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GRAVINER

OIL MIST DETECTOR MARK 5

Instruction Manual

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AMENDMENT INCORPORATION RECORD		
Amend No.	Brief Description of Content	Name of Person Incorporating Amendment
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CONTENTS

ILLUSTRATIONS

LEADING PARTICULARS

Dimensions:	
Height	394 mm (15.5 inch)
Width	608 mm (24 inch)
Depth	191 mm (7.5 inch)
Including anti-vibration mountings	233 mm (9.2 inch)
Weight	28kg (61.6 lb)
Power Supply, selected from:	115 V 50 Hz 115 V 60 Hz 220 V 50 Hz 220 V 60 Hz 230 V 50 Hz 230 V 60 Hz 240 V 50 Hz 240 V 60 Hz
Power Consumption:	70 Watts (approximately)
Air Supply Pressure:	1 bar±20% (12 to 18 p.s.i.). Inlet internally threaded 1/4 inch BSP.
Air Consumption (dry air):	6 litres per hour.
Suction Pressure (water gauge): (Sample port measured against atmosphere.)	12 mm (0.5 inch).
Number of sampling inlets:	4 to 10 (selectable).
Time per sample:	1 second.
Detection inlet connection:	17 mm inside diameter. 19 mm outside diameter.
Maximum distance between Oil Mist Detector and sample point:	15 m (48 feet) for 18 mm inside diameter. 7.5 m (24 feet) for 14 mm inside diameter.
Detector outlet connection:	45 mm inside diameter. 48 mm outside diameter. 10 m (33 feet) maximum length.
Displays on Oil Mist Detector:	SYSTEM ON lamp. Percentage of Alarm Level. Sample number being sampled. SIMULATION MODE lamp. TEST MODE lamp. AVERAGE LAMP lamp. DEVIATION ALARM lamp. FLOW FAULT lamp. OPTICAL FAULT lamp.
System Signal Outputs:	FAULT ALARM: 1 set volt-free change-over contacts. MAIN ALARM: 2 sets volt-free change-over contacts. ENGINE SLOW DOWN: 1 set volt-free change-over contacts.

Facility for operating TEST and RESET modes remotely.

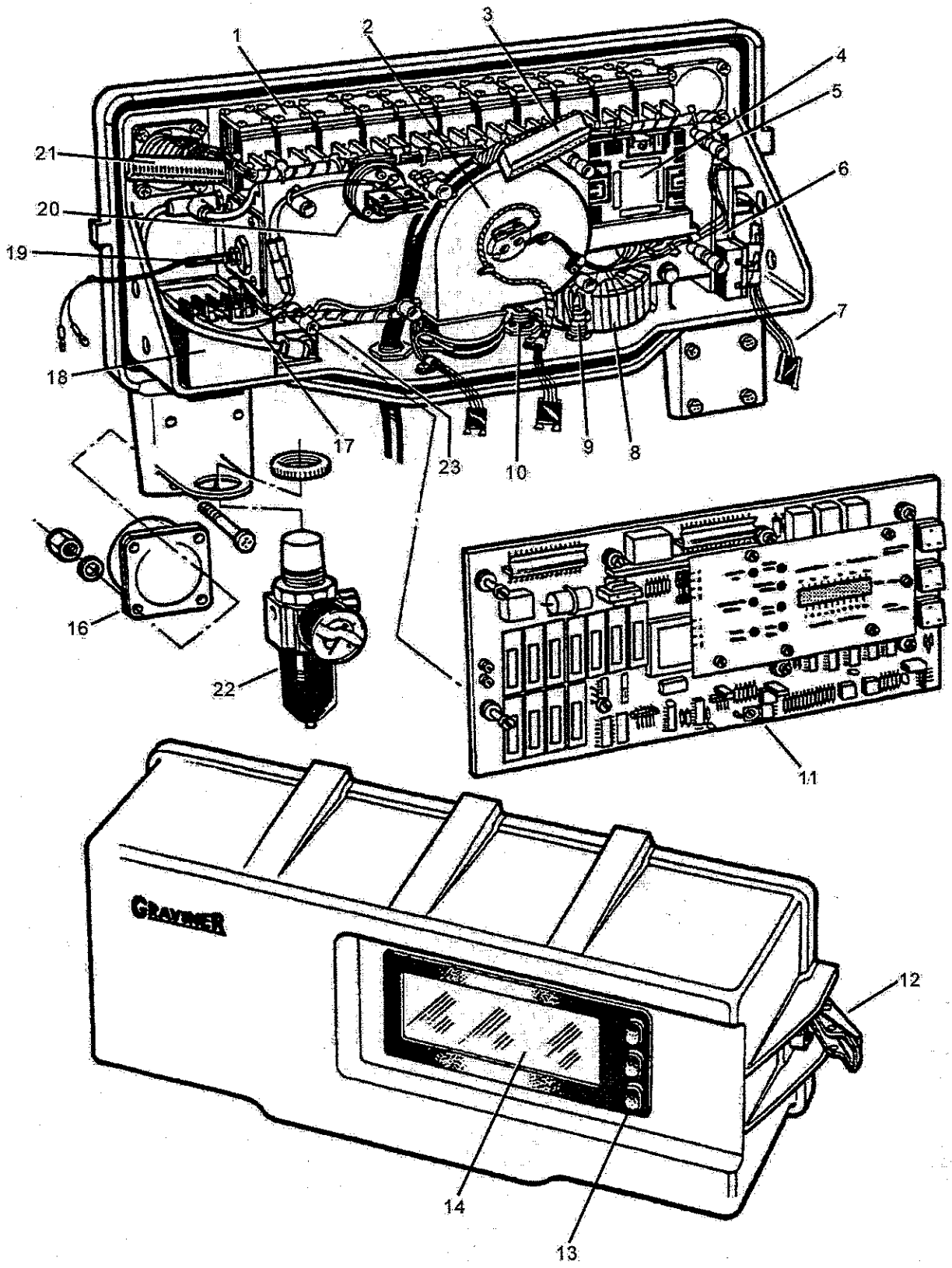


FIGURE 1 Mark V Oil Mist Detector

Key No.	Description	Part Number	No. off Per Set
1	Solenoid Assembly	See Figure 9b & 9c	1
2	Fan Assembly	See Figure 9f	1
3	Loom C (Alarm Output)	D4727-001	1
4	Power Supply Selection Card	39832-704	1
5	Label (shows Serial No. & Date)		1
6	Photo-cell Assembly	See Figure 9d	1
7	Loom E (Photo-cell)	44727-124	1
8	Toroid Assembly	See Figure 9e	1
9	Fuse Holder	27415-003	1
	Fuse Holder Boot	27415-901	1
	Fuse 1 Amp (anti-surge) 20 mm	27411-408	1
10	Power Input Cable	44727-125	1
11	Printed Circuit Board Assembly	44728-130	1
12	Fastener	22112-625	2
13	Cover Window/Switch	38531-766	1
14	Window	35158-803	1
16	Anti-vibration Mount (Top)	41143-401	4
	Anti-vibration Mount (Boot)	38531-764	4
17	Loom B (Power Supply)	44727-121	1
18	Power Supply	See Figure 9e	1
19	Light Source Assembly	See Figure 9c	1
20	Air Supply Assembly	See Figure 9c	1
21	Loom A (Solenoid)	44727-120	1
22	Air Regulator	24124-201	1
23	Mains Filter (not shown)	B8681-002	1

INTRODUCTION

Oil mist detection, now widely accepted as a means of providing early warning of incipient bearing failure in diesel engines, advances into the era of the microchip with the introduction of the Graviner Mark V Oil Mist Detector (OMD). The Mark V embodies electronic and electrical means of carrying out fast and accurate sampling of the crankspace oil mist. With the elimination of rotating mechanical parts in the Mark V and the introduction of microcircuits, oil mist detection reaches a level which is the very best available using current technology.

PRINCIPLE

At high temperatures the oil used for lubricating engines generates vapours. When these come into contact with the colder atmosphere in the crankspace at temperatures around 70°C, they condense into an oil mist and represent the condition associated with the excess temperatures such as those caused by main crankshaft, big end or connecting rod small end bearing defects.
The OMD working on the principle that oil mist density is proportional to optical obscurity, samples the oil mist in the crankspace in a regular repetitive sequence. The sample is measured by passing it through a measuring chamber which has a light source at one end and a photo-cell at the opposite end. The output signal from the photo-cell represents oil mist and is compared with threshold levels set during commissioning. If the thresholds are exceeded, an alarm indicates the need for an engine slow-down and an immediate investigation of the engine condition.

OUTLINE OPERATION

The outline operation of the OMD involves the support of a microprocessor programmed to operate in conjunction with other microcircuits to control the following sequence:

1. With the mains power and air supply connected, the green SYSTEM ON indicator will light, but the system will remain passive for a five second period. The first operation is to open the air valve to admit air into the measuring chamber. The output of the photo-cell is used to create an air reference signal which is stored in one of the data memory stores in the microprocessor.

2. The No. 1 sample inlet valve opens and oil mist is drawn from the crankspace by the fan, enters the measuring tube, the photo-cell output signal is converted to a digital signal by the microprocessor, stored in its memory and is used to compute and display its value as a percentage of the set average alarm level.

3. The No. 1 sample valve now closes and the No. 2 sample valve opens and again data is converted and stored. On this and all subsequent samples the microprocessor computes the average of the samples stored, returns this average to a memory store and updates the display indicating the average as a percentage of the set average alarm level.

4. Each subsequent sample valve is opened in sequence and its signal is similarly stored and an ongoing average signal is computed and displayed. After each crankspace has been sampled the first scan is completed. No alarms will be given during the first scan, as the system is forming the microprocessor memory stores.

5. When the No. 1 sample valve opens for the second time and oil mist enters the measuring chamber, the microprocessor computes the difference between the photo-cell output signal and the stored average. If it is greater, i.e. optically denser, compares the difference with a pre-set threshold. This threshold is established during commissioning by the setting of the DEVIATION control on the printed circuit board (which is adjustable over the range 0.05 to 0.5 milligrams of oil mist per litre of air) to suit the particular installation, see Figure 2a. Should this level be exceeded, the system will carry out a purge cycle in order to check and guarantee that the alarm level was caused by a failed photocell or light source. If neither have failed, then the alarm will be signalled, the system ceases to scan and displays the sample number which has initiated the alarm condition, the average percentage of alarm indication will change to show the percentage of alarm initiating the alarm. Simultaneously, the DEVIATION ALARM indicator will be illuminated and the MAIN ALARM and ENGINE SLOW DOWN outputs contacts operated.

>> NOTE *The DEVIATION control setting procedure is given in the section on COMMISSIONING.*

If no alarm signal is generated, the signal will be used to update the average, which is then displayed.

7. The new average will then be compared with a pre-set average threshold. This threshold is established during commissioning by adjustment of the SENSITIVITY control on the printed circuit board, which is adjustable over the range 0.3 to 1.3 milligrams of oil mist per litre of air.

   After setting up the OMD for normal running, a representative oil mist density level may be derived for any SENSITIVITY control setting, see Figure 2b.

   Example. If the SENSITIVITY control is set to position 5 and the sample selected shows a reading of 60% on the Percentage of Alarm Level display this would represent an oil mist density of 0.45 milligrams per litre.

8. If the threshold is exceeded, the system checks for optical faults and if none are present, ceases to scan. The display will show 100% alarm level. The AVERAGE ALARM indicator will be lit and the MAIN ALARM and ENGINE SLOW DOWN contacts operate.

>> NOTE *The SENSITIVITY control setting procedure is given in the section on COMMISSIONING.*

9. If this pre-set average threshold is not exceeded, the system will proceed to the next sample and the process will be repeated.

10. At intervals of 10 minutes, the air valve will open and a reference signal will be generated. This can occur during any part of a scan cycle and after operating, the system continues with the scan from the point of interruption. The reference is stored by the microprocessor and this allows compensation to be made for the build-up of oil mist on the optical surfaces, temperature variations and changes in output from the light source.

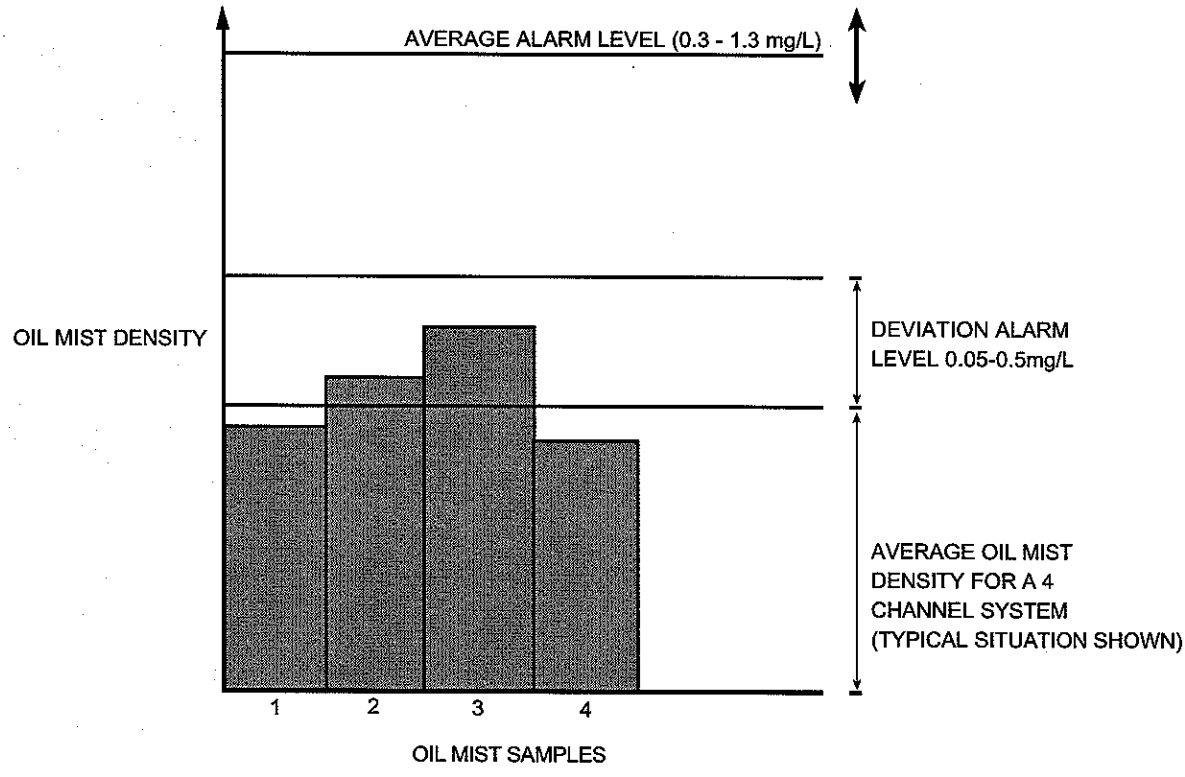


FIGURE 2a Alarm Levels

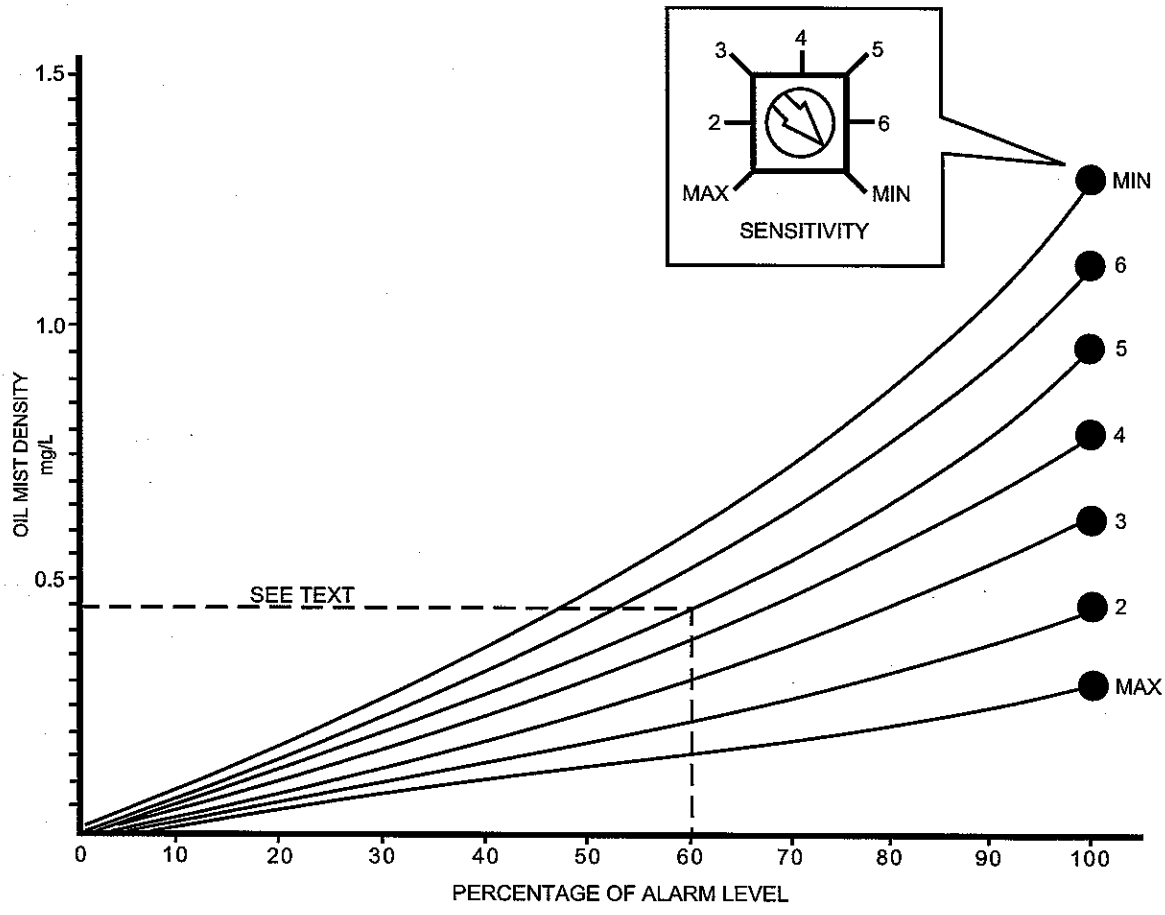


FIGURE 2b Oil Mist Density Relative to Display Reading and Sensitivity Potentiometer Settings

DESCRIPTION

See Figure 1.

Located on the underside of the OMD are: ten oil mist sample inlets, an air inlet for 1 bar pressurised air, the exhaust outlet, two cable glands each with a three metre length of cable (one for making connections to the power supply and one for connection of the system output signals). A terminal box can be supplied, see Figure 7a. A power supply fuse is included.

The power cable is connected to the mains supply via a system ON/OFF switch, (supplied by the customer). Construction is in the form of a main frame assembly of light alloy on which all the unit hardware is supported and to which a light alloy cover is fitted and secured by two quick release fasteners. A rubber gasket provides a seal between the cover and the main frame. The vertical back plate of the main frame incorporates four anti-vibration mounts by means of which the OMD is bolted either: directly on to the engine, or to a bulkhead, or other suitable support structure.

The cover is recessed for a control/monitor panel, see Figure 2c, on which the following controls and displays are fitted:

1. System status and operating mode indicators labelled: SYSTEM ON, SIMULATION MODE and TEST MODE.

2. Alarm and Fault conditions are displayed by four indicators labelled: AVERAGE ALARM, DEVIATION ALARM, FLOW FAULT and OPTICAL FAULT.

3. Three push buttons labelled: SELECT, TEST and RESET.

4. A display which indicates the oil mist density as a percentage of the alarm level together with the number of the sample currently being measured.

Between four and ten oil mist samples are fed to the appropriate inlets which are arranged on the underside of the main frame assembly. Reading, when viewed from the front and left to right, the first connection is for the air inlet, followed by the oil mist sample inlet tubes 1 to 10, see Figure 5.

The route taken by the oil mist samples and the air sample through the manifold, see Figure 3a, is controlled by 11 solenoid operated valves. A fan mounted on the front face of the manifold provides the required suction for flow of the samples through the detector. During a normal operating cycle, each oil mist sample is passed in turn through a measuring chamber while the remaining samples flow through a by-pass chamber. Every 10 minutes the normal operating cycle is interrupted for a period of between 1.1 and 1.2 seconds during which time all the oil mist samples pass through the by-pass chamber while a sample of air is admitted to the measuring chamber.

At the right-hand end of the manifold is a photo-cell and at the left-hand end is a light source (a pre-focused beam emitter) so that light is projected along the measuring chamber and illuminates the photo-cell. The output from the photo-cell is therefore a function of the opacity of the sample currently passing through the measuring chamber and is fed to a microprocessor on the main printed circuit board. For checking purposes, the photo-cell housing incorporates a simulation device consisting of an optical glass filter which can be interposed between the photo-cell and the beam emitter, see Figure 3a.

