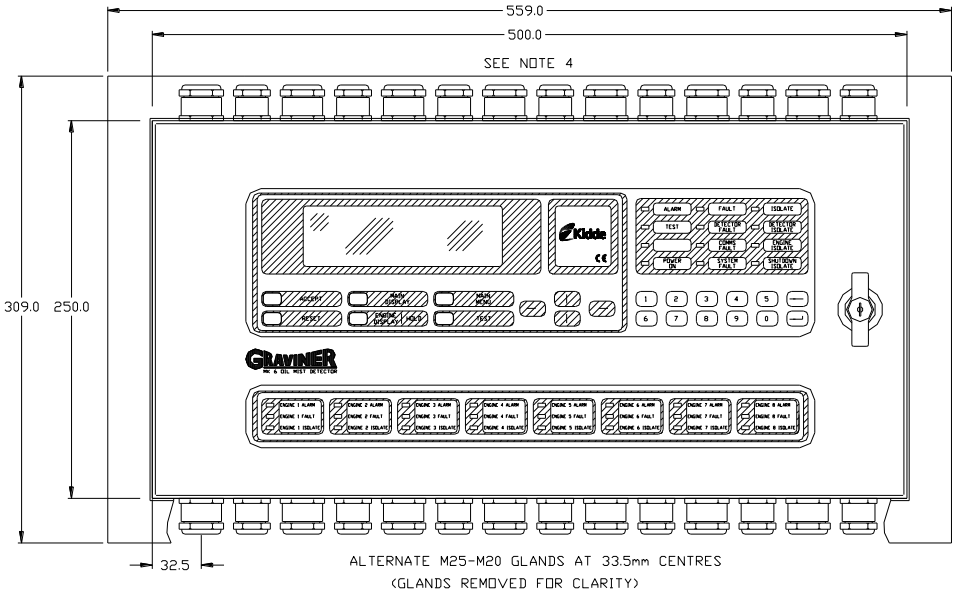
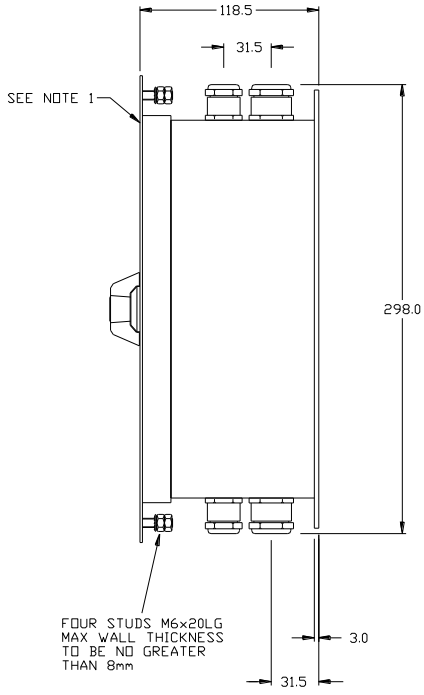


Figure 5 MK6 Control Panel Bulkhead Mounting (1-53836-K170) Installation Drawing





NOTES
1. IN ORDER FOR THE DOOR TO OPEN FULLY, AN ADDITIONAL 500mm MUST BE ALLOWED BEYOND THIS POINT.
2. SEE TABLE FOR THE NUMBER OF JUNCTION BOXES, RELAY OUTPUTS (ALARM, FAULT AND ENGINE SLOWDOWN) AND CABLE GLANDS/LOCKNUTS.
3. ON A ONE ENGINE SYSTEM ONE ALARM, ONE FAULT AND ONE ENGINE SLOW DOWN RELAY IS REQUIRED TOGETHER WITH TWO POWER SUPPLY INPUTS. IN CASES WHERE THERE ARE MORE ENGINES AN ADDITIONAL ENGINE SLOWDOWN RELAY WILL BE NEEDED FOR EACH ADDITIONAL ENGINE.
4. PROVISION HAS BEEN MADE FOR 14xM25 AND 14xM20 CABLE GLAND ENTRIES AT THE TOP OF THE ENCLOSURE AND 14xM25 AND 14xM20 AT THE BOTTOM. THESE ARE TO BE USED FOR POWER AND COMMUNICATIONS WIRING.

SYSTEM INSTALLATION REQUIREMENTS TABLE

NUMBER OF ENGINES	NUMBER OF JUNCTION BOXES	NUMBER OF RELAY OUTPUTS (SEE NOTE 3)	NUMBER OF M20/M25 CABLE GLANDS/LOCKNUTS REQUIRED.
1	1	3	7
2	2	4	10
3	3	5	13
4	4	6	16
5	5	7	19
6	6	8	22
7	7	9	25
8	8	10	28

Figure 6 MK6 Control Panel Flush Mounting (1-53836-K206) Installation Drawing

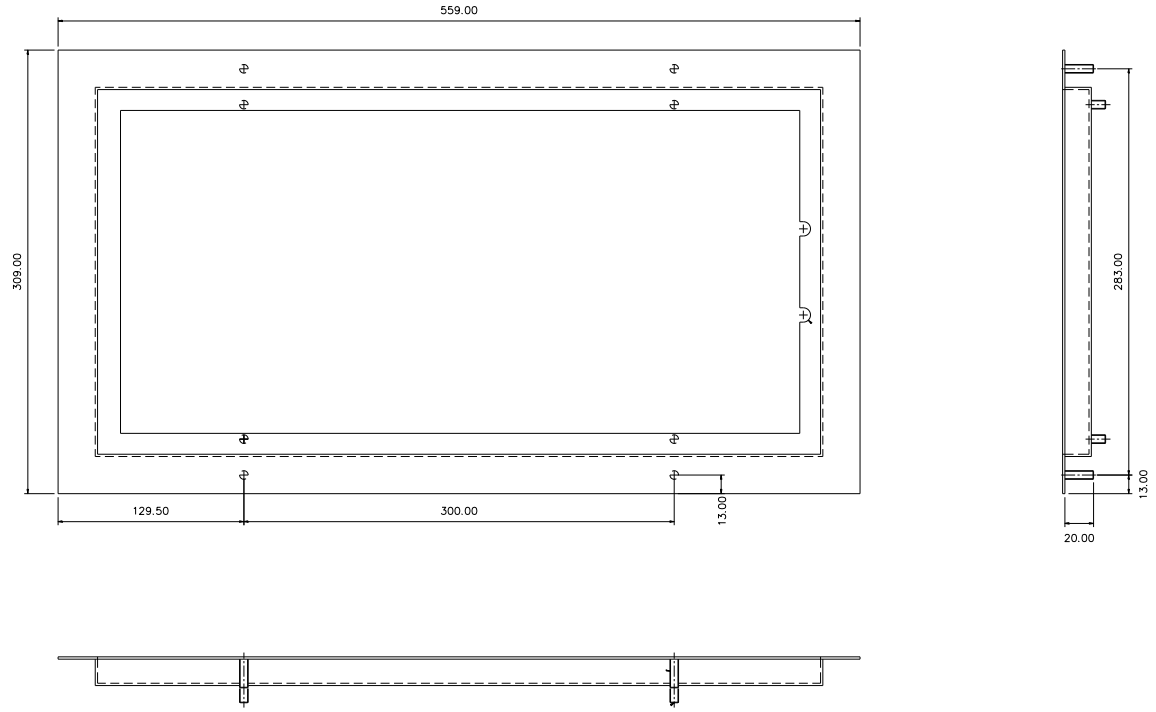


Figure 7 Bezel - Part Number 1-35100-K187

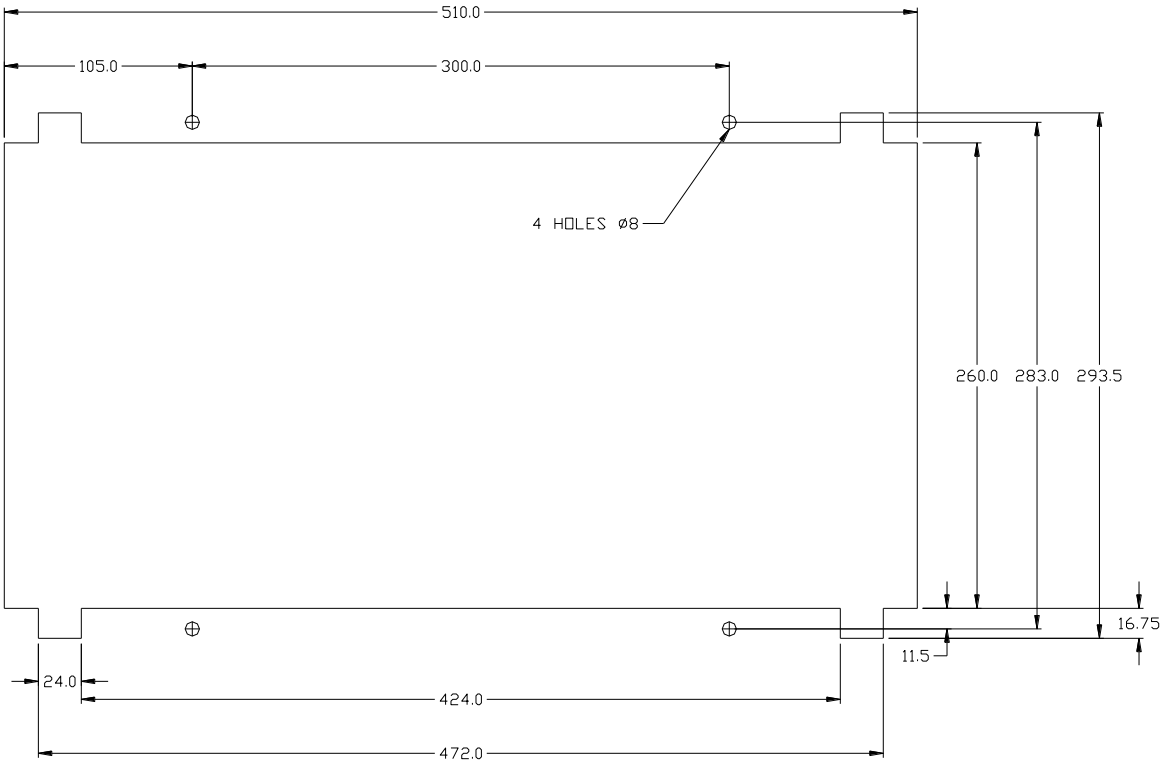


Figure 8 MK6 Control Panel Flush Mounting Installation Drawing Cut Out Details

2.2 CONTROL PANEL CABLING

24v DC Input supply

The Mk6 Control Panel should be powered from a floating 24v DC supply (+30% -25%) suitably rated depending on the number of detectors connected.

PLEASE NOTE: - The Control Panel 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 Error! Reference source not found. for connector location.

Refer Figure 36 for wiring drawing.

Communications

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 Panel and the Junction Boxes.

Refer Error! Reference source not found. for connector location.

Refer Figure 36 for wiring drawing.

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 0ºC + 80ºC.

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 Error! Reference source not found. for connector location.

Refer Figure 36 for wiring drawing.

2.3 JUNCTION BOX MOUNTING

The Junction Box is available with 20mm input glands, (1-D4720-001-14) or 25mm input glands, (1-53836-K224-14), and is designed for on-engine mounting. It is recommended that the box 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. Sufficient space must be left around the Junction Box to allow access to

the cable glands, the routing of the cables and to facilitate easy access to all aspects of the Junction Box.

Each Junction Box can connect up to 14 Detectors, where 14 Detectors are not required the additional gland holes must be covered using 20mm metal blanking plugs, Lapp Kabel 52103125, to maintain EMC and IP integrity.

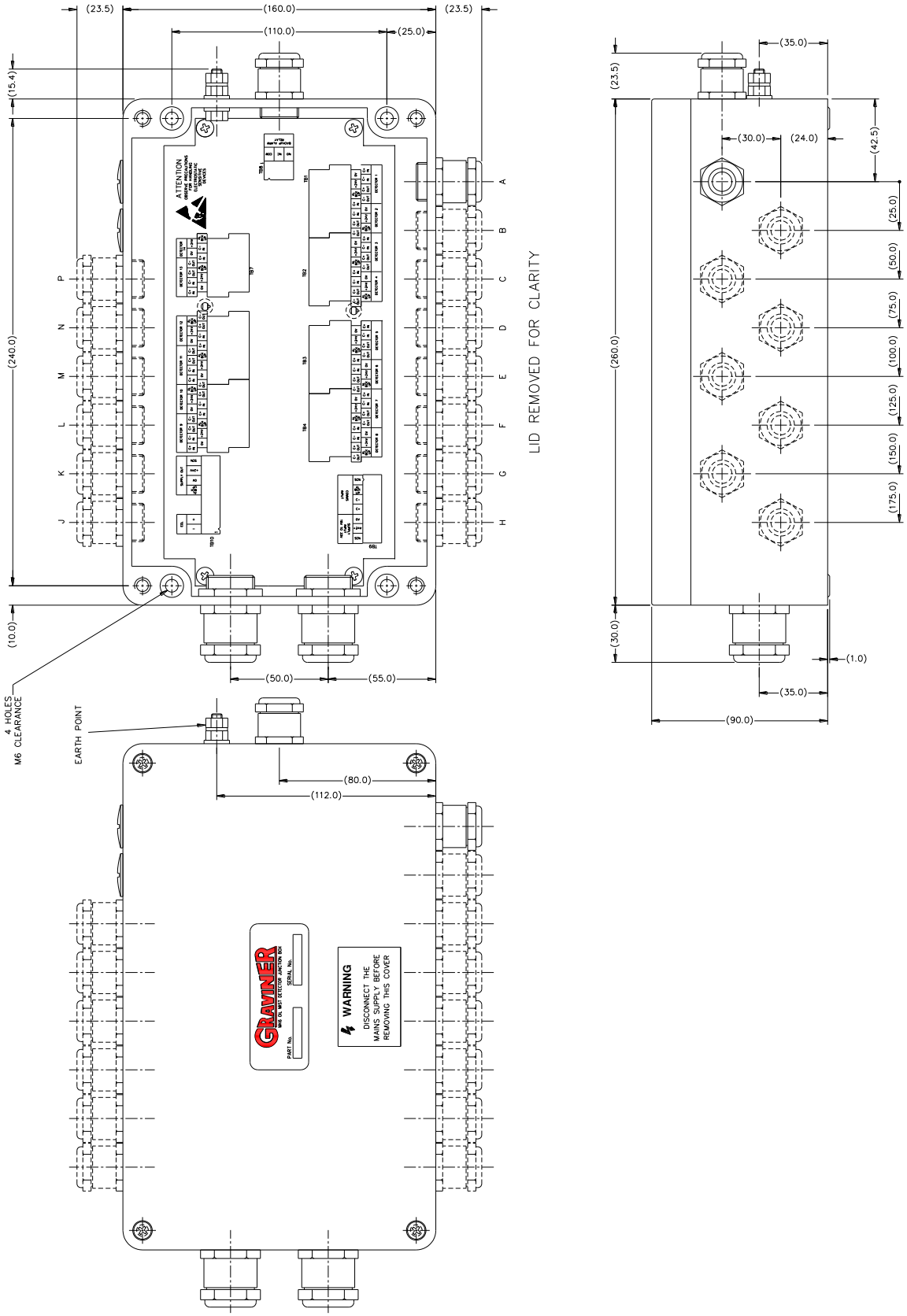


Figure 9 Junction Box Installation

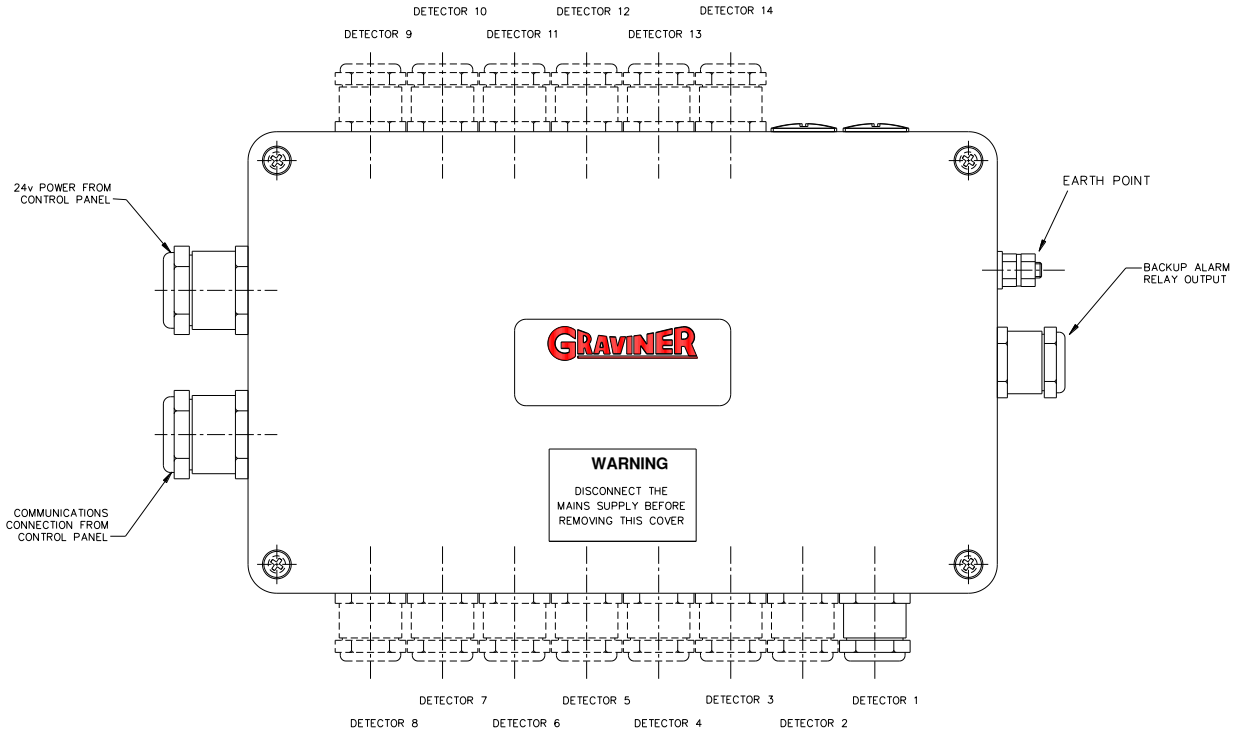


Figure 10 Junction Box External Connections

2.4 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.

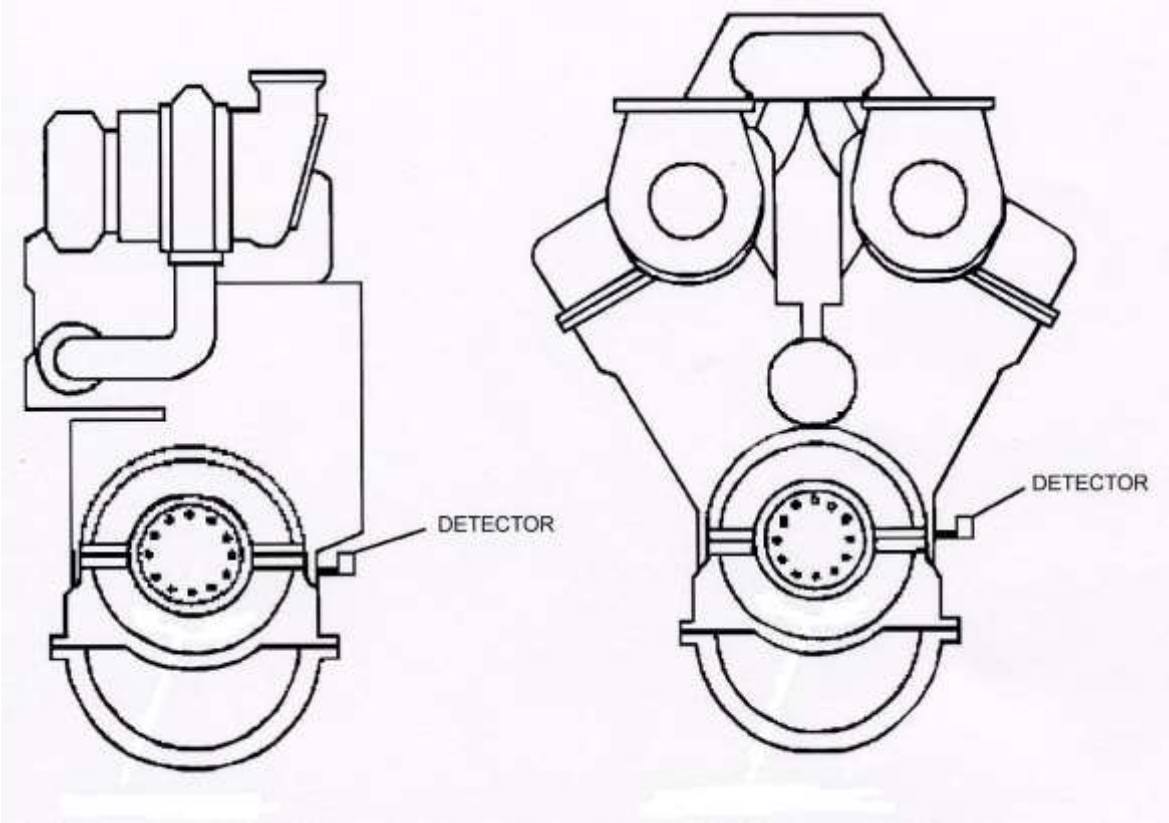


Figure 11 Ideal Mounting Position

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 12, and Figure 13.

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

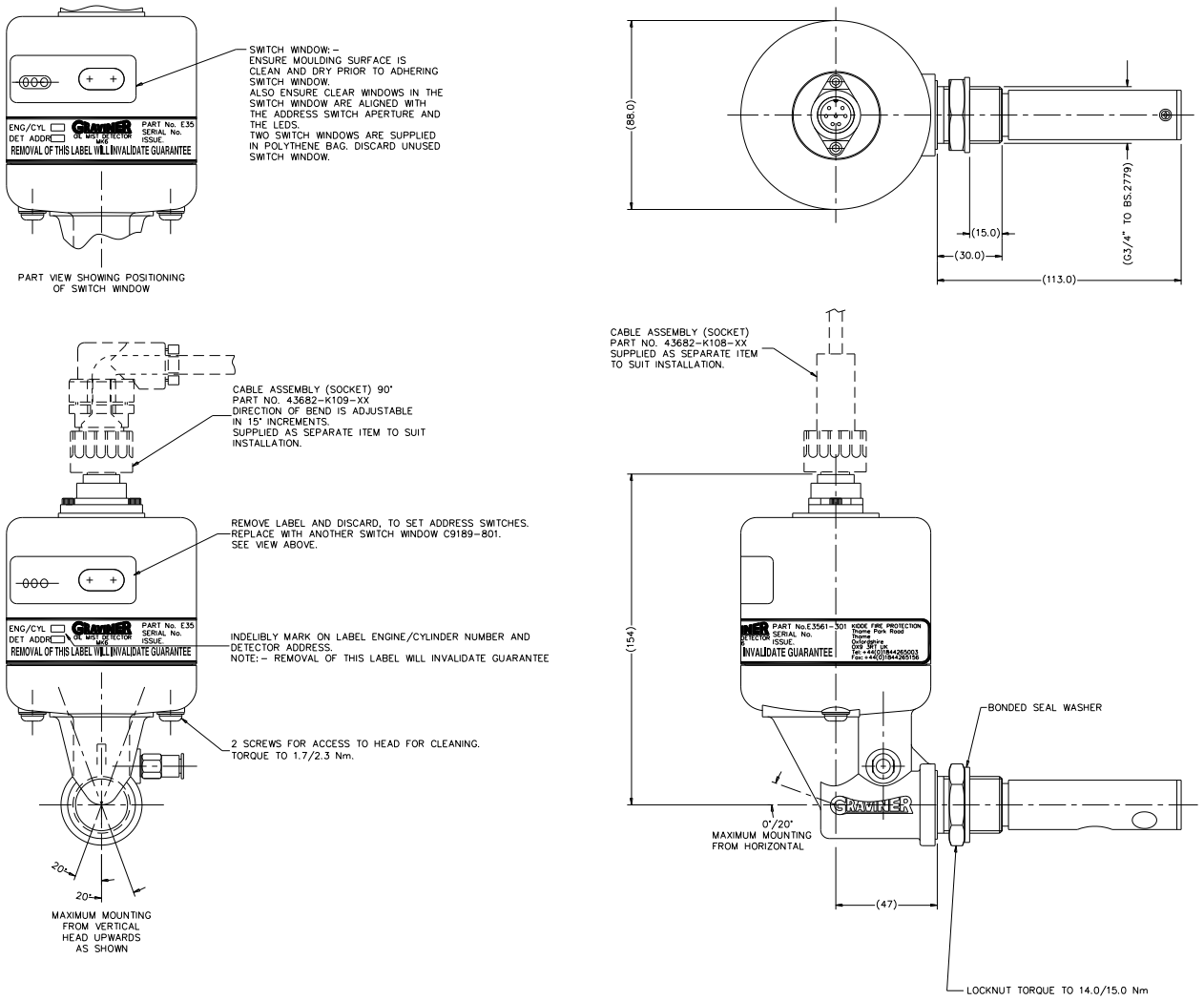


Figure 12 Detector Head Installation

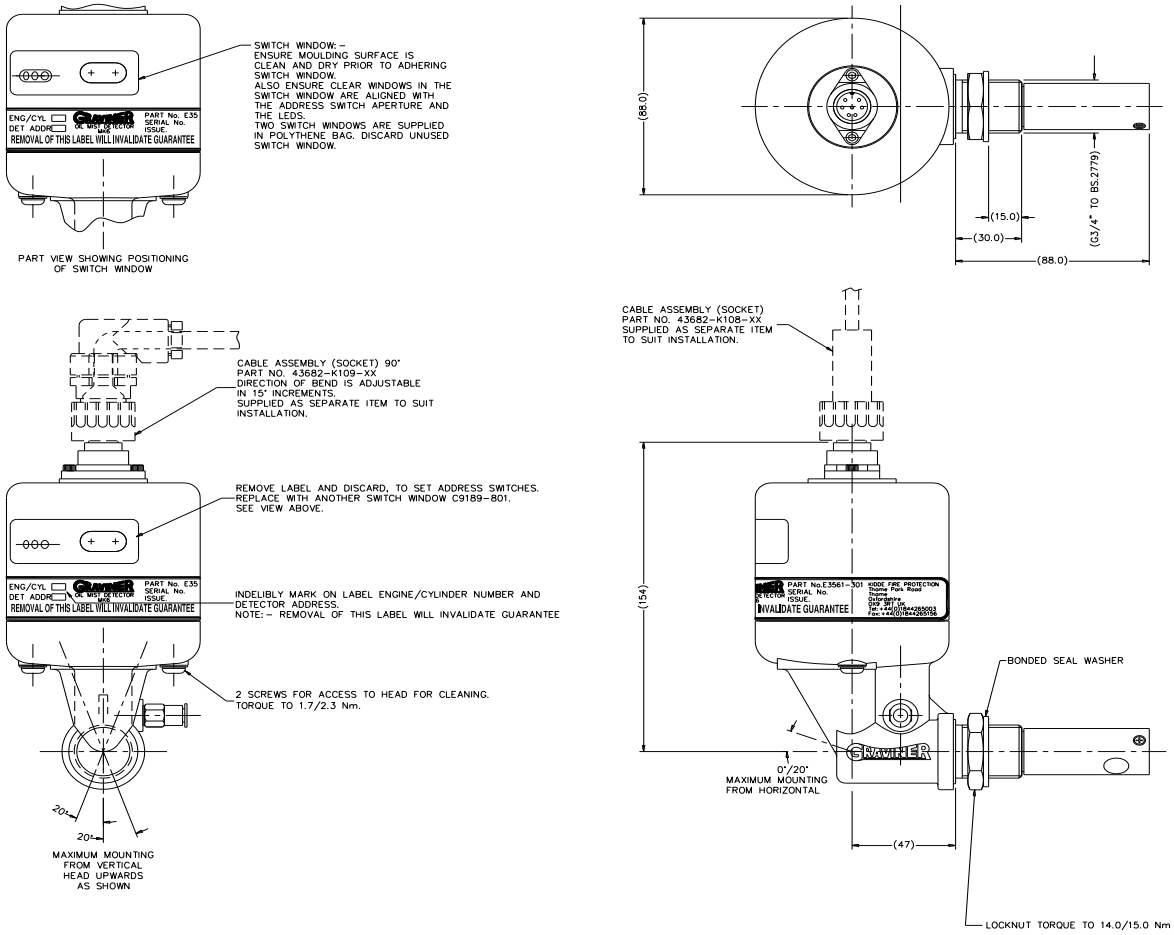


Figure 13 Detector Head Installation (Short Sample Pipe)

2.5 DETECTOR CABLES

Each detector must be connected to the Junction Box by way of a supplied detector cable.

Refer Figure 14.

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 14 Detector Cable

Refer to section Error! Reference source not found. for a list of available detector cables

All Detector connectors are pre-wired.