The printed circuit board containing the system electronics is attached by eight captive screws to pillars on the manifold.

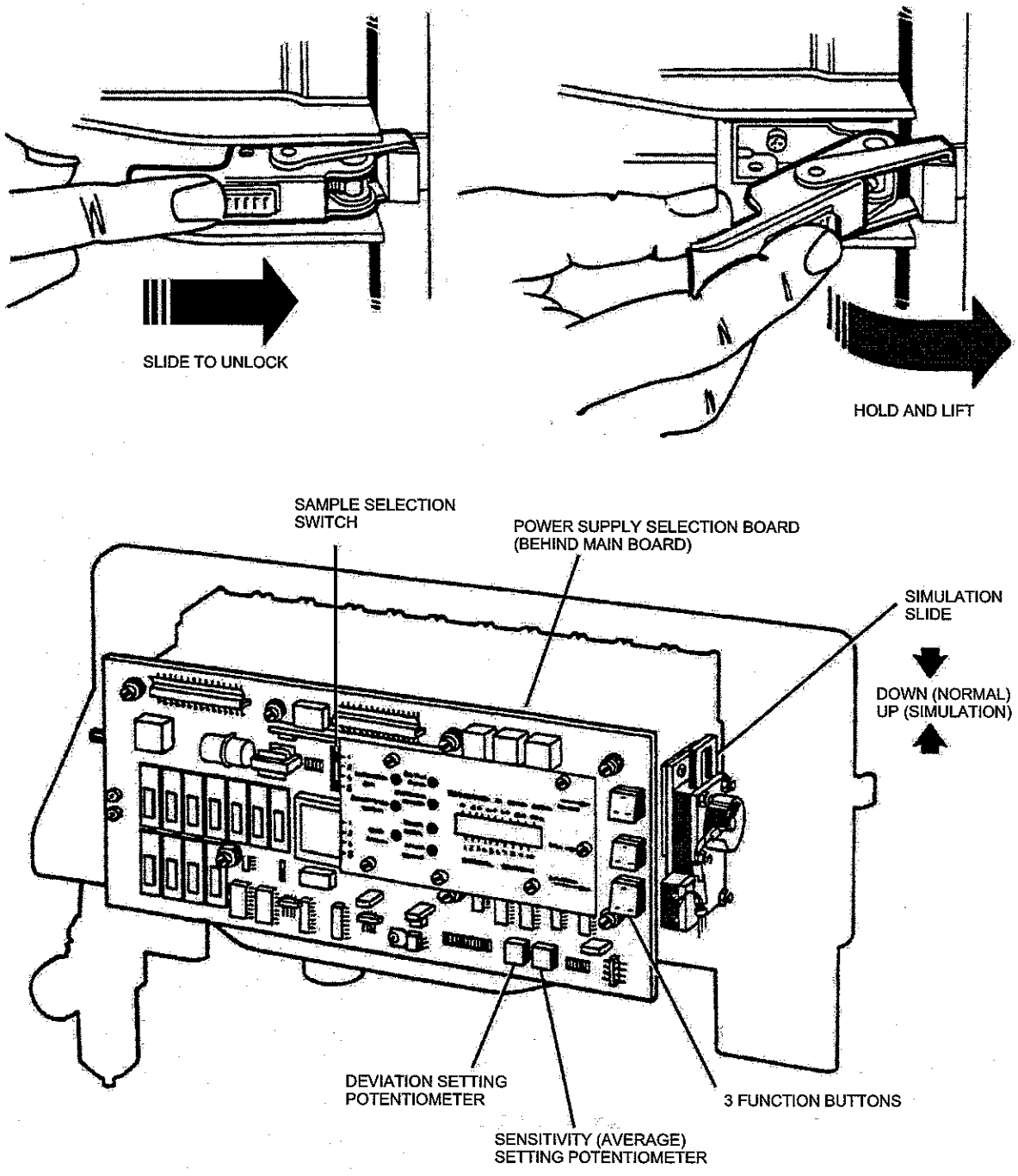


FIGURE 2c Display and Controls

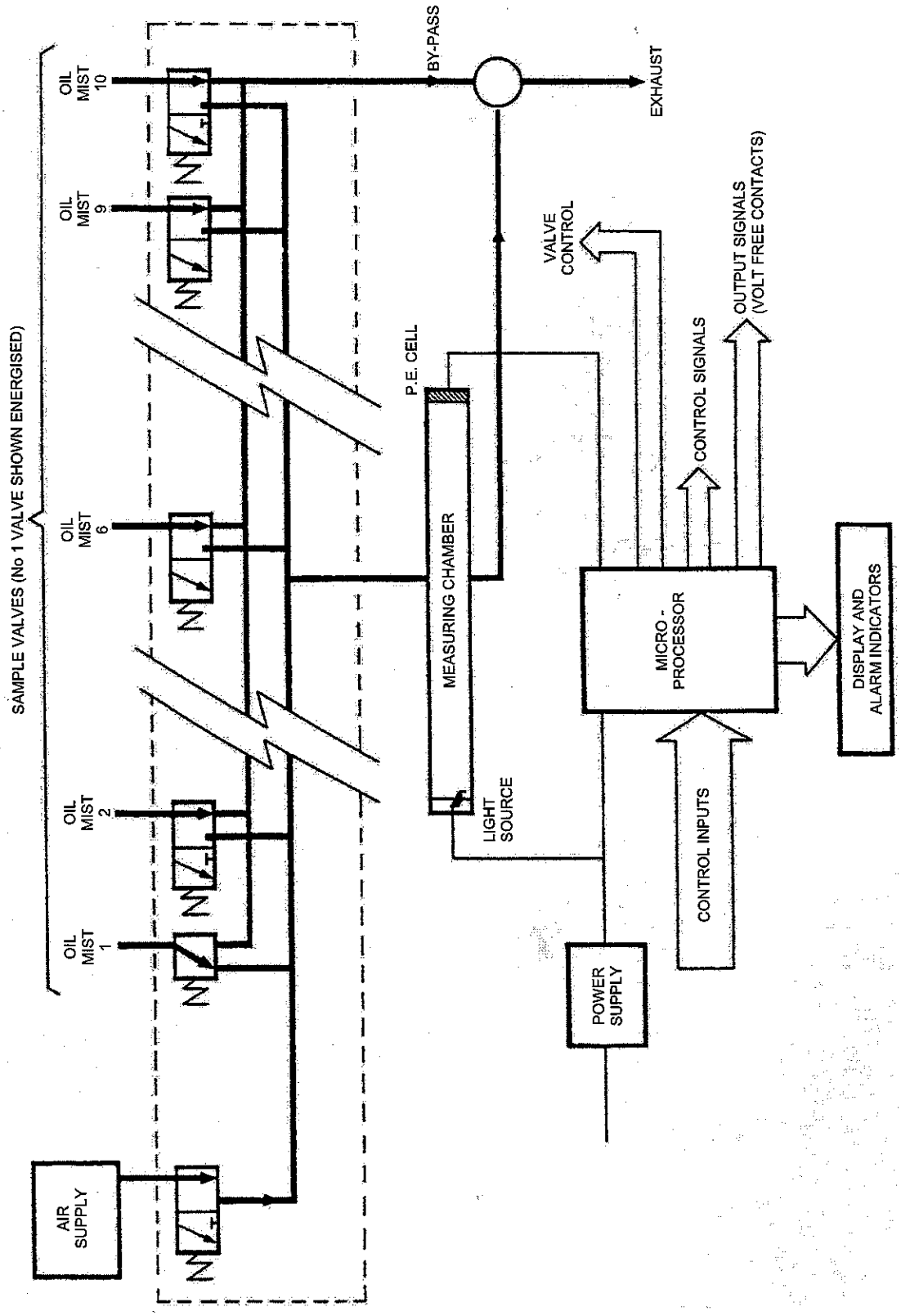


FIGURE 3a Flow System

OPERATION

For details of how the solenoid operated valves control the flow of samples through the manifold assembly, see Figure 3b. This illustration shows internal details of the manifold in which the by-pass chamber, the two distribution chambers and the measuring chamber extend the full length of the assembly.

On reaching the manifold, each oil mist sample follows one of two routes depending on the position of the respective solenoid valve. For each of the non-active sample inlets the shape of the valve is such that the oil mist sample flows through the valve body and thence through a port into the by-pass chamber and out to the exhaust via the fan. Meanwhile the position of the valve associated with the active sample inlet will be such that a port admits the oil mist sample to the upper distribution chamber whilst the port providing entry to the by-pass chamber is blanked off.

After admission to the upper distribution chamber the oil mist sample flows to its centre where it enters the lower distribution chamber which is constructed so that the sample flows into each end of the measuring chamber, passes to the centre and out of the exhaust via the fan which initiates the oil mist flow.

In Figure 3a, sample inlet 1 has been arbitrarily shown at the sample currently being sampled and is therefore shown with its solenoid energised, all remaining valve solenoids will be de-energised as shown.

The solenoids of the valve assemblies are controlled by the microprocessor. The number of crankcase compartments to be monitored, between 4 and 10, are programmed into the micro-processor by the use of links on SW1 on the printed circuit board during commissioning. This ensures that the valve for each of the "in-use" sample inlets energises in turn for a period of one second (the sample inlets unused are sealed and the valves for these remain permanently de-energised). An analogue signal from the photo-cell proportional to the opacity of the sample being measured is converted into a digital signal and stored in the microprocessors memory, this process being repeated for each sample in turn. After operating in this mode for 10 minutes, the oil mist valves are de-energised and the air valve energises for between 1.1 and 1.2 seconds. During this period the manifold measuring chamber is purged of oil mist, by the pressurised air. In this condition all of the oil mist samples flow through the by-pass chamber as already described for the non-active samples during the normal sampling sequence. With the air valve in the energised condition the air passes into the lower distribution chamber and into either end of the measuring chamber. During this period the photo-cell provides a reference output which is stored by the microprocessor, this allows temperature variations, light source output changes and oil mist build-up on the optical surfaces to be compensated for.

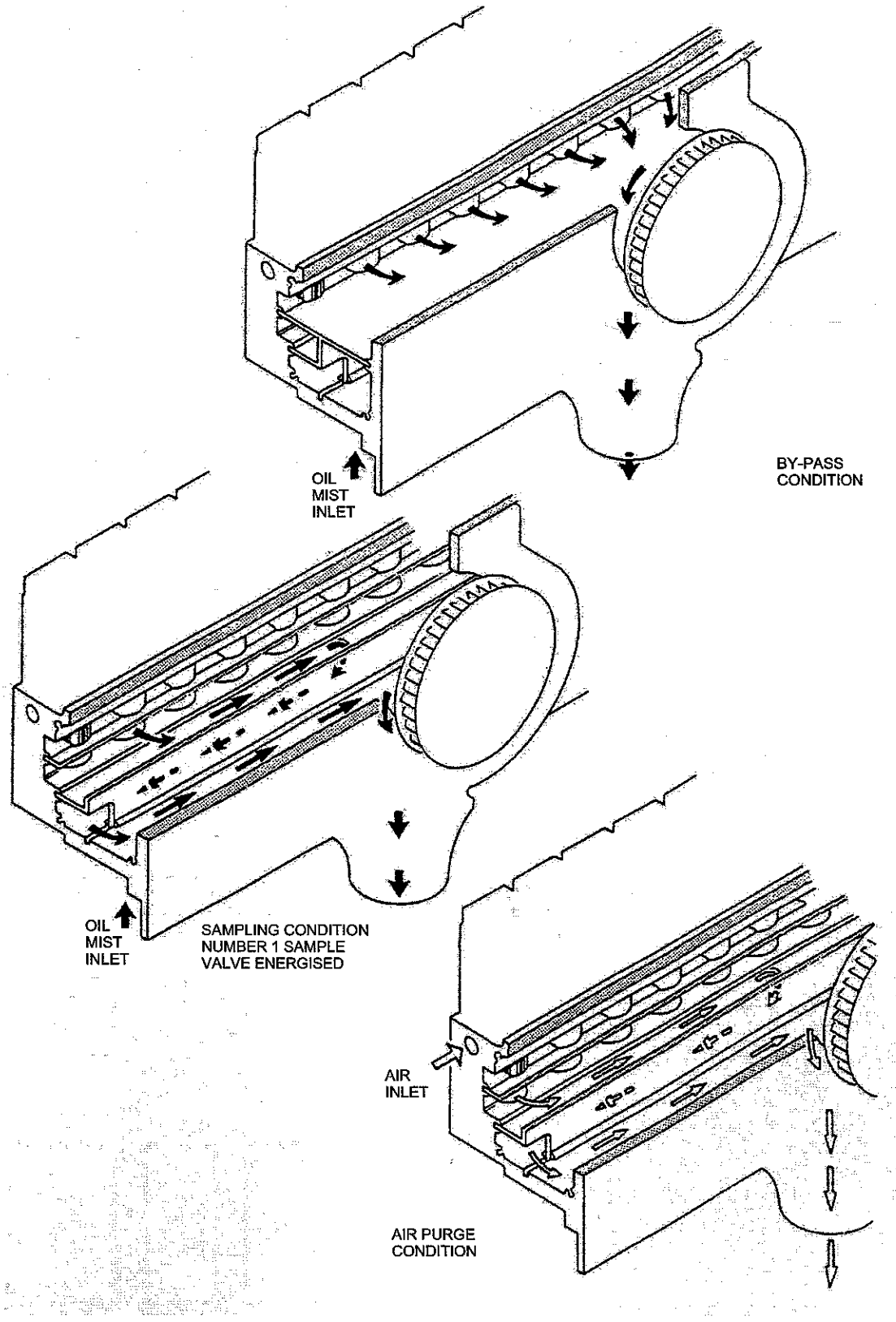


FIGURE 3b Oil Mist and Air Sampling - Flow System

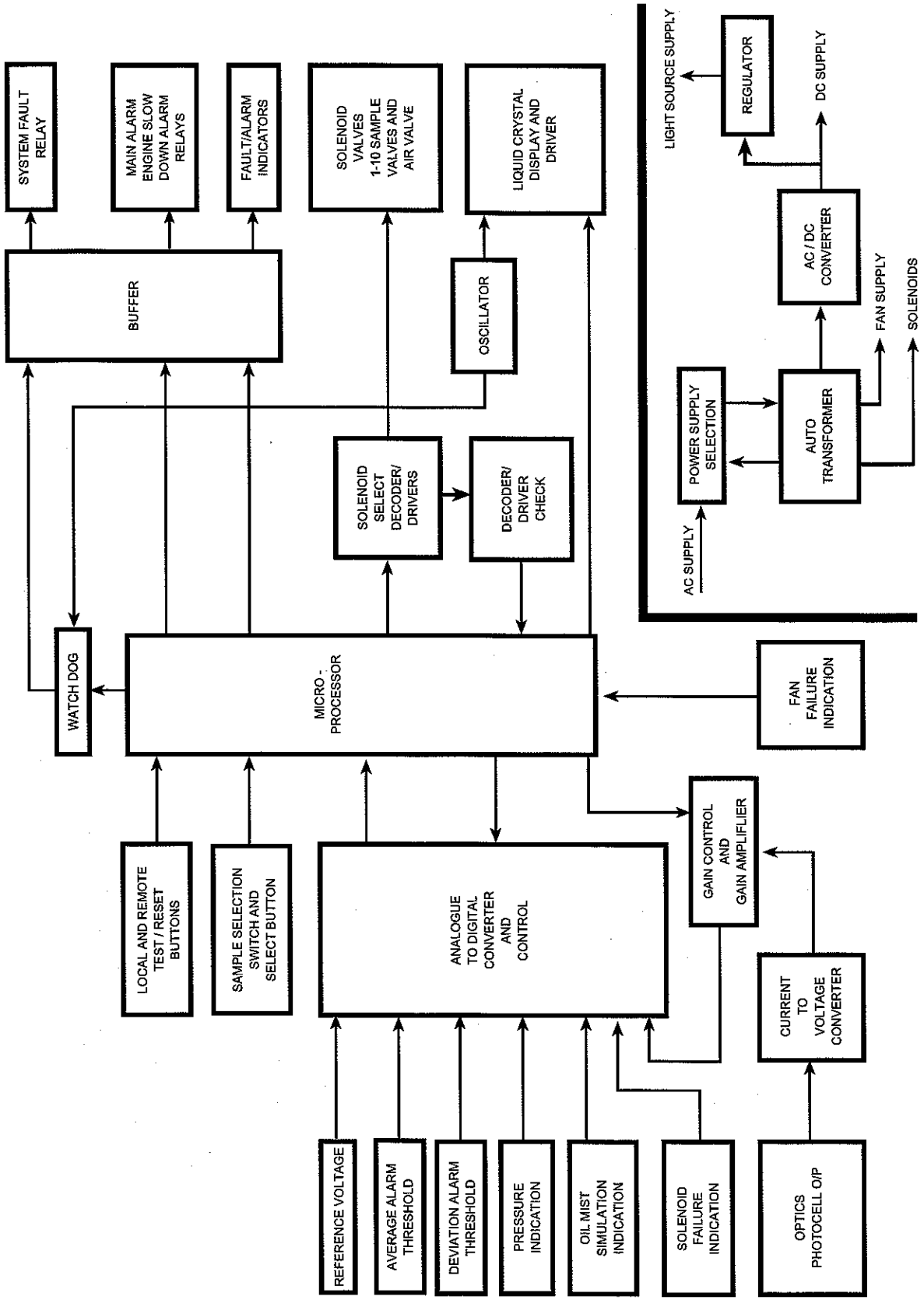


Figure 4 OMD Schematic

INPUT/OUTPUT OPERATION

The outline operation of the OMD is shown in Figure 4. The microprocessor is programmed to execute the operation of the displays, the sequenced operation of the selected sampling solenoids and the alarms. All information required by the microprocessor is converted into digital form. The microprocessor contains a clock which controls the timed operations of the detector. The outline operation of the various inputs and outputs functions which are given in the following paragraphs may be followed by reference to Figures 4 and 10.

Optical System

This is the main input of the system and is a d.c. level related to the oil mist level of the individual crankspace being monitored or a level related to the air sample during the periodic air purge operation. In a typical four cylinder engine installation each crankspace is monitored every four seconds. The light source is a low current long life beam emitter at one end of the measuring chamber with the photo-cell located at the other end, see Figure 3a.

Select Function

The SELECT switch is operated when a sample number indicated on the display corresponds with the one the operator requires to examine. The data stored in the microprocessor for that sample is then read out to the display to show the percentage of the alarm level which, in conjunction with the SENSITIVITY control setting, corresponds to the oil mist level for the sample selected, see Figure 2b. The scan cycle continues normally with all alarms operative during the select function.

Sample Selection

This is controlled by SW1 on the printed circuit board and is accessible after removing the cover. The switch is adjusted during commissioning to enable the OMD to operate with between four and ten oil mist sample inputs.

Examples of the required setting are shown in Figure 8b.

Simulation Check

This check is used to display a set signal against a simulated known level of oil mist.

When the SIMULATION slide is raised it interposes a glass filter between the photo-cell and the light source, and operates a microswitch which changes the normal cycle of the micro-processor to a SIMULATION cycle and illuminates the SIMULATION MODE indicator.

The cycle is as follows:

1 All oil mist inlet sample solenoids are switched OFF.

2. Air solenoid is switched ON which allows air to purge the manifolds and measuring chamber.

3. The optical density of the glass filter is computed and displayed on the percentage of alarm level read out and should be in the range 35 to 65%.

4. The FAULT ALARM relay contacts change state.

On the completion of the test the SIMULATION slide must be returned to its lower position and the RESET switch pressed, this is to ensure that the system is not left with the slide in the check position.

Display
The display is a liquid crystal type and is illuminated.

Test Functions
The TEST switch may be pressed at any time after the first complete cycle to initiate the microprocessor program for testing the OMD and is indicated by the TEST MODE indicator being lit.

The program will commence by the DEVIATION ALARM indicator being lit and will continue by simulating a gradually increasing average oil mist density resulting in the display building up to 100% of the Alarm Level at which point the AVERAGE ALARM indicator will light and the MAIN ALARM relay contacts will change state. The program now simulates a flow fault which lights the FLOW FAULT indicator. The microprocessor memory circuit is then checked and a test is conducted on the ENGINE SLOW DOWN relay coil without operating it.

Satisfactory completion of all tests results in the OPTICAL FAULT indicator being lit and the FAULT ALARM relay contacts will change state. Should the tests not be completed correctly the FAULT relay will not operate.

If the facility to operate TEST from a remote position is used, the test program remains the same but should it not be completed correctly it is not possible to RESET from this remote position. This ensures that the OMD is examined to define the fault condition.

Therefore at the end of a satisfactory test of the OMD the following should be seen:

1. DEVIATION ALARM indicator lit.
2. AVERAGE ALARM indicator lit.
3. FLOW FAULT indicator lit.
4. OPTICAL FAULT indicator lit.
5. MAIN ALARM relay contacts change state.
6. FAULT ALARM relay contacts change state.
7. TEST MODE indicator lit.