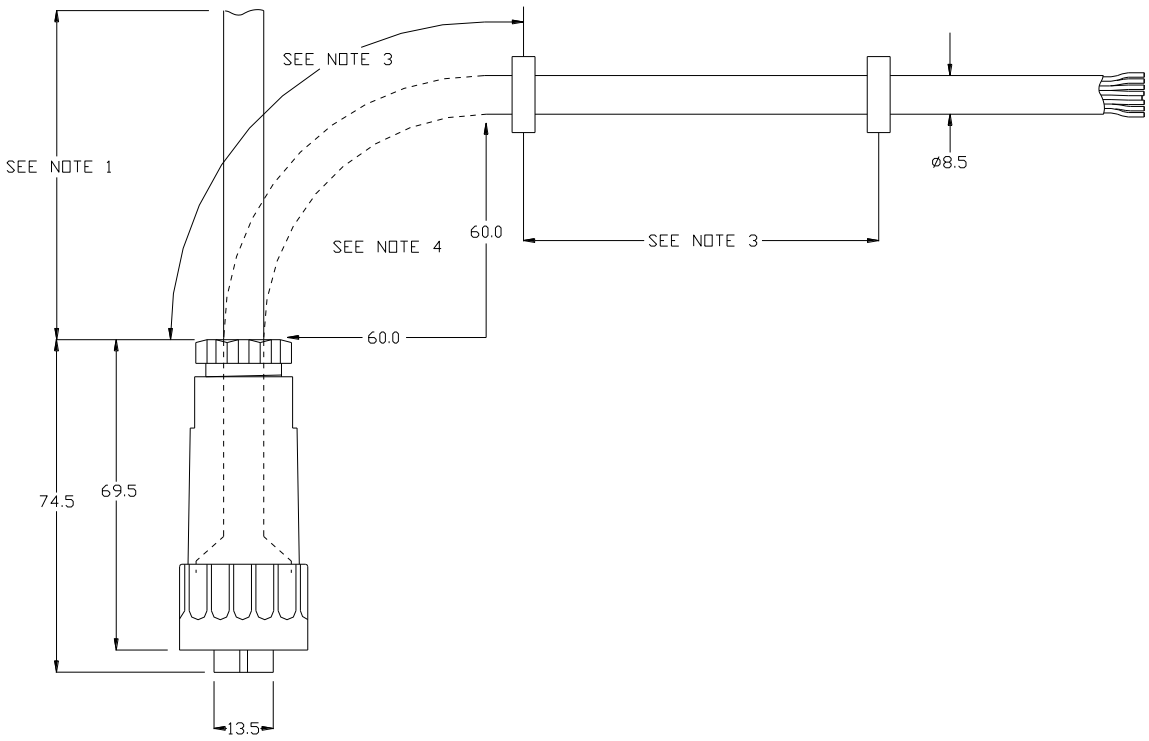


Figure 15 Detector Cable Assembly (Straight Connector)

Notes:

1. Cable Spec 8-core screened (90°C) Halogen free & oil resistant.
2. Cable lengths are 'straight lengths'.
3. Cables should be secured every 0.5m (cable clips are not provided).
4. Do not exceed the minimum bend radius as shown.

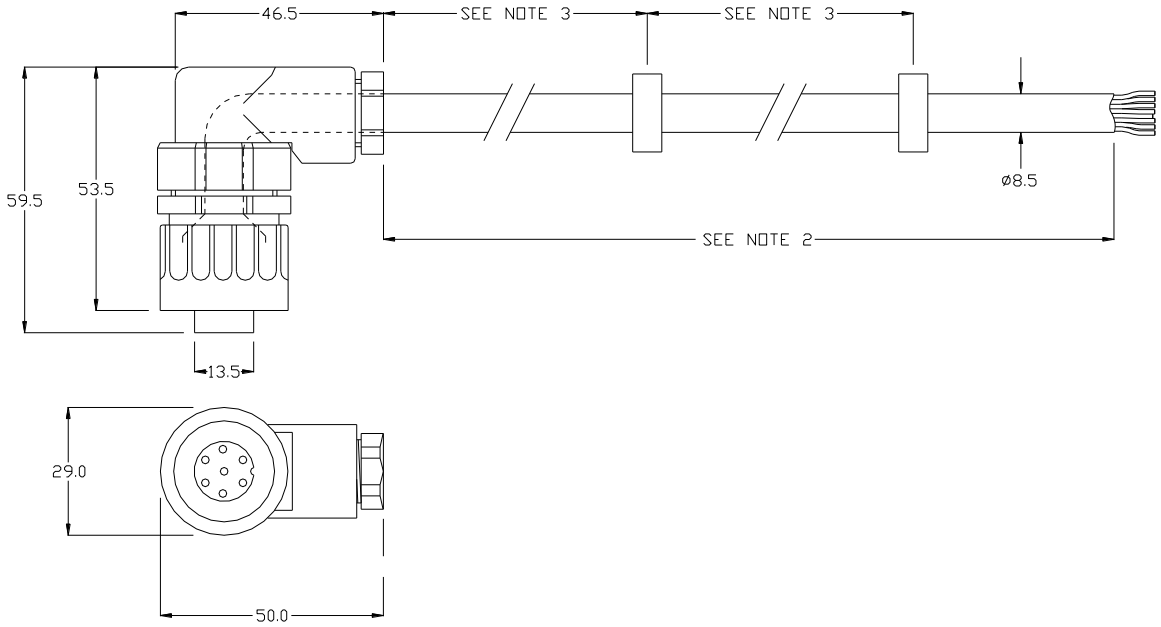


Figure 16 Detector Cable Assembly (Right Angle Connector)

The pin to pin connections for the Detector cables are shown in the table below:

Connector Pin No.	Colour of wire	Function	Last Detector Function
1	Pink	Comms Out -	TB10 EOL-
1	White	Comms In -	C- in
2	Yellow	Comms In+	C+ in
2	Brown	Comms Out +	TB10 EOL+
3	Grey	Backup Alarm	Back-up Alarm
5	Blue	0v supply	0V
6	Red	24v supply	+24V
Centre	Screen	Cable screen	Cable screen

2.6 CONNECTING THE SYSTEM

2.6.1 Input power

+24 V dc and 0 V dc power input cables for the Control Panel should be terminated onto Interface Board Supply Input (terminal block TB5).

Where required by the vessel approval authority two separate 24v supply cables may be necessary. The two cables should be routed by different paths to reduce the risk of damage affecting both cables.

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 Panel. Then remove approximately 1cm of the outer sheath to expose the cable screen as shown below.

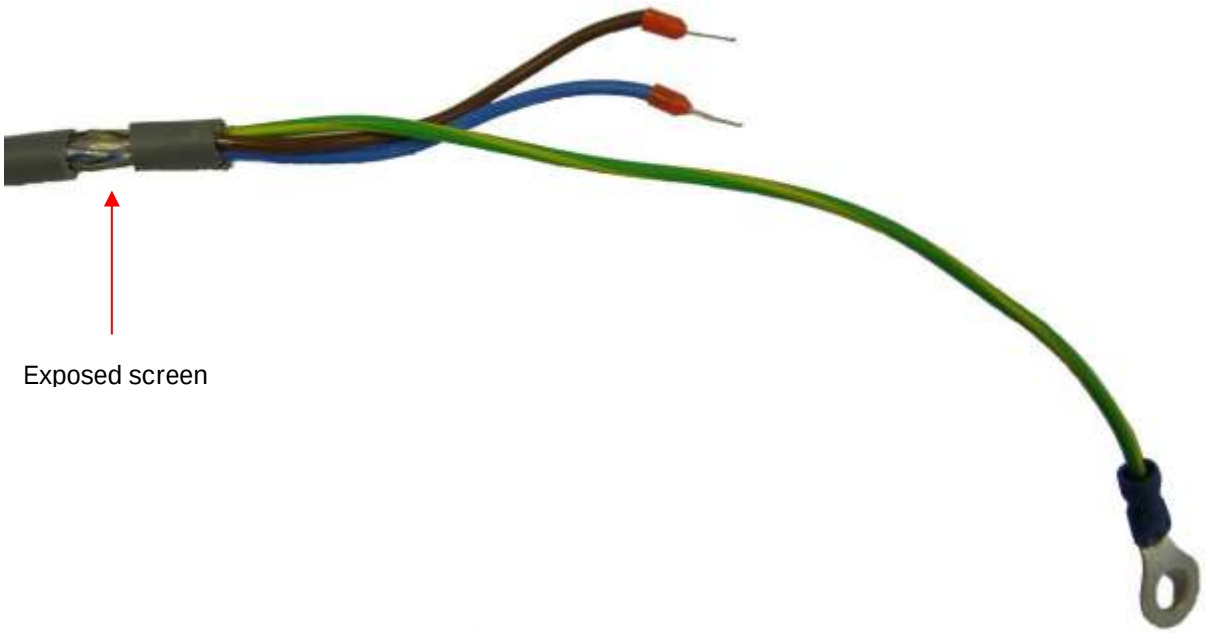


Figure 17 Power cable

Feed the cable into the Control Panel via a metal IP65 EMC gland supplied, ensuring that the metal prongs make a good contact with the exposed cable screen as shown below. The gland should be fixed in place using a toothed nut to cut through the Control Panel paint.

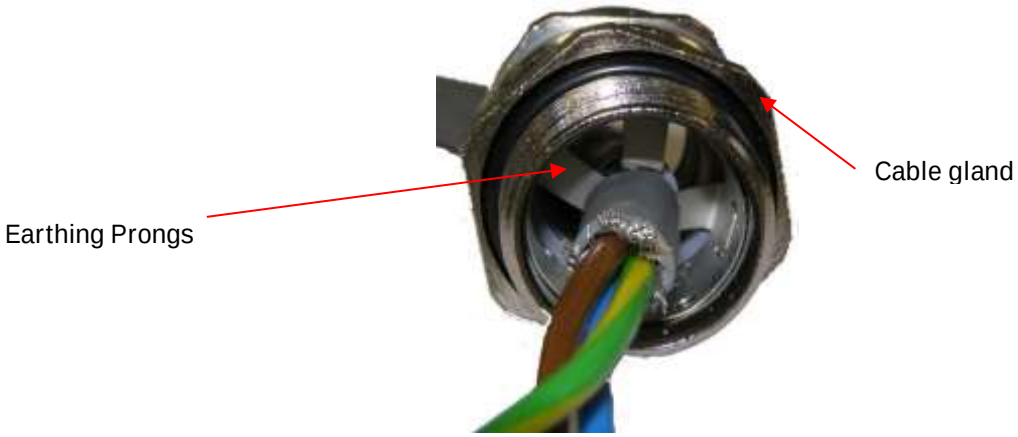


Figure 18 Power cable through EMC gland

Connect the earth wire to the earth stud, see Figure 19

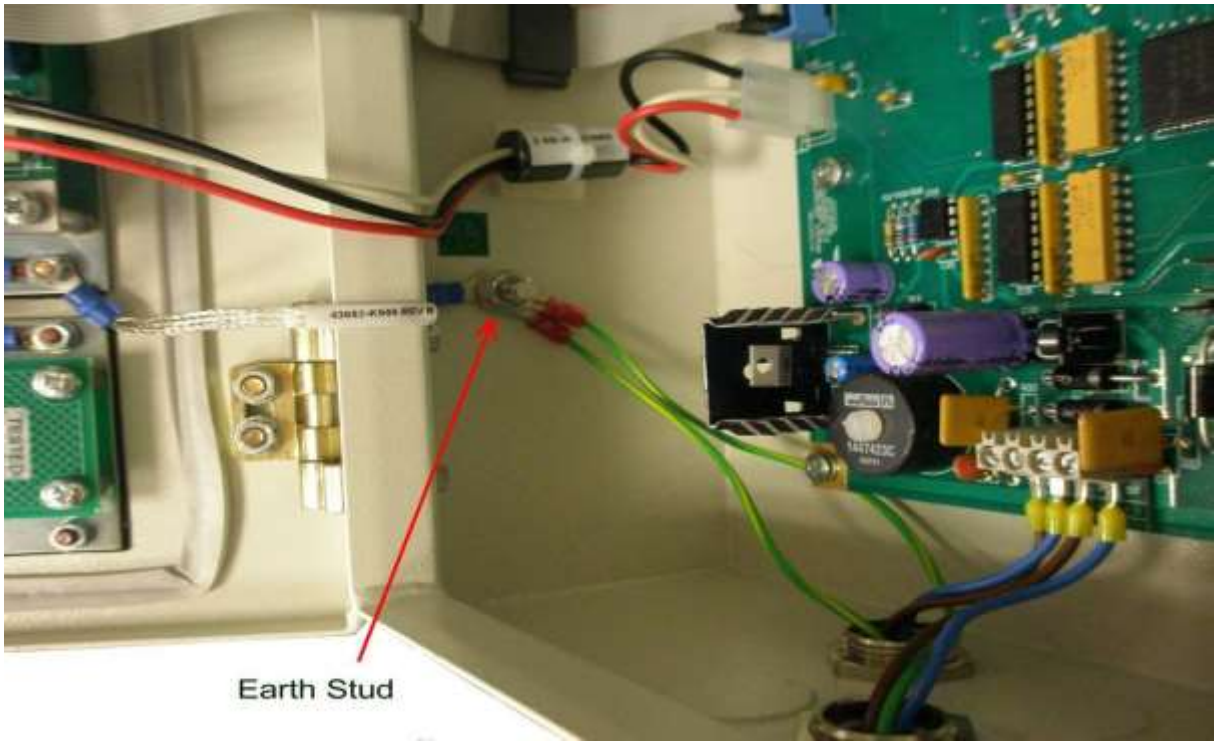


Figure 19 Power Input Cable Earth Stud

Connect the 24v and 0v in to TB5 on the Interface Board, 1-44782-K183, see Figure 19.

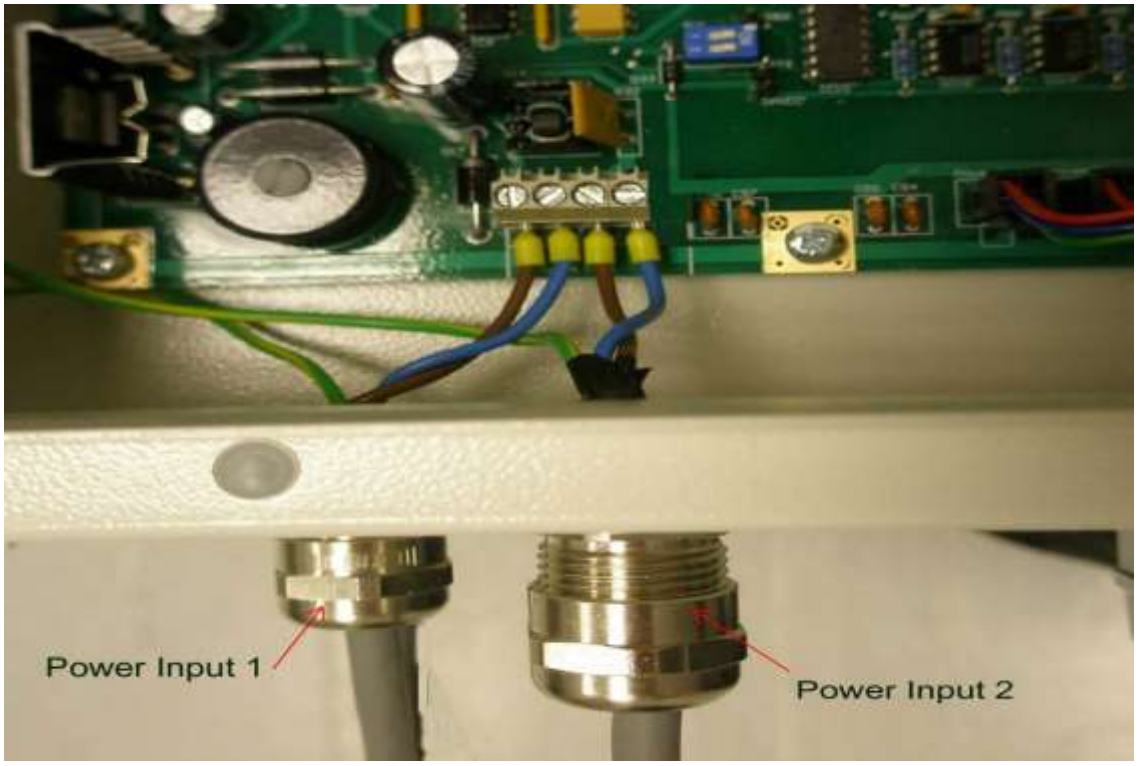


Figure 20 Power connections

The Control Panel should be connected from the earth stud to a suitable earthing point.

Where permitted by the vessel approval authority only one power cable may be required. Connections can be made to either power input 1 or power input 2.

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

2.6.2 Relay Cables

The connection to the Slowdown/Shutdown relays, Common Alarm relay, and Fault relay at the Control Panel 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 Panel. 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

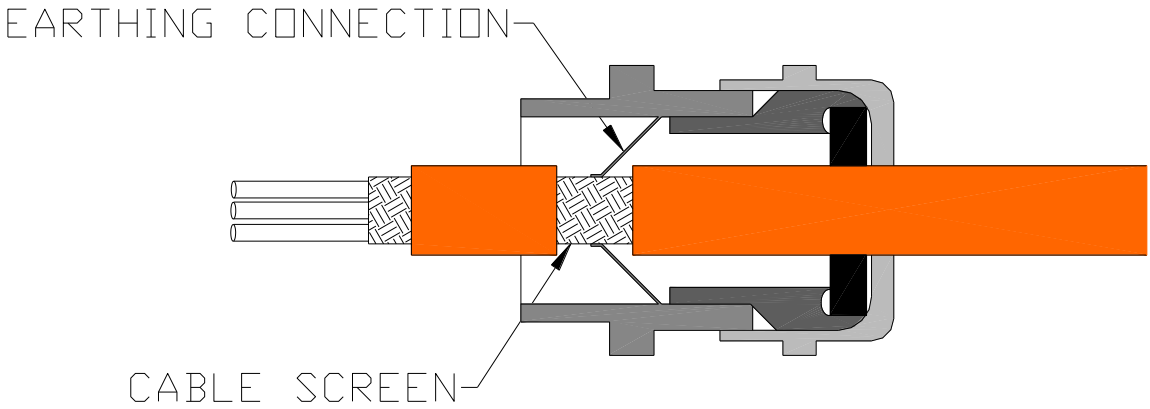


Figure 21 Control Panel relay cable assembly

Feed the cable into the Control Panel via a metal IP65 EMC gland supplied, ensuring that the metal prongs make a good contact with the exposed cable screen as shown. The gland should be fixed in place using a toothed nut to cut through the Control Panel paint.

The relays should be connected to the Alarm Monitoring System, AMS, to initiate the required response when the relay is activated.

2.6.3 Control Panel to Junction Box Connections

Control Panel Connections

The cables from the Control Panel to each Junction Box should be of the following types:

Power Cable:

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.

Approved 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

Communications Cable:

2 Twisted low capacitance pairs, 27(7) AWG tinned copper conductors, foam polyolefin insulation, each pair foil screened with a tinned copper drain wire, low smoke halogen free sheath – grey, outside diameter 8.1mm, operating temperature 0ºC to 70ºC.

Approved cables

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

At the Control Panel strip the power and communications cables to the required length. The cables should be long enough to reach easily from the gland to the terminal and run tidily around the edge of the Control Panel. Leave approximately 35mm of screen and fold it back over the outer insulation.

Alternatively, for the power cable remove approximately 1cm of the outer sheath to expose the cable screen as shown see Figure 21

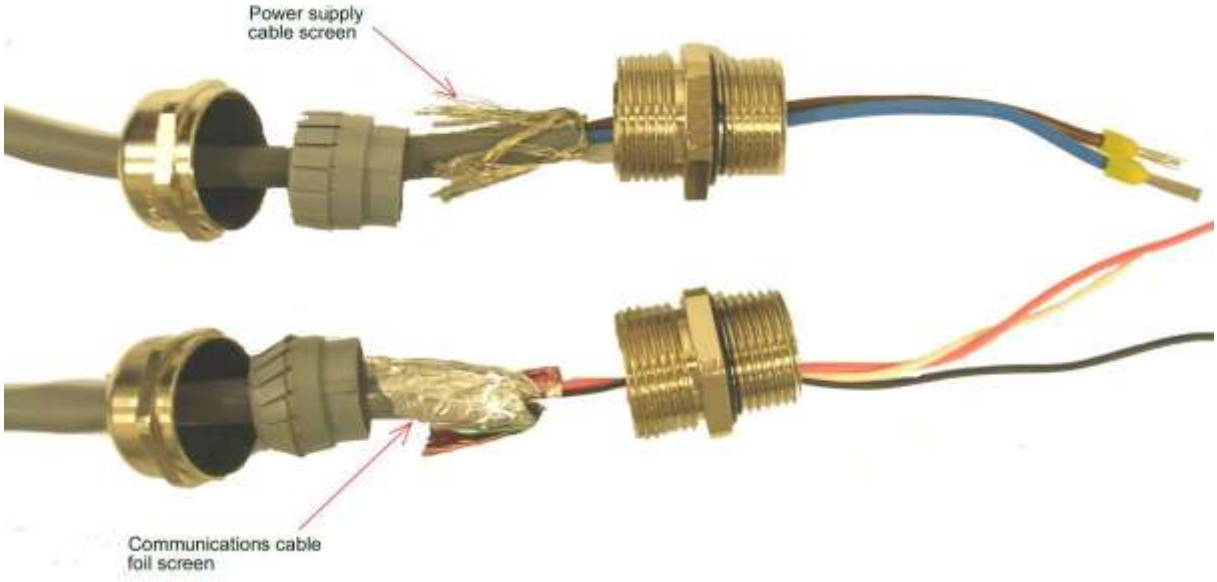


Figure 22 Cable Gland Isolation

Feed the cable into the Control Panel via a metal EMC gland, e.g. Lapp Kabel Skintop MS-SC-M-XL range, ensuring that the metal prongs make contact with the exposed cable screen as shown below

Figure 23 Cable Gland Isolation

Remove a suitable knockout from the Control Panel and fix the cable glands in place using a toothed nut, Error! Reference source not found. to cut through the paint.

Figure 24 Toothed Nut

Connect the power cable in place at the Interface Board within the Control Panel.

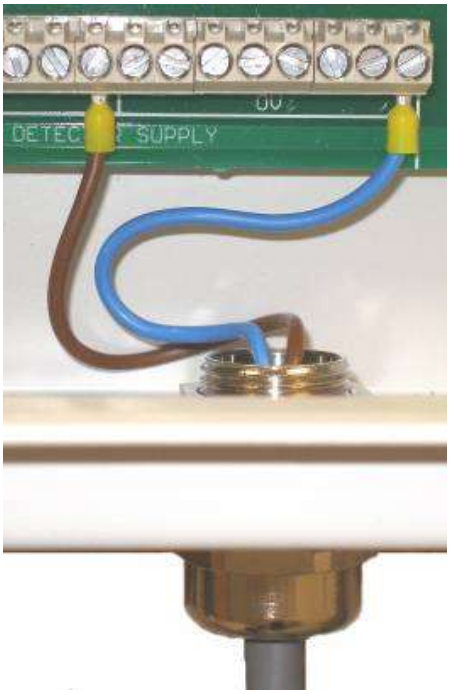


Figure 25 Power cable connections to Interface Board.

Connect the Communications cable in place at the top of the Interface Board.

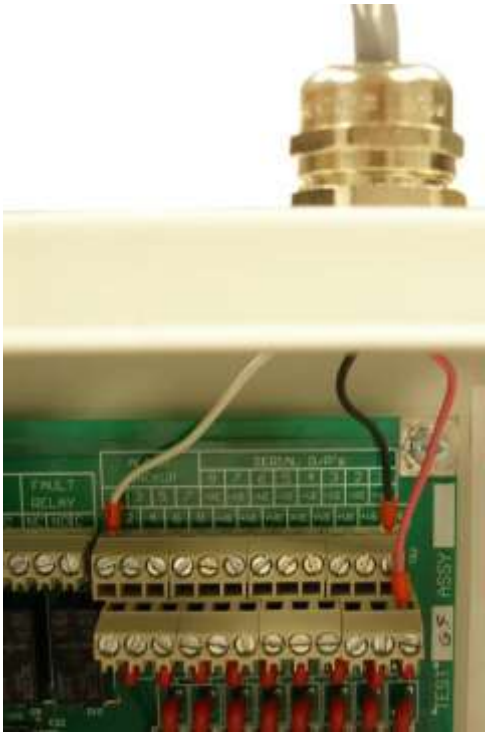


Figure 26 Communications cable connections to Interface Board

Junction Box Connections

At the Junction Box strip the power supply cable to the required length for ease of installation. Approximately 100mm is usually suitable. For braided cables twist the cable screen to produce a tail. For foil screened cables use the drain wire.

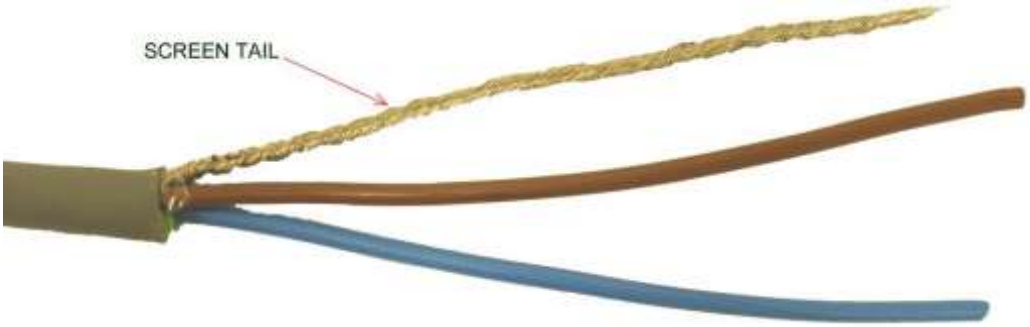


Figure 27 Power cable Screen Tail.

Place insulation around the earth tail

Figure 28 Power cable Screen Tail Insulation.

Feed the cables into the Junction Box via the two plastic glands. Connect the wires into the Junction Box Communications and Power Input terminals.

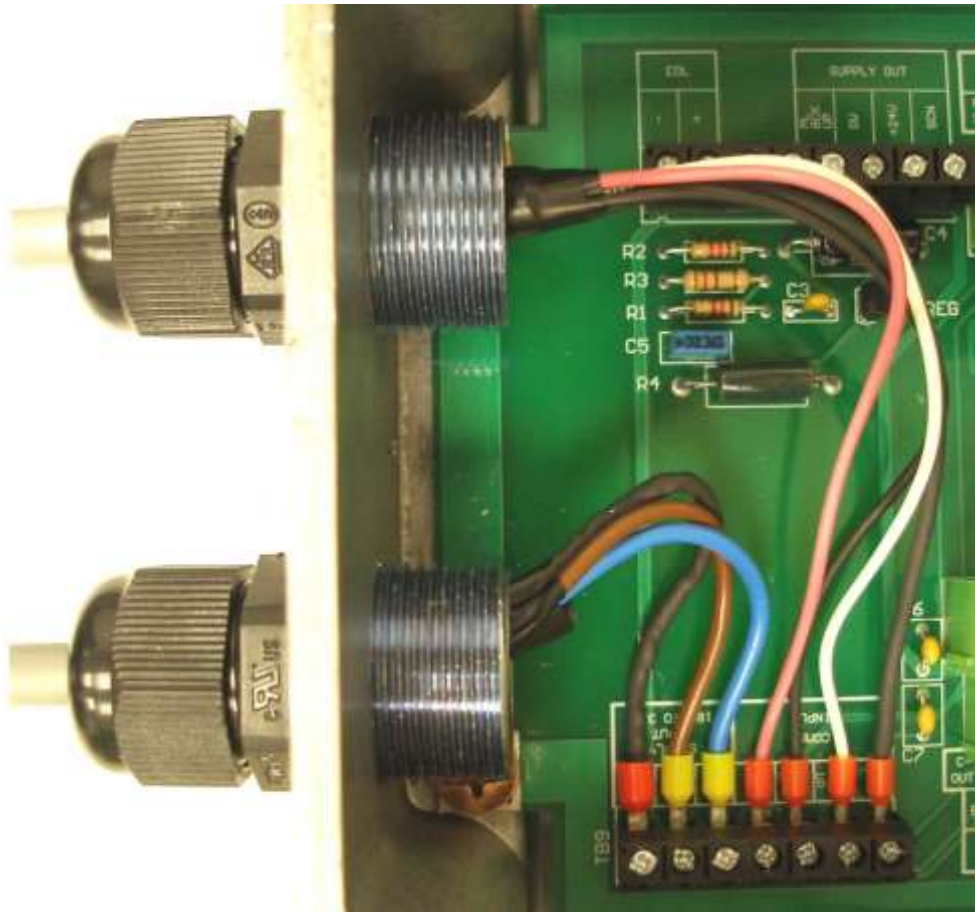


Figure 29 Junction Box Power cable & Communications terminal connections.

2.6.4 Junction Box to Detector Connections

At the Junction Box strip the Detector cables to the required length. The cables should be long enough to reach easily from the gland to the terminals. Remove approximately 1cm of the outer sheath to expose the cable screen as shown below

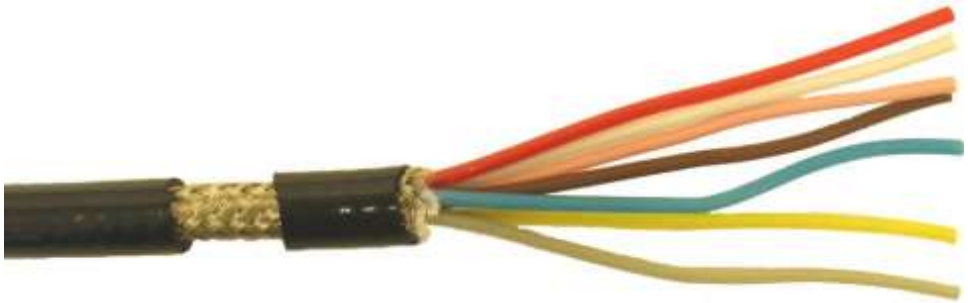


Figure 30 Detector cable, stripped.

Feed the cable through a metal EMC gland, e.g. Lapp Kabel Skintop MS-SC-M-XL range, ensuring that the metal prongs make contact with the exposed cable screen as shown below

Figure 31 Detector cable, EMC Gland assembly

Connect the cable via the relevant Detector position hole in the Junction Box.

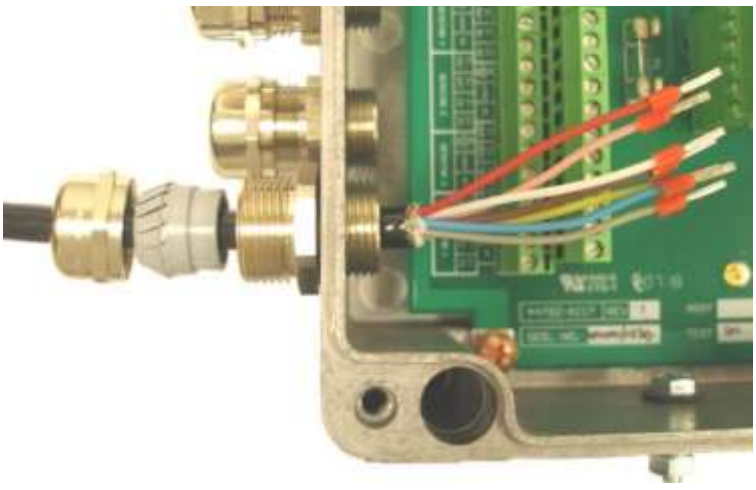


Figure 32 Detector cable, EMC Gland & Junction Box

Connect the wires into the Junction Box terminals as detailed in the table below and tighten the gland.