See Figure 7b.

Reset
The system will remain passive for a period of five seconds each time the RESET button is pressed.

INSTALLATION AND COMMISSIONING

GENERAL

The installation details are shown in Figures 5 through 7, and the information given in the LEADING PARTICULARS, should be used to plan the installation.

With the OMD installed, commissioning consists of a series of pre-adjustments followed by a functional test of all the switches.

Remote TEST and RESET controls and indicators must be tested if fitted.

The general sequence of setting up and checking is as detailed in the COMMISSIONING section.

INSTALLATION

1. The OMD is designed for mounting vertically using the four M10 studs protruding from the rear of the unit to the engine or a suitable bracket close to the engine. A central position, along the length of the engine, is recommended to give shorter sample pipes.

2. The sample pipes must not have any sharp bends and must slope away from the OMD. This ensures that any oil condensed in these pipes will return to the crankspace. These sample pipes must have a smooth bore with minimum changes of section so as not to affect the oil mist sample.

   The sample points on the crankspace must be located towards the top of the crankspace, but not in-line with oil spray from the bearings etc. This is generally the position that will give a maximum collection of oil mist generated by failed bearings.

   The flexible pipes are to be fitted as shown. They must have free movement to allow the anti-vibration mounts to operate.

   For details of the position of sample points on the crankspace in respect of engine rotation, see Figure 6b.

   Rigid pipework must be clipped in position to avoid fractures or damage due to vibration.

3. The exhaust from the OMD should be returned to the engine breather or crankspace. This exhaust must not drain any condensed oil back into the OMD. NO "U" bends must occur in this pipe, but if unavoidable, a self emptying syphon can return any oil back to the crankspace by suitable piping.

4. The power supply connections and the system alarm output contacts are shown in Figures 7a and 7b respectively.

   Before switching on the OMD, check the voltage and frequency of the local supply and confirm that the power selection board, located behind the printed circuit board is in the correct position for the local supply, see Figure 7d.

   All wiring must conform with the requirements laid down by the relevant approval authority.

5. Air supply connections are as shown in Figures 5, 6a and 9g.

   The air regulator supplied is NOT fitted to the OMD.

   To fit the air regulator: unscrew the knurled nut on the air regulator body, push the threaded part up through the bracket fixed to the bottom left-hand casting, refit the knurled nut and tighten securely.

   The nylon pipe between the air regulator and the OMD must now be fitted. Push the nylon pipe into the coupling brass sleeve. The pipe will now be locked in the coupling.

   To remove the nylon pipe, the brass sleeve must be pushed into the coupling plastic body whilst the nylon pipe is gently pulled out of the coupling. Finger pressure is all that is required on the brass sleeve and only a small movement will be found.

   Air pressure required is 1 bar (nominal) at a rate of 1 litre per second. Total usage is 6 litres per hour. Air is to be free of debris (rust etc.) and dry. Blow out pipeline before fitting air regulator.

   Free movement of flexible supply air pipe must be made to allow the anti-vibration mounts to operate.

   When not mounted on the OMD, the following applies:

   MAXIMUM DISTANCE OF AIR PIPE BETWEEN AIR REGULATOR AND OMD IS 60 METRES.

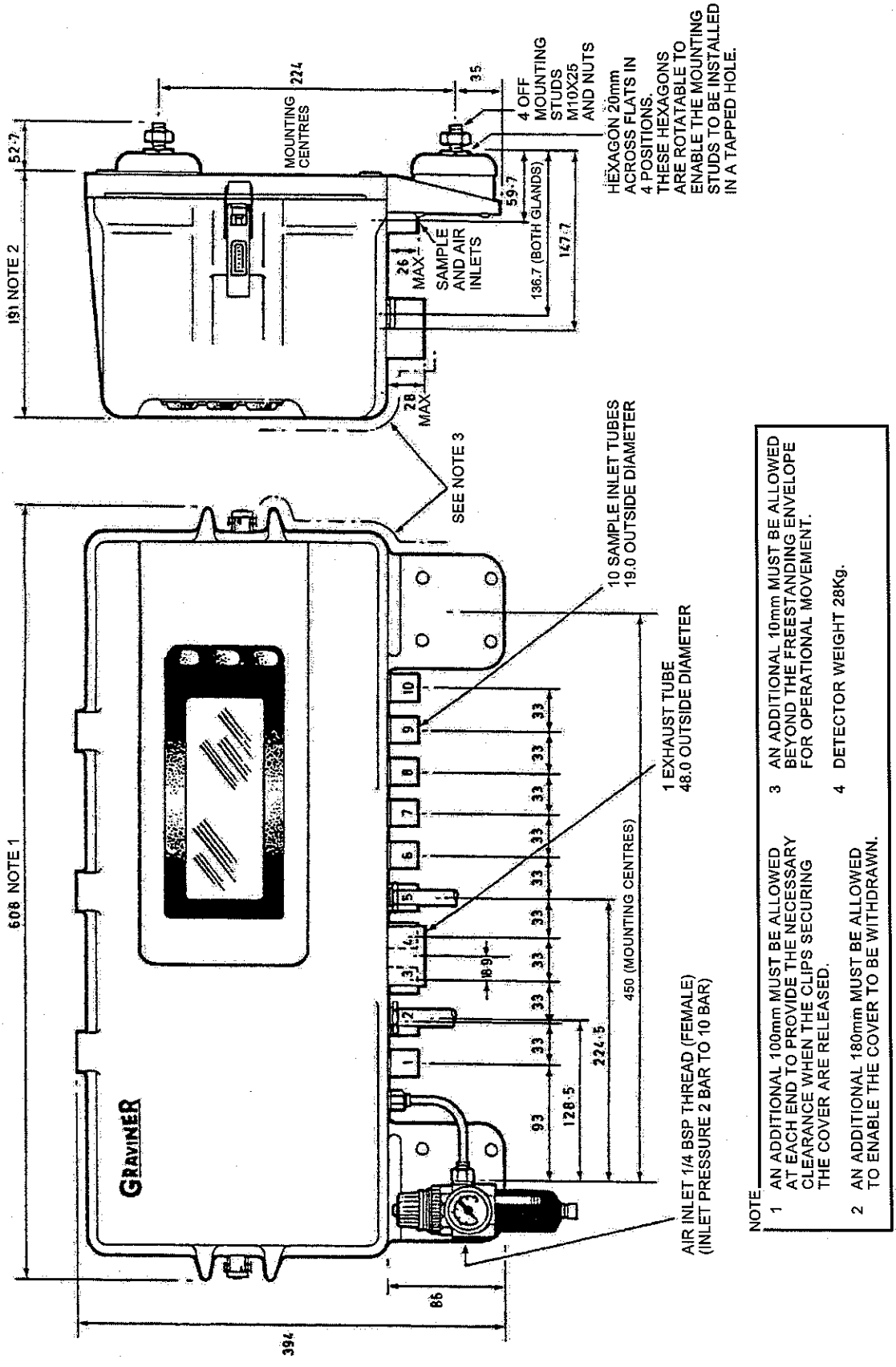
   MAXIMUM BORE SIZE OF AIR PIPE MUST NOT EXCEED 7 MM DIAMETER.

   Air inlet and outlet connections: 1/4 inch B.S.P.

>> ***NOTE*** *Flow direction is marked on the body. Unit is to be mounted upright as shown.*

   Maximum inlet air pressure: 10 bar (150 p.s.i.). Lock the setting of the air regulator after adjusting to the 1 bar reading. Refer to the COMMISSIONING section, para 7.

6. The installation of the remote TEST and RESET facilities are shown in Figure 7c.



NOTE

1 AN ADDITIONAL 100mm MUST BE ALLOWED AT EACH END TO PROVIDE THE NECESSARY CLEARANCE WHEN THE CLIPS SECURING THE COVER ARE RELEASED.

2 AN ADDITIONAL 180mm MUST BE ALLOWED TO ENABLE THE COVER TO BE WITHDRAWN.

3 AN ADDITIONAL 10mm MUST BE ALLOWED BEYOND THE FREESTANDING ENVELOPE FOR OPERATIONAL MOVEMENT.

4 DETECTOR WEIGHT 28Kg.

Figure 5 Dimensions

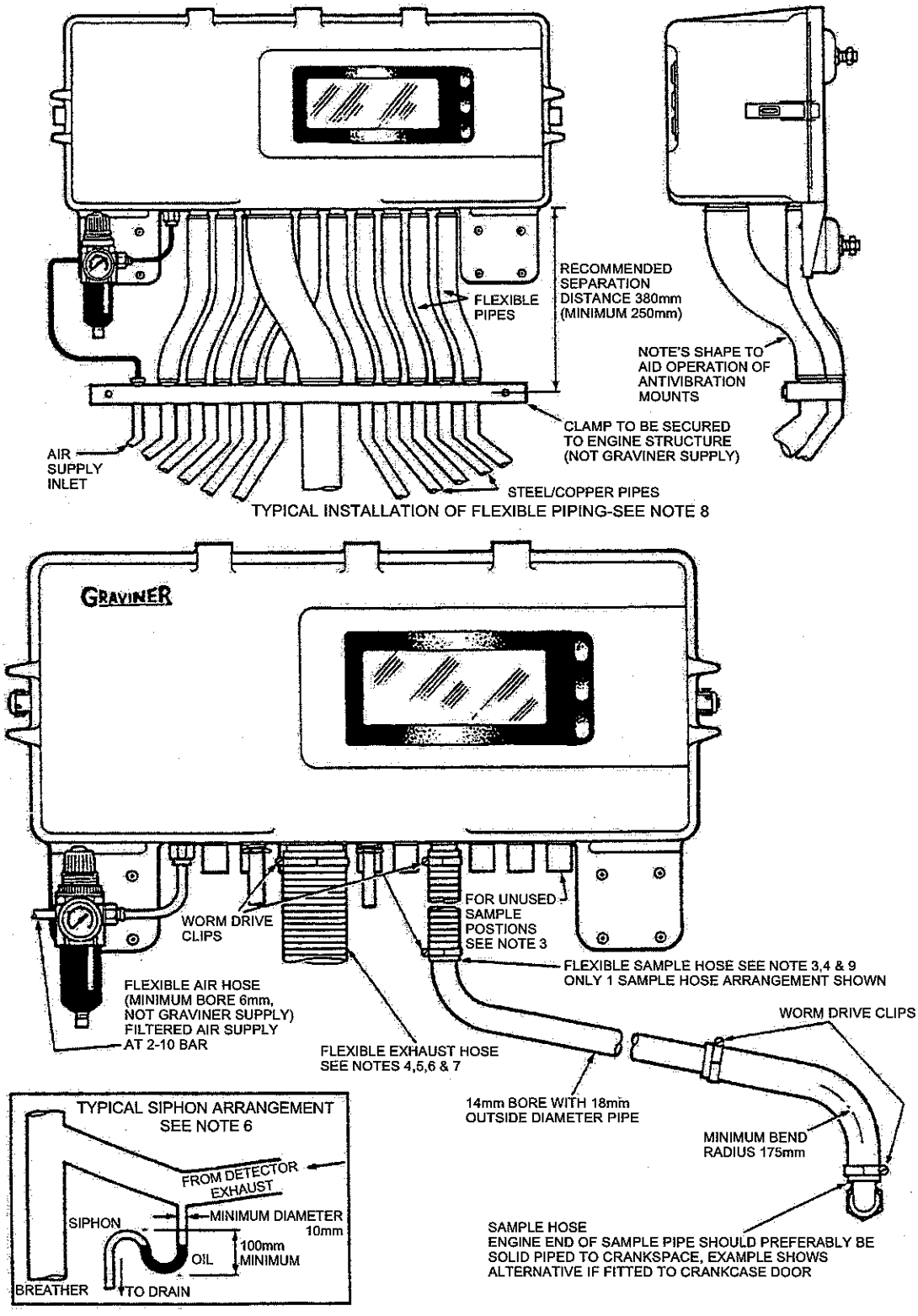


Figure 6a OMD Installation

POWER REQUIREMENTS

ELECTRICAL
Single phase: 220, 230, 240 or 115 V, 50 or 60 Hz.

>> *NOTE* System supplied with power supply selection board set at 240 V, 50 Hz.

Power consumption: 70 W, 24V d.c, 100 mA, if remote alarm option required, see Note 1 on Figure 7c.

PNEUMATIC
Filtered dry air, at I bar ± 20%, capable of supply rate of 1 litre/sec (free air).

Total usage 6 litres per hour (nominal) supplied by Kidde Fire Protection Ltd, Regulator Part No. 24124-201 from 2 to 10 bar source.

>> *NOTES* 1. The single phase supply should be connected to the 3-core cable as follows:
Earth to GREEN/YELLOW wire.
Neutral to BLUE wire.
Live to BROWN wire.

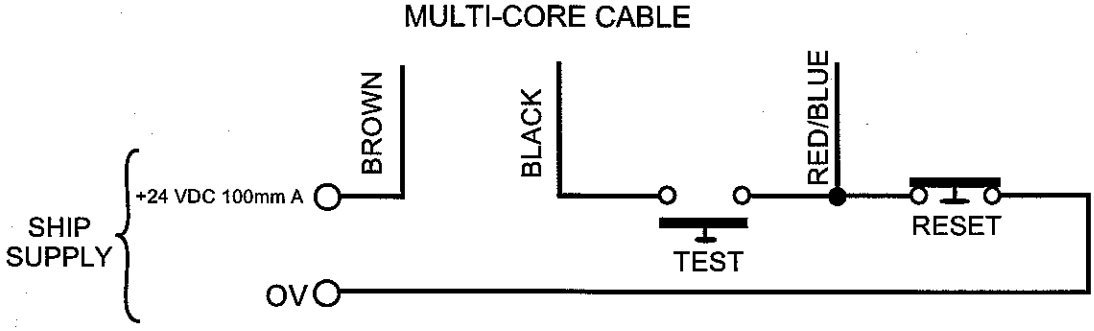
MAKE SURE THAT INTERNAL POWER SUPPLY SELECTION BOARD IS CORRECTLY POSITIONED BEFORE SWITCHING ON, SEE FIGURE 7D.

2. Alarm outputs are available at the multi-core cable, contacts of the alarm relays are connected as shown below, which shows the condition of the relays under both alarm and test conditions.

RELAY DESCRIPTION	WIRE COLOUR	UNIT OFF	UNIT ON	OIL MIST ALARM	FAULT ALARM	TEST MODE
MAIN ALARM (1)	PINK WHITE GREY					
MAIN ALARM (2)	GREEN/RED YELLOW/RED LIGHT GREEN					
SLOW DOWN ALARM	VIOLET BLUE DARK GREEN					
FAULT ALARM	YELLOW ORANGE RED					

CONTACTS RATED AT 24 V 1 AMP RESISTIVE LOAD

Figure 7b Electrical Details - Specific



>>NOTES *When using the REMOTE TEST facility it is essential that there are two remote annunciators visible when the "PRESS TO TEST" button is operated.*

Annunciator 1 is to be operated by one set of the main alarm contacts of the OMD.

Annunciator 2 is to be operated by the fault alarm contacts.

The TEST and RESET buttons, and annunciators are not supplied by Kidde Fire Protection.

Figure 7c Remote Test and Reset Facility

The board is located behind the main pcb and is accessible from the top of the unit.

Verify the power supply voltage and frequency that is to be supplied to the OMD.

To ensure correct operation, the power supply selection board must be inserted as follows (all board positions are viewed from the front of the unit):

Ensure board is locked in position by the clip which goes over the top of the board.

>> *NOTE* *The power selection board is factory fitted as: 240 V 50 Hz supply.*

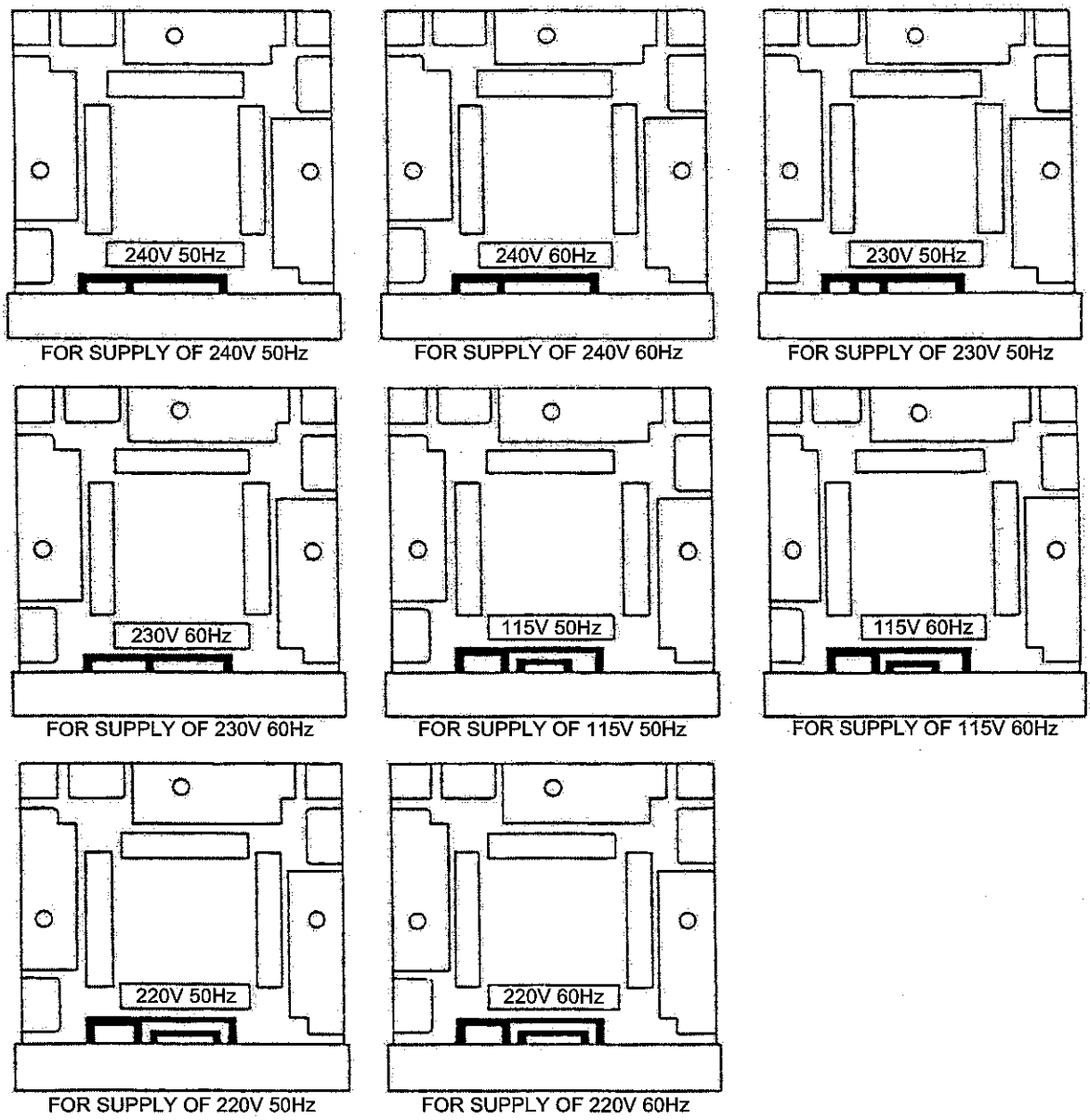


Figure 7D Power Supply Selection Board

COMMISSIONING

1. Unused sample points on the OMD must be sealed

2. Set SW1 on the printed circuit board, Figure 2c, so that the correct number of crankspace samples are selected for the engine being monitored, see Figure 8b. Check that the power selection card is inserted properly, see Figure 7d.

3. Check that the SIMULATION slide, Figure 2c, is in the fully down position.

4. Make sure that the SENSITIVITY control, Figure 2d, is set fully clockwise, i.e. minimum setting.

5. Make sure that the DEVIATION control, Figure 2c, is set fully clockwise, i.e. maximum setting.

6. Switch ON the OMD and check that the green SYSTEM ON indicator is illuminated, and after a five second period the display shows a reading on the Percentage of the Alarm Level and the sample number will be seen to scan.

>> NOTE *During the first scan the OMD is forming memory data in the micro-processor data stores and that no alarm will be given. This also occurs following the operation of the RESET button. Check that the number of sampling inlets are being correctly scanned by following the display.*

7. Air pressure setting, this must be set with the OMD running.

CAUTION

Air pressure in excess of 2 bar (30 p.s.i.) will damage the pressure switch.

The air pressure is adjusted by the regulator knob from a minimum setting up to the required setting of 1 bar (15 p.s.i.). The RESET button must be pressed after each adjustment, until the correct setting is reached. The regulator knob is locked in position by pushing the cap down. This requires removal of the regulator if it is mounted on the OMD.

8. Press the TEST button and check that: the TEST MODE indicator illuminates, the Percentage of Alarm Level Display rises to 100%, the DEVIATION and AVERAGE ALARM indicators, and the FLOW and OPTICAL FAULT indicators on the OMD, are Illuminated.

9. Press the RESET button to revert the system to normal operation.

10. Check that the DEVIATION ALARM operates satisfactorily, by setting the SENSITIVITY control to maximum and the DEVIATION control to a minimum setting and after disconnecting sample pipe introduce smoke into that sample inlet. The system will show a DEVIATION ALARM indicator lit and will stop scanning.

    DO NOT USE any inlet not used on the installation.

    Return the SENSITIVITY control to minimum, the DEVIATION control to maximum and press the RESET button on completion of the test.

11. Lift up the SIMULATION slide, Figure 2c, and check that the percentage of alarm level display shows between 35 and 65%. Return the slide to its normal down position and press the RESET button to return the unit to service.

12. Make sure that the engine has reached its normal operating temperature on a steady load. Turn the SENSITIVITY control counter-clockwise, to adjust the percentage of alarm level display to read approximately 50%. This should be performed in slow steps as one complete sample cycle is needed to display an average indication representative of the new SENSITIVITY setting.

>> NOTE *If the control reaches the full counter-clockwise setting before 50% alarm level is read, leave the SENSITIVITY control at the counter-clockwise setting. A low reading will usually be shown at switch on and during warm-up of up to 25%. After 10 minutes this reading will resort to between 0 and 5 % if the engine is not running.*

13. Press and hold the RESET button, adjust the DEVIATION control fully counter-clockwise to its minimum setting, release the RESET button.

14. If a Deviation Alarm occurs, check the individual sample readings as follows: Return the DEVIATION control fully clockwise to maximum setting. Press and release the RESET button. Press the SELECT button and note the percentage display reading of the selected sample, release the SELECT button, repeat this action and note the rest of the active sample, if there is a variance of between I and 2 segments positive from the average reading of any sample return the DEVIATION control to the fully counter-clockwise position less than half a division as marked on its surrounding scale. For a variance of more than 2 segments the DEVIATION control must be set more clockwise as appropriate. If a particular sample is showing a high deviation, check whether this sample is from a chain or gear case position. If so, the DEVIATION control must be adjusted higher so that the DEVIATION ALARM will not occur during normal engine running.

>> NOTE *The DEVIATION control setting should not be set more clockwise than is absolutely necessary as this will make the detector insensitive to genuine deviation alarms, see Figure 2a.*

15. The RESET button must be pressed after any adjustments of control settings.

If the sample is no longer in the alarm condition the system will cancel the stored alarm signal and will return to the normal scan cycle. Thus an external alarm is only given in the event of two successive signals of oil mist at alarm level on the same sample inlet

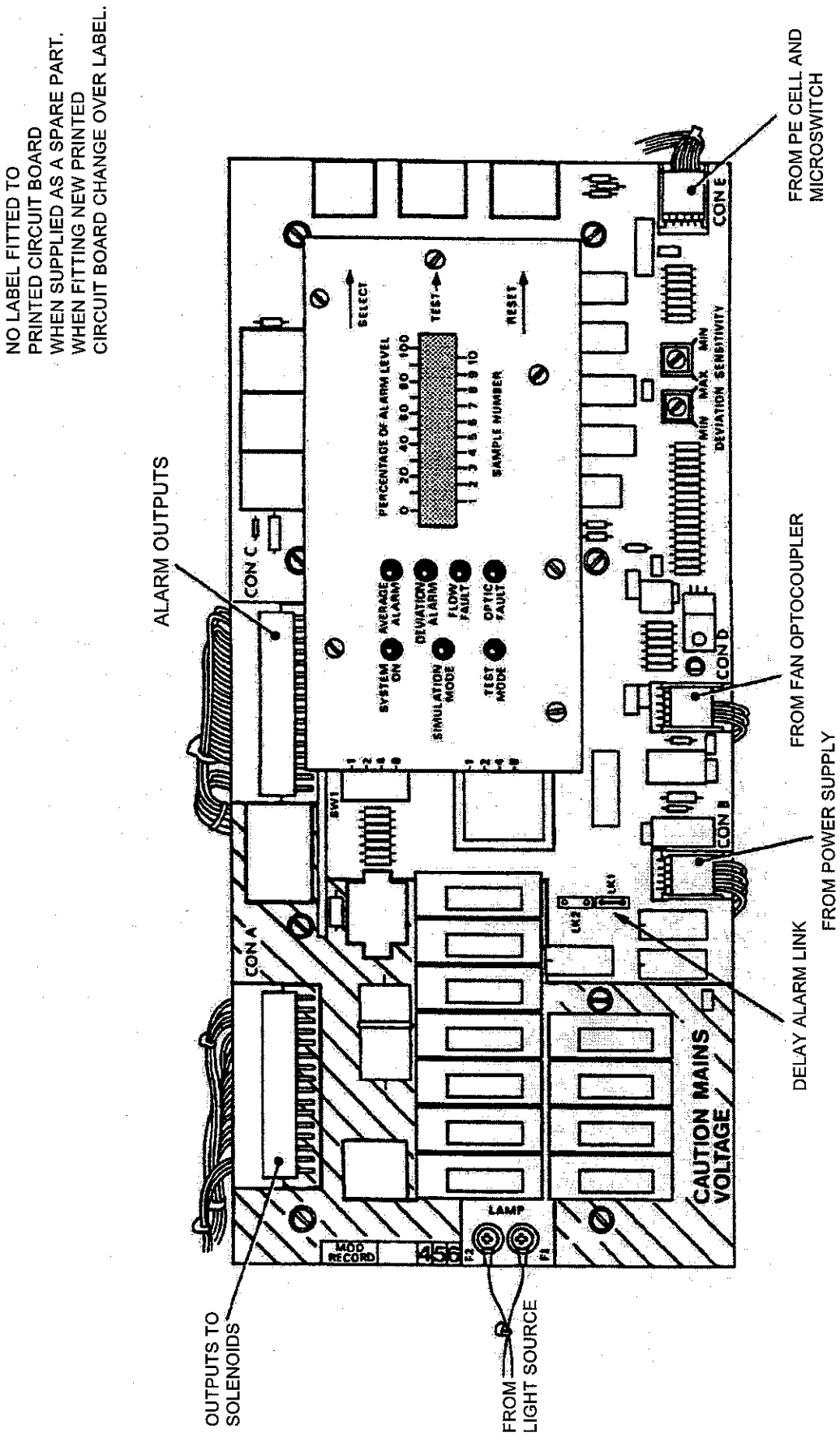
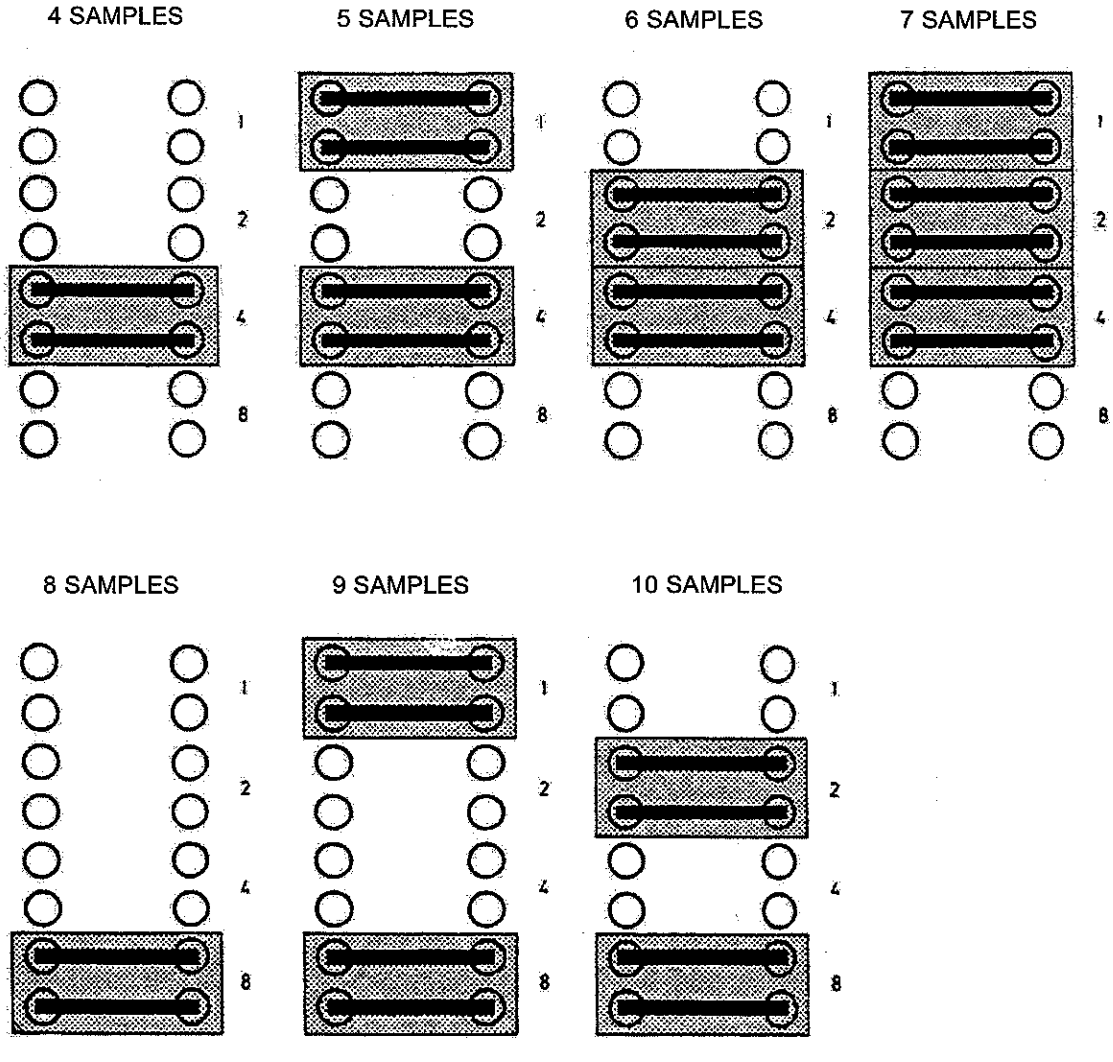


Figure 8a Printed Circuit Board

To select the number of samples to be scanned, the position of the SELECTION SWITCH (SW1) are as follows:



All units leave the factory in the 7 sample position.

>> NOTE *Each segment consists of two pairs of linked pins and must be fitted at two row spacing as shown*

Figure 8b Sample Selection Switch

MAINTENANCE

WARNING

240 V A.C. ARE PRESENT IN THE OMD. THE FOLLOWING AREAS SHOULD BE TREATED WITH GREAT CARE: THE VOLTAGE SELECTION CARD INPUTS TO THE POWER SUPPLY, THE SOLENOIDS AND THE AREAS ON THE PRINTED CIRCUIT BOARD INDICATED BY CROSSHATCHING.

TEST ROUTINES

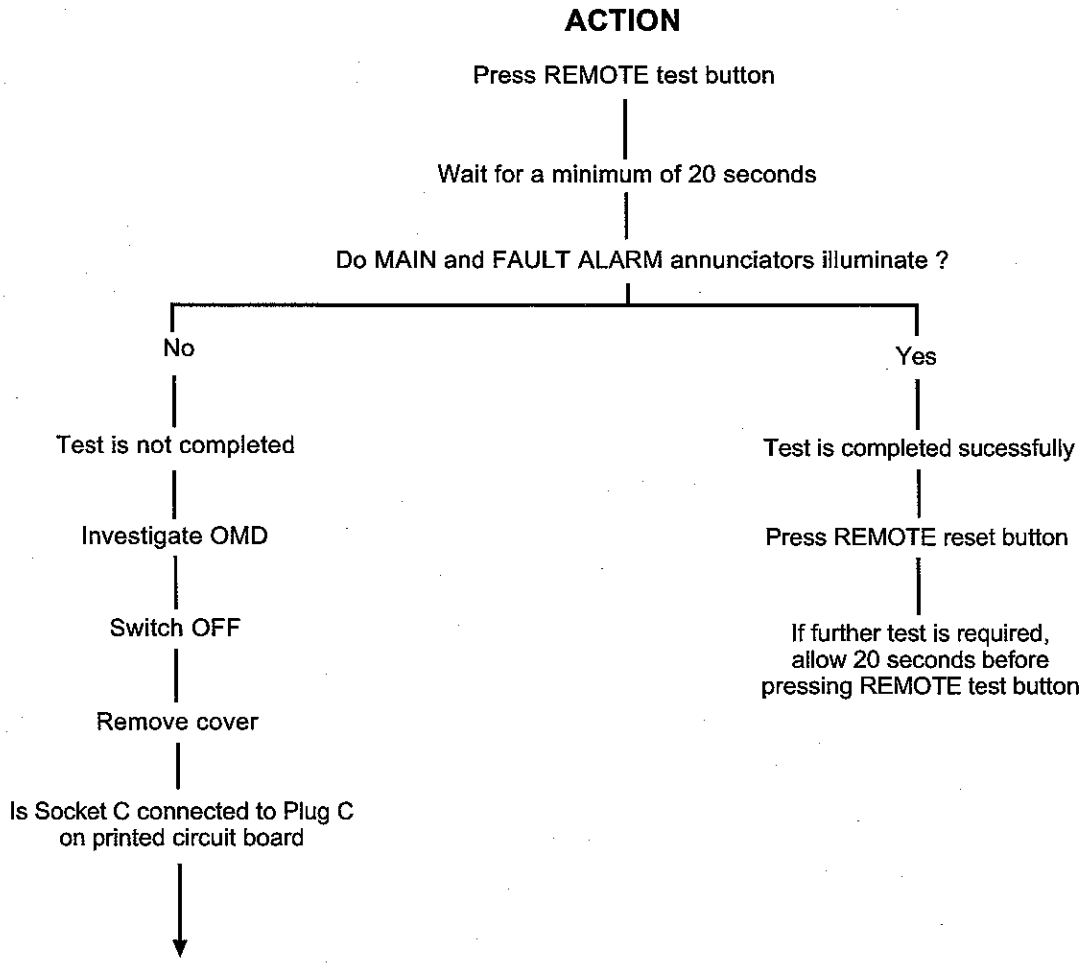
The OMD incorporates self-checking routines which operate when it is switched ON.

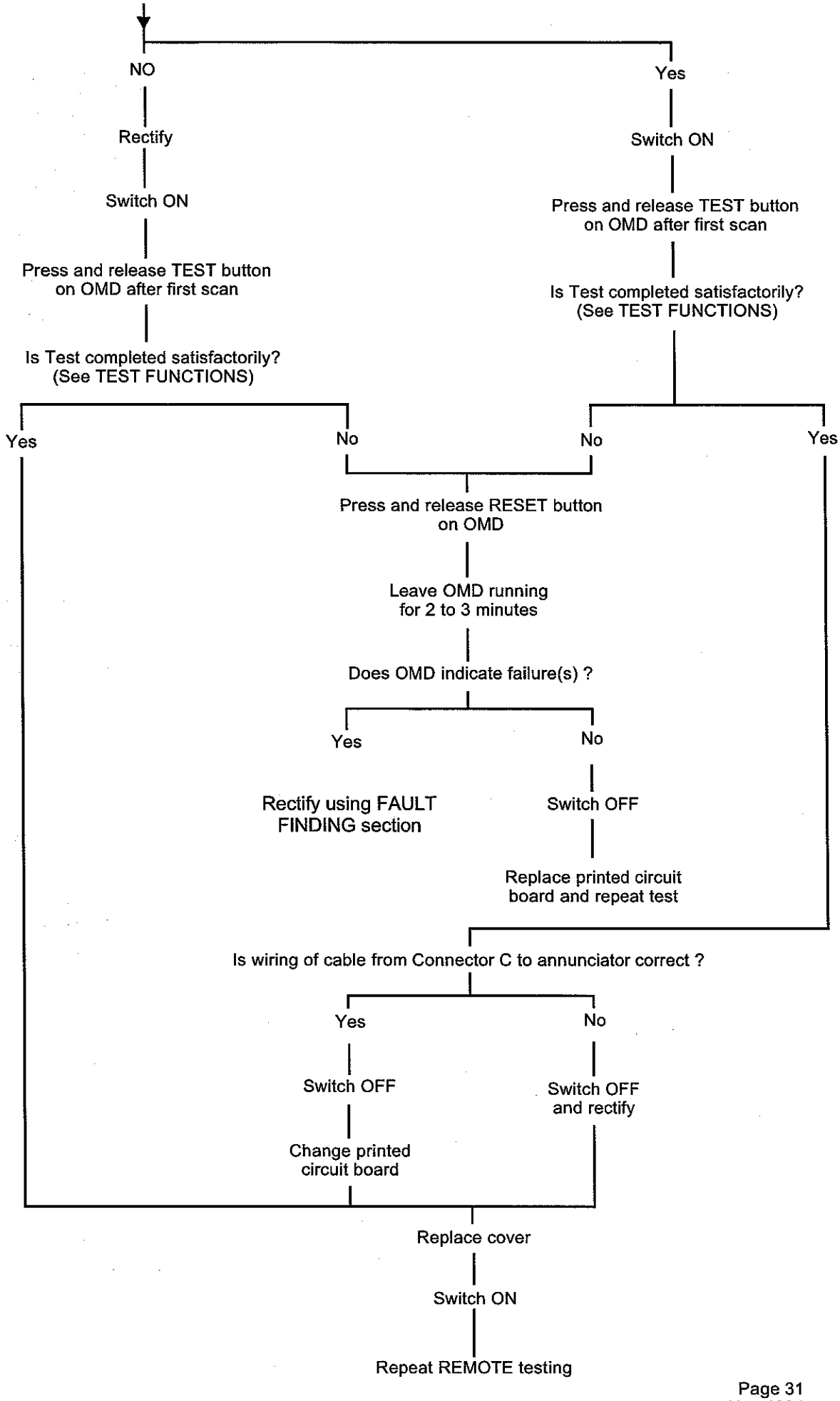
The only routine maintenance is running a brief additional self-test prior to engine starting and at four-weekly intervals. Provided the OMD is switched ON, the test is commenced by operating the local TEST switch and subsequently the RESET switch on the OMD, refer to COMMISSIONING, steps 8 and 9.

REMOTE TESTING AND INDICATIONS (when fitted)

A test of the OMD from the remote position should be carried out daily. Pressing the REMOTE test switch initiates the same test program as the TEST switch on the OMD. Passing of the test is indicated by the remote MAIN ALARM and FAULT ALARM annunciators being lit.

The following procedure must be used when operating the REMOTE test:




NO
Yes
Rectify
Switch ON
Switch ON
Press and release TEST button on OMD after first scan
Press and release TEST button on OMD after first scan
Is Test completed satisfactorily? (See TEST FUNCTIONS)
Is Test completed satisfactorily? (See TEST FUNCTIONS)
Yes
No
No
Yes
Press and release RESET button on OMD
Leave OMD running for 2 to 3 minutes
Does OMD indicate failure(s) ?
Yes
No
Rectify using FAULT FINDING section
Switch OFF
Replace printed circuit board and repeat test
Is wiring of cable from Connector C to annunciator correct ?
Yes
No
Switch OFF
Switch OFF and rectify
Change printed circuit board
Replace cover
Switch ON
Repeat REMOTE testing

PREVENTATIVE MAINTENANCE

Optical System

The system is self-compensating for fouling of the optical components by oil. A warning will be produced when no further compensation is possible. However, to avoid the need for unscheduled cleaning, an initial check of the optical system, i.e. lens and lamp, should be made no later than six months after commissioning. The level of contaminations should be assessed. If lit, the next routine inspection and cleaning can be extended to nine months. The level of contamination and maintenance periods depends on the individual engine type and operating conditions.

No definite maintenance periods can be given. However, experience has shown that this period should not be more than 12 months. See Figures 9c and 9d.

>> *NOTE* *End gaskets should only be used twice.*

Sample Valves

The solenoid assemblies, see Figure 9b, should be removed at 12 monthly intervals. The valve bobbin on the sample valve assembly should be cleaned of any excess oil. Make sure that an oil film remains for smooth operation. Clean the valve bore.

>> *NOTE* *0-ring seals should be inspected for damage and may be used up to four times.*

CAUTION

Care must be taken when re-assembling the solenoid and valve assembly, refer to REPLACEMENT OF SUB-ASSEMBLIES,SOLENOID AND AIR VALVE ASSEMBLY.

Sample Pipe Cleaning

CAUTION

The compressed air must be blown back from the OMD to the engine, to avoid excess oil within the OMD.

Every six months. The sample pipes should be blown through using the ships or the shore base compressed air supply with a recommended pressure of 7 to 10 bar.