Connector Pin No.	Colour of wire	Function	Last Detector Function
1	Pink	Comms Out -	TB10 EOL-
1	White	Comms In -	C- in
2	Yellow	Comms In+	C+ in
2	Brown	Comms Out +	TB10 EOL+
3	Grey	Backup Alarm	Alarm Back-up
5	Blue	0v supply	0V
6	Red	24v supply	+24V
Centre	Screen	Cable screen	Cable screen

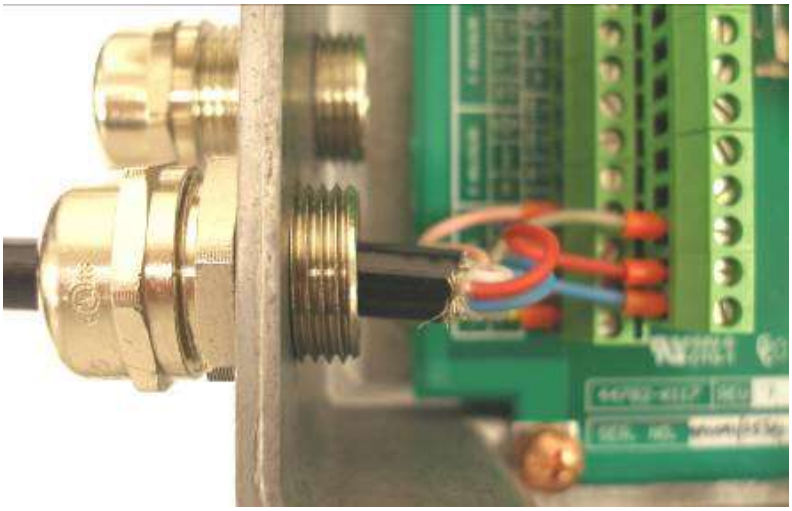


Figure 33 Close-up of Detector cable, EMC Gland assembly

When complete the Junction Box wiring should look like the photograph below.

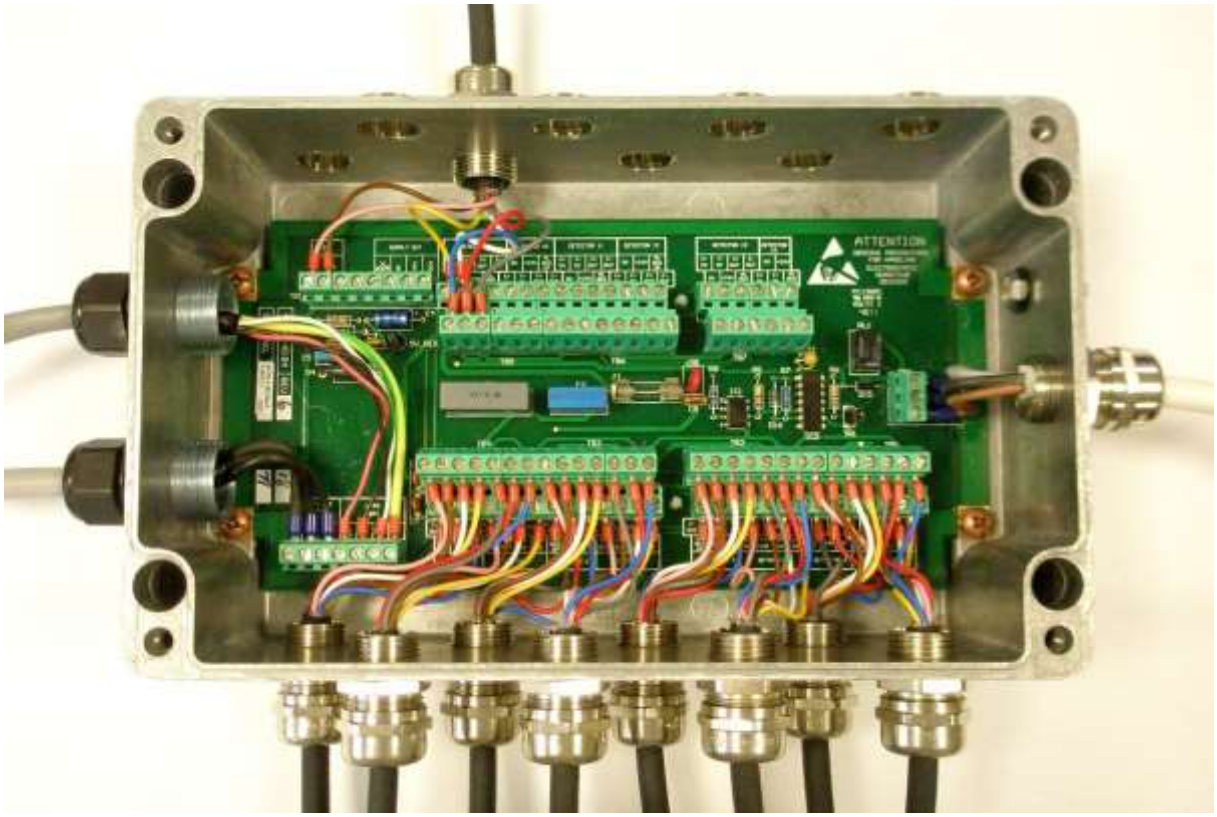


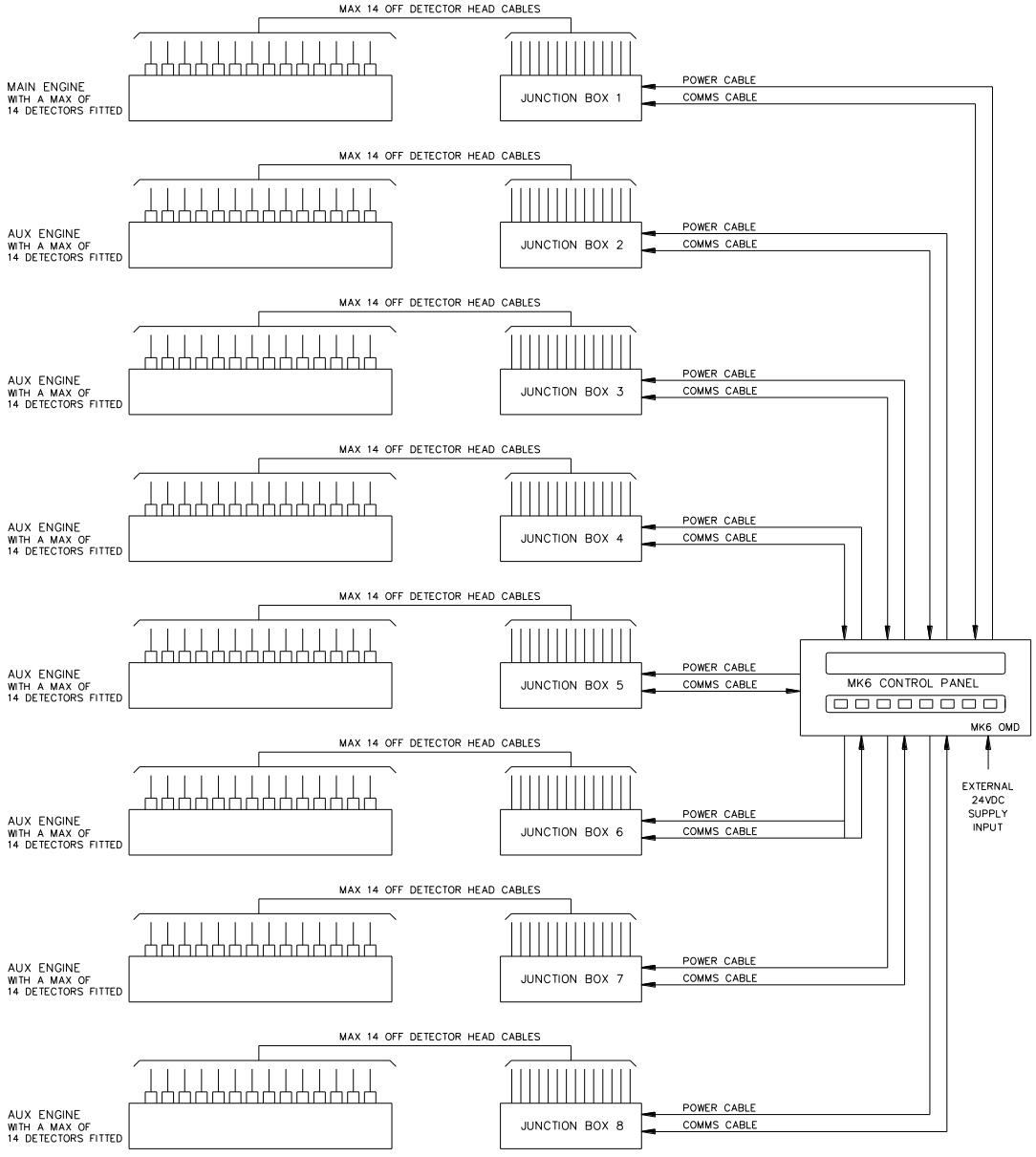
Figure 34 MK6 Junction Box Connections

Locate and tighten the collar of the connector to the top of the Detector.

Figure 35 Connection to the Detector Head Assembly.

2.6.5 Backup relay connection in the Junction Box.

The connection to the Backup Alarm relay can be made using a screened cable. The screen of the cable being terminated inside a metal EMC gland, e.g. Lapp Kabel Skintop MS-SC-M-XL range, ensuring that the metal prongs make contact with the cable screen. See Figure 21.



EQUIPMENT LIST	
PART No.	DESCRIPTION
E3561-301	MK6 OMD DETECTOR HEAD
53836-K170	MK6 OMD CONTROL PANEL
D4720-001-14	MK6 OMD JUNCTION BOX M20 GLANDS
1-53836-K224-14	MK6 OMD JUNCTION BOX M25 GLANDS
43682-K108-02	CABLE ASSY SKT- 10M LONG - DETECTOR HEAD
43682-K108-08	CABLE ASSY SKT- 25M LONG - DETECTOR HEAD
43682-K109-00	CABLE ASSY 90DEG SKT- 5M LONG - DET HEAD
43682-K109-02	CABLE ASSY 90DEG SKT- 10M LONG - DET HEAD
43682-K109-05	CABLE ASSY 90DEG SKT- 17.5M LONG - DET HEAD
43682-K109-08	CABLE ASSY 90DEG SKT- 25M LONG - DET HEAD
CUSTOMER SUPPLY	POWER CABLE - SEE BELOW
CUSTOMER SUPPLY	COMMS CABLE - SEE BELOW

POWER CABLE: 2 CORES + EARTH, CSA 2.5mm^2 (50/0.25mm),
FLEXIBLE STRANDED BARE COPPER CONDUCTORS,
LOW SMOKE HALOGEN FREE INSULATION,
CORES LAID UP, ALUMINIUM/POLYESTER FOIL
PLUS A TINNED COPPER WIRE BRAID.
LOW SMOKE HALOGEN FREE SHEATH - GREY
OUTSIDE DIAMETER 9.8mm.
OPERATING TEMPERATURE 0°C TO +80°C.

SUPPLIER - FS CABLES
ORDER CODE 42302503.
OR SIMILAR.

COMMS CABLE: 2 TWISTED LOW CAPACITANCE PAIRS,
24 (7) AWG TINNED COPPER CONDUCTORS,
FOAM POLYOLEFIN INSULATION,
EACH PAIR FOIL SCREENED WITH A
TINNED COPPER DRAIN WIRE,
LOW SMOKE HALOGEN FREE SHEATH - GREY.
OUTSIDE DIAMETER 8.1mm.
OPERATING TEMPERATURE 0°C TO +70°C.

SUPPLIER - FS CABLES
ORDER CODE 2402PIFFH.
OR SIMILAR.

Figure 36 System Drawing

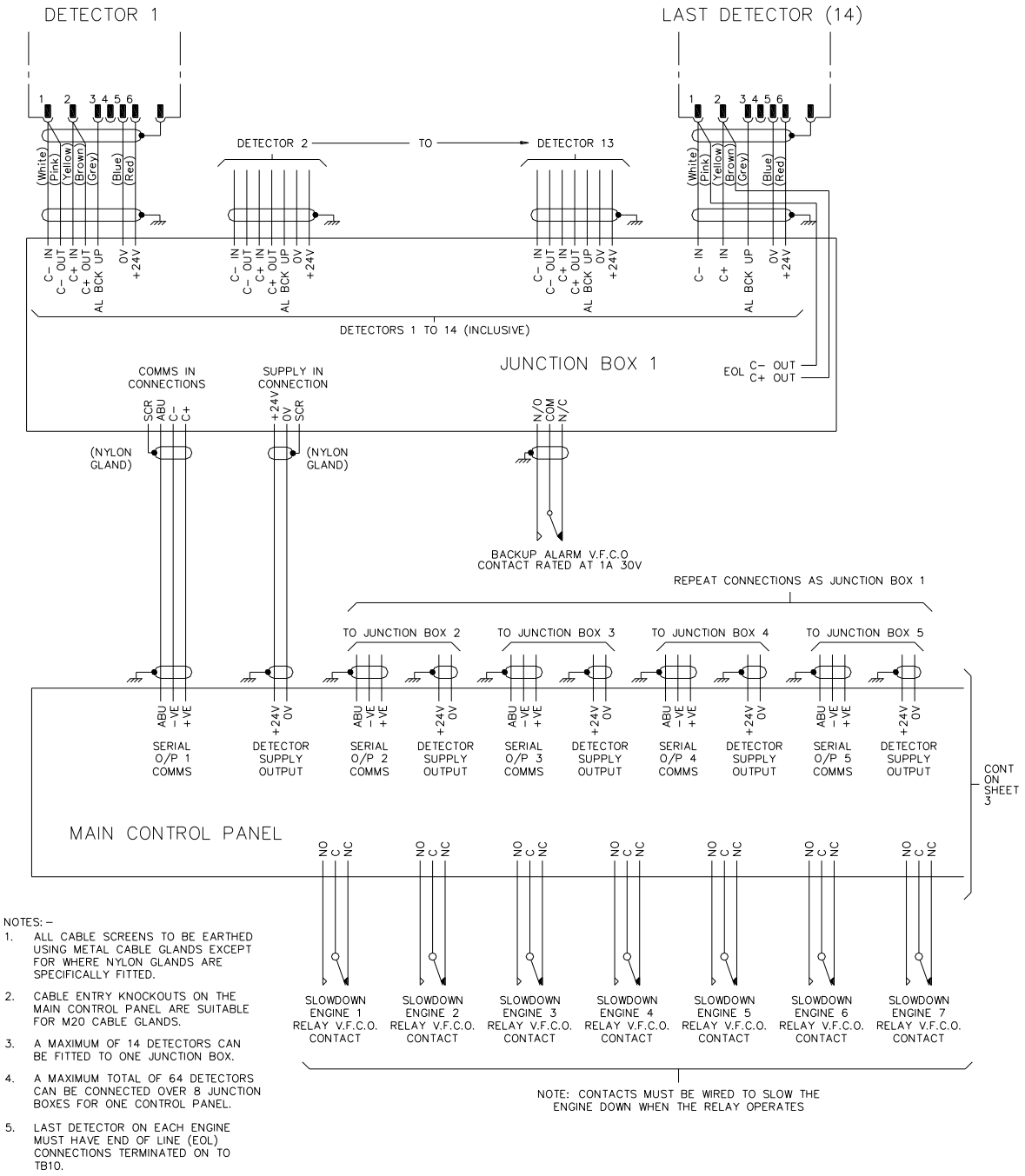


Figure 37 Wiring Diagram

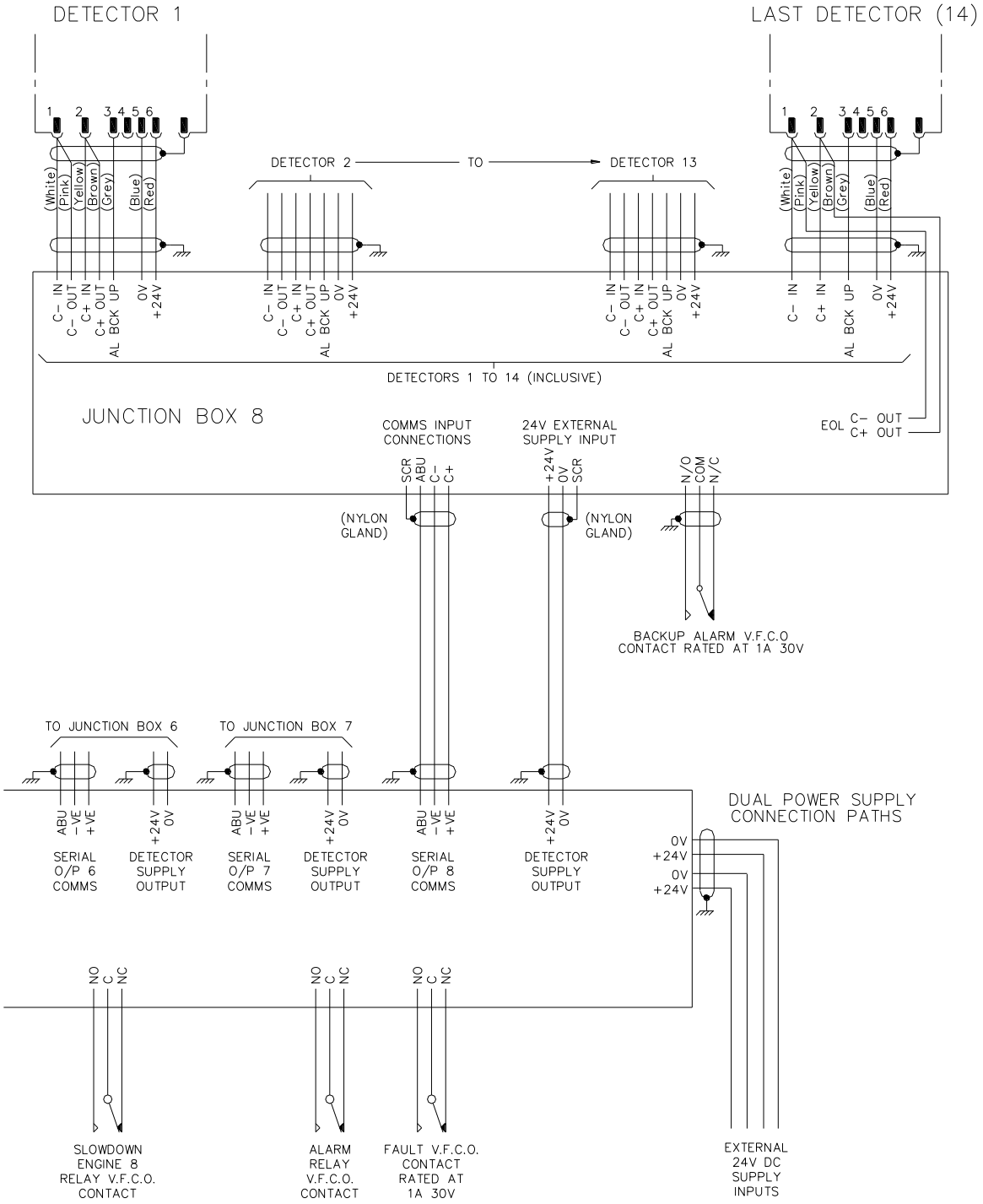


Figure 38 Wiring Diagram

2.6.6 Cable screening

It is critical that the cable screening instructions are followed. Failure to correctly connect the cable screens may result in communication failures and / or permanent damage to components.

Note where armored cable is used the armor must not be used as the cable screen.

2.7 SYSTEM CHECKS PRIOR TO SWITCHING ON

2.7.1 Setting Detector Address

Correct operation of the system depends on all Detector heads being correctly addressed.

This is carried out after installation (refer to Figure 39).

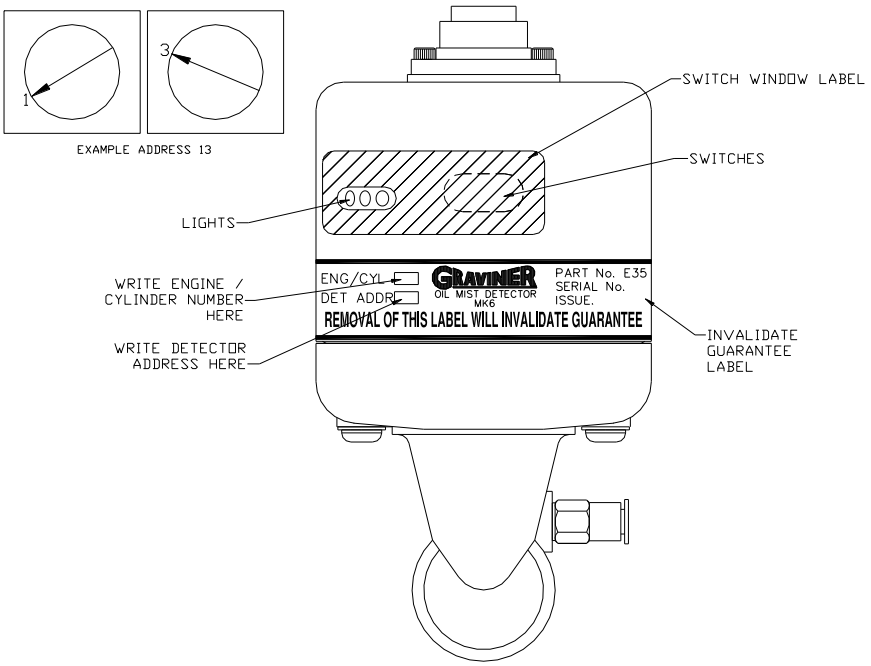


Figure 39 Detector Head 1-E3561-301

1. Remove the adhesive label covering the access port to the address switches.
2. Use an instrument screwdriver to set the switches.

   The left-hand switch sets the TENS, the right-hand switch sets the UNITS.
3. Detectors are supplied with the switches set to 00 as factory default.
4. The Detector addresses must be sequential and should run in sequence from engine to engine, i.e. if the last Detector head on the first engine is address 08, then the first Detector head on the second engine must be 09. It is essential that if Detector heads are removed for overhaul they are returned to their original position or they must be re-addressed.

   Where a detector is re-addressed the power must be removed from the detector before the address change will take effect.
5. Clean the Detector head in the area around the address switches and indicator lights with wet and dry wipes to ensure any oil or grease is removed. Attach the switch window label so that both the indicator lights are visible through the clear window and the switches are covered by the opaque area. Ensure the label is fully adhered to maintain the IP65 rating of the Detector and the product guarantee.
6. The engine/cylinder number and address should be written on the invalidate guarantee label in the position shown.

2.7.2 Check that the Detector addressed 01 is connected to the Detector 1 position in the Junction Box, and the Detector addressed 02 is connected to the Detector 2 position in the Junction Box

etc. Ensure that the pink and brown wires from the last Detector are connected in to the EOL terminals in the Junction Box.

2.7.3 Ensure that the Communication and Junction Box power supply cables are connected correctly at the Junction Box (refer to section 2.6.3).

2.7.4 Check the cable run of the Communication and Junction Box power supply cables back from the Junction Box to the Control Panel to ensure that they are not damaged.

2.7.5 Ensure that the Communication and Junction Box power supply cables are connected correctly at the Control Panel.

2.7.6 Ensure that the Engine Slowdown/Shutdown, Common Alarm and Fault Alarm relays are connected correctly at the Control Panel.

2.7.7 Ensure that the supply input cables are connected correctly to the Control Panel (refer to Figure 20).

2.7.8 Ensure that the input voltage at the Control Panel is a clean 24 V dc +30%, - 25%

2.7.9 Check the location and function of the main controls on the front of the Control Panel (refer to Error! Reference source not found.).

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

2.7.11 Allow the engine to reach its' normal working temperature before continuing to system configuration and commissioning.

2.8 SYSTEM SETUP / CONFIGURATION

2.8.1 Initial Actions and Settings

1. After switch on, the Control Panel display shows the message SCANNING FOR DETECTORS. Followed by a flashing COMMS FAULT message. The green LED's on the Detectors illuminate.
2. Press ACCEPT to silence the audible alarm. The COMMS FAULT continues to flash. Select MAIN MENU use the cursor to highlight ENGINEER. Press ↵

Figure 40 Main Menu – User Level

3. The display calls for a password. Enter the default password 012345 press ↵ The display shows MAIN MENU ENGINEER. Use the cursor to highlight option 1 CONFIGURE SYSTEM. Press ↵

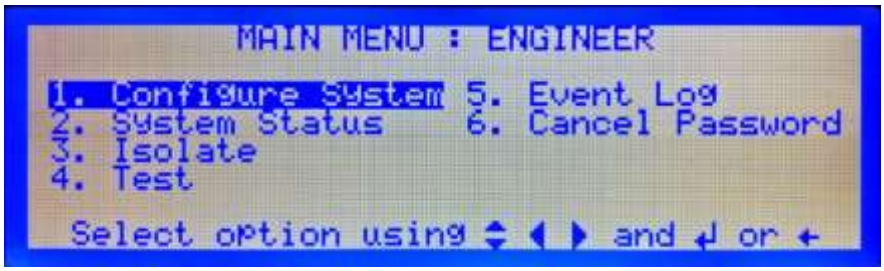


Figure 41 Main Menu – Engineer Level

2.8.2 Setting Engine Details

1. Select ENGINEER MAIN MENU, followed by CONFIGURATION SYSTEM and ENGINE/DETECTOR

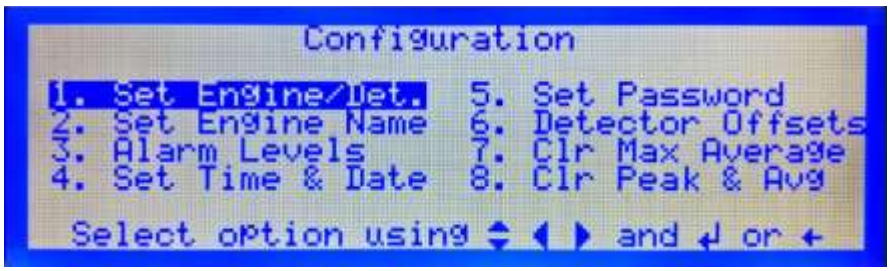


Figure 42 Configuration Menu

2. In ENGINE/DETECTOR CONFIGURATION enter number of Engines. Press ↵

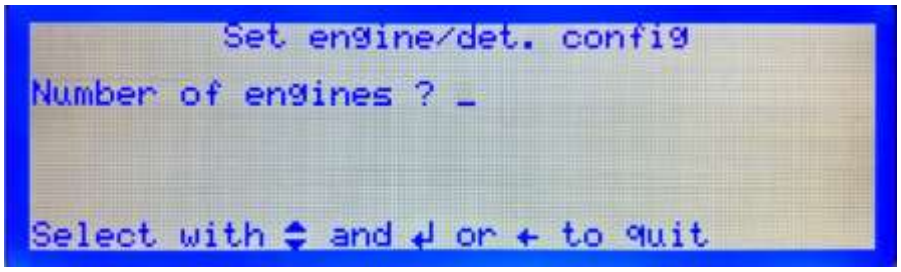


Figure 43 Engine Configuration

3. Select each Engine in turn using the ▲ and ▼ navigation keys.
4. For each engine enter the number of Detectors. Press ↵after each entry.

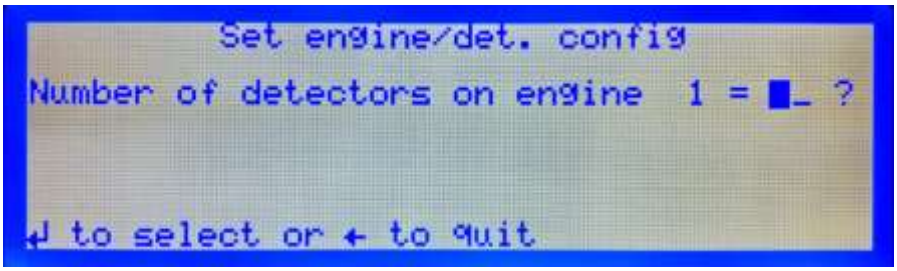


Figure 44 Detector Configuration

5. Press ← to return to configuration menu,

The system configuration value range is shown below

Attribute	Default	Range
Number of engines	1	User selectable – 1 to 8
Number of Detectors	4	User selectable – 1 to 14 per engine System maximum 64 detectors

2.8.3 Set Engine Name - Optional

1. Select SET ENGINE NAME. Select engine 1(2, 3, 4, etc) press ↵

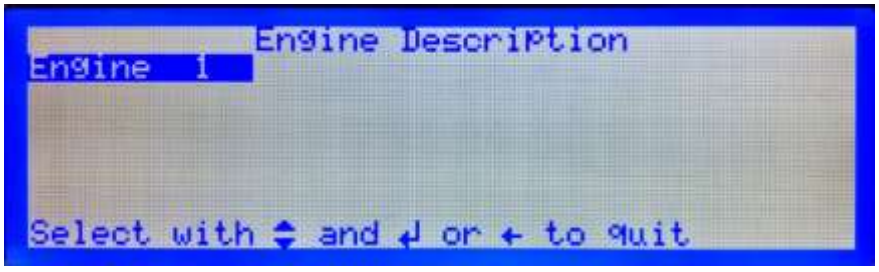


Figure 45 Engine Description

2. Enter engine description letter by letter using the ▲/▼ keys to sequence through the alphabet and the ◄/► keys to move to the next letter Press ↵store the name. Press ← to return to engine description page and select NEXT ENGINE.

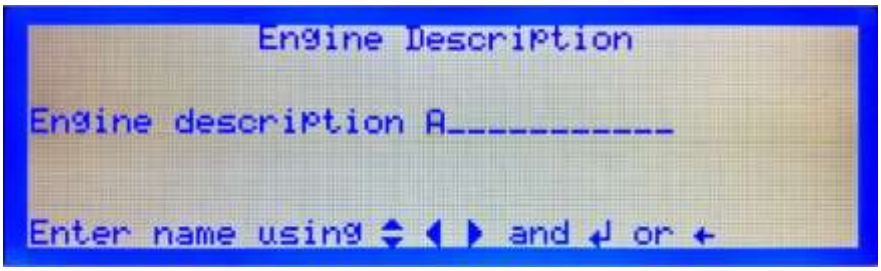


Figure 46 Entering Engine Description

3. Repeat this section to name all configured engines.

2.8.4 Setting Time and Date

To change the Time & Date press '4. Set Time & Date in the Configuration Menu, Figure 42

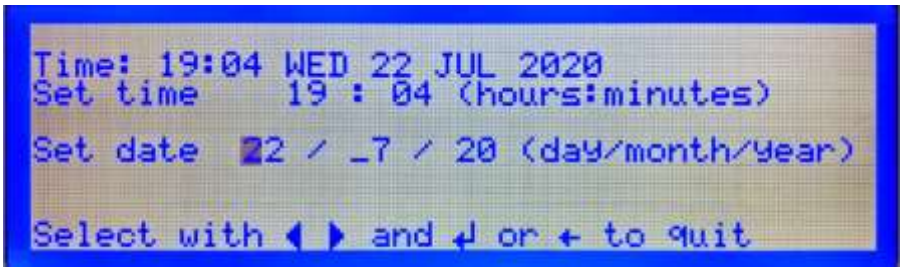


Figure 47 Set Time & Date

Use numeric keys to set the Time and Date.