Air Regulator/Filter

CAUTION

Do not use carbon tetrachloride, trichlorethylene, thinners, acetone or similar solvents.

Inspect and clean, with methanol, the air line filter element at four-weekly intervals. After cleaning, blow out parts with compressed air, see Figure 9g.

FAULT FINDING

FAILURE MODE

1. FLOW FAULT indicator ON.
   Display shows Sample Number at fault. Scan is stopped.

2. FLOW FAULT indicator ON.
   Display blank. Scan is stopped.

3. FLOW FAULT indicator flashing.
   Scan is stopped.

4. OPTICS FAULT indicator ON.
   Scan is stopped.

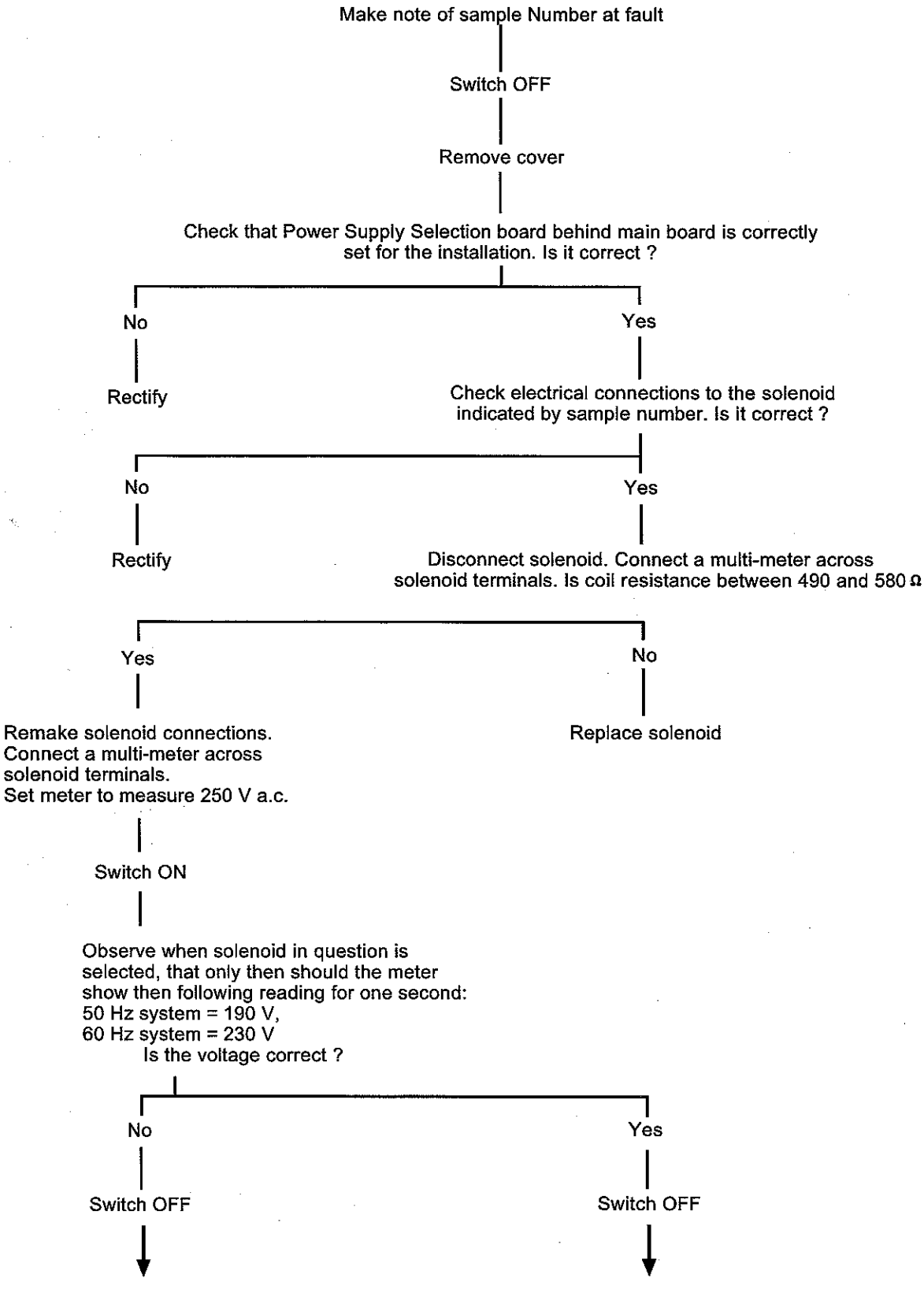
5. SYSTEM ON indicator OFF.

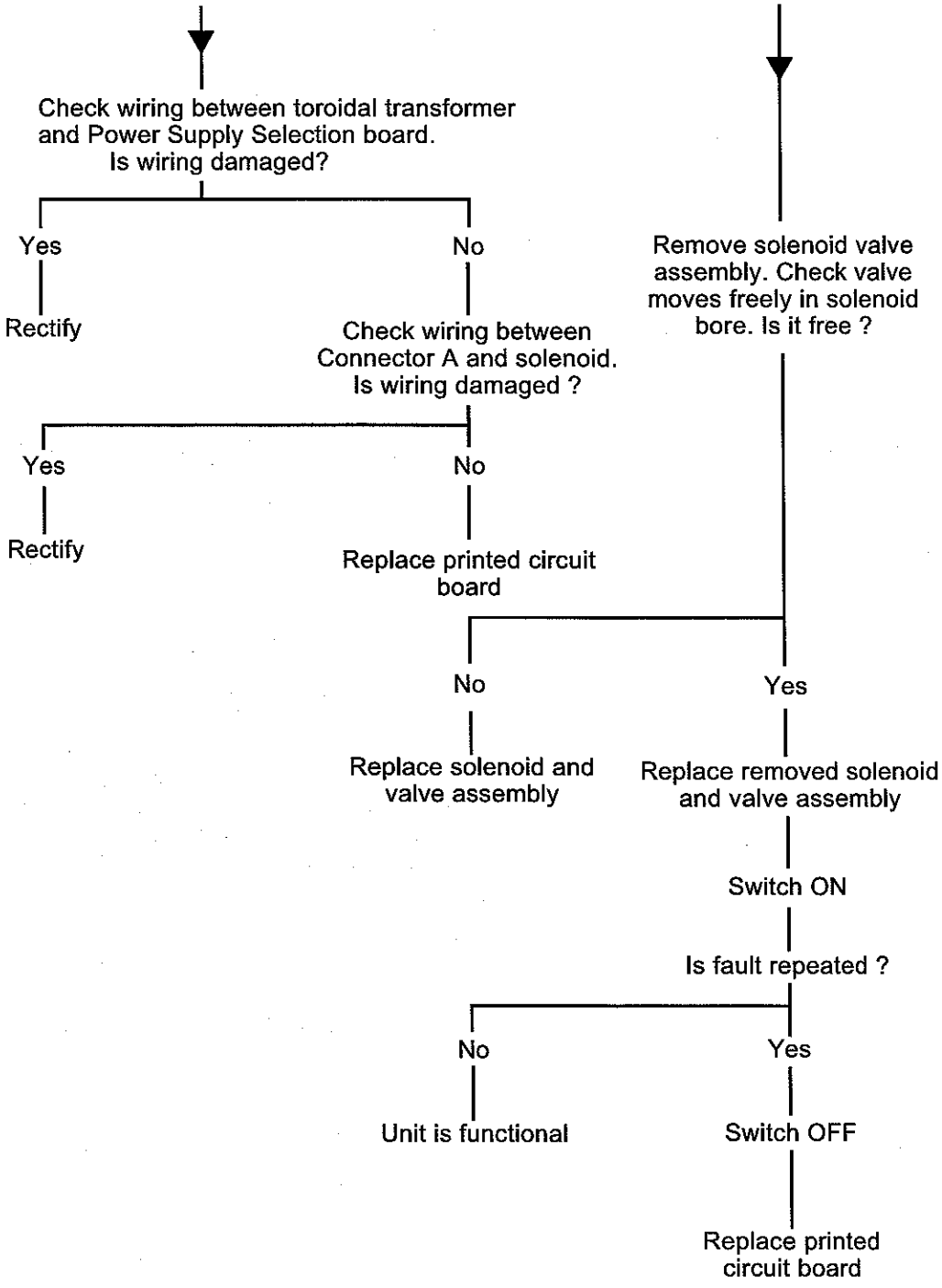
6. SYSTEM ON indicator ON.
   ALARM and FAULT indicators OFF Scan is stopped.

- System gives spurious alarms where the value jumps up & down.
  * Check lamp. Wires.

FAILURE MODE	FAULT
1. FLOW FAULT indicator ON. Display shows Sample Number at fault. Scan is stopped.	Sampling system failure.

ACTION





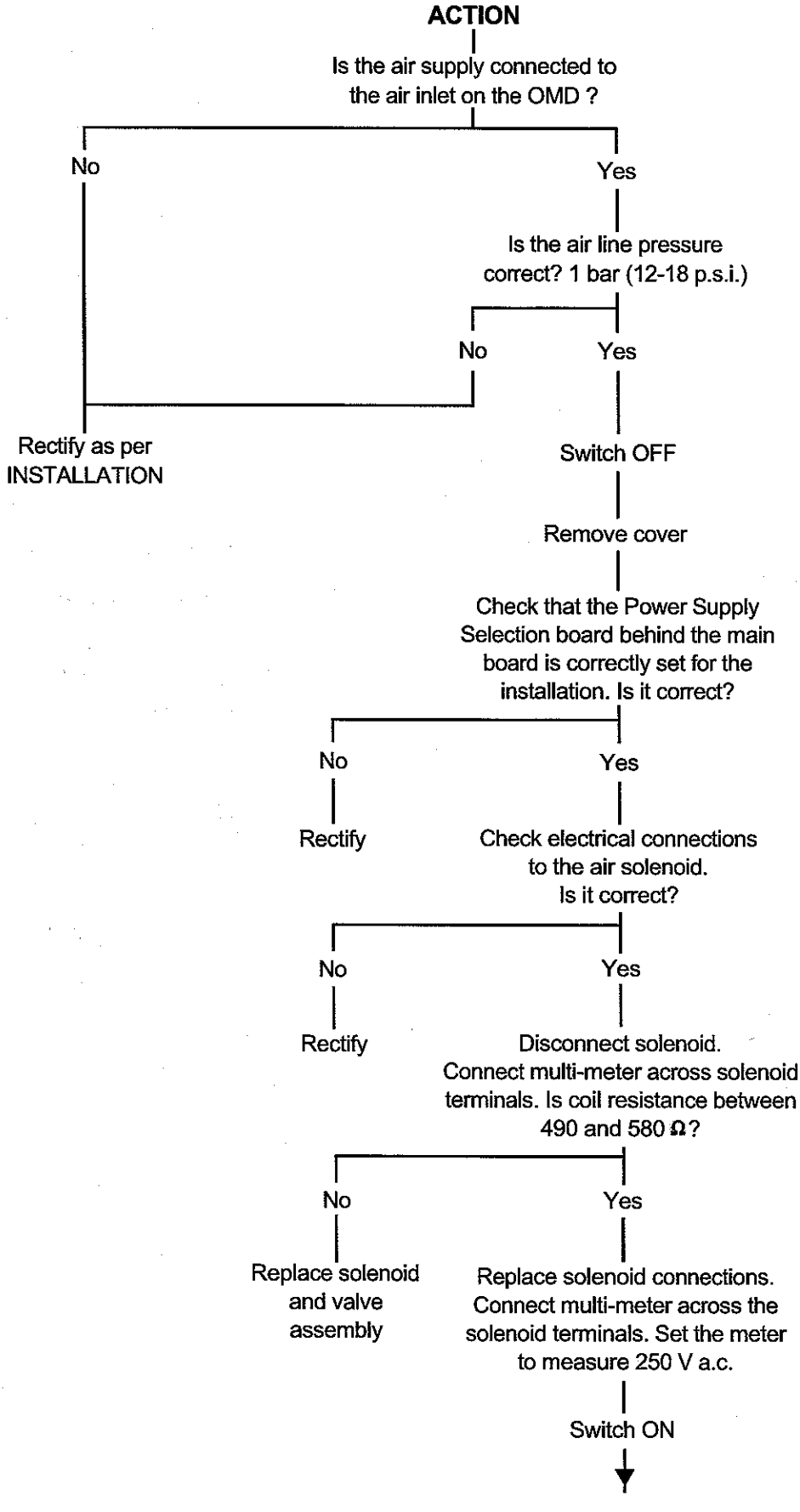
>> NOTE *Solenoid and valve are supplied as matched assemblies. After replacing the printed circuit board: sample selection (SW1), AVERAGE and DEVIATION adjustments must be reset.*

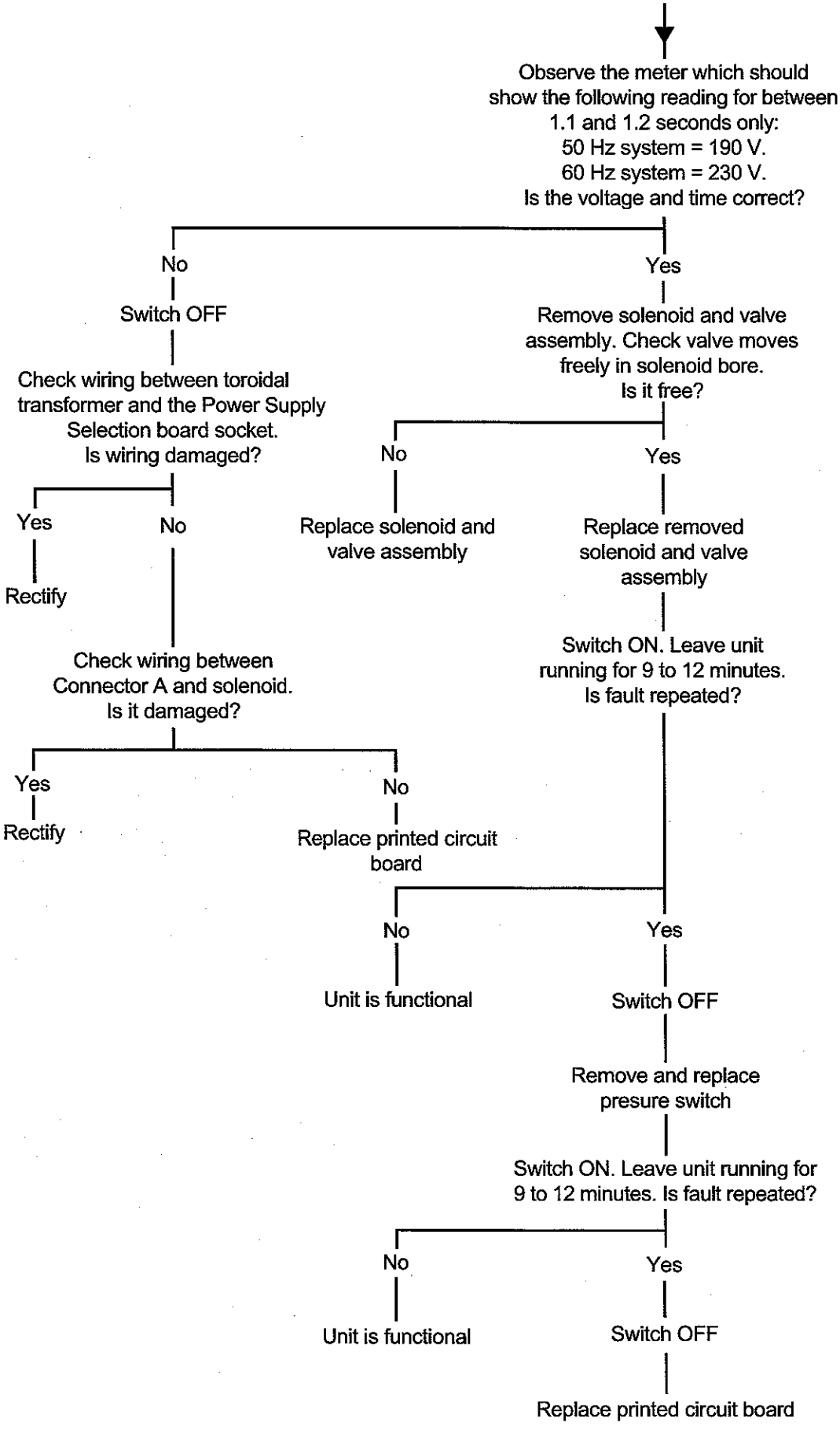
FAILURE MODE

6. FLOW FAULT indicator ON.
   Display blank. Scan is stopped.

FAULT

Air purge failure.





>> NOTE *Solenoid and valve supplied as matched assemblies. After replacing the printed circuit board: sample selection (SW1), AVERAGE and DEVIATION adjustments must be reset.*

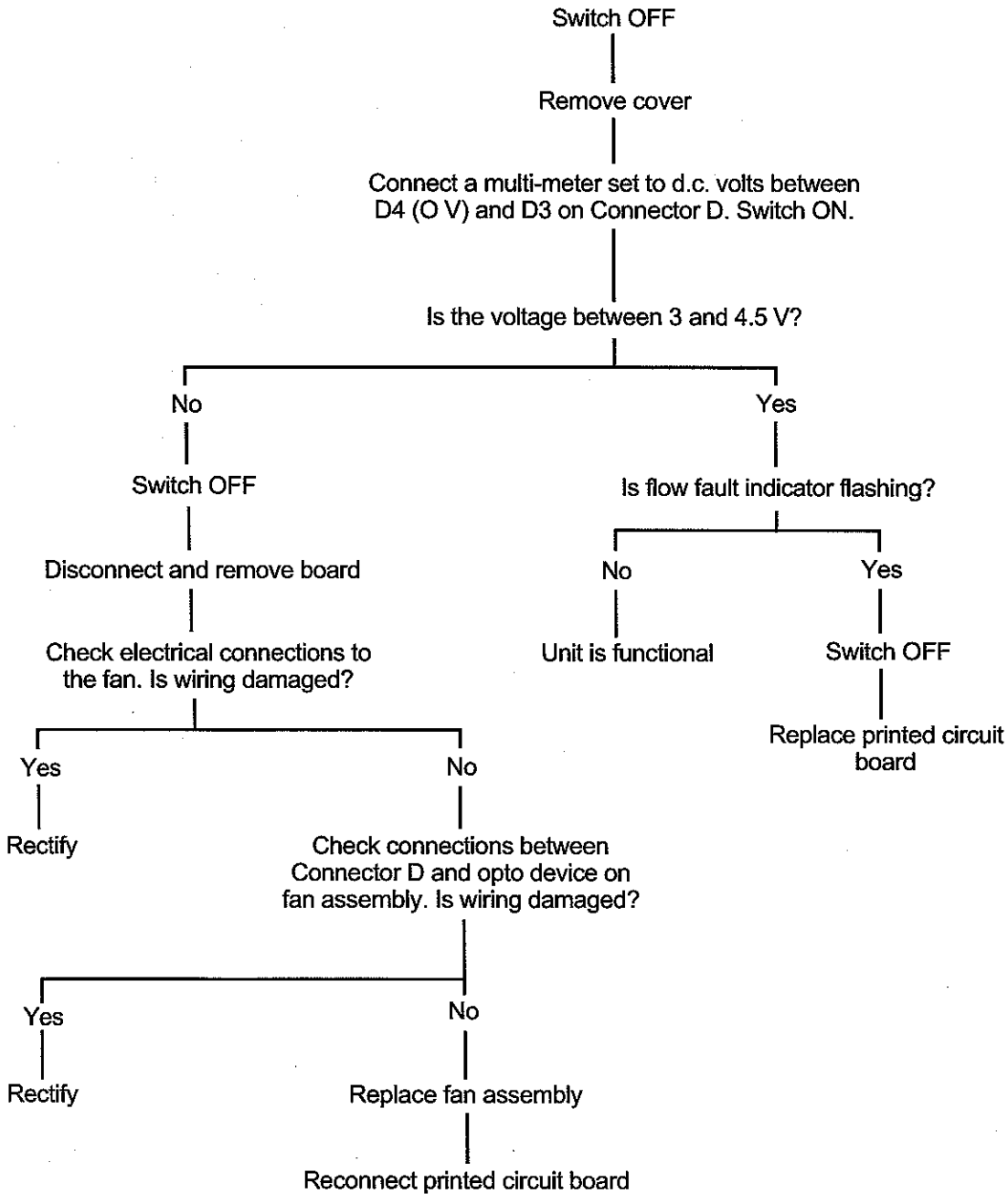
FAILURE MODE

3. FLOW FAULT indicator flashing.

FAULT

Fan/fan speed detection failure.

ACTION



>> NOTE *After replacing the printed circuit board: sample selection (SW1), AVERAGE and DEVIATION adjustments must be reset.*

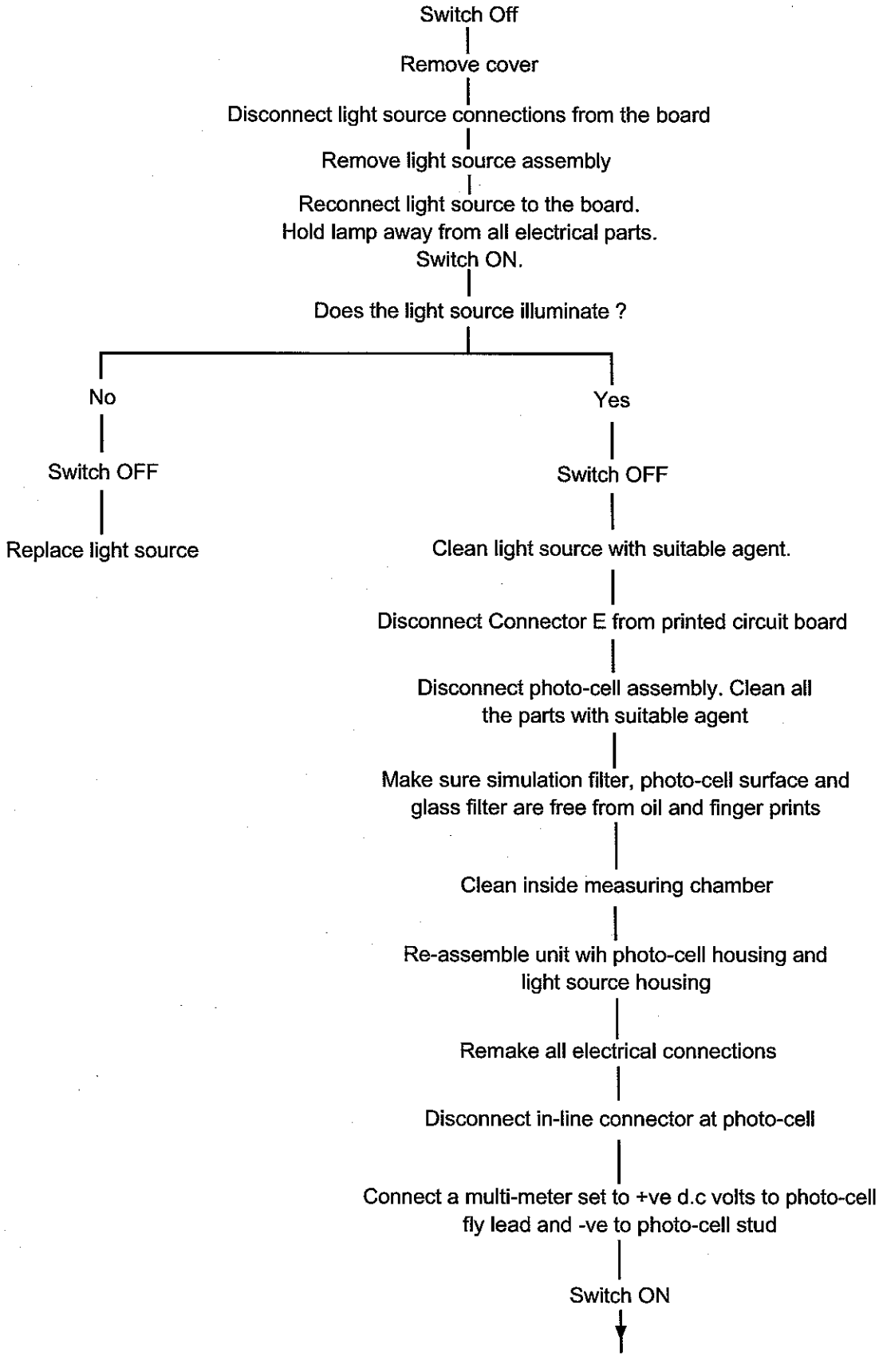
FAILURE MODE

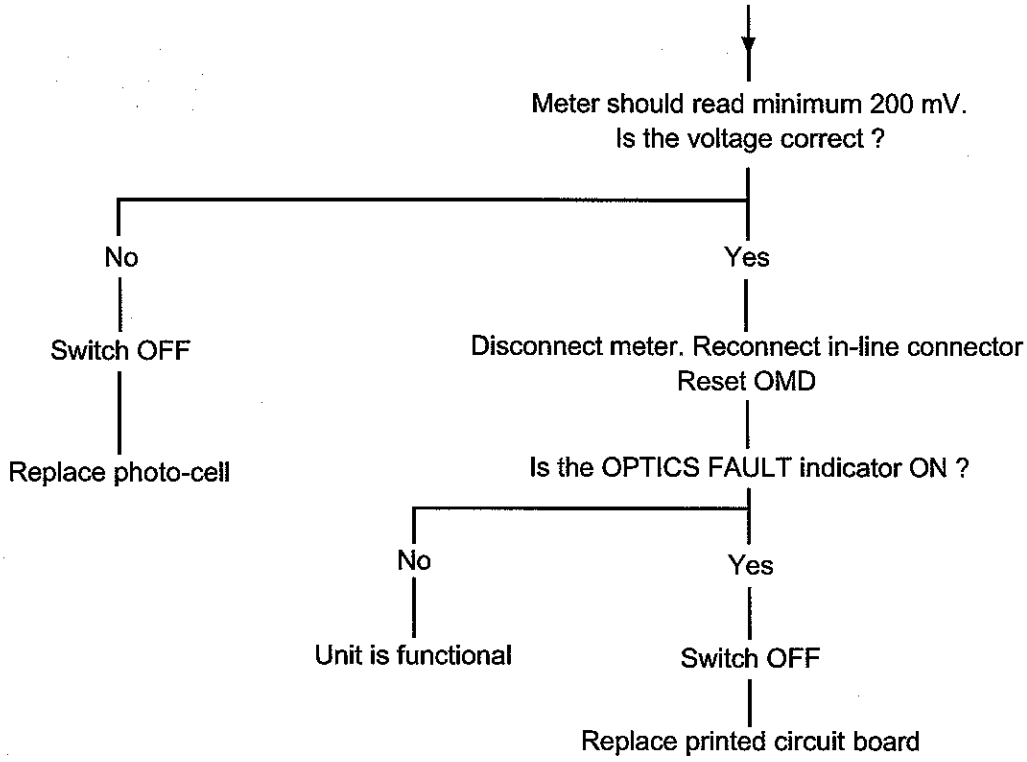
4. OPTICS FAULT indicator ON. Scan is stopped.

FAULT

Light source failure, or photo-cell failure, or optics need cleaning

ACTION





>> *NOTE* *After replacing the printed circuit board: sample selection (SW1), AVERAGE and DEVIATION adjustments must be reset.*

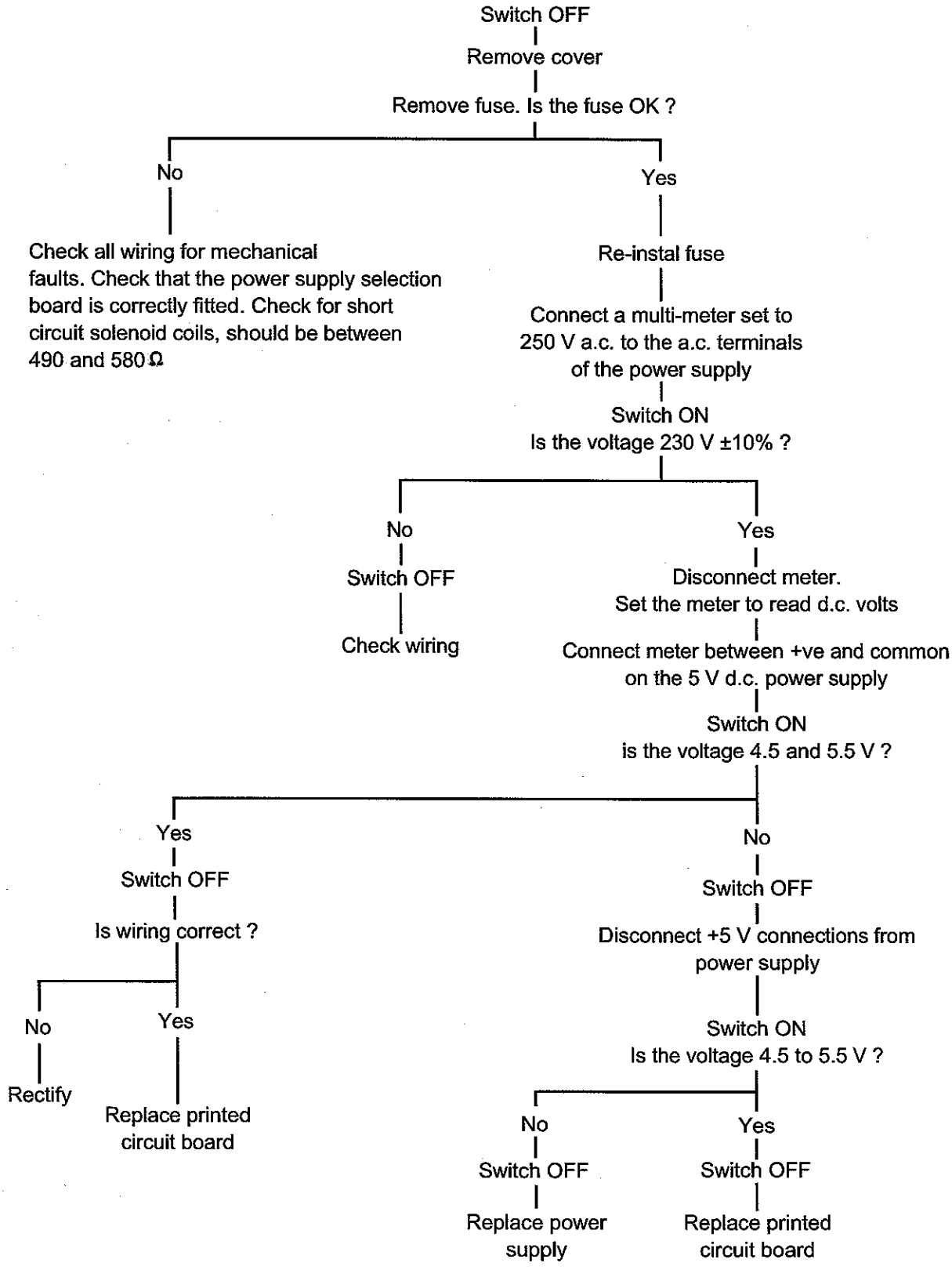
FAILURE MODE

5. SYSTEM ON indicator OFF.

FAULT

No power.

ACTION



>> NOTE *After replacing the printed circuit board: sample selection (SW1), AVERAGE and DEVIATION adjustments must be reset.*

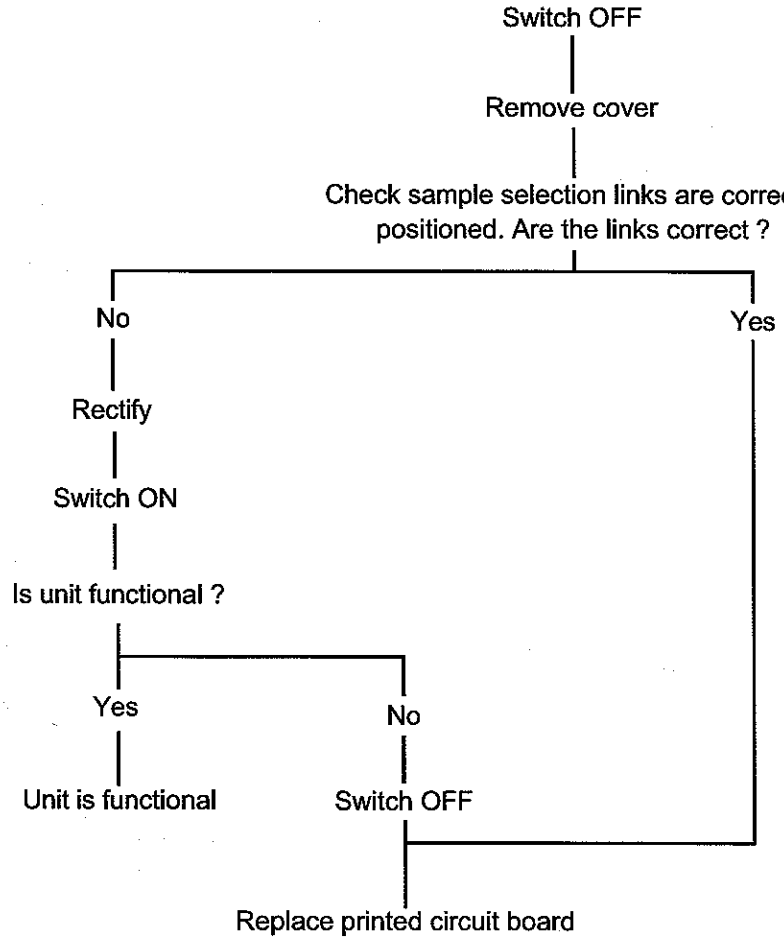
FAILURE MODE

6. SYSTEM ON indicator ON.
   ALARM and FAULT indicators OFF.
   Scan is stopped.

FAULT

Sample selection (SW1) failure
or data conversion failure
or solenoid selection failure.

ACTION



>> NOTE *After replacing the printed circuit board: sample selection (SW1), AVERAGE and DEVIATION adjustments must be reset.*

REPLACEMENT OF SUB-ASSEMBLIES

Unscheduled maintenance operations will normally be associated with the renewal of faulty assemblies or sub-assemblies. After removal of the cover and with the power supply switched OFF, the operations required for replacement, of these assemblies are detailed as follows.

>> *NOTE* *When using less than 10 sample positions, the solenoid and valve assemblies from the unused sample positions may be interchanged with any faulty sample position. The faulty assembly, MUST be marked FAULTY and refitted into the unused position.*

FUNCTION

A full test of the OMD must follow any servicing.

PRINTED CIRCUIT BOARD

See Figure 9a.

1. Make sure that the power supply is switched OFF.

2. Carefully unplug the six connectors from the printed circuit board. On connectors A and C, ease the latches away from the plugs. On connectors B, D and E press the blue levers to release the plug and unscrew the Light Source Terminals F. Release the eight screws securing the printed circuit board to the main frame of the OMD. Use the reverse procedure when refitting the printed circuit board.

SOLENOID AND SAMPLE VALVE ASSEMBLY

See Figure 9b.

1. Make sure that the power supply is switched OFF.

2. Ease off, with the aid of a screwdriver, the two connections from the solenoid coil. Do not strain the cables.

3. Remove the four slotted screws securing the solenoid to the extrusion. Remove the top cap, note the position and orientation of the Belleville washer and button.Lift the solenoid body upwards and carefully remove it. The solenoid core and valve assembly may now be removed. Note the position of the spacer and 0-ring.

4. Inspect the valve port for damage. Replace the faulty parts as necessary.

5. Before refitting make sure that the solenoid core and valve assembly is free in the solenoid housing, and that the valve is free in the bore of the extrusion.

6. When replacing the solenoid housing, make sure that the spacer and 0-ring are not trapped and that the solenoid base sits flat and square onto the extrusion. A little grease may be used to hold the 0-ring in position during assembly.

7. Replace the four slotted screws with top cap assembly. Make sure that the button and Belleville washer are fitted correctly and tighten the screws to a torque of between 0.99 and 1.09 Nm.

8. Replace the two connections.

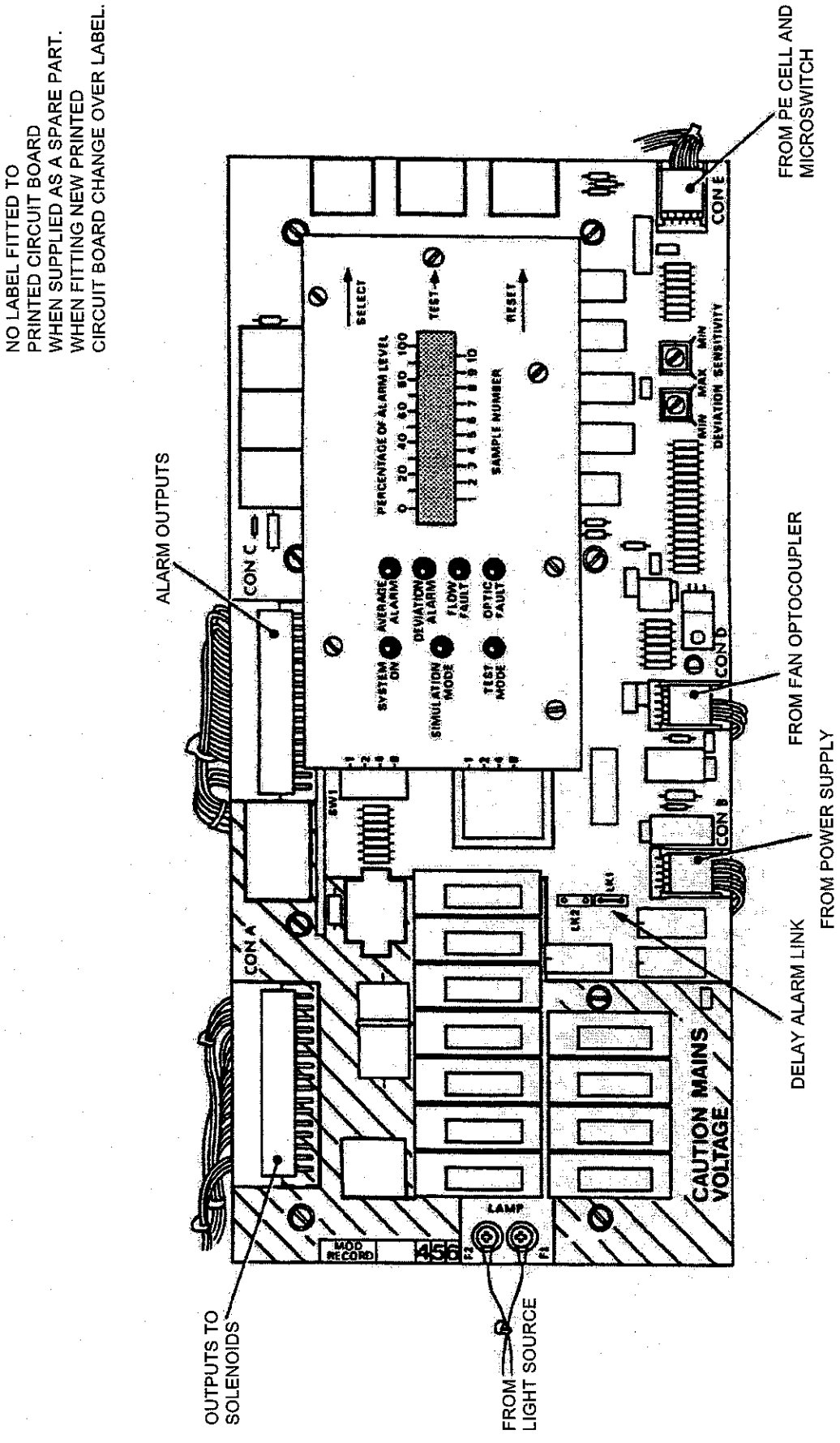
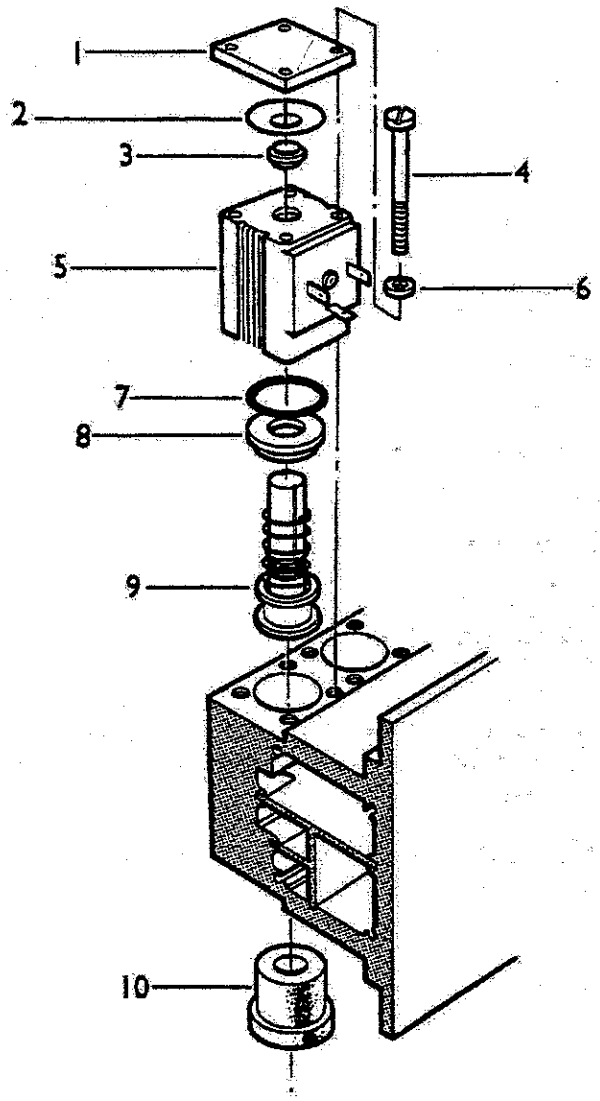


Figure 9a Printed Circuit Board



Key No.	Description	Part Number	No. Off per Set
1	Solenoid Cap	31571-101	1
2	Belleville Washer	23723-055	1
3	Solenoid Button	33111-103	1
4	Screw M4 x 63	27481-951	2
5	Solenoid	27481-953	1
6	Washer Spring	21175-065	2
7	O-ring	25124-317	1
8	Locating Spigot	32617-403	1
9	Sample Valve Assembly	45625-155	1
10	Buffer	38531-720	1

Figure 9b Sample Valve Solenoid Assembly

SOLENOID AND AIR VALVE ASSEMBLY

See Figure 9c.