2.8.5 Setting Alarm Levels

The system is supplied with default alarm settings for both average and deviation alarms. These are based on past experience and allow the system to operate initially and gather data from the engines being monitored. The default alarm values and the allowable range are detailed below.

Alarm Type	Default Settings	Range
Deviation	0.3 mg/l	0.05 to 0.5 mg/l
Average	0.7 mg/l	0.3 to 1.3 mg/l
Back-up	1.6 mg/l	Fixed

Prior to taking oil mist level measurements the Detector temperatures should be allowed to stabilize to the engine room temperature, this may take approximately 20 minutes.

To enable the alarm settings to be matched to the individual engines, the actual oil mist density readings should be taken from each engine after it has been operating at full load and reached maximum operating temperature. This could take up to 2 hours.

Prior to operating the engine all stored oil mist levels must be cleared.

1. The test readings for the Detectors should be cleared. This is done via MAIN MENU: ENGINEER – 1. Configure System – 8. Clr Peak & Avg

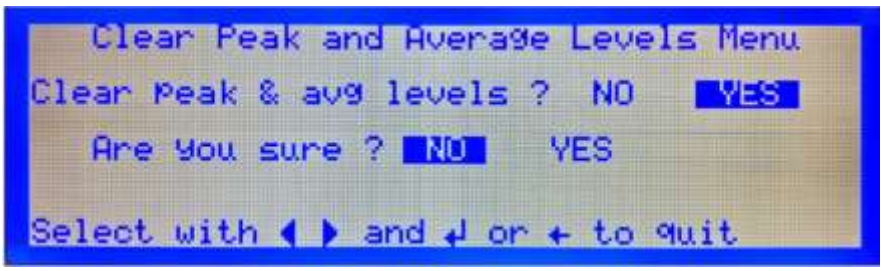


Figure 48 Clear Peak and Average Values

Select YES and press ↵

2. Clear the maximum average reading for each engine to ensure all test readings are erased. This can be done via MAIN MENU: ENGINEER – 1. Configure System –7. Clr Max Average.

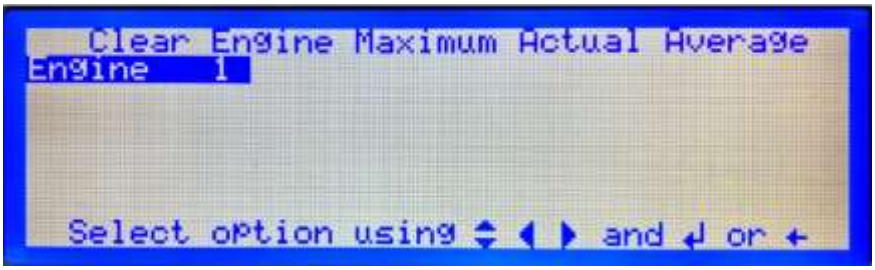


Figure 49 Clear Maximum Average Values

Select the required engine and press ↵

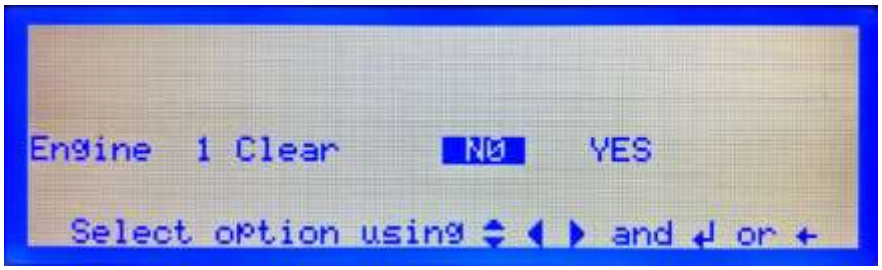


Figure 50 Confirm Clear Maximum Average Values

Select YES and press ↵

The above should be carried out for all engines being monitored. This should also be carried out after any smoke testing.

2.8.6 Average Alarm

1. Enter the Main Menu: Engineer, Figure 41, and select 2. System Status.

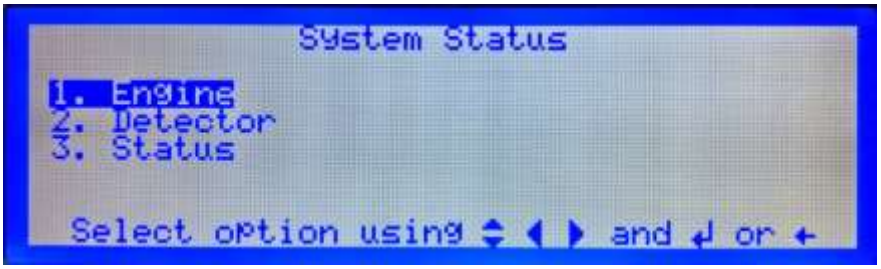


Figure 51 System Status Menu

2. Select 1. Engine

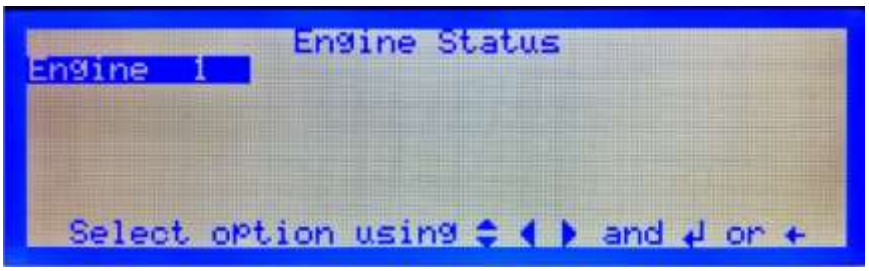


Figure 52 Engine Status Selection

3. Select the required Engine (1 2, 3, 4, etc) from the list.

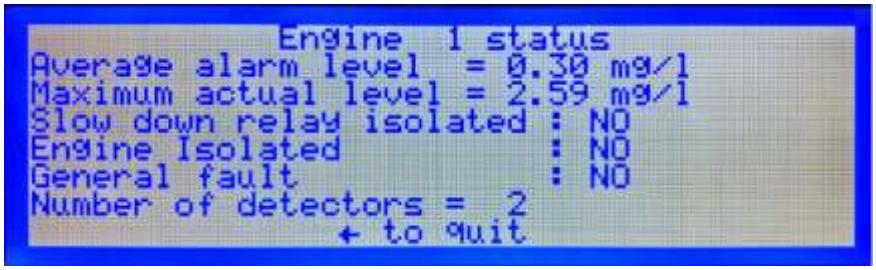


Figure 53 Engine Status

4. Read Maximum actual level value (retain this value for deviation alarm setting).
5. Set Average alarm level to twice the Maximum actual level, as follows:

   Return to the Configuration menu, Figure 42 select 3, Alarm Levels,

Figure 54 Set Alarm Levels

Select 1. Set Average Alarm.

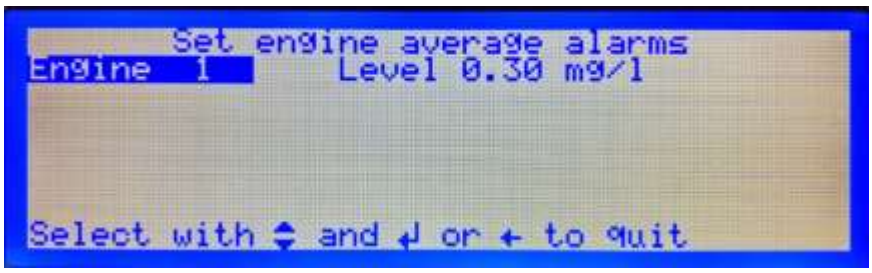


Figure 55 Set Engine Average Alarm

Select engine number, press ↵Enter the new alarm level in the range 0.3 to 1.3mg/l as calculated from above. If the calculated value is outside these limits set the alarm level to the nearest value in the range.

6. Repeat steps 1 to 5 for all engines.

2.8.7 Deviation Alarm

Have the Maximum actual level for each engine to hand as used in setting the Average alarm level (from step 4. in section 2.8.6 above).

Enter MAIN MENU and select ENGINEER MAIN MENU. Enter the password, Press ↵

1. Enter the System Status menu, Figure 51, and select 2. Detector.

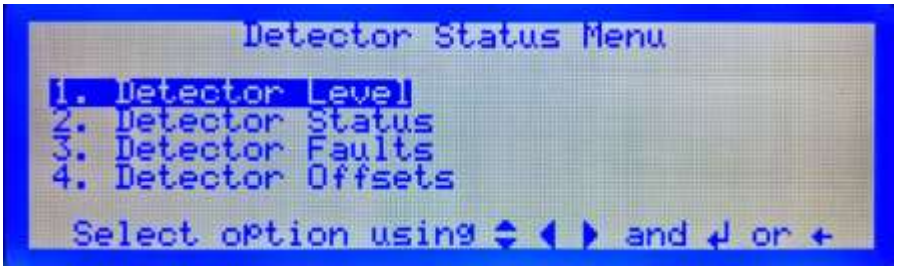


Figure 56 Detector Status Menu

2. Select 2. Detector Status,

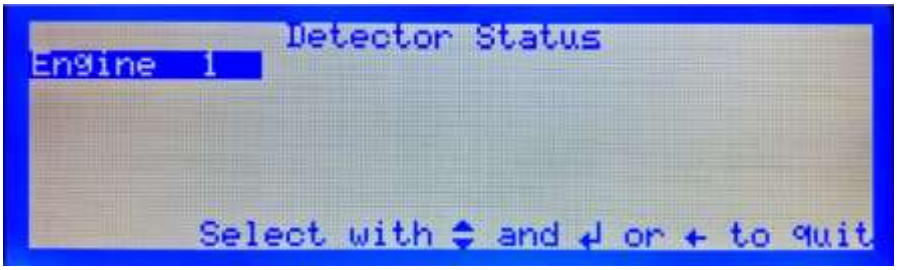


Figure 57 Detector Status – Engine Selection

3. Select the required Engine from the list.

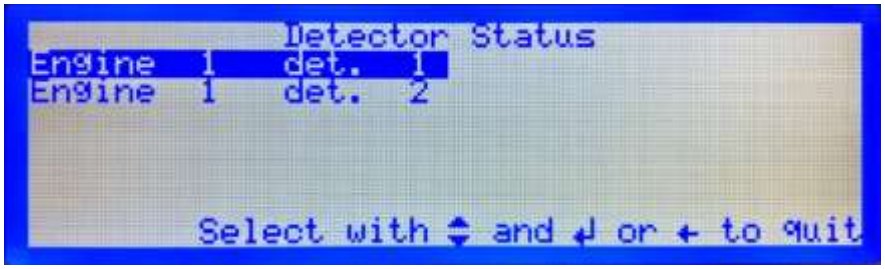


Figure 58 Detector Status – Detector Selection

4. Select the required Detector from the list.

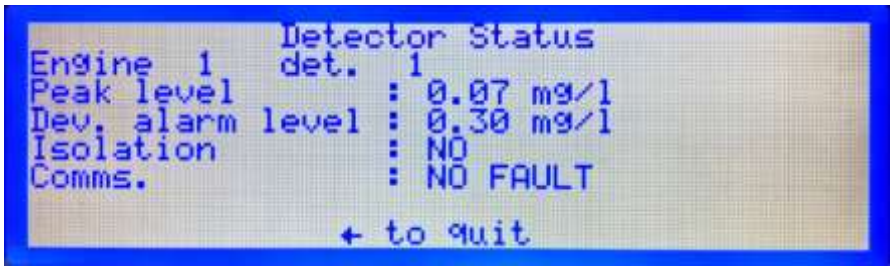


Figure 59 Detector Status

5. Read the Peak Level on each Detector. Subtract the Maximum actual level for that engine from each of the Detector peak levels and multiply each result x 2. This becomes the deviation alarm level entered into the Control Panel.

Dev. Alarm level = 2 x (Detector Peak Level minus engine Maximum actual level).

6. Repeat for each detector on each engine by using ← key to return to the required Detector Status screen. Note the required deviation alarm level in the range 0.05 to 0.5mg/l for each detector. If the calculated value is outside these limits set the alarm level to the nearest value in the range.
7. To set the deviation alarm levels, select 2. Set Deviation Alarm from Set Alarms menu, Figure 54,

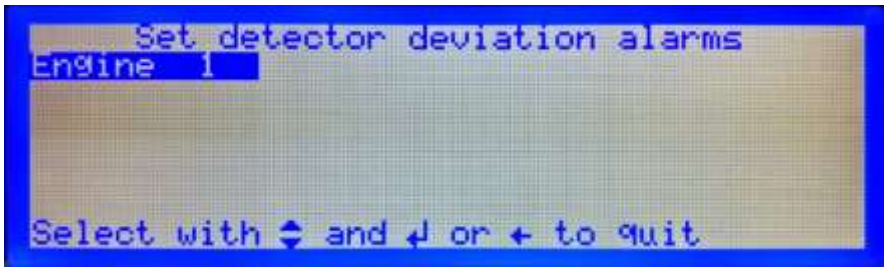


Figure 60 Set detector deviation alarms – Engine Selection

8. Select the required engine.

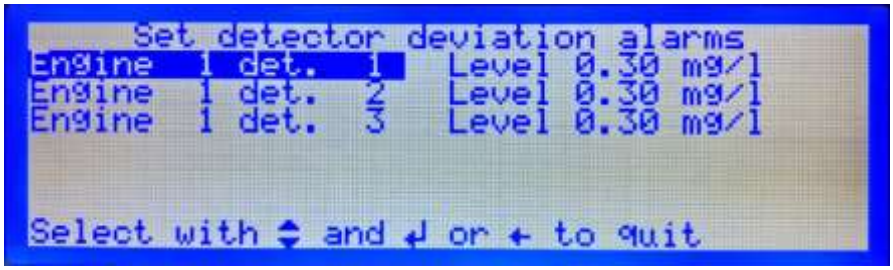


Figure 61 Set Deviation Alarms

9. Select the required detector. Enter new Deviation Alarm Level for each detector on each engine.
10. It may become necessary over a period of time, due to changes in the engine's characteristics, to readjust the alarm levels.

2.9 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.

2.9.1 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 the Control Panel check that the green Power LED is on. All alarm and fault LED's should be off.

On the LCD check that a bar graph is displayed for each of the engines configured. Press the Engine Display / Hold button and use the ▲/▼ keys to select each engine. Check that the correct number of detectors are displayed and that the Alarm levels indicated on the bar graphs are as expected.

2.9.2 Relay operation.

Each of the relay connections between the Control Panel and the AMS should be tested and the required response observed.

The operation of the Fault and Common Alarm relays may be tested with User level access however Engineer Level access is required to test the operation of the Slowdown/Shutdown relay.

2.9.2.1 Fault and Common Alarm relays

1. On the Control Panel press the Test key to access the Test Menu.

   The test menu can also be accessed from the Main Menu, Figure 40, by selecting 1. User – 2. Test

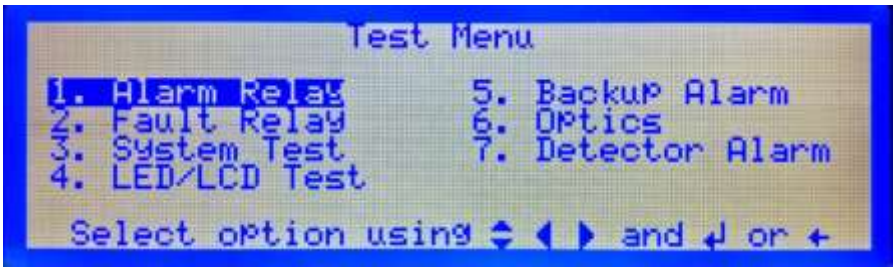


Figure 62 Test Menu – User Level

2. Select 1. Alarm Relay.

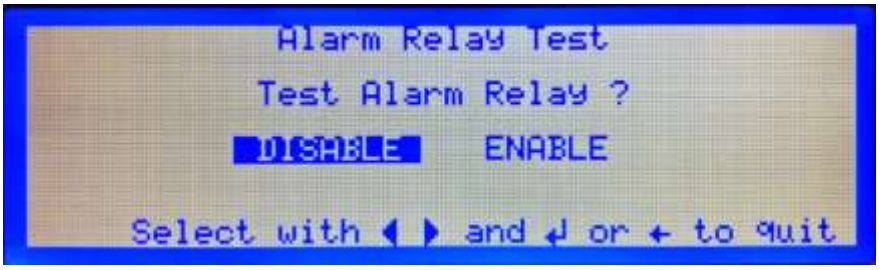


Figure 63 Alarm Relay Test

3. Select Enable or Disable to change the relay state and ensure that the correct engine response is initiated by the AMS.
4. From the Test Menu, Figure 62, select 2. Fault Relay

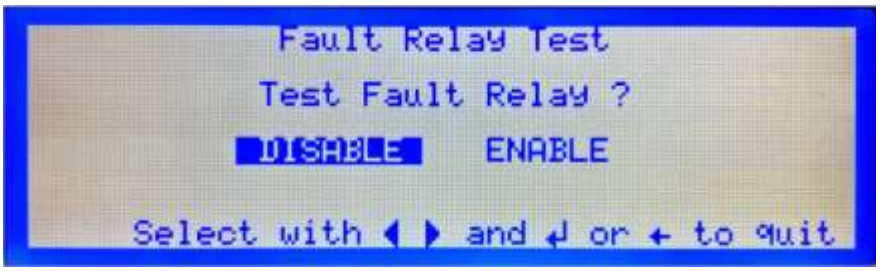


Figure 64 Fault Relay Test

5. Select Enable or Disable to change the relay state and ensure that the correct engine response is initiated by the AMS.

2.9.2.2 Shutdown / Slowdown Alarm relays

1. From the Main Menu : Engineer, Figure 41, select 4. Test

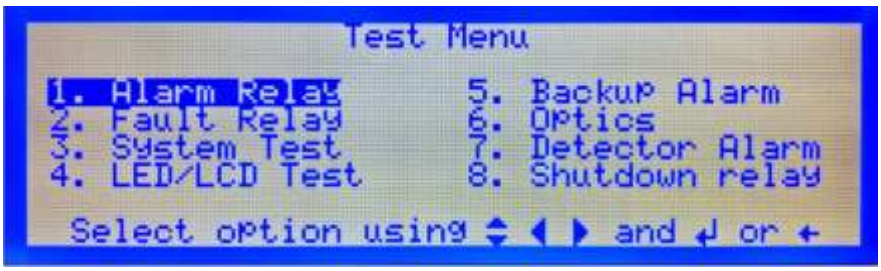


Figure 65 Test Menu – Engineer Level

2. Select 8. Shutdown relay.

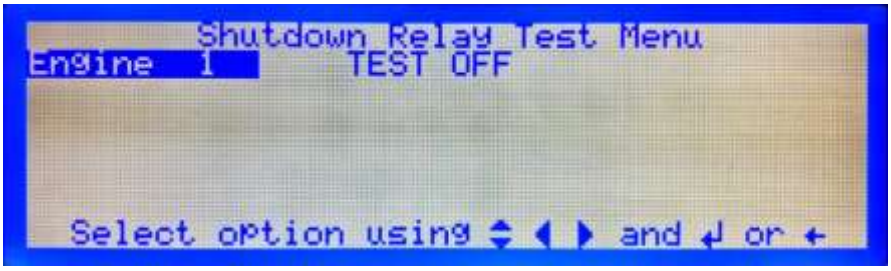


Figure 66 Shutdown / Slowdown Relay Test – Engine Selection

3. Select the engine to be tested from the list.

Figure 67 Shutdown / Slowdown Relay Test

4. Select ACTIVATE or DE-ACTIVATE to change the relay state and ensure that the correct engine response is initiated by the AMS.

2.9.3 Backup Alarm

The Back-up Alarm is a hard-wired link from each Detector installed on the system. This facility will allow any Detector which is in a fault condition and sees an oil mist level of 1.6mg/l or greater to produce a 'Backup Alarm. This will produce operation of both the Backup Alarm Relay in the Junction Box and the Common Alarm Relay in the Control Panel, 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 1.6mg/l.

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

To check the integrity of the Backup Alarm signal between the Control Panel and the Detector a Backup Alarm Test should be performed.

1. From the Test Menu, Figure 62, select 5. Backup Alarm

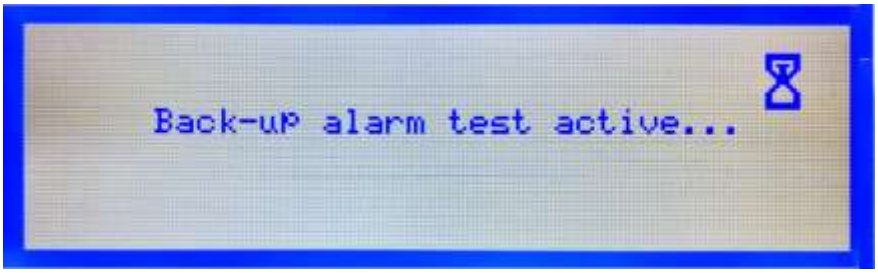


Figure 68 Backup Alarm Test

If the Backup Alarm test is completed successfully the display will return to the Test Menu. If a fault is detected a Backup Alarm Fault will be indicated on the display.

2.9.4 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 Slowdown/Shutdown relays is required before commencing the smoke alarm test, see sections Error! Reference source not found. and Error! Reference source not found.. If the Common 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

1. 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 Error! Reference source not found.).

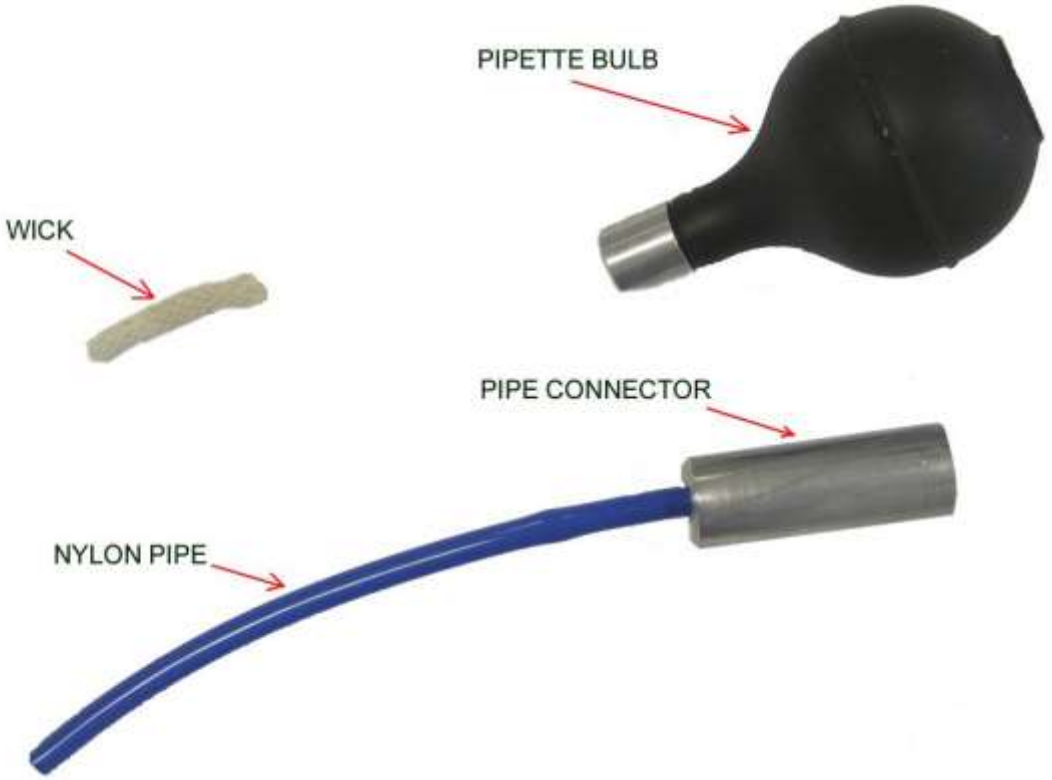


Figure 69 Smoke Tester

2. Push the nylon pipe of the smoke tester into the connector on the side of the Detector base body (refer to Error! Reference source not found.).

Figure 70 Smoke Test

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

   Only a small quantity of oil is required.

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

   Care to be taken with this activity at all times.

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

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

7. After tests are completed the maximum actual average level, Detector peak level and current average readings should be erased.

   a. From the Configuration menu, Figure 42, select 7. Clr Max Average

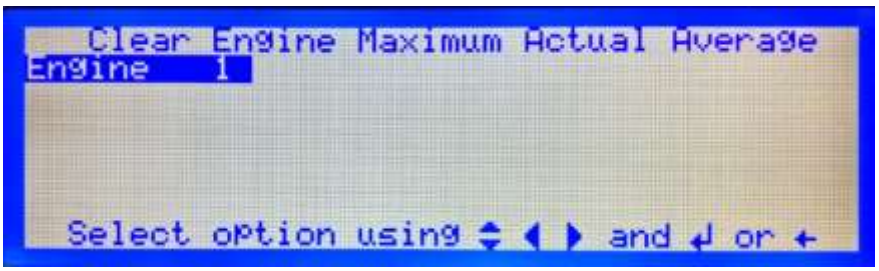


Figure 71 Clear Max Average Levels – Engine Selection

   b. Select the required engine from the list.

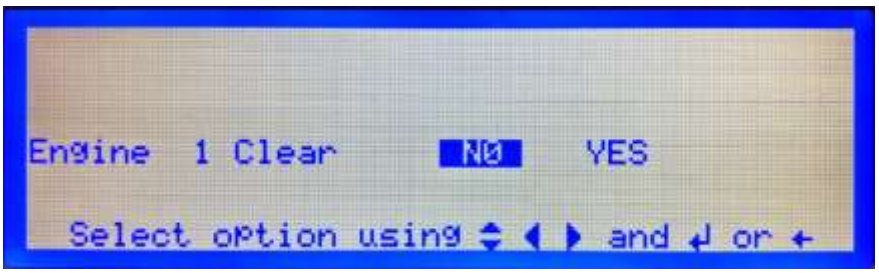


Figure 72 Clear Max Average Levels

c. Select Yes to confirm the levels are to be cleared.

d. From the Configuration menu, Figure 42, select 8. Clr Peak & Avg

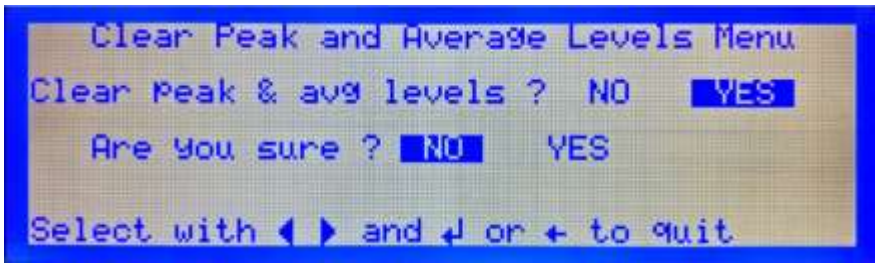


Figure 73 Clear Peak and Average Levels

e. Select Yes to confirm the levels are to be cleared.

8. 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

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

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

11. 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.

1. Push the nylon pipe of the smoke tester into the connector on the side of the detector base body (refer to Figure 70).

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

3. After tests are completed the maximum actual average level, Detector peak level and current average readings should be erased.

4. 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
5. Remove the nylon pipe from the pipe connector for stowage purposes.
6. 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 Panel communicates with each connected detector to obtain the measured oil mist level and the detector status. The Control Panel determines if the measured oil mist level is above the alarm levels or if there is a fault condition and activates the appropriate relays.

This information is also displayed on the Control Panel in graphical form on an LCD. A membrane keypad 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 Panel

All LED's on the Control Panel membrane will be switched on for a short period allowing a visual check of their operation to be made.

Following this sequence, the Control Panel Power LED shall be on, all other LED's shall be off.

The LCD shall show a bar graph for each engine indicating the average oil mist level and indicate that the system is Normal.

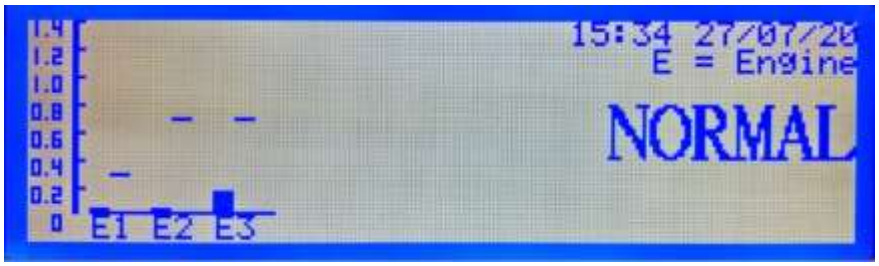


Figure 74 Main Screen

Short lines to the right of each bar graph show the average alarm level for that engine.

3.1.3 Engine Overview

During normal operation the Control Panel will display the Main Screen, Figure 74, showing a bar graph for each engine.

The name of the engine is shown below the bar graph.

The level displayed on the bar graph indicates the average oil mist level being measured on that engine at that moment in time. The indicated level will change in real time as the oil mist level in the engine changes.

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 Main Menu key on the Control Panel.