1. Make sure that the power supply and air supply are switched OFF.
2. Ease off, with the aid of a screwdriver, the two connections from the solenoid coil. Do not strain the cables.
3. Remove the four slotted screws securing the solenoid to the extrusion. Remove the top cap, note the position and orientation of the Belleville washer and button. Lift the solenoid body upwards and carefully remove it. The solenoid core and valve assembly may now be removed. Note the position of the spacer and 0-ring.
4. Remove the air chamber only if damage or air blockage is suspected. Check the 0-ring and the neoprene washer at the bottom of the chamber. Replace if damaged.
5. Inspect valve port for damage. Replace faulty parts as necessary.
6. Refit air chamber, if removed, a little light oil will ease assembly of the 0-ring. Note air holes at 180° apart must be in a line from front to back of the unit, refit the washer into the bottom of the chamber.
7. Before refitting, make sure that the solenoid core and valve assembly is free in the solenoid housing.
8. When replacing the assembly, make sure that the spacer and 0-ring are not trapped and that the solenoid base sits flat and square onto the extrusion. A little grease may be used to hold the 0-ring in position.
9. Replace the four slotted screws and top cap assembly. Make sure that the button and Belleville washer are fitted correctly and tighten the screws to a torque of between 0.99 and 1.99 Nm.
10. Replace the two connections.

PRESSURE SWITCH

See Figure 9c.

1. Make sure that the power supply and air supply are switched OFF.
2. Remove the printed circuit board..
3. Disconnect the two leads from the pressure switch at the snap connections.
4. Unscrew the pressure switch.
5. Refit new pressure switch, remaking the joint with pipe thread tape or compound.
6. Remake cable connections.
7. Replace the printed circuit board.
8. Check air pressure is 1 bar (15 p.s.i.). If pressure switch failure was due to excess air pressure being supplied to the OMD, reset the air regulator, refer to COMMISSIONING.

LIGHT SOURCE

See Figure 9c.

1. Make sure that the power supply is switched OFF.

2. Disconnect the two leads from the light source assembly at the screw receptacles on the printed circuit board (Connector F).

3. Unscrew the light source housing from the end plate with the aid of a spanner over the large hexagon nut (27 mm across the flats), do NOT remove end plate.

4. Provided it is in good condition, retain the 0-ring fitted to the groove of the light source housing.

5. Remove the two lock-outs and washer from the light source assemble, remove and fit a replacement, make sure that the washer is correctly fitted under the locknuts which should be torqued to between 1.30 and 1.40 Nm.

6. Refit the 0-ring if retained from step (4) or fit a new 0-ring to the groove of the light source housing.

7. Refit light source housing to the end plate and tighten to a torque of between 10.3 and 11.4 Nm.

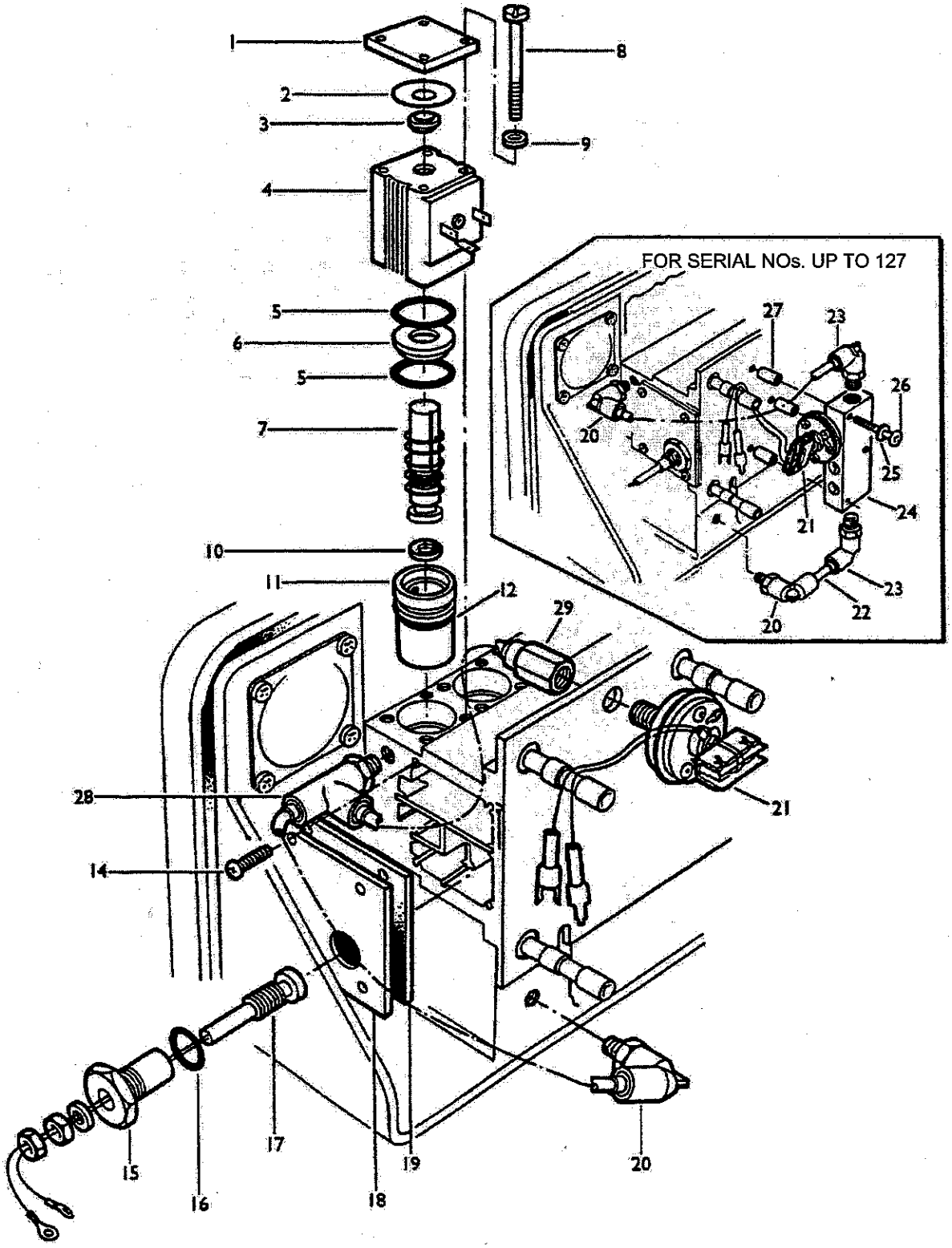


Figure 9c Lamp and Air Valve solenoid Assembly

Key No.	Description	Part Number	No. Off per Set
1	Solenoid Cap	31571-101	1
2	Belleville Washer	23723-055	1
3	Solenoid Button	33111-103	1
4	Solenoid (see Note)	27481-953	1
5	0-ring	25124-317	2
6	Locating Spigot	32617-403	1
7	Air Valve Assembly	45625-130	1
8	Screw M4 x 63	27481-951	4
9	Washer Spring	21175-065	4
10	Washer	31421-804	1
11	Air Chamber	33813-402	1
12	Air Chamber 0-ring	25126-040	1
14	Screw M3 x 12	21833-025	4
15	Light Source Housing	32777-402	1
16	0-ring	25126-014	1
17	Light Source	45626-120	1
18	End Plate	35331-107	1
19	Gasket	35311-711	1
20	Elbow 1/8	25466-025	2
21	Pressure Switch	45625-131	1
22	Nylon Pipe	18272-024	AR
23	Elbow 1/4	25466-026	2
24	Manifold	35154-403	1
25	Washer M5	21173-008	3
26	Screw M5 x 40	21833-167	3
27	Spacer	31612-419	3
28	Tee	25466-101	1
29	Female Adaptor	25466-902	1

>> NOTE *Solenoid and valve supplied as matched assemblies.*

PHOTO-CELL

See Figure 9d.

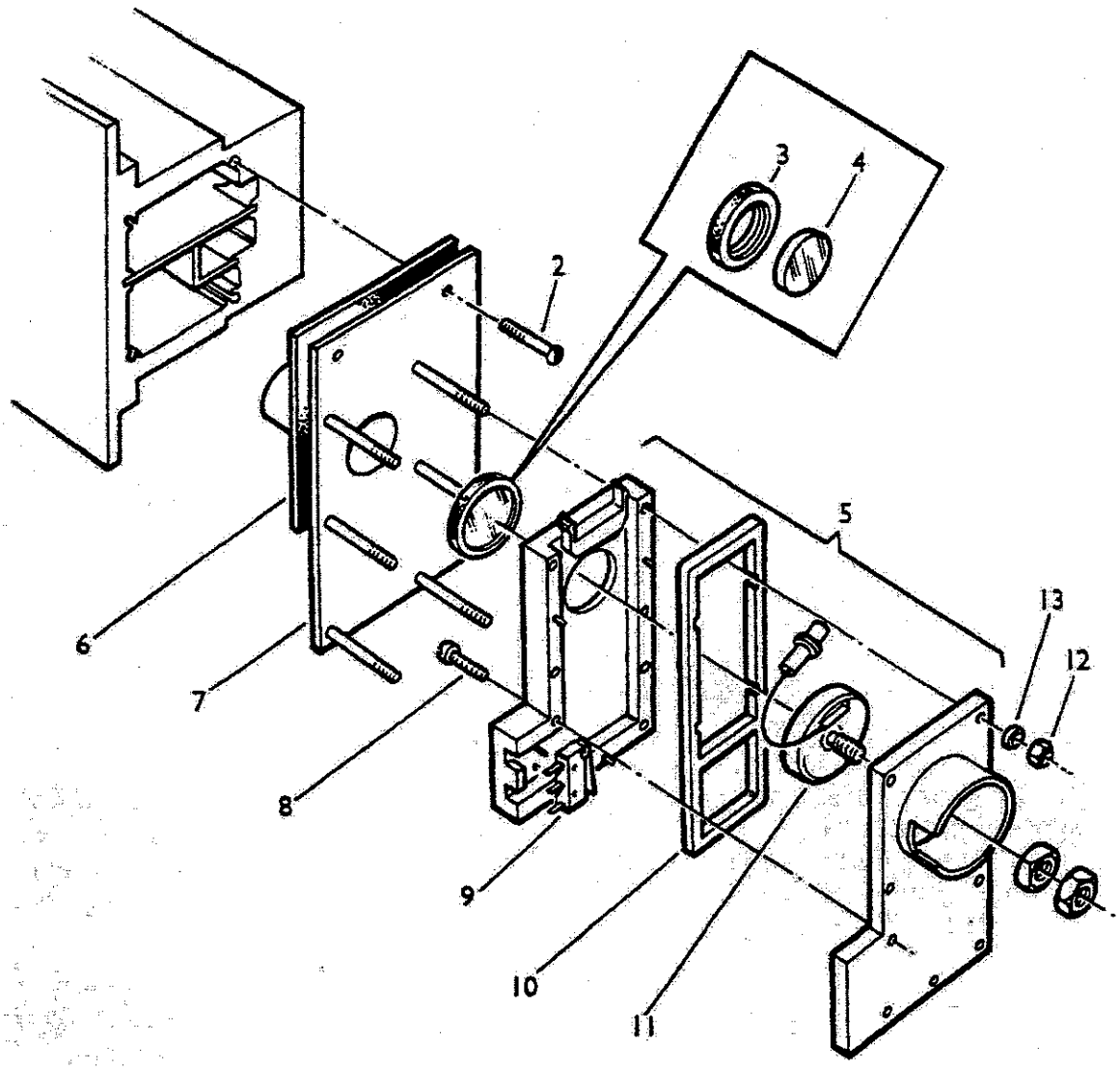
1. Make sure that the power supply is switched OFF.

2. Disconnect the two leads from the photo-cell housing assembly, one at the snap connector and the other after unscrewing the outer nut from the centre stud. Remove the two small cable tags at the base of the assembly.

3. Remove the six M3 nuts and plain washers securing the photo-cell housing. Withdraw housing from studs.

4. Remove the two screws, now exposed, at the rear of the housing, separate the housing and remove the faulty photo-cell after removing the nut and washer from the centre stud.

5. Fit the new photo-cell and re-assemble in the reverse order. Tighten the six M3 nuts to a torque of between 0.74 and 0.82 Nm. First tighten the nut on the photo-cell stud to between 1.0 and 1.4 Nm. Refit the two leads, one to the snap connector and the other over the photo-cell stud and tighten the second nut to between 1.0 and 1.4 Nm. Refit the two cable tags at the base of the housing.



Key No.	Description	Part Number	No. Off per Set
2	Screw M3 x 12	21833-025	4
3	Retainer	38553-702	1
4	Window	31111-804	1
5	Photo-cell Housing Assembly	45626-122	1
6	Gasket	35311-711	1
7	End Plate	45626-117	1
8	Screw, self-tap, 6 x 5/8	21258-026	2
9	Microswitch	27483-101	1
10	Simulation Housing Assembly	45627-105	1
11	Photo-cell Assembly	45626-112	1
12	Nut, Full M3	21883-004	6
13	Washer Crinkle M3	21176-303	6

Figure 9d Photo-cell Assembly

POWER SUPPLY UNIT

See Figure 9e.

The power supply unit should be removed from the main frame casting as follows:

1. Make sure that the power supply is switched OFF.

2. Disconnect all input and output connections from the terminals at the front of the power supply unit.

3. Remove the two screws from the base of the power supply unit and then remove the unit by carefully prising it off, as it is secured with an adhesive.

4. On fitting the new power supply, use an epoxy resin adhesive to secure the unit in position, refit the two screws to hold the unit in position while the adhesive is setting.

5. Remake input and output connections.

MAIN TRANSFORMER (Toroid)

See Figure 9e.

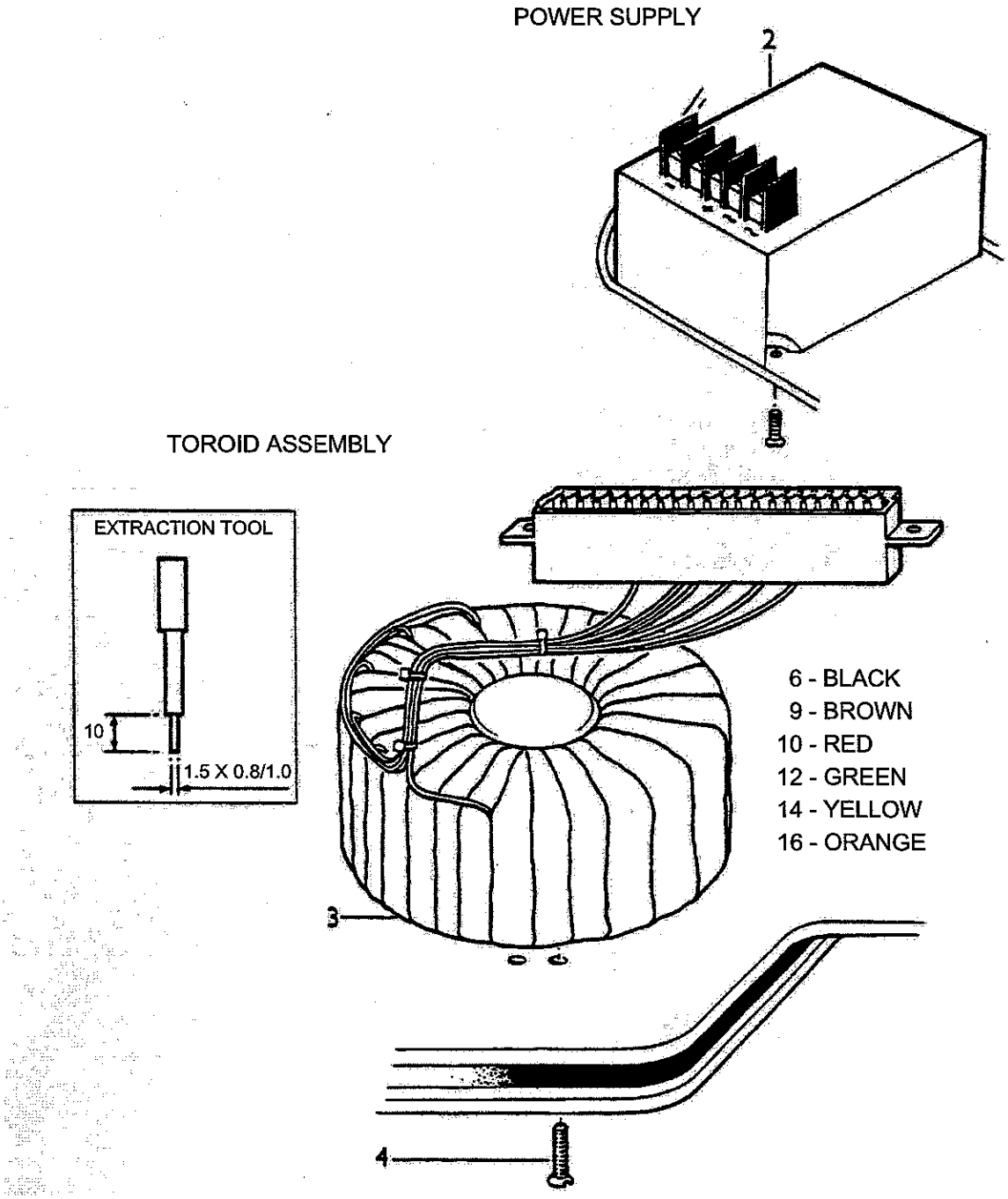
1. Make sure that the power supply is switched OFF.

2. Remove the power supply selection board.

3. Remove the six leads from the transformer at the power supply selection socket. Insert the extractor tool into the small slot inside the connector between the selected socket and the connector wall. This will release the locking tag on the socket which may then be removed by gently pulling on the cable. Remove the two cross-headed screws securing the transformer to the casting of the OMD. Remove the transformer.

4. Fit the new transformer in the reverse order taking care to fit the transformer leads into the correct positions in the power supply selection board socket. See Figure 9e for the correct coloured wire locations in the socket.