Figure 75 Main Menu

Using the numeric keys enter password 012345 ↵ to display the Engineers Main Menu

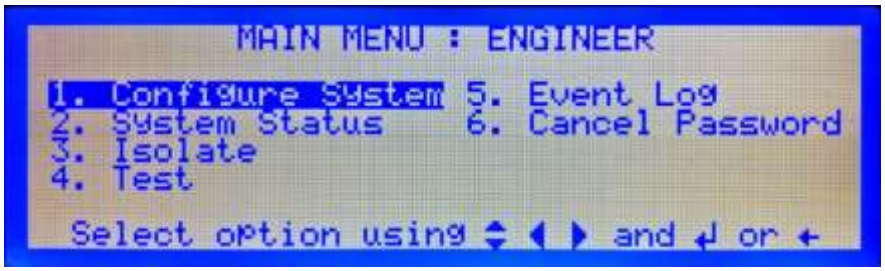


Figure 76 Main Menu – Engineer Level

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 Engine Display | Hold key.

The engine screen displays a bar graph for each detector, up to 14 detectors.

Figure 77 Engine Screen – User

The detector number is shown below the bar graph.

The height of each bar indicates the oil mist level being measured by the detectors at that moment in time. The scale on the left-hand side indicates the oil mist level in mg/l. The indicated level will change real time as the oil mist level in the cylinder changes.

The last, right most, bar shows the average oil mist level calculated for the engine.

Alarm levels are indicated by the short lines to the right of each bar graph. The line indicating the Average Alarm level remains fixed at the set level while the Deviation Alarm levels will fluctuate maintaining a set level above the current engine average level.

Each of the engines may be examined using the up and down arrow keys to scroll through the available engines.

3.4 ENGINE STATUS INFORMATION

Engine status information may be accessed at User Level by selecting 1. System Status on the Main Menu: User screen.

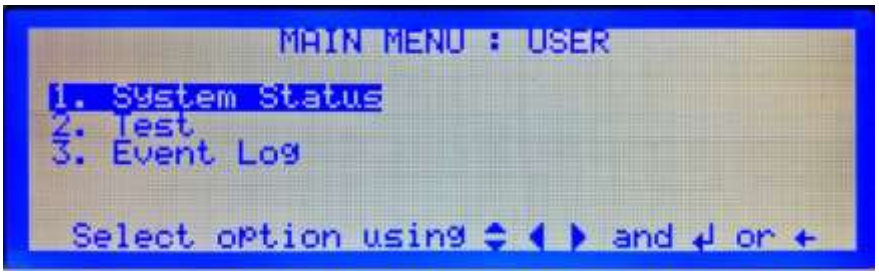


Figure 78 Main Menu – User Level

Or by selecting 2. System Status in the Main Menu: Engineer screen, Figure 76.

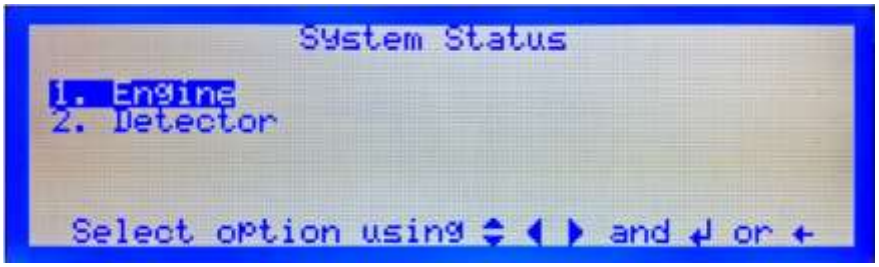


Figure 79 System Status Menu – User Level

Select 1. Engine

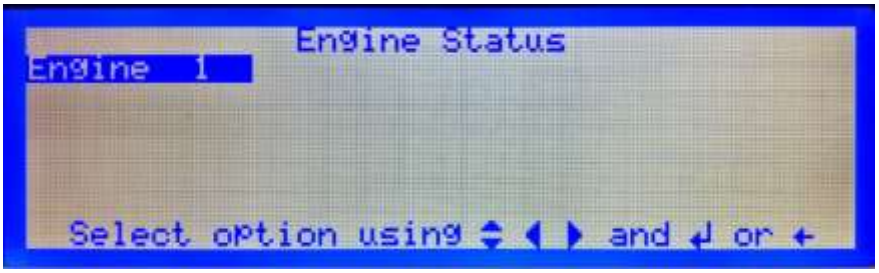


Figure 80 Engine Status Selection

Select the engine from the list to display the engine status information for that engine.

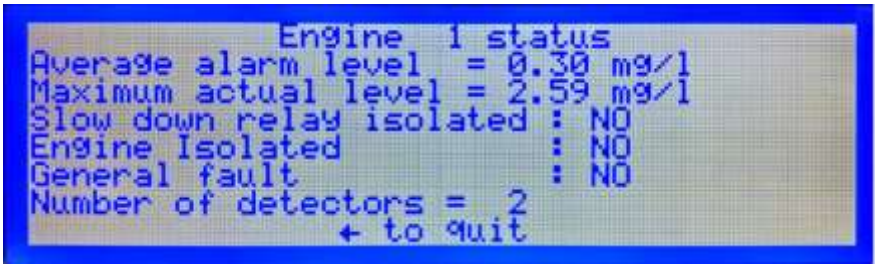


Figure 81 Engine Status

The status screen shows:

Average alarm level	The Average Alarm Level set for that engine.
Maximum actual level	Shows the highest average oil mist level recorded on that engine since the maximum level was reset.
Current Level	The current highest oil mist level indicated by a detector on that engine.
Slow down relay isolated	Yes indicates the Slowdown / Shutdown relay for that engine is isolated.
Engine Isolated	Yes indicates all of the detectors on that engine are isolated.
General fault	Yes indicates there is a fault associated with that engine.
Number of detectors	Shows the number of detectors configured for that engine

3.5 TEST MENU

Although the Control Panel 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

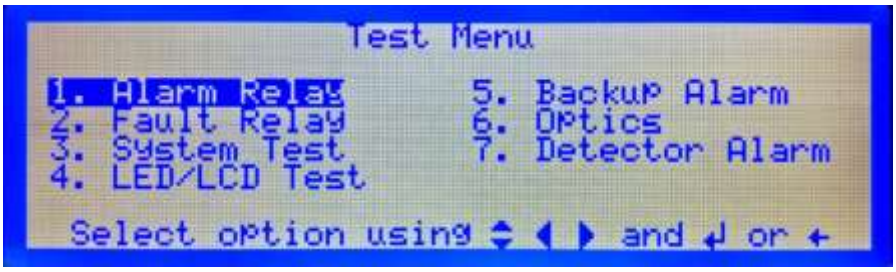


Figure 82 Test Menu – User Level

3.5.1 Alarm Relay

Allows the Common Alarm Relay to be tested.

1. Select 1. Alarm Relay.

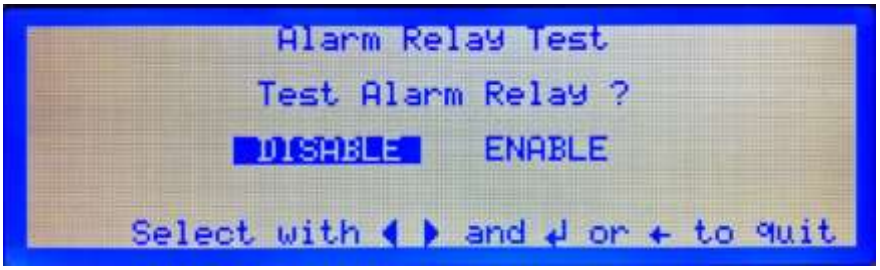


Figure 83 Alarm Relay Test

2. Select Enable or Disable to change the relay state and ensure that the correct engine response is initiated by the AMS.

3.5.2 Fault Relay

Allows the Fault Relay to be tested.

1. Select 2. Fault Relay

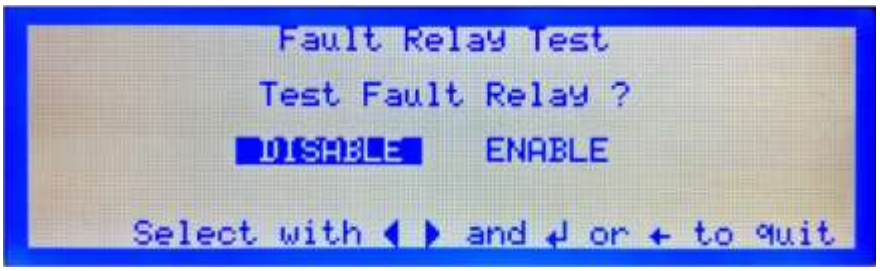


Figure 84 Fault Relay Test

2. Select Enable or Disable to change the relay state and ensure that the correct engine response is initiated by the AMS.

3.5.3 System Test

This is a legacy option and no longer performs a function. If selected the screen returns to the Test Menu.

3.5.4 LED/LCD Test

The test allows a visual inspection to be made of the LCD and LED operation on the Control Panel.

Select 4.LED/LCD Test, the panel will;

Illuminate all of the LED's on the panel allowing a visual check to be made or their operation.

Each line of the display will be made dark allowing the LCD pixels to be visually checked.

The text shown in Figure 85 will be displayed, the Version being the current software in the Control Panel.

The Control Panel buzzer will sound at the end of the test allowing an audible check of the buzzer.

After completion of the test sequence the screen returns to the test menu.

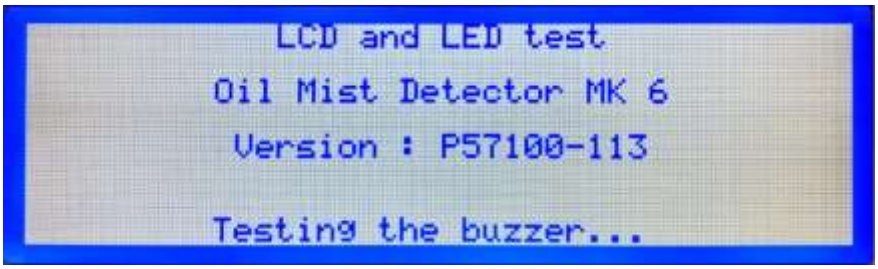


Figure 85 LED/LCD Test

3.5.5 Backup Alarm

Tests the Backup Alarm signal between each detector and the Control Panel.

Select 5. Backup Alarm

A short beep maybe heard from the Control Panel buzzer while the connection from each detector is tested.

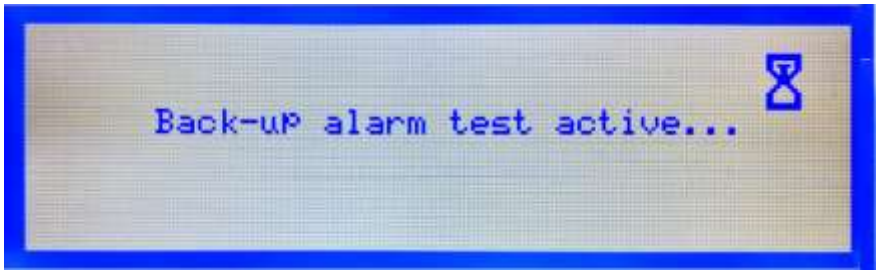


Figure 86 Backup Alarm Test

If the Backup Alarm test is completed successfully the display will return to the Test Menu. If a fault is detected a Backup Alarm Fault will be indicated on the display and the failed detector is listed.

3.5.6 Optics

Instructs all detectors to perform an optics test to ensure that oil contamination within the detector sample chamber is within acceptable limits.

Select 6. Optics

This test may take up to 30 seconds to complete.

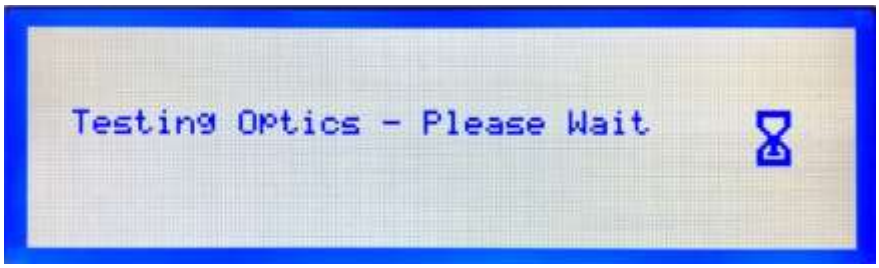


Figure 87 Optics Test

If the Optics test is completed successfully the display will return to the Test Menu. If a fault is detected either an LED Average Fault or a Detector Fault will be indicated on the display and the failed detector is listed.

3.5.7 Detector Alarm

Simulates an oil mist alarm from a specified detector. This test does not operate the Shutdown / Slowdown Relay.

Select 7. Detector Alarm

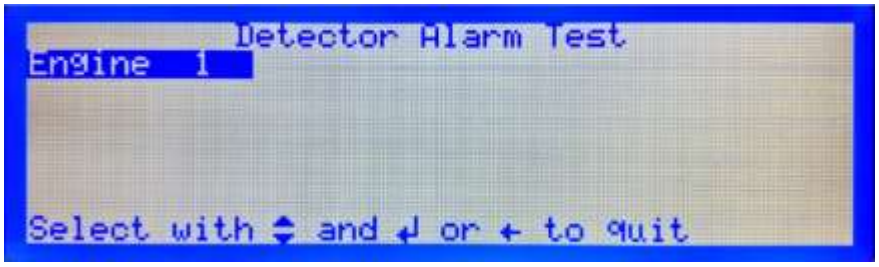


Figure 88 Alarm Test Engine Selection

Select the required engine from the list.

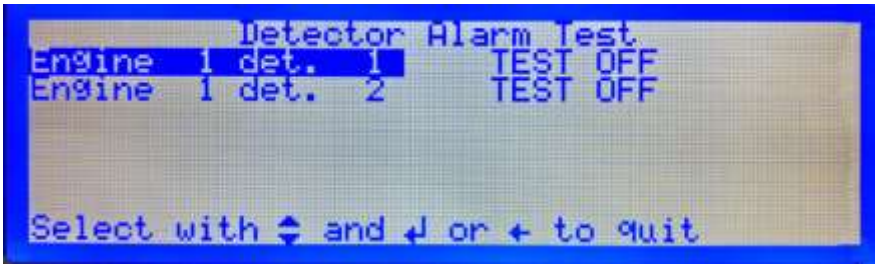


Figure 89 Alarm Test Engine

Select the required detector from the list. The Control Panel and Detector will indicate an alarm condition on the selected detector. The Common Alarm Relay will be operated but not the Shutdown / Slowdown Relay.

The alarm condition is cleared by pressing the Acknowledge and Reset keys. The Control Panel display with return to the Main Screen, Figure 74.

3.5.8 Shutdown Relay

Selecting the Test Menu, 4. Test, from Main Menu: Engineer, Figure 41, provides an additional test option to those obtained at the user level, allowing the operation of the Shutdown / Slowdown Relay to be tested.

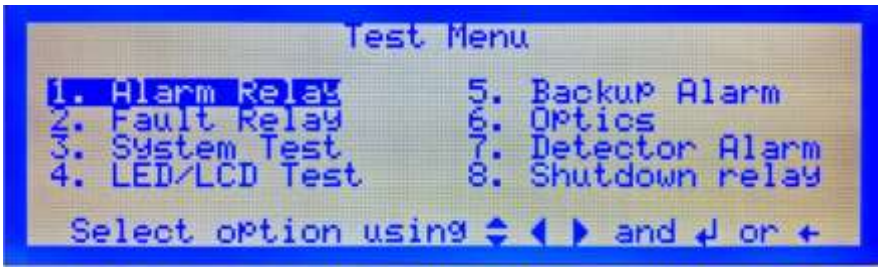


Figure 90 Test Menu – Engineer Level

1. Select 8. Shutdown relay.

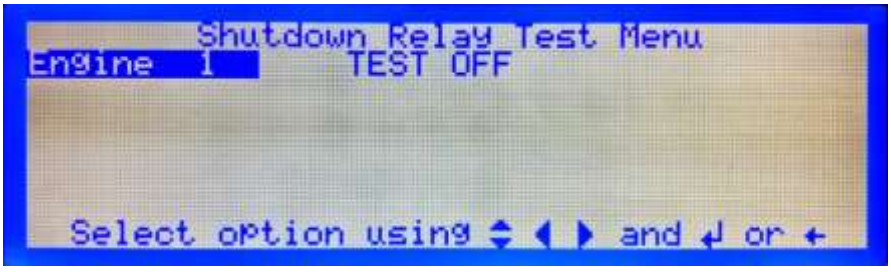


Figure 91 Shutdown / Slowdown Relay Test – Engine Selection

2. Select the engine to be tested from the list.

Figure 92 Shutdown / Slowdown Relay Test

3. Select ACTIVATE or DE-ACTIVATE to change the relay state and ensure that the correct engine response is initiated by the AMS.

3.6 EVENT LOG

The Event Log enables the user to interrogate the past 256 events and can be accessed via the menus below. The Event Log is a rolling buffer and when the events exceed 256 then the oldest event is dropped off the Event Log.

From the Main Menu: User screen, Figure 78, select 3. Event Log.

Figure 93 Event Log Menu

Three display formats for the Event Log are provided:

Display all events in the Event Log

Display only specific events in the Event Log

Display only event which occurred on a specific date.

3.6.1 All Events

Select 1. List All Events

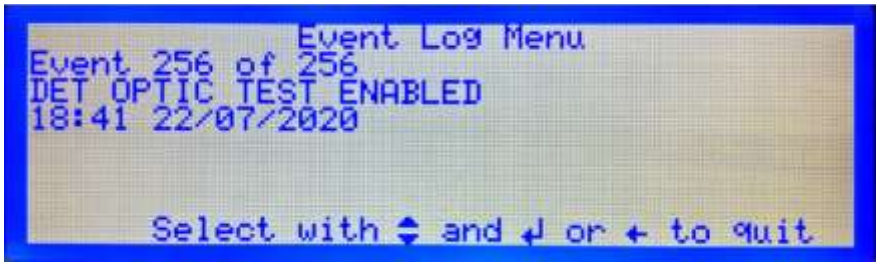


Figure 94 Event Listing

The latest event held in the log will be displayed providing:

The number of that event in the log together with the total number of events in the log.

The even that occurred

The events which occurred after a specified time and date.

Additional events held in the log can be displayed using the up and down cursor keys.

3.6.2 By Event

The events log may be filtered to show only specified events.

Select 2. List by Event

Figure 95 Event Log – Select Event Type

Select the type event type to be displayed from the list.

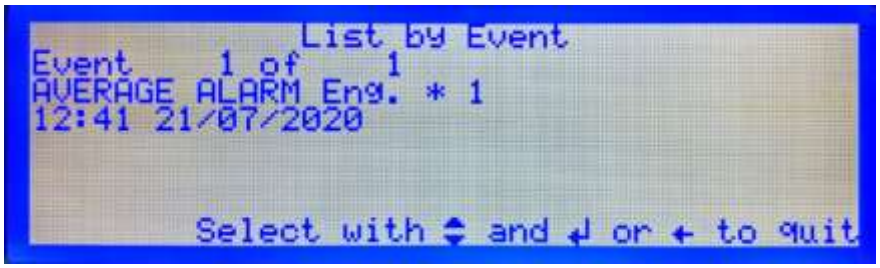


Figure 96 Event Log by Event

Additional events held in the log can be displayed using the up and down cursor keys.

3.6.3 From Date and Time

The events log may be filtered to show events occurring after a particular time and date.

Select 3. List from Date.

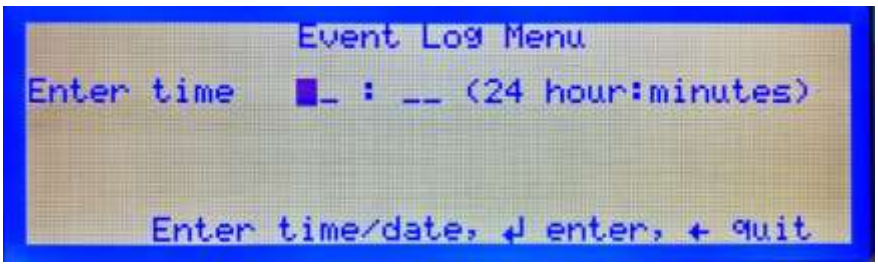


Figure 97 Event Log -Select Date

Enter the time and date the events are to be displayed from.

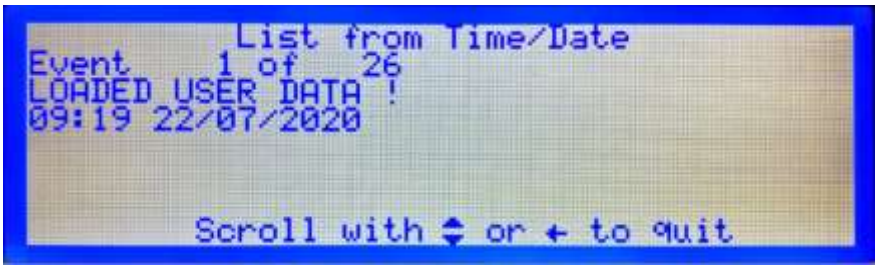


Figure 98 Events Log from Time and Date

Additional events held in the log can be displayed using the up and down cursor keys.

3.6.4 Download to PC

With Engineer Level access an additional menu option is available allowing the Event Log contents to be downloaded to a PC.

Downloading the Event Log requires software to be installed on the PC and a connecting cable between the Control Panel and PC. See Appendix 3 for further details.

3.7 DETECTOR STATUS – USER

In addition to information relating to the engine status, section 3.4, detector status information can also be displayed for the individual detectors.

Select 2. Detector in the System Status Menu, Figure 79

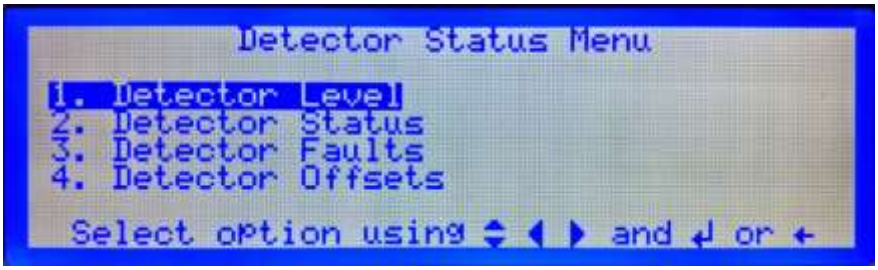


Figure 99 Detector Status Menu

3.7.1 Detector Level

Displays the real time oil mist levels in mg/l for each detector on a specified engine.

Select 1. Detector Level and select the required engine from the list.

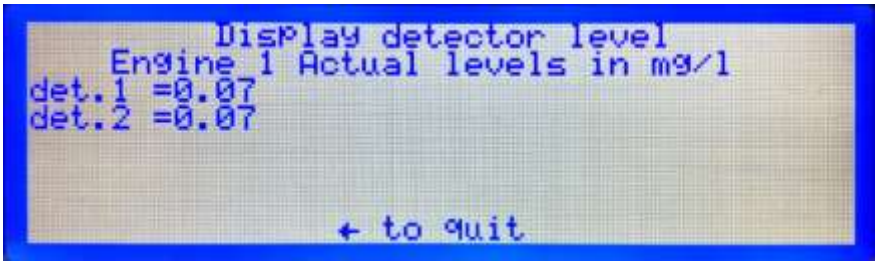


Figure 100 Detector Levels

3.7.2 Detector Status

Displays the current status of a specified detector.

Select 2. Detector Status

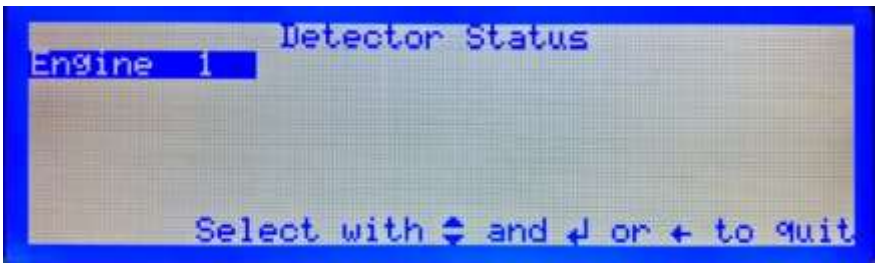


Figure 101 Detector Status – Engine Selection

Select the required engine from the list.

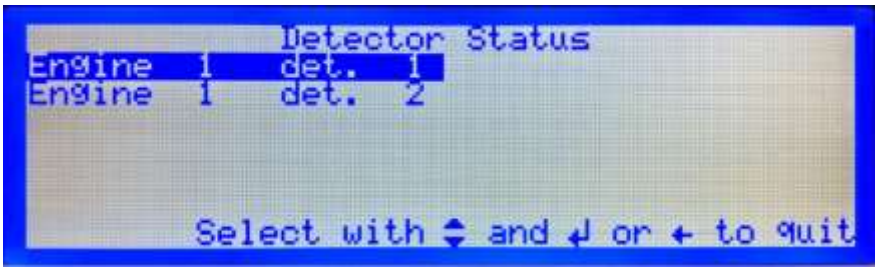


Figure 102 Detector Status – Detector Selection

Select the required detector from the list

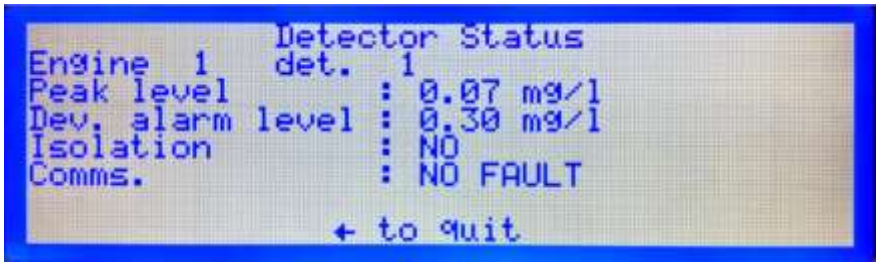


Figure 103 Detector Status

The status screen shows:

The engine and detector being examined

Peak level	Shows the highest level recoded for that detector since the peak value was reset.
Dev. alarm level	Shows the deviation alarm level set for that detector.
Isolation	Indicated if the detector is currently isolated.
Comms.	Indicated if the detector currently has a communications fault.

3.7.3 Detector Faults

Indicates and fault present on a selected detector.

Select 3. Detector Faults

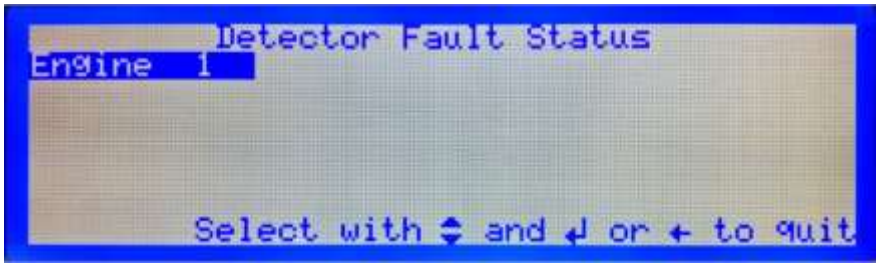


Figure 104 Detector Faults – Engine Selection

Select the required engine from the list

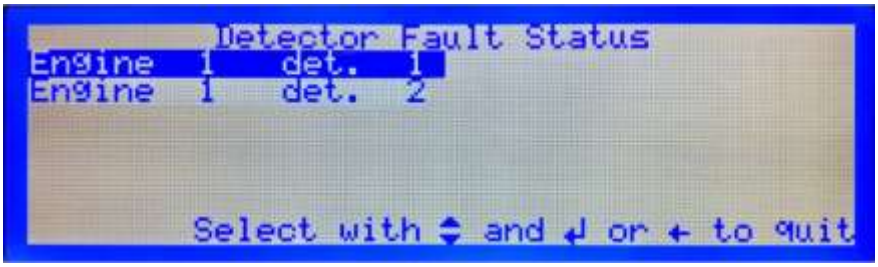


Figure 105 Detector Faults – Detector Selection

Select the required detector from the list

Figure 106 Detector Fault Status

The status screen shows:

The engine and detector being examined	
Fan fault	Indicates if the detector fan has failed.
LED fault	Indicates if the detector sample chamber is contaminated with oil.
Detector CPU fault	Indicated if a failure has occurred on detector microcontroller.
LED Failure	Indicated if an LED illuminating the sample chamber has failed.

3.7.4 Detector Offsets

Detector offsets is a legacy option and should not be used, adding a detector offset will compromise the calibration of the detector.

3.8 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.

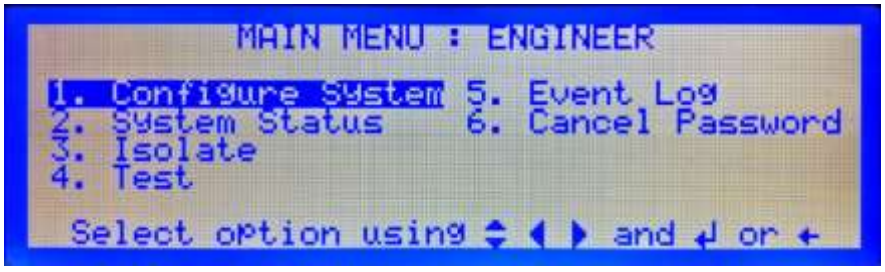


Figure 107 Main Menu – Engineer Level

Configure System	Allows the system configuration to be input, see section 3.9

System Status	Provides status information on the current system operation, see section 3.10
Isolate	Allows isolation of Detectors, Engines and Relays, see section 4.1
Test	Accesses the Test Menu in Engineer Level, see section 3.5
Event Log	Accesses the Event Log Menu in Engineer Level, see section 3.6
Cancel Password	If the Engineers password has been altered Cancel Password reverts it to the default password.

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

3.9 SYSTEM CONFIGURATION MENU

Pressing the Menu button accesses the System Configuration Menu.

Figure 108 Configuration Menu

Set Engine/Det	Configures the number of engines connected to the Control Panel and the number of detectors associated with each engine, see section 2.8.2
Set Engine Name	Allows the engine names to be changed from the default, see 2.8.3
Alarm Levels	Configures the Average and Deviation Alarm levels, see Figure 54, Figure 55, Figure 60 and Figure 61
Set Time & Date	Sets the real time clock time and date, see 2.8.4
Set Password	Allows an alternative Engineers Password to be set.
Detector Offsets	Detector offsets is a legacy option and should not be used, adding a detector offset will compromise the calibration of the detector.
Clr Max Average	Clears the highest average reading recorded for each engine, see 2.8.5
Clr Peak & Avg	Clears the highest reading recorded for each detector on an engine and clears the calculated average value for the engine, see

3.10 SYSTEM STATUS – ENGINEERS

The System Status Menu is accessible via the Engineers Main Menu, Figure 76 and provides an additional option compared with the User level menu.

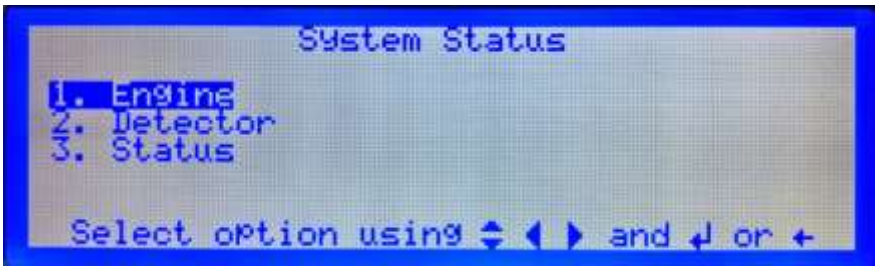


Figure 109 System Status – Engineer Level

Engine	See section 3.4

Detector	See section 3.7
Status	Allows the panel Configuration to be reset to the default state.

3.10.1 Erase Configuration

Select 3. Status

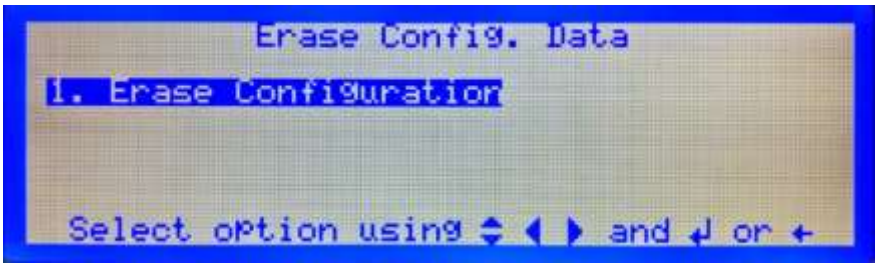


Figure 110 Erase Configuration

Select 1. Erase Configuration

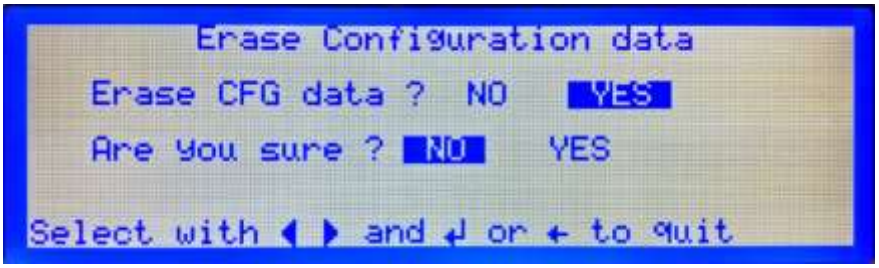


Figure 111 Confirm Configuration Reset.

Confirm the configuration is to be erased. The panel configuration will revert to the factory default.

Default Configuration

Engines	1
Detectors	4
Average Alarm	0.7mg/l
Deviation Alarm	0.3mg/l

3.11 ALARM OPERATION

3.11.1 Action on Alarm

On receipt of either a Deviation or Average 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. Investigations can then be carried out to identify and rectify the cause of the alarm. Once the fault in the engine has been rectified the OMD system can be re-set and the display returns to the normal mode.

Note: When the engine is started from cold in Arctic/Antarctic conditions, a water mist can be produced that could give a false alarm.

All events are stored in the alarm/fault queue in order of occurrence. The user can scroll through the queue by use of the arrow keys.

Once an event is active the event is displayed on the LCD in the appropriate format. To clear the display press the ACCEPT key. Once the ACCEPT key is pressed, the display shows the ENGINE AVERAGES display.

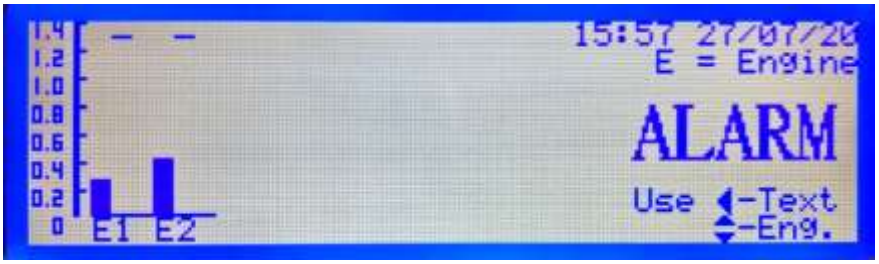


Figure 112 Accepted Alarms

3.11.2 Average Alarm

Following each scan of the Detectors the Control Panel calculates the average oil mist level for each engine. If the calculated average oil mist level rises above the set average alarm level an average alarm condition will be initiated. This is indicated by:

Detector	Alarm LED on
Control Panel	Activation of the Common Alarm Relay and the relevant engine Shutdown / Slowdown Relay.
	Buzzer sounding.
	Alarm indicator LED on
	Relevant engine Alarm LED on
	Alarm indicated on the LCD.
	The bar graph for the engine will be displayed on the LCD. If more than one engine is in alarm the screen will cycle between engines.

Following acceptance of the alarm the buzzer will silence and the common alarm relay is deactivated.

Pressing reset will clear the alarm and return the Control Panel to the normal state.

3.11.3 Deviation Alarm

Following each scan of the Detectors the Control Panel compares the individual detector oil mist reading with the engine average oil mist level. If the detector reading exceeds the engine average level by more than the set deviation alarm value, then a deviation alarm is initiated. This is indicated by:

Detector	Alarm LED on
Control Panel	Activation of the Common Alarm Relay and the relevant engine Shutdown / Slowdown Relay.
	Buzzer sounding.
	Alarm indicator LED on
	Relevant engine Alarm LED on
	Alarm indicated on the LCD.
	The bar graph for the engine will be displayed on the LCD with the detector in alarm flashing. If more than one engine is in alarm the screen will cycle between engines.

Following acceptance of the alarm the buzzer will silence and the common alarm relay is deactivated.

Pressing reset will clear the alarm and return the Control Panel to the normal state.

3.12 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 1.6mg/l or greater to produce a 'Backup Alarm. This will result in the operation of the buzzer, Alarm LED and Common Alarm Relay at the Control Panel. The backup alarm relay in the Junction Box will also be activated; 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 1.6mg/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

3.13 RELAY OPERATION

Communication of alarm and fault conditions between the OMD Mk6 system and the ship's Alarm Management System (AMS) is via a series of volt free contact relays. Individual relays are provided for Slowdown/Shutdown Alarm, one per engine, Common 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:

Slowdown/Shutdown Alarm Relay, a separate relay is provided for each engine.	Activated when the oil mist level of a detector rises above the configured the average or deviation alarm levels.
Common Alarm Relay	The Fault Relay is normally activated and de-activated when an alarm occurs on the Control Panel.
Fault Relay	The Fault Relay is normally activated and de-activated when a fault occurs on the Control Panel or Detectors. In the event power is lost to the Control Panel the relay is de-activated ensuring a fault is indicated to the AMS.

A graphical representation of the relay operation is shown below:

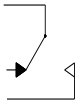
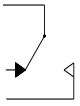
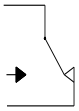
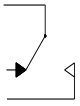
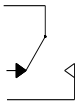
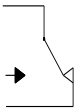
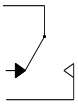
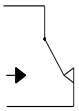
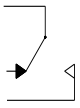
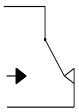
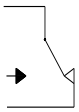
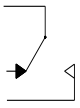
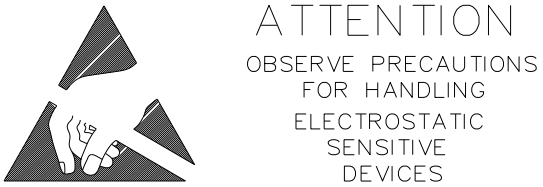
Relay Description	Unit off	Unit on	Slowdown/ Shutdown	Fault
Engine Slow/Shutdown Alarm				
Common Alarm				
Fault				

Figure 113 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 Invalidate 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 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 Panel.

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 ISOLATIONS

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

To access the Engine Isolation Menu select 3. Isolate in the Engineer Main Menu, Figure 107.

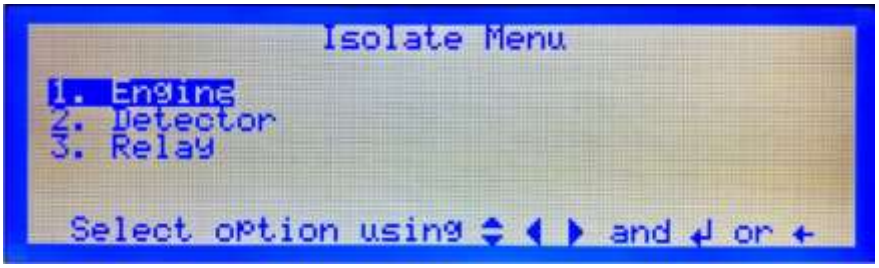


Figure 114 Isolate Menu

Engine	Isolates/De-isolates all detectors associated with a particular engine.
Detector	Isolates/De-isolates individual detectors.
Relay	Isolates/De-isolates the Control Panel Slowdown / Shutdown Alarm Relays.

4.1.1 Isolate Engine

Select 1. Engine

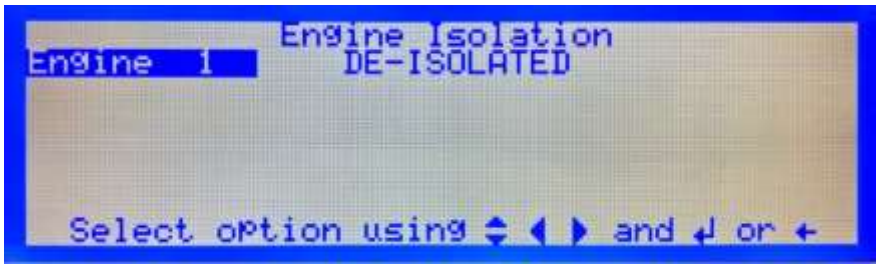


Figure 115 Isolate Engine Selection

Select the required engine from the list.

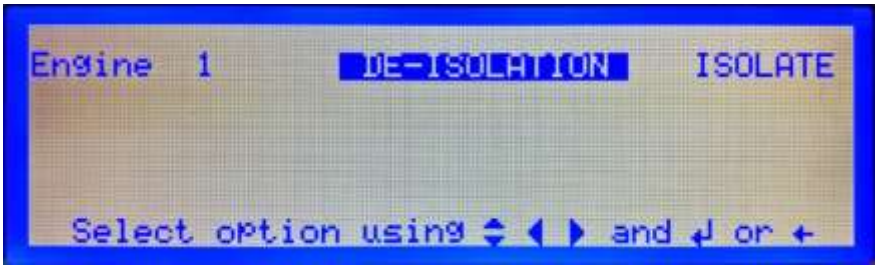


Figure 116 Isolate Engine

Select ISO to isolate the engine, preventing the reporting of alarms or faults from all detectors on the engine. The Isolate and Engine Isolate LED's will illuminate together with the relevant Engines Isolate LED.

Select DE-ISO to de-isolate the engine and return all detectors to normal operation.

4.1.2 Isolate Detector

Select 2. Detector

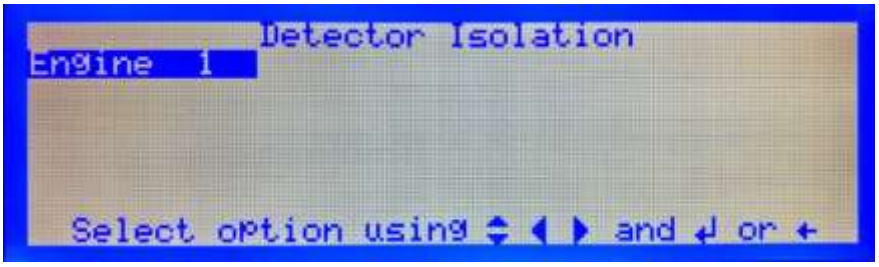


Figure 117 Detector Isolate – Engine Selection

Select the relevant engine from the list.

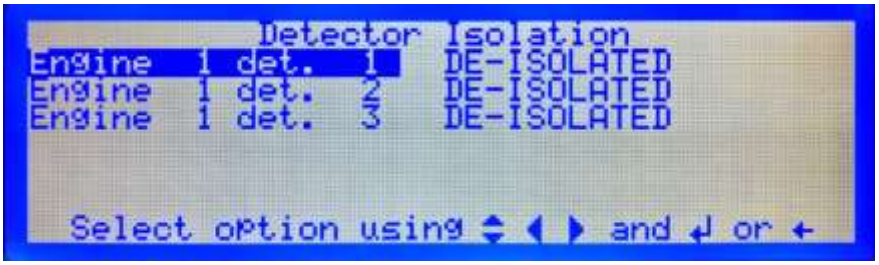


Figure 118 Detector Isolate – Detector Selection

Select the required detector from the list.

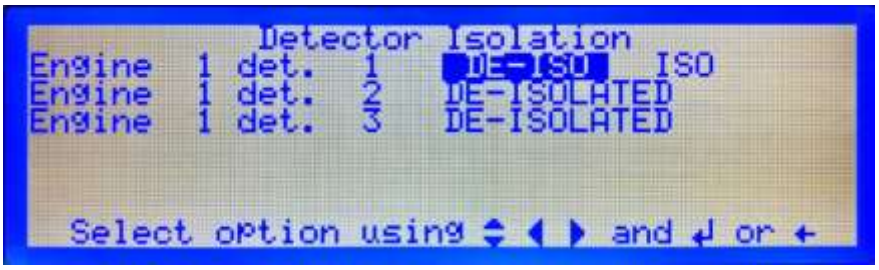


Figure 119 Isolate Detector

Select ISO to isolate the detector, preventing the reporting of alarms or faults. The Isolate and Detector Isolate LED's will illuminate together with the relevant Engine Isolate LED.

Select DE-ISO to de-isolate the detector and return it to normal operation.

4.1.3 Isolate Relay

Select 3. Relay

Figure 120 Isolate Relay – Engine Selection

Select the required engine from the list.

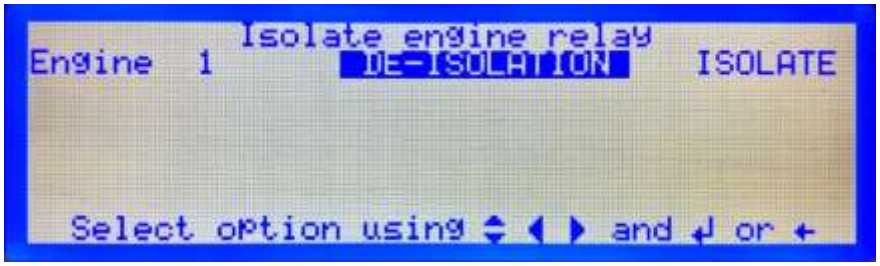


Figure 121 Isolate Relay

Select ISOLATE to isolate the relay, preventing operation in the event of an alarm or DE-ISOLATE to return the relay to normal operation.

4.2 SYSTEM MONITORING

The OMD Mk6 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 maximum average oil mist level measured on the engine.

Detector Screen, see section 3.7.

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

Event Log, see section 3.6.

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

4.3 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:

Note the Trend Peak and Maximum levels of Detectors

Record maximum actual engine average and peak level for each detector head.

-> From Mk6 Control Panel press the Main Menu button

-> Engineer Mode (Code 012345)

-> 2. System Status

-> 1. Engine, see section 3.4

-> Select the required engine (Record maximum actual level)

-> 2. Detector

-> 2. Detector Status, see section 3.7

-> Select the required engine

-> Select the required detector-> (Record Peak Levels).

A sample recording sheet is provided in Appendix 1.

After recording engine maximum actual level & detector peak levels, clear maximum average (engine average) and detector peak readings. This will ensure reliable and accurate status of the engine and detector data.

-> From the Mk6 Control Panel press the Main Menu button

-> Enter Engineer Mode (Code 012345)

-> 1. Configuration System

-> 7. Clr Max Average, see section 2.8.5

-> 8. Clr Peak & Avg

The maximum average and detector peak readings should be cleared after weekly trending, monthly alarm testing and smoke test of vital alarms.

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 2.9.4

TWICE PER YEAR:

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

Perform a visual inspection

1. Externally inspect the Mk6 Control Panel and Junction Box(s) taking note of the condition of all Glands, External Wiring and LED indications displayed.
2. To retain IP & EMC Rating ensure all holes are blanked off using the correct blanking plug.

3. Internally inspect the Mk6 Control Panel and Junction Box(s).
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. All other enclosures (external view) and wiring used to connect the OMD relay contacts to the vessel Alarm Monitoring & Engine Shutdown systems.
6. All faulty components must be removed from the vessel and environmentally destroyed to ensure that they are not replaced on the system in error.

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

7. Inspect the contents of the Mk6 Event log.

   It is important to understand the contents of the Mk6 Event log to diagnose and remove the reason for any fault messages, see section 3.6

   Please download photograph and document the event log.

   Check the Status of each Detector prior to any cleaning taking place. If any Faults are indicated, please take appropriate actions to clear the indication(s).

   See section 4.4 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.

8. 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 122 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 123 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 124 Fuel in the lube oil

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

9. Verify all vital and non-vital alarm actions at Mk6 Control Panel function correctly.

   Using the Test Menu, see section 3.5, check the correct operation of the Shutdown / Slowdown Relays, Common Alarm Relay and Fault Relay.

CLEAR MAXIMUM AVERAGES & PEAK DEVIATION AVERAGE LEVELS AFTER TEST PROCEDURES.

ANNUAL:

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

1. Record serial numbers and software revisions for the Control Panel.
2. Verify all Graviner Mk6 System Functions.
3. Review and record Event log.
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 125 Detector Base Cleaning

6. Verify cable terminations and earthing.
7. Perform laptop Parameter Diagnostics.
8. Record Oscilloscope communication line readings
9. Test all vital and non-vital alarm functions
10. Review the average and peak level trending report
11. Upgrade software to current version if required
12. Upgrade Detector heads or hardware if required
13. Load current manual on Control room computer
14. Instruct crew on Mk6 procedures & System operation.

4.4 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 126 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.

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.

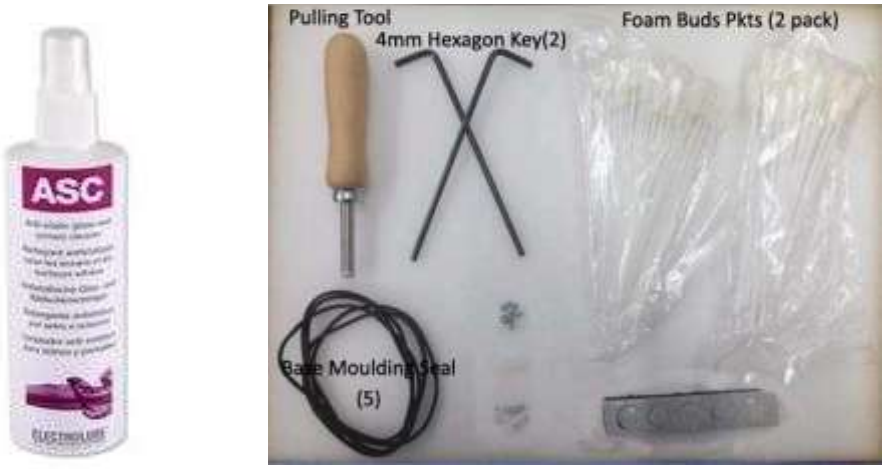


Figure 127 Cleaning Kit

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 128 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. When cleaning older detectors take care not to damage the test LED.

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

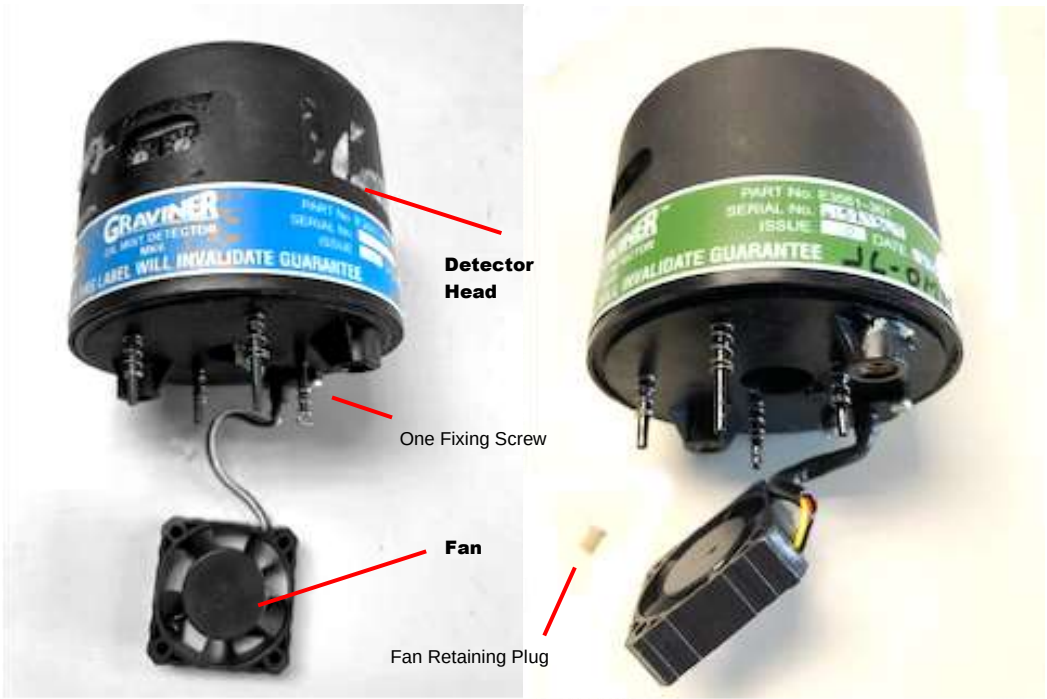


Figure 129 Sample Chamber Cleaning

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.
17. Via the test menu perform an optics test, Test > 6. Optics.

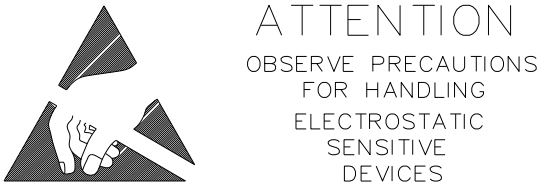
18. If a fault is indicated for that Detector the Detector Head should be replaced, as it is approaching the end of its operational service life.
19. Repeat the above procedure for all Detectors cleaned.

4.5 DECOMMISSIONING

All the components of the Graviner Mk6 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 Slowdown/Shutdown Relays and the detectors being examined see section 4.1. 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 Panel	Activation of the Fault Relay
	Buzzer on
	Fault LED flashing
	Fault type LED flashing, Detector Fault or Comms Fault
	Relevant Engine Fault LED flashing
	Fault indicated on the LCD

Figure 130 Example Fault Screen

Further details on the type of fault indicated can be obtained by examining the event-log, see section 3.6

5.1.2 Control Panel Faults

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

Detector	No fault indication.
Control Panel	Activation of the Fault Relay
Buzzer on	
Fault LED flashing	
System Fault LED flashing	
Fault indicated on the LCD	

Further details on the type of fault indicated can be obtained by examining the event-log, see section 3.6

5.1.3 Accepted Faults

To silence the Control Panel buzzer press the ACCEPT key. The LCD screen will return to the main screen but will show a fault has occurred, as shown below.

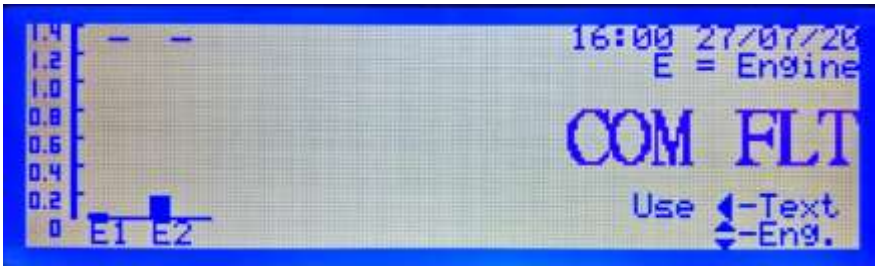


Figure 131 Example Accepted Fault Screen

The fault text can be displayed by pressing the left arrow key.

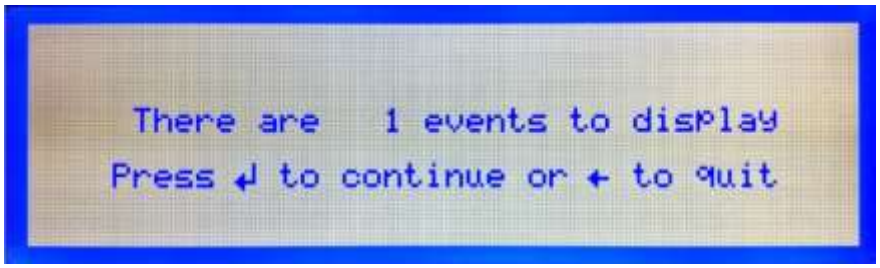


Figure 132 Accepted Events Screen

Press the enter key to display the fault text.

Figure 133 Event Text

Use the up and down arrows to scroll through the event text if there is more than one event indicated.

Use the cancel key to return to the main screen.

Pressing the reset key will clear the fault indication and return the system to normal. If the fault has not been rectified it will be displayed again.

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	Section
Back-up Test Failed	Following a Backup Alarm Test the Control Panel failed to detect the activation of the backup alarm signal from a detector. The event message will identify which detector has failed.	5.2.1
Comms Fault	Communications failure between the Control Panel and a Detector. The event message will identify which detector has failed.	5.2.2
Detector CPU Fault	A memory error or CPU watchdog occurred on a detector. The event message will identify which engine relay has failed.	5.2.3
Detector Fault	A fault has been identified in the detector	5.2.4
Engine Relay Fault	The Engine slowdown / shutdown relay has failed. The event message will identify which engine relay has failed.	5.2.5
Fan Fault	A detector fan has stopped rotating. The event message will identify which detector has failed.	5.2.6
LED 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.	5.2.7
PSU Fault	The power supply to the Control Panel is outside the required specification.	5.2.8
System Fault	A fault occurred when accessing the Control Panel memory, either the Flash Memory, the Random Access Memory (RAM) or the Real Time Clock Memory (RTC).	5.2.9

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

Fault	Description	Section
Continuous Backup Alarm	A backup alarm is indicated without a deviation or average alarm.	5.2.10
Control Panel Reset	The Control Panel is continuously resetting every 2 seconds.	5.2.11
Replace EEPROM	The EEPROM has reached the guaranteed number of write operations.	5.2.12

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

Figure 134 Backup Alarm Fault

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

Back-Up Test Failed Eng X det Y

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 Panel.
3. Perform a Backup Alarm Test via the Test Menu, see Error! Reference source not found.

   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. Open the Junction Box lid. For the indicated failed detector position check the connection of the backup alarm wire (grey wire).
5. Using a wire link connect the backup alarm terminal (grey wire) to the 0v terminal (blue wire) for the indicated failed detector position.

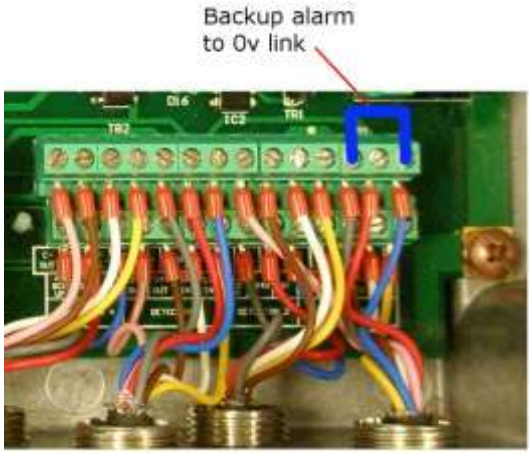


Figure 135 Link at Detector Connections

If the buzzer sounds at the Control Panel while the link is in place, replace the detector cable.

If the buzzer does not sound at the Control Panel while the link is in place, replace the Junction Box PCB.

6. Reset the Control Panel.
7. Perform a Backup Alarm Test via the Test Menu, see Error! Reference source not found., to ensure that the fault has been cleared.

Warning: The Common Alarm Relay may be activated during the diagnostic testing.

5.2.1.2 All detectors on an engine in fault

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

1. Using a wire link at the Control Panel connect the relevant backup alarm terminal to the 0v terminal.

   If the buzzer sounds at the Control Panel while the link is in place, go to item 2.

   If the buzzer does not sound at the Control Panel while the link is in place, replace the Control Panel Interface Board.

2. Using a wire link at the Junction Box connect the backup alarm connection from the Control Panel, TB9, to the 0v terminal.

Figure 136 Link on Junction Box TB9

If the buzzer sounds at the Control Panel while the link is in place, replace the Junction Box PCB.

If the buzzer does not sound at the Control Panel while the link is in place, replace the cable between the Control Panel and Junction Box.

5.2.1.3 All Detectors in fault

If all the detectors connected to the Control Panel are shown with a Backup Alarm Fault the Control Panel Interface Board should be replaced.

5.2.2 Communications Fault

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

Figure 137 Communications Fault

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

Comms Fault Eng X det *Y*

5.2.2.1 Cable Screening

A major cause of communications faults is incorrect screening of the cables.

1. Ensure that screened cables have been used for both the communications and power supply connections between the Control Panel and each Junction Box. The outer braid surrounding armoured cable must NOT be used as the cable screen.
2. At the Control Panel ensure that the communications and power supply cable screens are connected directly to the earth via EMC metal glands.
3. At the Junction Box ensure that the communications and power supply cables pass through the plastic glands and the screens are terminated in the SCN terminals in the Junction Box.

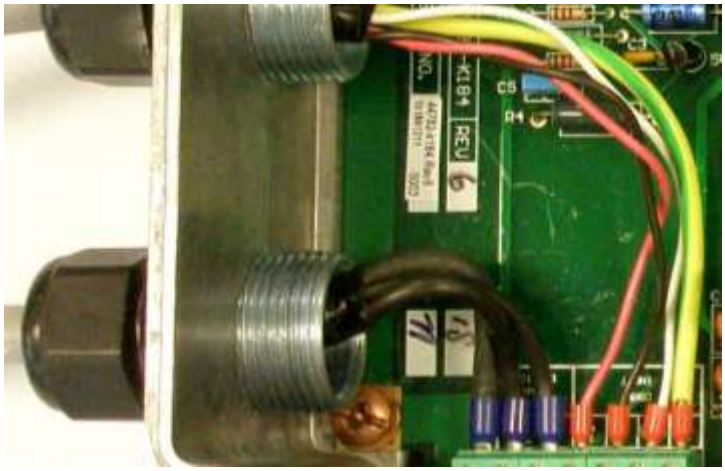


Figure 138 Control Panel to Junction Box Terminations

4. Disconnect the screens from the SCN terminals in the Junction Box. Using a multi-meter measure the resistance between the SCN terminals and the Junction Box earth stud. The resistance measured should be >10MΩ.

   If the resistance is less than 10MΩ the Junction Box PCB should be replaced.

5. Reconnect the cable screens in the SCN terminals.

6. At the Control Panel disconnect the communications + and – connections from the terminals.
7. Using a multi-meter measure voltage between the two wires. The voltage measured should be between 200 – 300mV.

   If the voltage measured is not between 200 – 300mV go to 8.

   If the voltage measured is between 200 – 300mV replace the wires into the communications + and – terminals.
8. At the Junction Box measure the voltage across the EOL terminals, TB10. The voltage measured should be between 200 – 300mV.

   If the voltage measured is not between 200 – 300mV the Junction Box PCB should be replaced.
9. At the connections to the Control Panel, TB9, measure the voltage between the communications + and – terminals. The voltage measured should be between 200 – 300mV.

   If the voltage measured is not between 200 – 300mV there may be a break in the detector cable connections. Measure the voltage between the C+ IN and C- IN terminals of each detector. To identify the failed connection. In each case the measured voltage should be between 200 – 300mV.

   If the voltage measured is between 200 – 300mV replace the communications cable between the Control Panel and Junction Box.

5.2.2.2 Single Detector in fault

In this situation the Control Panel indicates a communication fault on an individual detector on an engine.

When moving detectors, it is recommended that the detectors are first isolated and the detector cable disconnected before removing the detector head from the base. The detectors should be deisolated after moving.

1. Swap the detector with a known working detector. It is not necessary to change the detector addresses.
2. Reset the Control Panel.
3. 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.
4. Check the connections of the detector cable in the Junction box.

   If the connections are correct the detector cable is damaged internally and should be replaced.

   If the connections are incorrect, they should be corrected.

5.2.2.3 Consecutive detectors on an engine in fault

In this situation the Control Panel indicates communication faults on a number of consecutive detectors on an engine.

A daisy chain connection is used for communications between the Junction Box and the detectors. Communications data is passed from the Junction Box to detector 1, returns to the Junction Box and is passed to detector 2 etc. A break in the communications path will result in a loss of communications between the break and subsequent detectors in the chain.

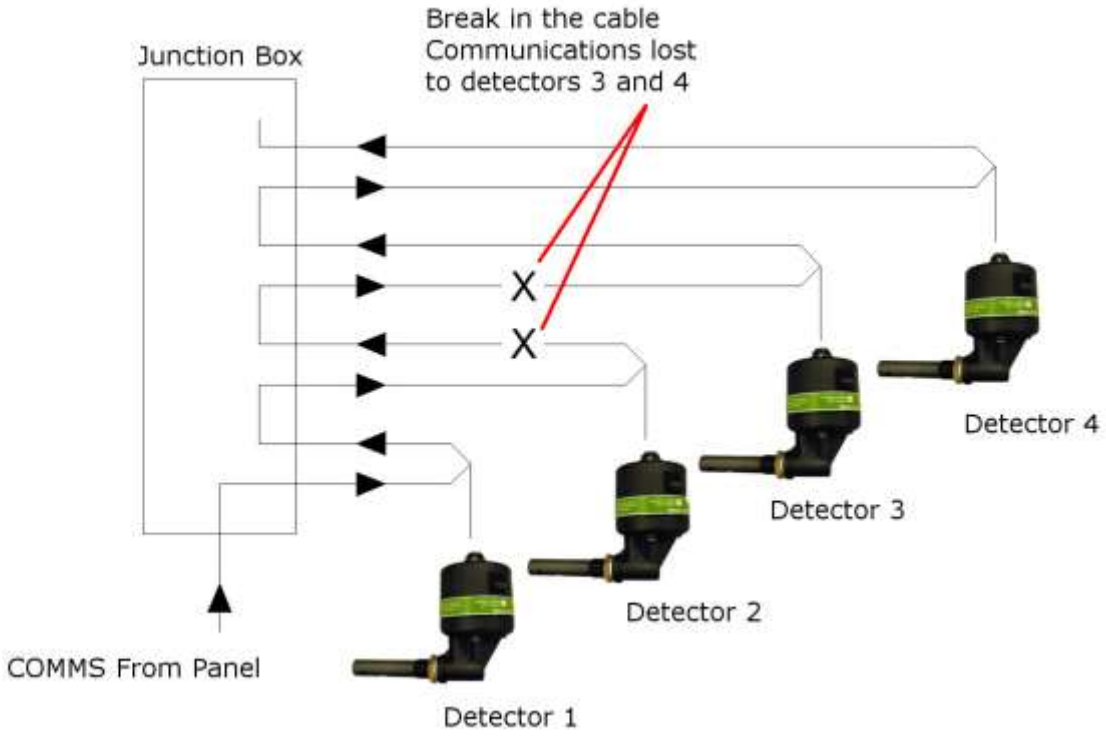


Figure 139 Loss of communications on consecutive detectors

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

1. Remove the power from the system
2. Using a multi-meter measure the continuity between the c+ in (yellow), c+ out (brown) and between c- in (white), c- out (pink) terminals in the Junction Box for the detectors before and after the first detector with communications fault
3. In each case a short circuit should be measured

   If a short circuit is not measured the detector cable should be replaced.
4. After checking the detector cables for continuity measure the continuity between the c+ in (yellow) terminals and between c- in (white) terminals in the Junction Box for the detectors before and after the first detector with communications fault.
5. In each case a short circuit should be measured

   If a short circuit is not measured the Junction Box PCB should be replaced.

5.2.2.4 All detectors on an engine in fault

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

1. Check that the detectors are powered, i.e. the green LED on each detector is on.

   If the power is present, go to 9.
2. Isolate all detectors on the engine and disconnect detector cables from the detector heads.
3. Remove the power from the system.
4. Check the continuity of the glass fuse in the Junction Box.

   If the fuse has blown it should be replaced with a 4A Slow Blow 20mm fuse.
5. Switch on the power to the system.

6. Reconnect each detector head one at a time ensuring the green LED is on.

   If the green LED is not on replace the detector. Reconnecting a failed detector may cause the Junction Box fuse to blow.

7. Continue reconnecting the detectors until all are reconnected and powered.

8. De-isolate all detectors on the engine.

   If the detectors are now communicating with the Control Panel no further action is required.

9. Check that the C+ out and C- out wires of the last detector are connected to the EOL terminals in the Junction Box. EOL + (brown) EOL – (pink).

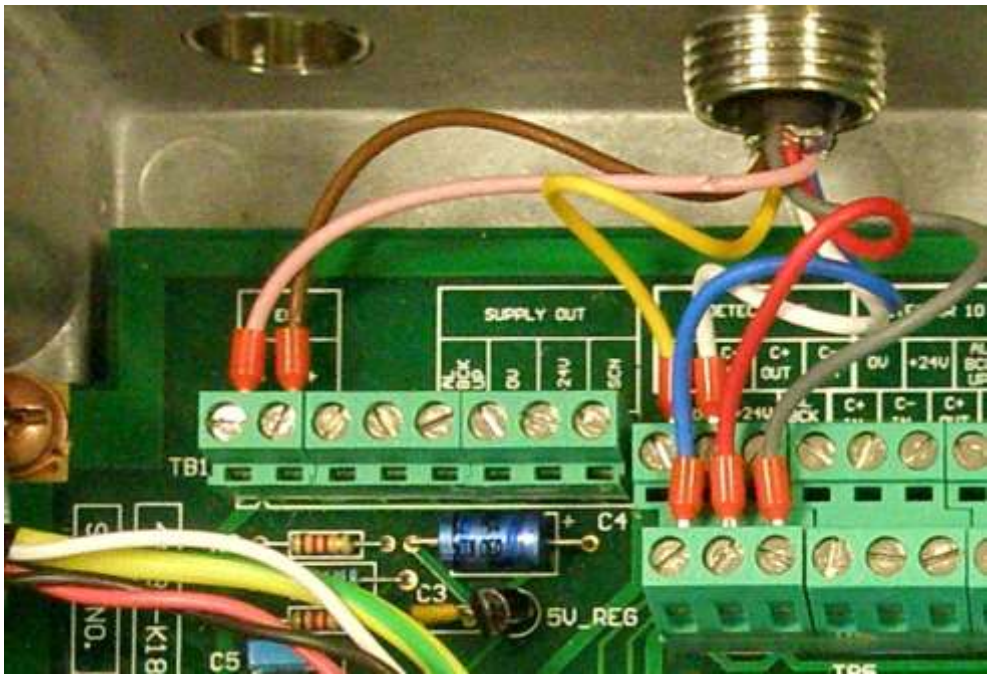


Figure 140 Communications End of Line Termination

10. Follow the steps outlined in section 5.2.2.1 to check for a wiring fault.

    If all wiring is correct, replace the Interface Board in the Control Panel.

Note: In some situations, a temporary fix may be possible by moving the communications connections to a spare output on the Interface Board.

5.2.2.5 All Detectors in fault

In the event of a loss of communications with all Detectors it is not possible to identify the failure without specialized equipment. The failure may be located on either the Control Panel Interface Board or the Main Processor Board.

If spare boards are available, it is possible to isolate the fault by replacing each board.

1. Replace the Control Panel Interface Board, see section 6.1.10.

   If this does not eliminate the fault replace the Main Control Processor Board, see section 6.1.1.

5.2.2.6 Undiagnosed communications fault

In the event that communications faults persist after following the steps detailed in sections 5.2.2.1 to 5.2.2.5 a service visit will be required.

5.2.3 Detector CPU 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 in the event log as a Detector CPU Fault.

1. Examine the event log.

   If the detector has repeatedly indicated a Detector CPU Fault the detector should be replaced.

2. Accept and Reset the fault at the Control Panel.

3. Monitor the system.

   If the detector repeatedly indicates a Detector CPU Fault the detector should be replaced.

5.2.4 Detector 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 Mk6 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 Panel. The Control Panel will then indicate a detector fault, see section 5.1.1.

Figure 141 Detector Fault

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

Detector Fault Eng X Det Y

Clean the detector, see section 4.4 for proper Detector Head removal, cleaning and refitting. Ensure Detector Heads & Detector base O-Ring seals are properly fitted with Molykote O-Ring Lubricant.

5.2.5 Engine Relay Fault

The operation of the engine shutdown / slowdown relays is continuously monitored at the Control Panel. A fault in the relay operation may result in the relay failing to operate when an alarm occurs. If an Engine Relay Fault is indicated in the event log the Control Panel Interface Board 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 Panel if the fan stops rotating.

Figure 142 Fan Fault

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

Fan Fault Eng X det Y

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

Figure 143 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 144.

Screw Removal

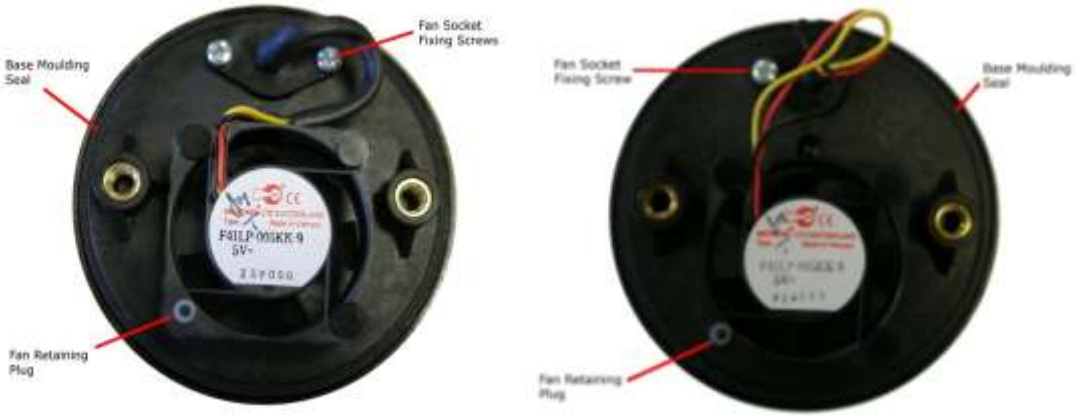


Figure 144 Base Moulding Seal

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

3. Using the Pulling Tool, Figure 145, remove the Fan Retaining Plug by capturing the shoulder and pulling. Carefully remove the Fan from its mountings, Figure 146.

Figure 145 Pulling Tool

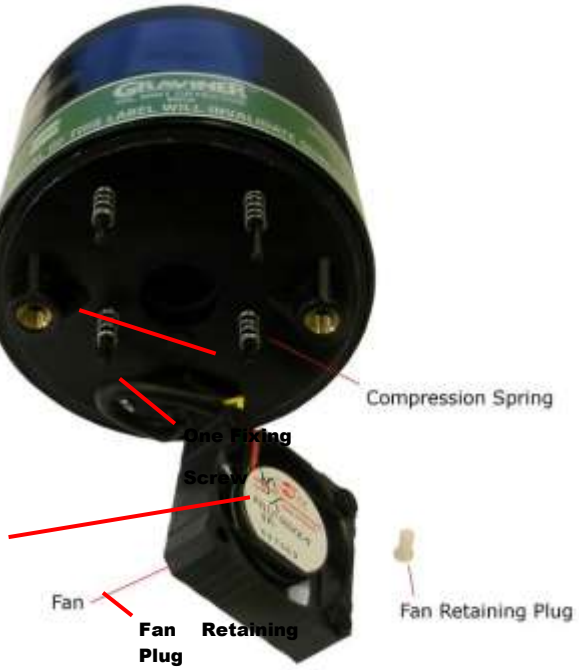


Figure 146 Fan Removal

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 Junction Box, ensure that the fault does not reoccur.

5.2.7 LED 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. When an optics test is performed the OMD Mk6 Detector 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 Panel. The Control Panel will then indicate an LED fault, see section 5.1.1.

Figure 147 LED Fault

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

LED Fault Eng X det Y

Clean the detector, see section 4.4 for proper Detector Head removal, cleaning and refitting. Ensure Detector Heads & Detector base O-Ring seals are properly fitted with Molykote O-Ring Lubricant.

5.2.8 PSU Fault

The power supply to the Control Panel is constantly monitored to ensure it is within the required limits, 18 – 31.2v. If the power supply is outside these limits a power supply fault is indicated.

Figure 148 Power Supply Fault

Control Panel Fitted with Interface Board, 1-44782-K183

1. Using a multi-meter measure the input power supply voltage at the Supply 1 and Supply 2 terminals on the Interface Board.

   If the measured voltage is outside the limits 18 – 31.2v the power supply should be investigated.

2. Inspect the Interface Board in the Control Panel. The two green power LED's on the board should be on.

   If the Interface Board has a single power supply connection and only one LED is on place a short wire link between the Supply 1 and Supply 2 24v terminals.

3. Accept and Reset the fault.

   If the PSU fault persists and both Supply 1 and Supply 2 LED's are on the Interface Board should be replaced.

Control Panel Fitted with Interface Board, 1-44782-K085

1. Using a multi-meter measure the input power supply voltage at the Supply In terminals on the Interface Board.

   If the measured voltage is outside the limits 18 – 31.2v the power supply should be investigated.

2. Inspect the Interface Board in the Control Panel. Ensure that both switches of SW1 are in the on position.

   If the PSU fault persists the Interface Board should be replaced.

5.2.9 System Fault

A system fault is indicated if the Control Panel detects an error while accessing onboard memory or real time clock.

Figure 149 System Fault

1. Accept and Reset the fault.

   If the system fault persists the Main Control Processor Board should be replaced.

5.2.10 Continuous Backup Alarm

The backup alarm system is an additional safety feature to ensure a high oil mist level is indicated even when the detector or Control Panel software has failed. The alarm is activated if the oil mist level rises above a level of 1.6mg/l. As this level is higher than the Average or Deviation Alarm settings an alarm condition will be indicated before the backup alarm level is reached.

A fault in the backup alarm system may cause a backup alarm to occur in the absence of either an Average or Deviation Alarm. This will be indicated by the continuous sounding of the Control Panel buzzer. In this situation pressing the accept key does not silence the buzzer.

1. Ensure that the Control Panel is operating normally, i.e. the LCD is not blank, and that there are no communications faults indicated.

   If the Control Panel display is blank stop all engines and check each for causes of high oil mist levels when it is safe to do so.

   If the Control Panel is indicating communications faults stop the engine with the fault and check for causes of high oil mist levels when it is safe to do so.

2. Press Accept on the Control Panel.

3. Disconnect each of the Backup Alarm connections from the Interface Board terminals one at a time.

   If the buzzer stops sounding this identifies the engine associated with the fault, go to 5

4. With all Backup Alarm connections disconnected from the Interface Board and the buzzer sounding continuously, disconnect the ribbon cable between the Interface Board and the Main Control Processor Board. Ignore any faults indicated.

   If the buzzer continues to sound after pressing Accept replace the Main Control Processor Board.

   If the buzzer is silenced after pressing Accept replace the Interface Board.

5. Reconnect the Backup Alarm connection, this shall cause the buzzer to sound continuously.
6. Isolate all detectors on the associated engine and disconnect all detectors.

   If the buzzer stops after pressing Accept the fault is associated with a detector, go to 9.

   If the buzzer continues to sound go to 7

In the Junction Box disconnect the Backup Alarm connection to the Control Panel, TB9.

If the buzzer continues to sound after pressing Accept replace the cable between the Control Panel and the Junction Box.

7. Reconnect the Backup Alarm connection, this shall cause the buzzer to sound continuously.
8. In the Junction Box disconnect the Backup Alarm connection, grey wire, from each detector cable.

   If the buzzer stops sounding replace the associated detector cable.

   If the buzzer continues to sound after disconnecting all of the detector backup alarm connections replace the Junction Box PCB.

9. Reconnect each detector one at a time.

   If the buzzer sounds continuously replace the associated detector.

With the fault cleared and the buzzer silenced ensure all wiring connections are made, detectors are de-isolated.

Perform a Backup Alarm test, see 3.5.5.

5.2.11 Control Panel Reset

The Control Panel continually checks both internal power supply and the operation of the software to ensure that it has not been corrupted or locked up. If the internal power supply is not within specification or an error in the software operation occurs an automatic reset will be performed to restart the Control Panel operation.

If the Control Panel restart has been successful restarted the system will continue as normal with no loss in performance.

If the fault persists the Control Panel will continue to reset every 1 – 2 seconds.

1. Using a multi-meter measure the voltage across diode D13 on the Interface Board.
2. The measured voltage should be between 4.5v and 5.5v.

   If the voltage is outside the limits go to 3.

   If the voltage is within the limits go to 7.

3. Remove the power from the system
4. Disconnect the power and ribbon cables between the Interface board and Main Control Processor Board.
5. Switch on the system, ignoring any faults indicated.
6. Using a multi-meter, measure the voltage across diode D13 on the Interface Board.

   If the voltage is outside the limits replace the Interface Board.

7. Using a multi-meter, measure the voltage across diode D4 on the Main Control Processor Board.
8. The measured voltage should be between 4.5v and 5.5v.

   If the voltage is outside the limits go to 9.

If the voltage is within the limits replace the Main Control Processor Board.

9. Remove the power from the system
10. Disconnect the power cable between the Interface board and Main Control Processor Board.
11. Check that the connector pins are clean and there is no oxidation. If necessary, lightly clean the pins with emery paper.
12. Reconnect the cable and switch on the system.
13. If the Control Panel continues to reset replace the Main Control Processor Board.

5.2.12 Replace EEPROM

The EEPROM is the flash memory which stores the system configuration data and the Event Log data in the Graviner Mk6 OMD system.

The EEPROM is device IC17 on the Main Control Processor Board (part number 1-44782-K071-02).

The "Replace EEPROM" is a warning message to indicate that the EEPROM flash memory device (IC 17) has reached the maximum number of write cycles recommended by the chip manufacturer and should now be replaced. The EEPROM device manufacturer guarantees a minimum of 10,000 write cycles.

NOTE:- This message is advisory only, all other features and functions of the OMD Mk6 will continue to operate normally and the ability to detect oil mist is not affected.

A read/write failure could mean that recent Event Log data is not stored and any changes made to the configurable engine parameters may not be saved.

Due to the memory capacity with normal operation of the system it is expected that memory will last over 10 years before the memory limit is met. Earlier failure of the EEPROM may be due to underlying faults being recorded in the event log. The event log should be examined prior to replacing the EEPROM.

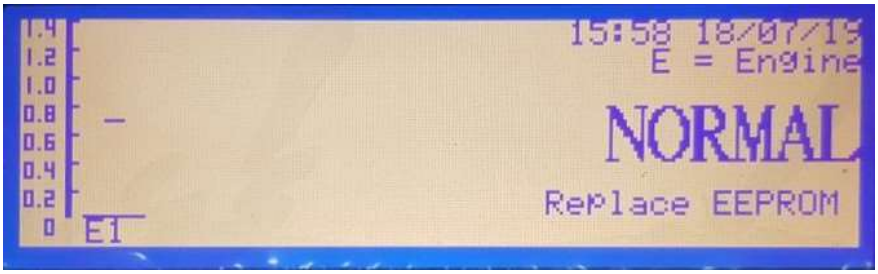


Figure 150 Replace EEPROM

The action required to remove this warning message depends on the version of the Main Control Processor Board fitted in the Control Panel.

On earlier versions of the PCB, the EEPROM (device IC17 in the images shown below) is soldered directly to the Processor board. The EEPROM device cannot be de-soldered without the risk of damaging the PCB and so requires the Main Control Processor Board to be replaced.

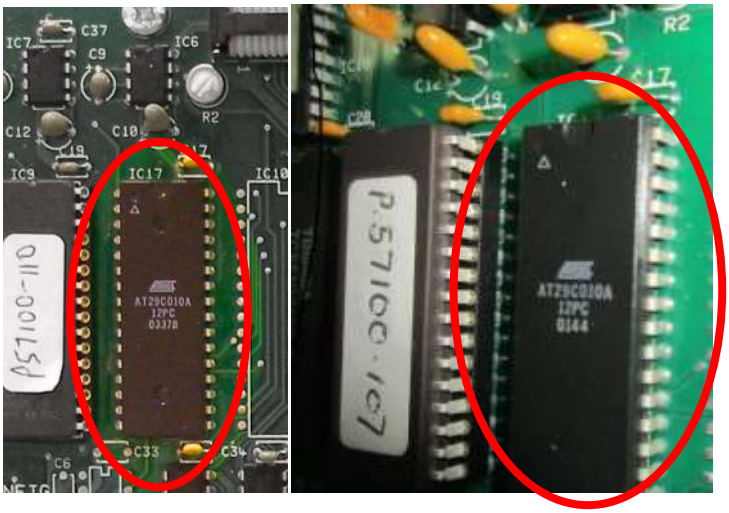


Figure 151 Soldered EEPROM

On later versions the EEPROM (device IC17) is fitted in a socket (see below) and can be replaced without removing the Main Control Processor Board.

Figure 152 Plug in EEPROM

You will note from the image above that the EEPROM is now a smaller device and is supplied on a small daughter board which plugs into the existing socket on the Main Control Processor Board.

The part number of the MK6 Replacement EEPROM PCB is 1-44782-K182.

Before starting any replacement work you must first record the following system configuration details.

- Number of engines. Can be seen on the main display screen
- Number of detectors per engine. Can be seen on the engine display screen
- Average alarm setting for each engine. Default value 0.7mg/l.
- Deviation alarm for each engine. Default value 0.3mg/l.

5.2.13 Replacing the MK6 Replacement EEPROM (1-44782-K182) only

Figure 153 1-44782-K182 Board

1. Switch off the power to the system.
2. Carefully remove the EEPROM from the socket, IC17 on the Main Control Processor Board.
3. Plug the new EEPROM into the socket, ensure it is the right way up (as shown on the image on the left) and that all the pins are correctly aligned in the socket.
4. Switch on the power to the system.
5. Re-program the panel configuration and alarm levels.

5.2.14 Replacing the EEPROM where the EEPROM is soldered directly to the Main Control Processor Board.

Please also note that the LCD Backlight inverter circuitry (labelled as 'Inverter 1') in the image below is not supported on Revision 6 and above of the Main Control Processor Board.

The original Control Panel display used a CCFL backlight that contained small amounts of mercury now prohibited by the RoHS directive.

To comply with this directive Carrier have re-engineered the LCD and the display driver electronics on the Main Control Processor Board.

Revision 6 and above of the Main Control Processor Board are now unable to drive the older CCFL backlit display. The display will remain black and so to remove the Replace EEPROM message the vessel will need to install a new Main Control Processor Board and a new LCD module.

Order part number 1-43782-K178 for the Main Control Processor Board and LCD Assembly.

5.2.15 Removal & Replacement of the Main Control Processor Board and LCD Display module

1. Switch off the power to the system.

2. Unplug the cables from the Main Control Processor Board.
3. Remove the PCB fixing screws, 8 screws in total.
4. Remove the Main Control Processor Board.
5. The LCD must also be replaced if an old version is fitted.

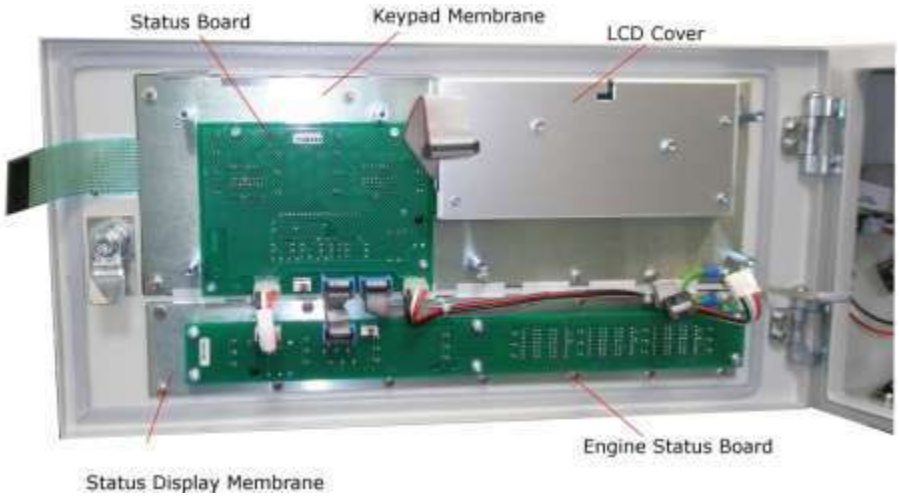


Figure 154 Control Panel – Main Control Processor Board Removed

6. Remove the LCD Cover, this will require the removal of 4 fixing screws

Figure 155 Control Panel – LCD Cover Removed

7. Remove the LCD, this will involve unscrewing and removing the 4 metal pillars holding the PCB.
8. Reverse the procedure to fit the replacement LCD, LCD cover and the replacement Main Control Processor Board.
9. Ensure ALL connections are correct BEFORE powering on the system.
10. If the LCD appears blank as shown in the image.

Figure 156 Unadjusted Display

11. Adjust the contrast on the Main Control Processor Board to produce a readable display.

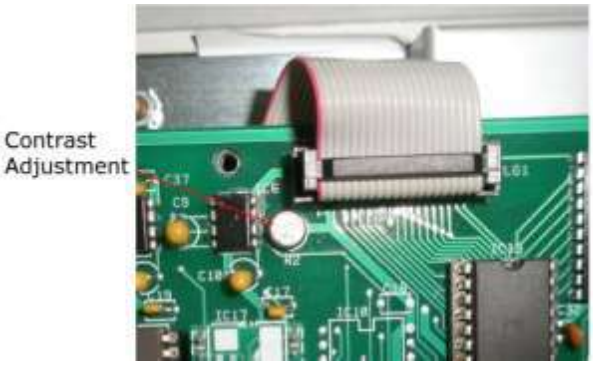


Figure 157 Contrast Adjustment

12. Re-program the original parameters for the system configuration and alarm levels.

6 SPARE PARTS

6.1 CONTROL PANEL

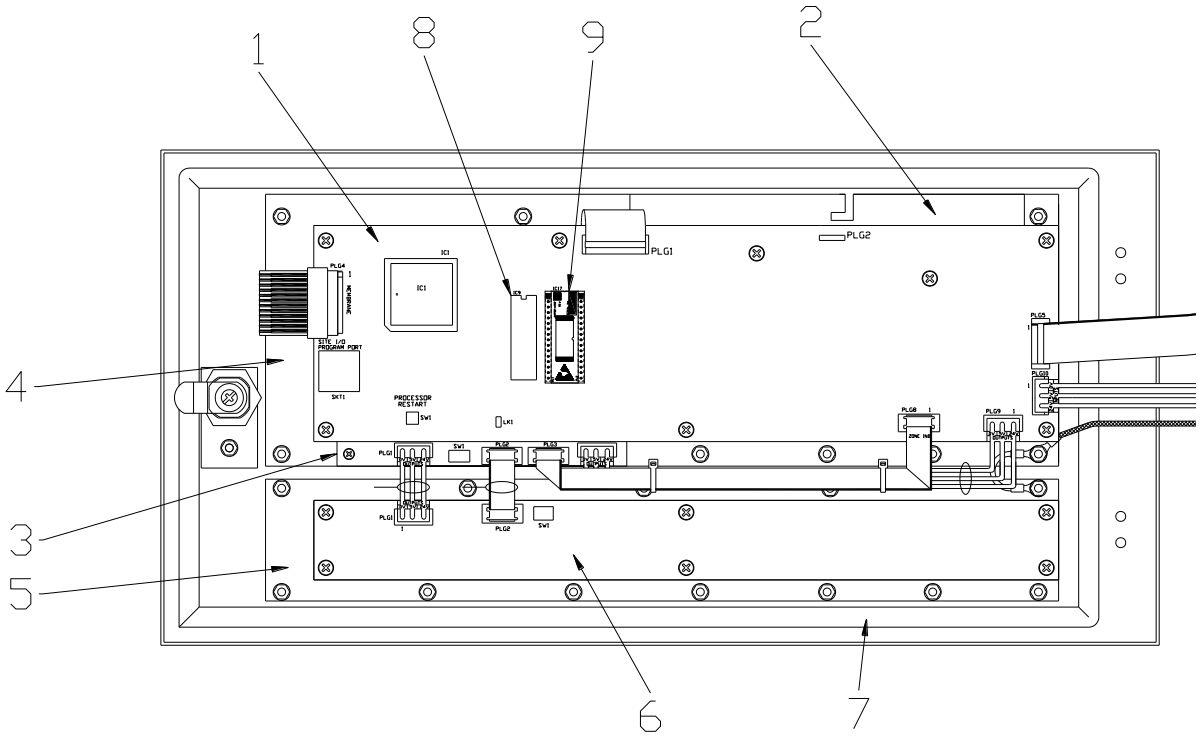


Figure 158 Control Panel Door

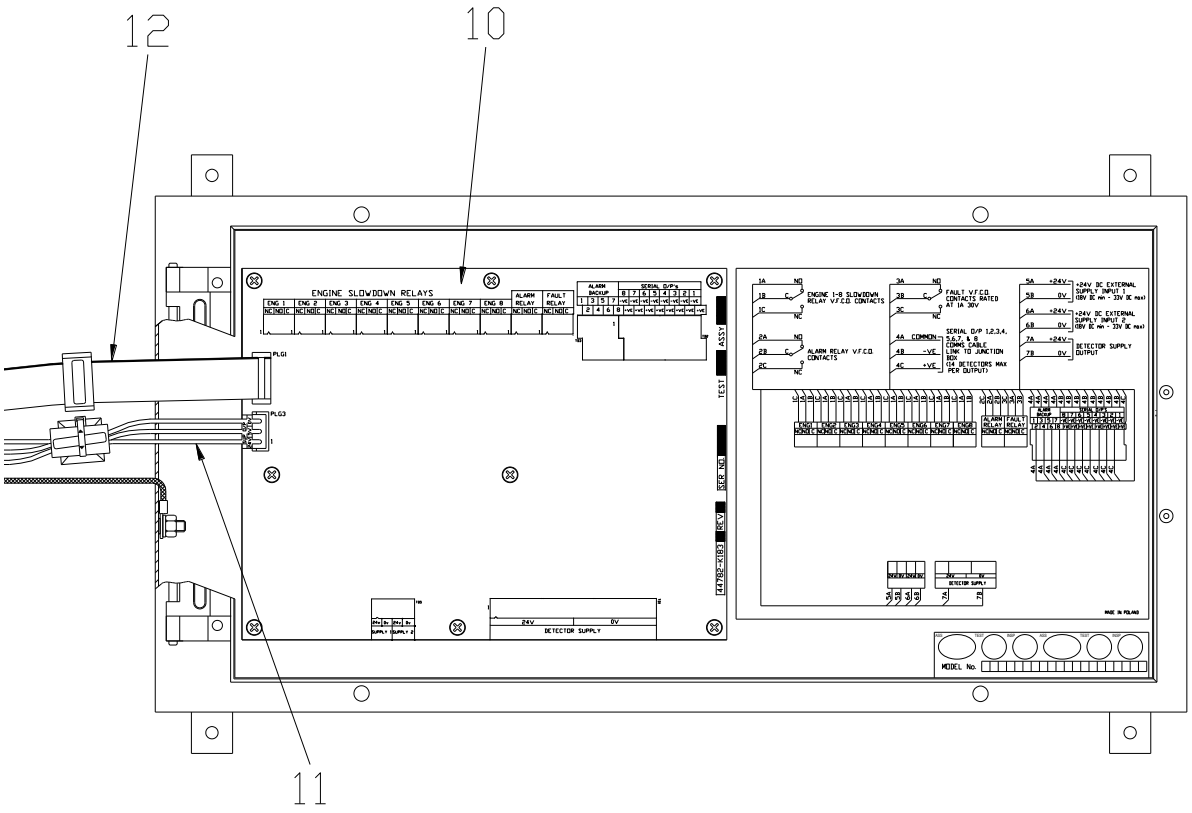


Figure 159 Control Panel Box

Control Panel Spares		
Item	Description	Part No.
1	Mk6 Main PCB	1-44782-K071-02
2	Mk6 LCD Display	1-43782-K120
3	Mk6 Status Display PCB	1-44782-K102-02
4	Function Key Membrane	1-39155-K047
5	Status Display Membrane	1-39155-K048
6	Mk6 8 Engine Status Display PCB	1-44782-K098-01
7	Door Seal	1-13455-D033
8	Firmware OMDMk6 Panel	1-P57100
9	Mk6 Replacement EEPROM	1-44782-K182
10	Mk6 Interface PCB Non GL	1-44782-K183X
	Mk6 Interface PCB GL Version	1-44782-K183GL
11	OMD Mk6 Harness MCP to IF PCB	1-43682-K261
12	Harness MCP-MBLC	1-43682-K032
	Mk6 Download Cable	1-MT0021

6.1.1 Main Control Processor PCB Replacement

1. Prior to powering down the Mk6 OMD system use read and make note of the parameters below.
   These values will need to be re-entered into any replacement Main Control Processor PCB.
   a. The number of engines.
   b. The number of Detectors connected to each engine,
   c. The Average Alarm level for each engine.
   d. The Deviation Alarm levels for each detector.

      Average Alarm: adjustable between 0.3 - 1.3mg/l

      (Factory Default level of 0.7mg/l).

      Deviation Alarm level: adjustable between 0.05 – 0.5mg/l

      (Factory Default level of 0.3mg/l).
2. Power down the system.
3. Remove all connectors, PLG1, PLG2, PLG4, PLG5, PLG8, PLG9 and PLG1O noting the orientation.
4. Remove the 8 fixing screws and washers.
5. Remove the PCB.

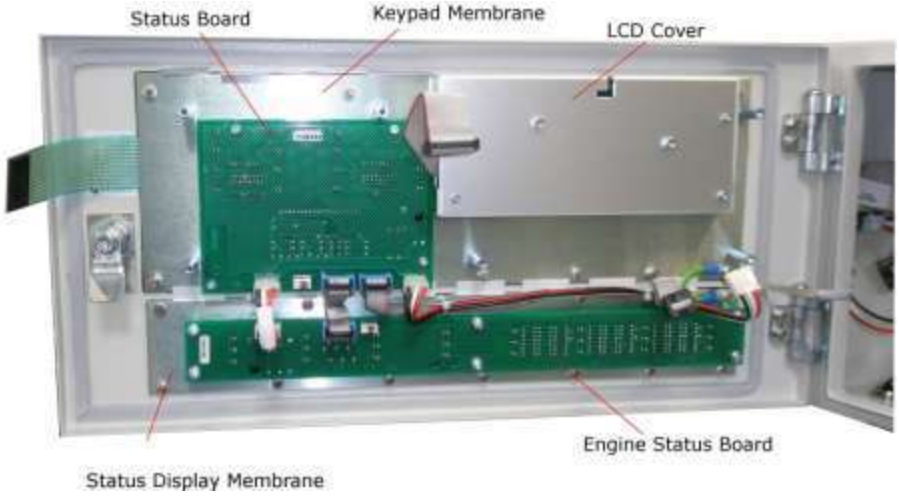


Figure 160 Control Panel – Main Control Processor Board Removed

6. Fit the replacement PCB with the 8 fixing screws and washers, re-fit all connectors.
7. Switch on system and allow it to initialise.
8. Re-program the system to the required configuration.

Note: After changing the Processor PCB, it may be necessary to adjust gain control R2 to ensure the clarity of the LCD.

6.1.2 LCD Display Replacement

To replace the LCD follow the steps detailed in section 5.2.15

6.1.3 Status Display PCB Replacement

1. Power down the system.
2. Remove the Main Control Processor Board as described in section 6.1.1
3. Remove all connectors, PLG1 – PLG4 noting the orientation.

4. Remove the 4 fixing screws, washers and remove the PCB.
5. Fit the replacement PCB with the 4 fixing screws and washers.
6. Replace the Main Control Processor Board, re-fit all connectors.
7. Switch on system and allow it to initialise. Observe the LED's, all LED's shall be switched on as part of the initialisation process.

6.1.4 Function Key Membrane Replacement

1. Power down the system.
2. Remove the Main Control Processor Board and LCD as detailed in section 5.2.15.
3. Remove the Status Display PCB as detailed in section 6.1.3.
4. Remove the 12 fixing nuts and washers. Remove the membrane from the fixing studs.
5. Fit the replacement membrane with the 12 fixing nuts and washers.
6. Replace the LCD and cover, Status Display PCB and Main Control Processor Board. Refit all connectors.
7. Switch on system and allow it to initialise.
8. Press the Engine Display key and ensure that the buzzer sounds when the key is pressed and that the LCD shows the Engine Screen, Figure 77.

6.1.5 Status Display Membrane Replacement

1. Power down the system.
2. Remove the Engine Status Display PCB as detailed in section 6.1.6.
3. Remove the 7 fixing nuts and washers. Remove the membrane.
4. Fit the replacement membrane with the 7 fixing nuts and washers.
9. Replace the Engine Status Display PCB. Refit all connectors.
10. Switch on system and allow it to initialise. Observe the LED's, all LED's shall be switched on as part of the initialisation process.

6.1.6 Engine Status Display PCB Replacement

1. Power down the system.
2. Remove the two connectors located on the top left-hand side of the board, noting the orientation.
3. Remove 6 off fixing screws and washers. Remove the PCB.
4. Fit the new PCB with the 6 off screws and washers. Replace the two connectors.
5. Switch on system and allow it to initialise. Observe the LED's, all LED's shall be switched on as part of the initialisation process.

6.1.7 Door Seal Replacement

1. Remove the damaged length of door seal from the door removing and glue residue left on the door.
2. Remove the backing paper from the replacement door seal and stick the seal in place.
3. Trim the ends of the seal to match the existing seal.

6.1.8 OMD Mk6 Firmware Replacement

1. Power down the system.
2. Using a small screwdriver or other suitable tool ease IC9 on the Main Control Processor Board out of the socket.

3. Fit the firmware replacement in the socket ensuring the correct orientation and that all of the IC's legs are in the socket.
4. Switch on system and allow it to initialise.

6.1.9 EEPROM Replacement

Follow the steps detailed in section 5.2.12

6.1.10 Interface PCB Replacement

Prior to replacing the Interface Board ensure the replacement board is the correct version, 1-44782-K183X where one input power supply connection is required or 1-44782-K183GL were two input power supply connections are required.

1. Power down the system.
2. Disconnect all external wires from the Interface Board ensuring each wire is identified to allow correct reconnection to the replacement board.
3. Disconnect cables between the Interface Board and Main Control Processor Board.
4. Remove 8 fixing screws and washers. Note the fixing screw in the centre of the board is fitted with a nylon washer. Remove the PCB.
5. Fit the new PCB with the 8 screws and washers, refitting the screw with the nylon washer in the correct location. Replace the cables between the Interface Board and Main Control Processor Board.
6. Reconnect the external wires into the correct terminals.
7. Switch on system and allow it to initialise.
8. Ensure no communications faults are indicated on the Control Panel.
9. Using the test menu test each of the relay connections and ensure the correct response is produced by the AMS.

6.2 JUNCTION BOX

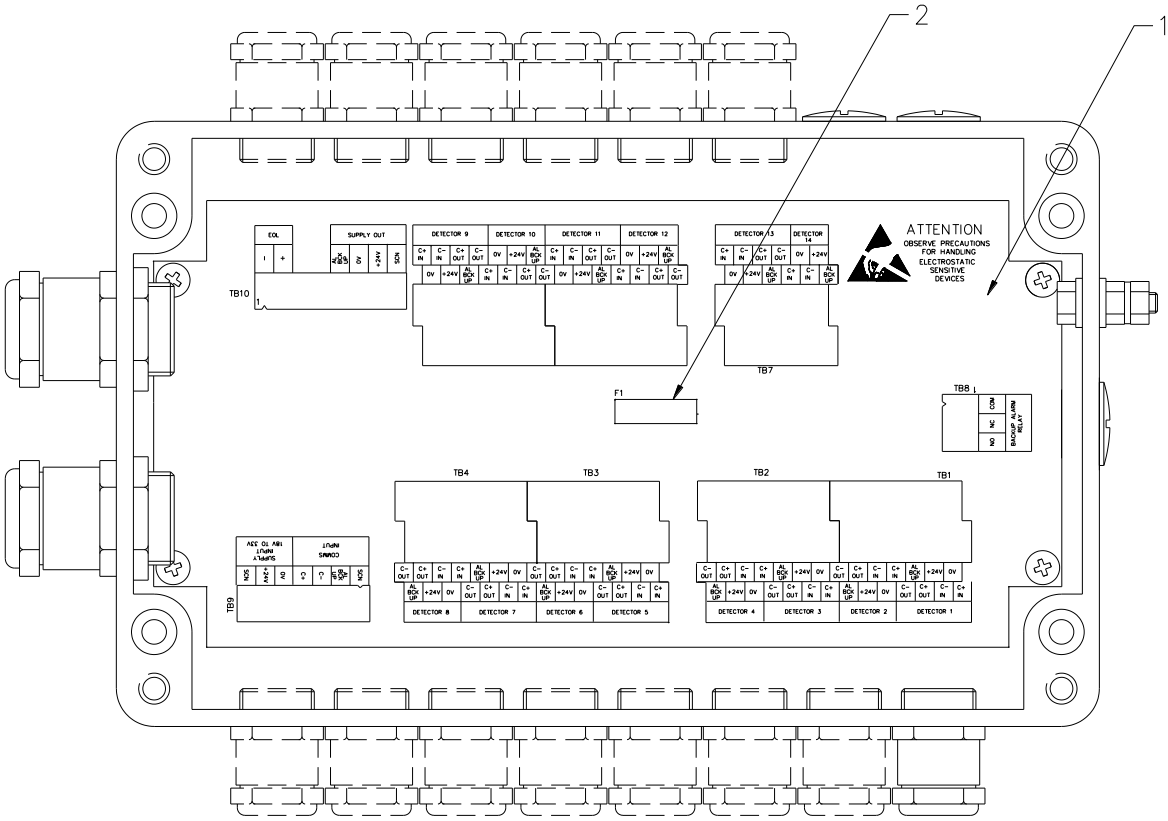


Figure 161 Junction Box

Junction Box Spares		
Item	Description	Part No.
1	MK6 Junction Box PCB	1-44782-K184
2	4A 20mm Slow Blow Fuse	1-27411-K001

6.2.1 Junction Box PCB Replacement

1. Power down the system.
2. Disconnect all external wires from the Junction Box Board ensuring each wire is identified to allow correct reconnection to the replacement board.
3. Remove 4 fixing screws and washers. Remove the PCB.
4. Fit the new PCB with the 4 screws and washers,
5. Reconnect the external wires into the correct terminals.
6. Switch on system and allow it to initialise.
7. Ensure no communications faults are indicated on the Control Panel.

6.3 DETECTOR

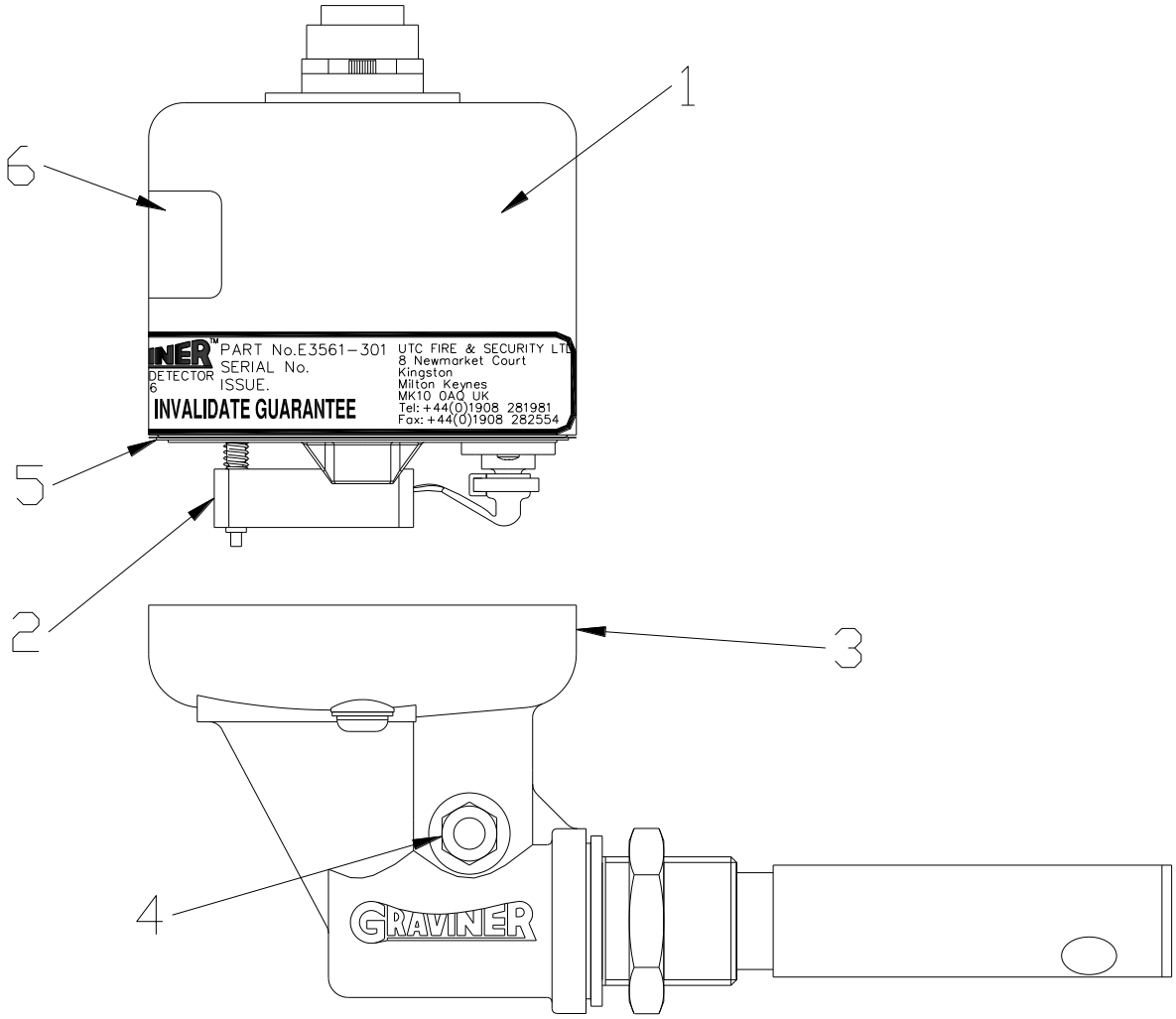


Figure 162 Detector Spares

Detector Spares		
Item	Description	Part No.
1	Mk6 Detector Head Replacement	1-D5622-001
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	Mk6 Switch Window	1-C9189-801

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 163 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,

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 Junction Box, disconnect each wire from the terminals.
4. Unscrew the top of the gland to release the cable strain release.
5. To prevent damage to the cable gland cut the cable near the top of the gland and pull the cable through the gland.
6. Discard the damaged cable.
7. Fit the replacement cable as detailed in 2.6.4
8. Connect the cable connector to the Detector
9. 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	
Interface Board	1-44782-K183X Or 1-44782-K183GL	1	
Main Processor Board	1-44782-K071-02	1	
Switch Window Label	1-C9189-801	2	
Cable, 25 metres	1-43682-K108-08 Or 1-43682-K109-08	1	
Detector Head Assembly	1-D5622-001	1	
For systems with more than 10 detectors, it is recommended that additional detector head assemblies (1-D5622-001) are supplied.			

6.6 CABLE ASSEMBLIES

Straight Connector		
Description	Part No.	Length
10.0m Cable with Straight Connector	1-43682-K108-02	10.0 Metres
17.5m Cable with Straight Connector	1-43682-K108-05	17.5 Metres
25.0m Cable with Straight Connector	1-43682-K108-08	25.0 Metres

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

Cable Assemblies

90° Connector		
Description	Part No.	Length
2.5m Cable with 90° Connector	1-43682-K109-00	2.5 Metres
10.0m Cable with 90° Connector	1-43682-K109-02	10.0 Metres
17.5m Cable with 90° Connector	1-43682-K109-05	17.5 Metres
25.0m Cable with 90° Connector	1-43682-K109-08	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	
M3 screw	1-21833-H01	
Connector Push in (Replaces 1-B5465-307)	1-21888-K073	
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	
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	

6.7 AUXILARY

The parts listed below are not supplied by Carrier and should be purchased locally.

Description	Manufacture	Manufactures Part No.	Supplier	Supplier Stock No.
M20 Metal Gland	Lapp Kabel	53112630	RS Components Farnell Digikey	839-5340 1204200 2181-53112630-ND
M25 Metal Gland	Lapp Kabel	53112640	RS Components Farnell Digikey	839-5343 1204201 2181-53112640-ND
M20 Lock Nut	Lapp Kabel	52103320	RS Components Farnell	839-5381 1204237
M25 Lock Nut	Lapp Kabel	52103330	RS Components Farnell	839-5390 1204238
M20 Blanking Plug	Lapp Kabel	52103125	RS Components Farnell	406-9407 3487271

Appendix 1

GRAVINER Mk6 OIL MIST DETECTOR SYSTEM WEEKLY PEAK READINGS

Engine Name														
Detector Name														
Date	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level

EXAMPLE SHEET

Engine Name	Main Engine													
Detector Name	1	2	3	4	5	6	7	8						
Date	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level	Peak Level
01/03/21	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1						
08/03/21	0.2	0.1	0.1	0.5	0.2	0.1	0.2	0.1						

Appendix 2

Twice Yearly Maintenance

See Section 4.2 for further details

External Inspection Performed	☐
Internal Inspection Performed	☐
Detector status LED's documented	☐
Correct number of engines and detectors displayed on the Control Panel	☐
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 4.2 for further details

System component serial numbers and software versions recorded	☐
System functions verified	☐
Event 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	☐
Current manual is available	☐
Instruction provided to the crew	☐

Appendix 3

6.8 OMD MK6 LOG READER

The OMD Mk6 Log Reader is a Windows© programme which allows the event log from the OMD Mk6 panel to be downloaded to a PC, examined and saved.

6.8.1 Requirements

PC running Windows

Download cable, MT0021, available from Carrier

USB to RS232 converter, if the PC does not have an integrated RS232 communications port (not supplied)

OMD Log Reader software, P57972

6.8.2 Setup

Plug one end of the MT0021 Download cable into the PC Serial port, and the other end into the OMD Panel Main Board, as shown below

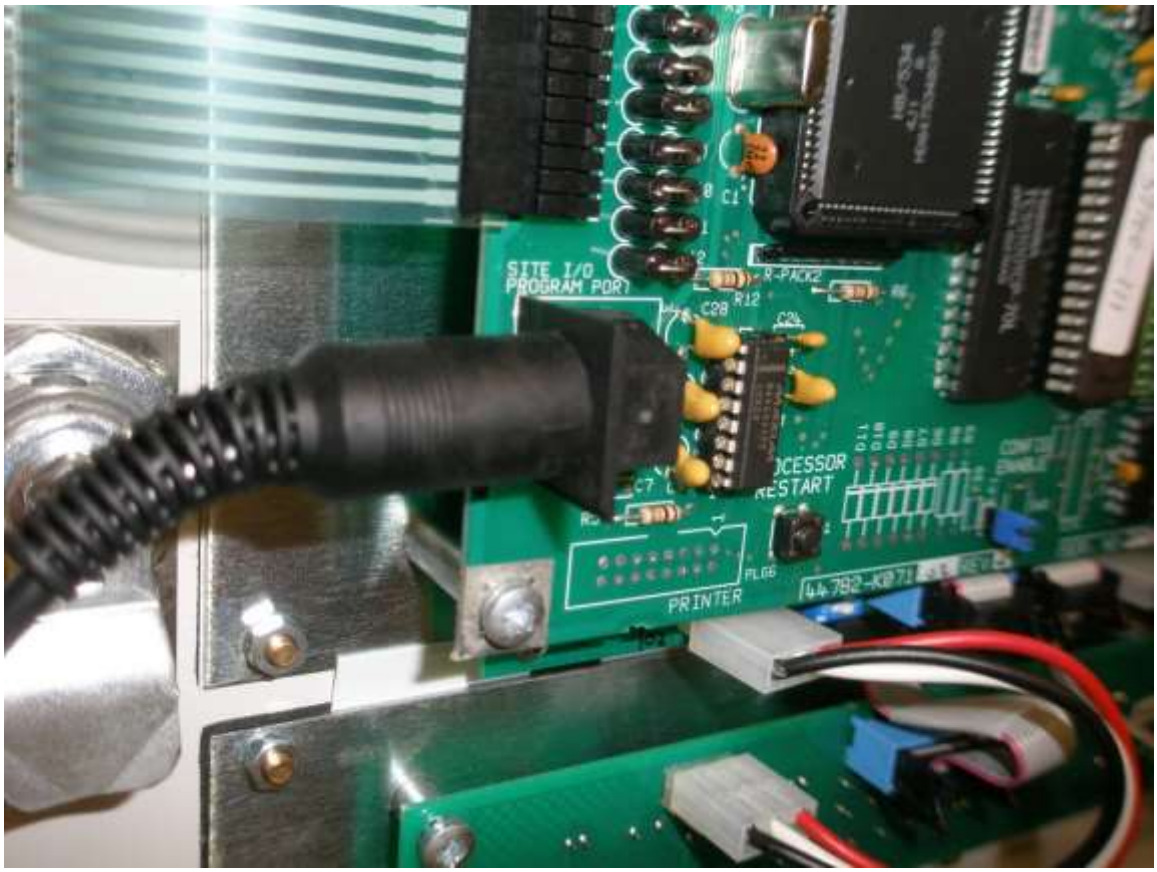
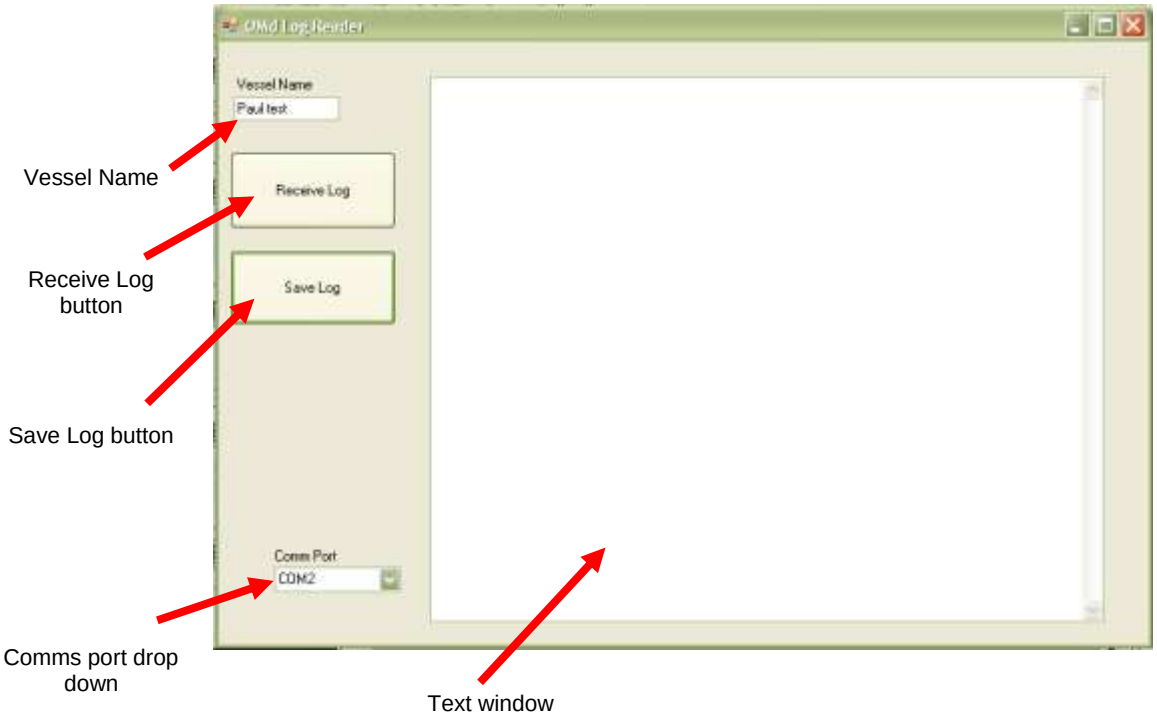


Figure 164 Download Cable Connection

Copy the OMD Log Reader directory to the hard drive of the PC

Open the OMD Log Reader directory and double click on the setup file. Setup will install the OMD Log Reader program on the PC hard drive. Note during the installation process it may be necessary to connect to the internet to allow downloading to the Microsoft .NET framework if this is not already installed on the PC.

From the Windows© Start menu run the OMD Log Reader program. This will open the window shown below.



6.8.3 Features

Vessel Name – Text box allowing the event log to be saved under the vessel name

Receive Log button – Clicking on the button will allow the programme to accept incoming data via the communications port

Save Log button – Save the contents of the text window as a text file

Comms port drop down box – Select the communications port the download cable is connected to

Text window – displays the data downloaded from the panel.

6.8.4 Operation

Plug the 9-way D type connector on the download cable, MT0021 into the PC RS232 communications port or the USB to RS232 converter if required.

Connect the 5 pin DIN plug on the download cable to the socket SKT1 on the OMD Mk6 Main Processor Board, 44782-K071-02, mounted on the panel door.

Run the Log Reader on the PC.

6.8.4.1 Downloading the event log

Select the correct PC communications port from the dropdown box; this can be found in the hardware settings of the PC if not already known.

Select download event log from the Engineers menu on the panel, refer to the OMD Mk6 manual if necessary.

Click the Receive Log button the button text will change to Stop Receive.

Initiate the download at the panel.

The event log will appear in the text window as it is downloading. A count down of the number of events left to download is displayed on the panel. When the download is complete, click the Stop Download button on the OMD Mk6 Log Reader.

The event log can be examined in the text window by scrolling up and down.

6.8.4.2 Saving the event log

To save the event log enter the vessel name in the Vessel Name text box

Click on the Save Log button

The log is saved as a text file in C:\vessel name\vessel name time date, e.g. C:\Seaham\Seaham 06_12 01_06.txt

The text file can be read using any Windows© text reader – Notepad, WordPad etc.