5. Refit the power supply selection board after checking the power supply, see Figure 7d.



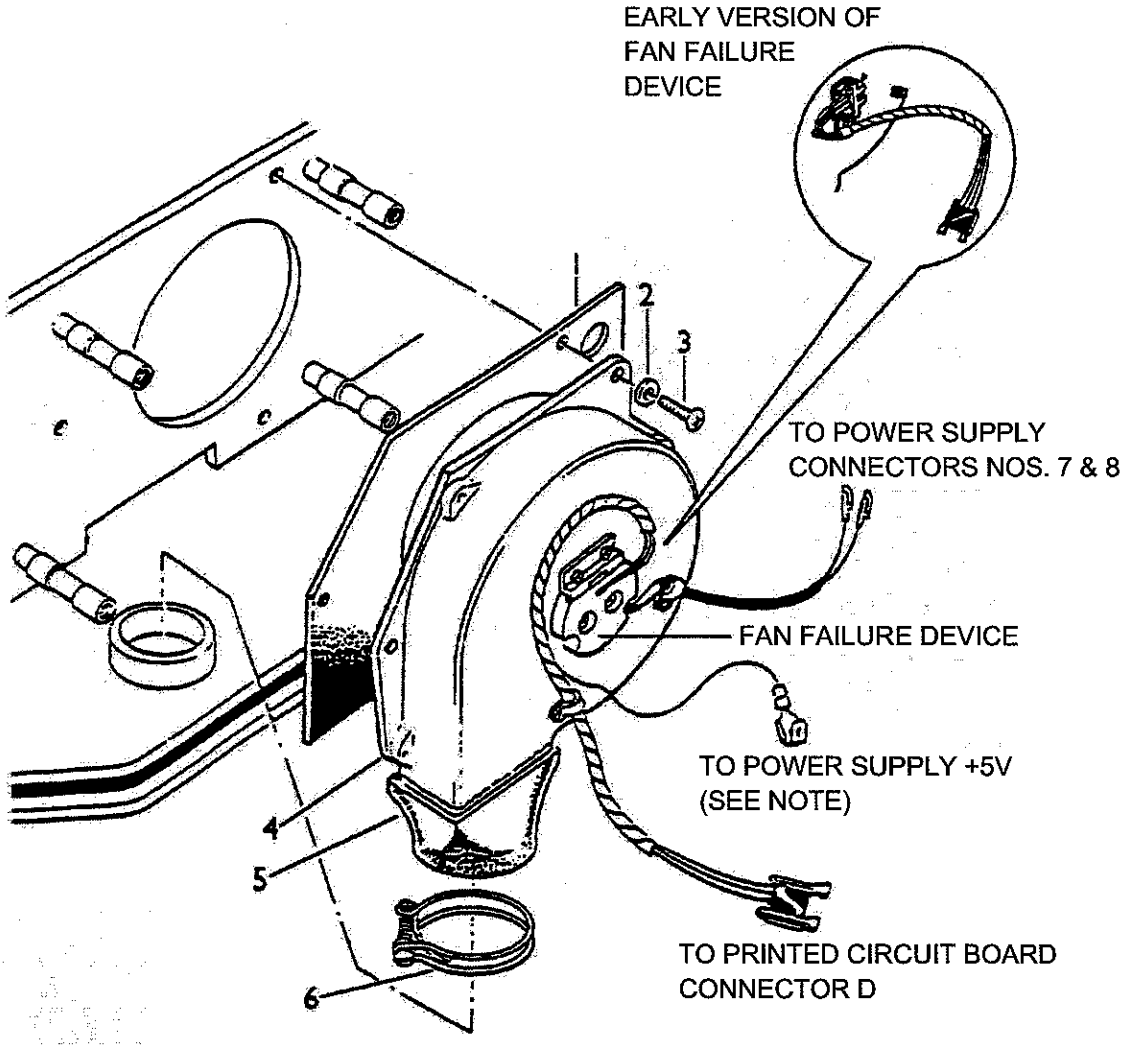
Key No.	Description	Part Number	No. Off per Set
2	Power Supply	45626-113	1
3	Toroid Assembly	44211-115	1
4	Screw M4 x 20	21833-048	2

Figure 9e Power Supply and Toroid Assembly

FAN WITH FAN-FAILURE DEVICE

See Figure 9f.

1. Make sure that the power supply is switched OFF.
2. Remove the printed circuit and the power selection boards.
3. Remove the brown and blue a.c. mains leads from the power supply selection socket, refer to MANS TRANSFORMER step 3.
4. Remove the p-clip securing the lead to the chassis.
5. Remove the wire hose clip by releasing the securing screw.
6. Remove the three cross-headed screws securing the fan housing.
7. Remove the fan the with fan-failure device from the OMD.
8. Fit the new fan assembly complete with the fan-failure device in the reverse order, making sure that the fan is correctly fitted over the rubber gasket. Make sure that the legs of the wire hose clip are to the rear of the unit or they will foul the printed circuit board when it is refitted. The fan-failure device cannot be supplied separately.
9. Refit the power supply selection and printed circuit boards.



Key No.	Description	No. Off Part Number	per Set
1	Gasket	35411-709	1
2	Washer Plain M4	21173-007	3
3	Screw M4 x 8	21833-043	3
4	Fan Assembly	44726-106	1
5	Fan Boot	38531-761	1
6	Clip	25812-199	1

>> NOTE *To fit this cable to the power supply:*

1. *On the power supply, remove the cable from the + ve tag.*
2. *Connect the red cable from the fan-failure device to the + ve connection on the power supply.*
3. *Refit the cable, removed in step 1, to the red cable connector fitted to the + ve tag on the power supply.*

Figure 9f Fan Assembly

AIR REGULATOR/FILTER

See Figure 9g.

1. Make sure that the air supply is switched OFF.

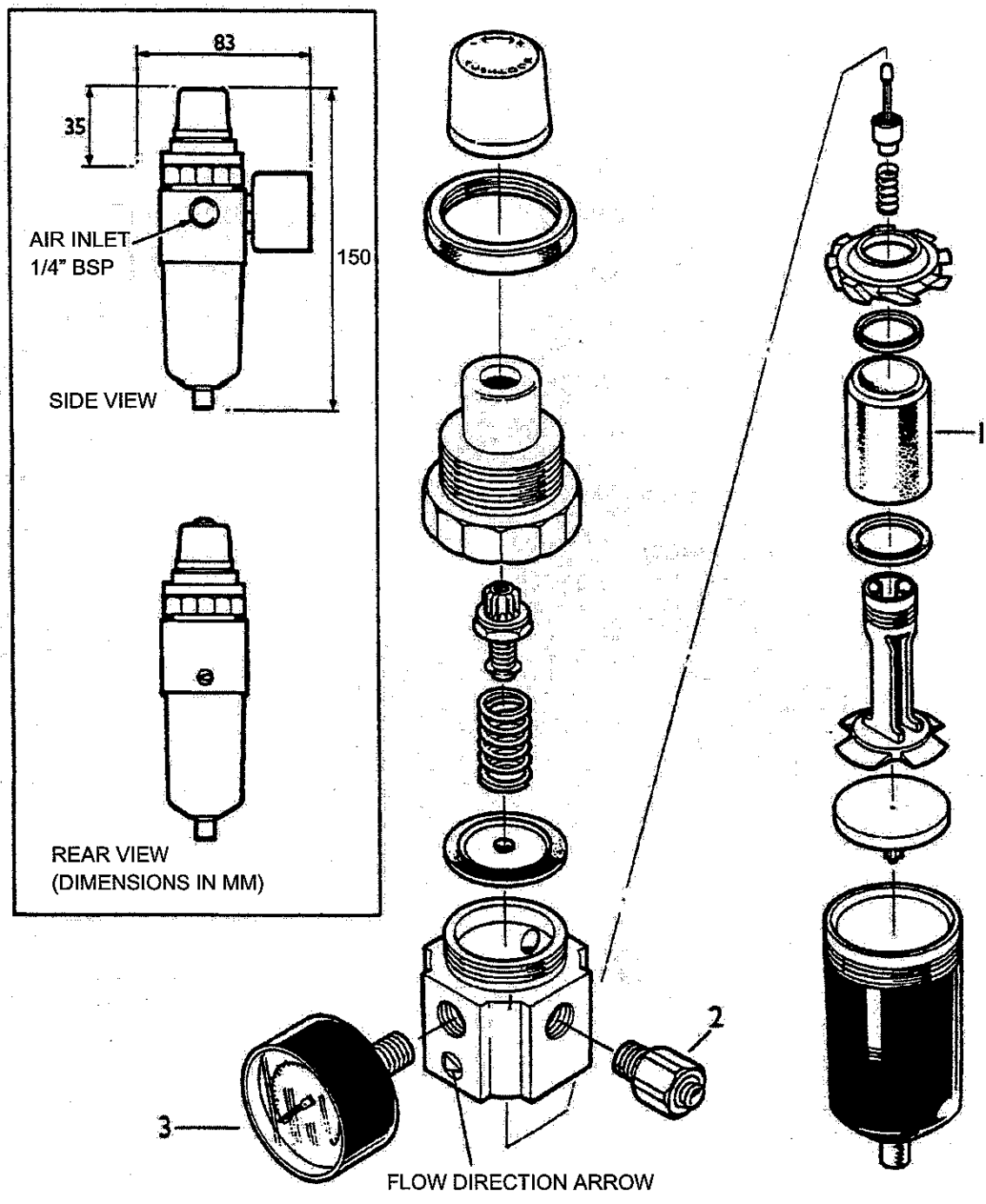
2. Unscrew the metal bowl of the filter.

CAUTION

Do not use carbon tetrachloride, trichlorethylene, thinners, acetone or similar solvents.

3. Clean or replace the filter element as necessary. Clean parts with methanol. After cleaning blow out parts with compressed air.

4. Refit in the reverse order, filter bowl to be hand tightened only.



Key No.	Description	Part Number	No. Off per Set
1	Filter Element	24124-202	1
2	Taper Male Stud	24124-204	2
3	Pressure Gauge	B4112-002	1

Figure 9g Air Regulator/Filter

SPARES PACK NO. 1

Part No. 53569-107

Consisting of:

No.	Description	Part Number
1	Printed Circuit Board Assembly	44728-130
1	Solenoid Assembly	27481-953
1	Sample Valve Assembly	45625-155
1	Photo-cell Assembly	45626-112
1	Light Source	45626-120
6	Fuse 1 Amp, anti-surge, 20 mm	27411-408
1	0-ring	25124-317
1	Air Valve Assembly	45625-130
1	Pressure Switch	45625-131

SPARES PACK NO. 2

Part No. 53569-108

Consisting of:

No.	Description	Part Number
1	Photo-cell Assembly	45626-112
1	Light Source	45626-120
6	Fuse 1 Amp, anti-surge, 20 mm	27411-408

SPARE PARTS LIST

Fig. No.	Key. No.	Description	Part Number	No. Off per Set
9c	22	Nylon Pipe	18272-024	AR
9d	13	Washer M3 Crinkle	21173-303	6
9f	2	Washer M4 Plain	21173-007	3
9c	25	Washer M5 Plain	21173-008	3
9b, c	6, 9	Washer Spring	21175-065	44
9d	8	Screw self-tap, 6 x 5/8	21258-026	2
9c, d	14, 2	Screw M3 x 12	21833-025	8
9f	3	Screw M4 x 8	21833-043	3
9e	4	Screw M4 x 20	21833-048	2
9c	26	Screw M5 x 40	21833-167	3
9d	12	Nut Full M3	21883-004	6
1	12	Fastener	22112-625	2
9b, c	2,2	Belleville Washer	23723-055	11
9g	2	Taper Male Stud	24124-204	1
9b, c	7, 5	0-ring	25124-317	12
9c	16	0-ring	25126-014	1
9c	12	0-ring	25126-040	1
9c	20	Elbow 1/8	25466-025	2
9c	23	Elbow 1/4	25466-026	2
9c	28	Tee	25466-101	1
9c	29	Female Adaptor	25466-902	1
9f	6	Hose Clip	25812-199	1
1	9	Fuse Holder	27415-003	1
1	9	Fuse 1 Amp, anti-surge, 20 mm	27411-408	1
1	9	Fuse Holder Boot	27415-901	1
9b, c	4, 8	Screw M4 x 63	27481-951	44
9b, c	5, 4	Solenoid	27481-953	11
9d	9	Microswitch	27483-101	1
9d	4	Window	31111-804	1
9c	10	Washer Air Chamber	31421-804	1
9b, c	1, 1	Solenoid Cap	31571-101	11
9c	27	Spacer	31612-419	3
9b, c	8, 6	Locating Spigot	32617-403	11
9c	15	Light Source Housing	32777-402	1
9b, c	3, 3	Solenoid Button	33111-103	11
9c	11	Air Chamber	33813-402	1
9c	24	Manifold	35154-403	1
1	14	Window	35158-803	1
9c, d	19, 6	End Plate Gasket	35311-711	2
9c	18	End Plate	35331-107	1
9f	1	Fan Gasket	35411-709	1

SPARE PARTS LIST (continued)

Fig. No.	Key. No.	Description	Part Number	No. Off per Set
1	13	Cover Window/Switch	38521-766	1
9b	10	Buffer	38531-720	10
9f	5	Fan Boot	38531-761	1
1	16	Anti-vibration Mount (Top)	41143-401	2
1	16	Anti-vibration Mount (Boot)	38531-764	4
9d	3	Window Retainer	38553-702	1
1	4	Power Supply Selection Card	39832-704	1
9e	3	Toroid Assembly	44211-115	1
9f	4	Fan Assembly	44726-106	1
1	21	Loom A (Solenoid)	44727-120	1
1	17	Loom B (Power Supply)	44727-121	1
1	3	Loom C (Alarm Output)	D4727-001	1
1	7	Loom E (Photo-cell)	44727-124	1
1	10	Power Input Cable	44727-125	1
1	11	Printed Circuit Board Assembly	44728-130	1
9c	7	Air Valve Assembly	45625-130	1
9c	21	Pressure Switch	45625-131	1
9b	9	Sample Valve Assembly	45625-155	10
9d	11	Photo-cell Assembly	45626-112	1
9e	2	Power Supply	45626-113	1
9d	7	End Plate Cuff Assembly	45626-117	1
9d	5	Photo-cell Housing Assembly	45626-122	1
9c	17	Light Source	45626-120	1
9d	10	Simulation Housing Assembly	45627-105	1
9g	3	Pressure Gauge	B4112-002	1
1	23	Mains Filter	B8681-002	1

ACCESSORIES

Description	Part Number
Air Regulator/Filter	24124-201
Air Filter Element	24124-202
Crankcase Fitting 3/4 inch BSP	25467-067 (see Note)
Flexible Hose Clip	25812-034
Sample Hose Clip	25812-037
Exhaust Hose Clip	25812-040
Blanking Cap	25815-314
Flexible Sample Hose 2.5 m	31941-708
Flexible Exhaust Hose 0.425 m	31941-709
Sample Hose 0.5 m	31941-710
Crankcase Elbow	34311-303 (see Note)

*>> **NOTE** These items are supplied together.*

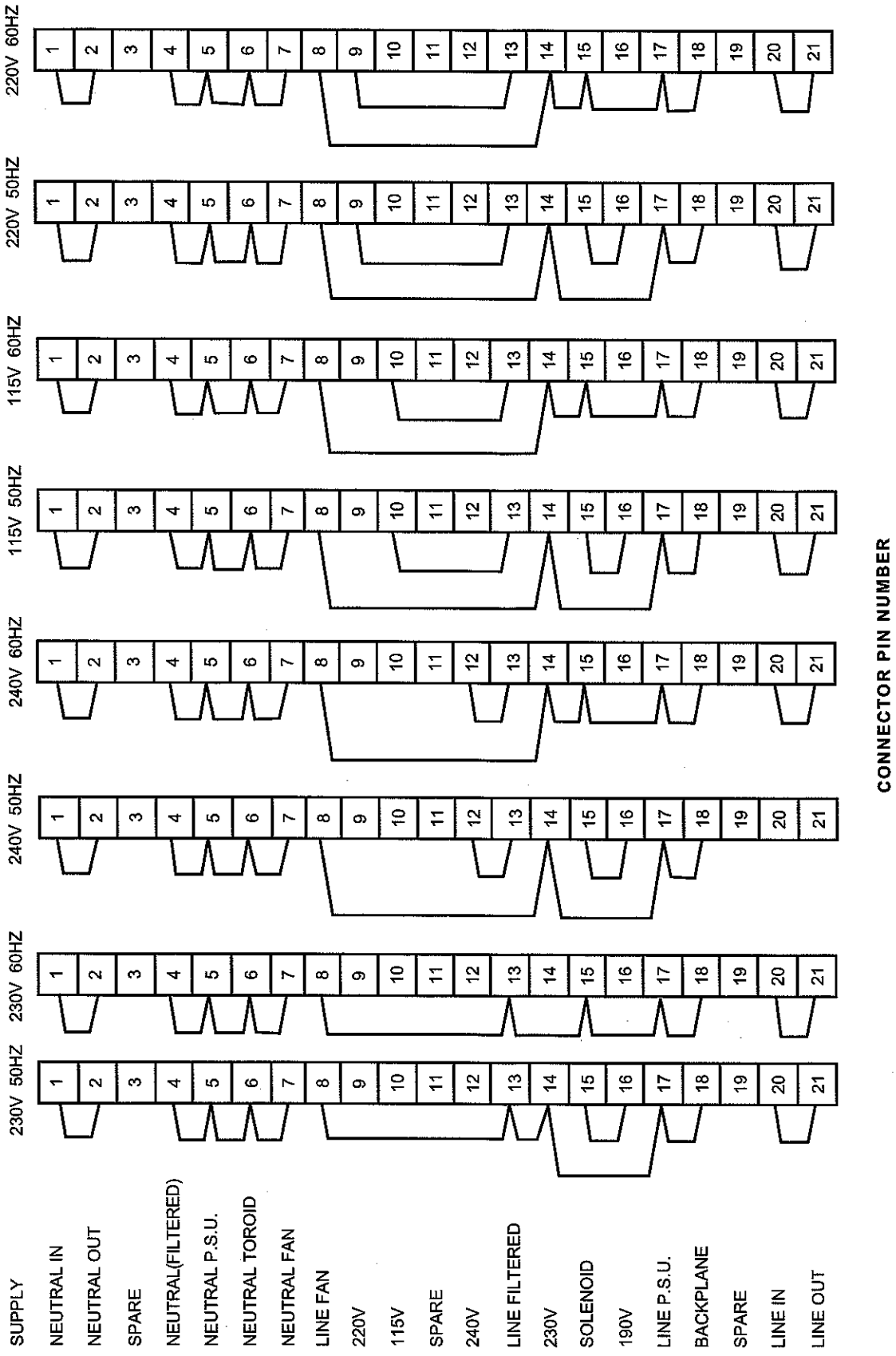


Figure 10 Connector Pin Numbers

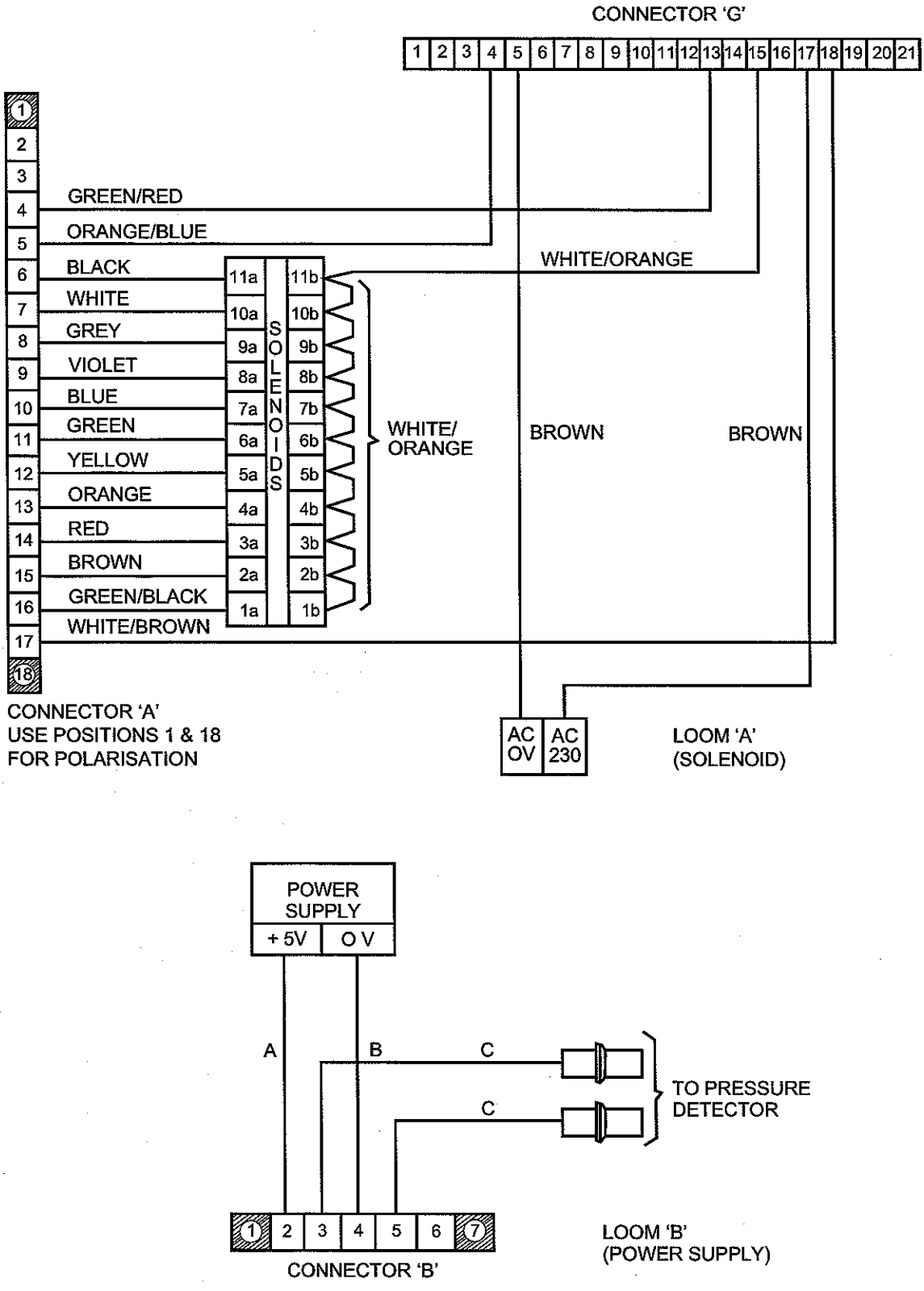
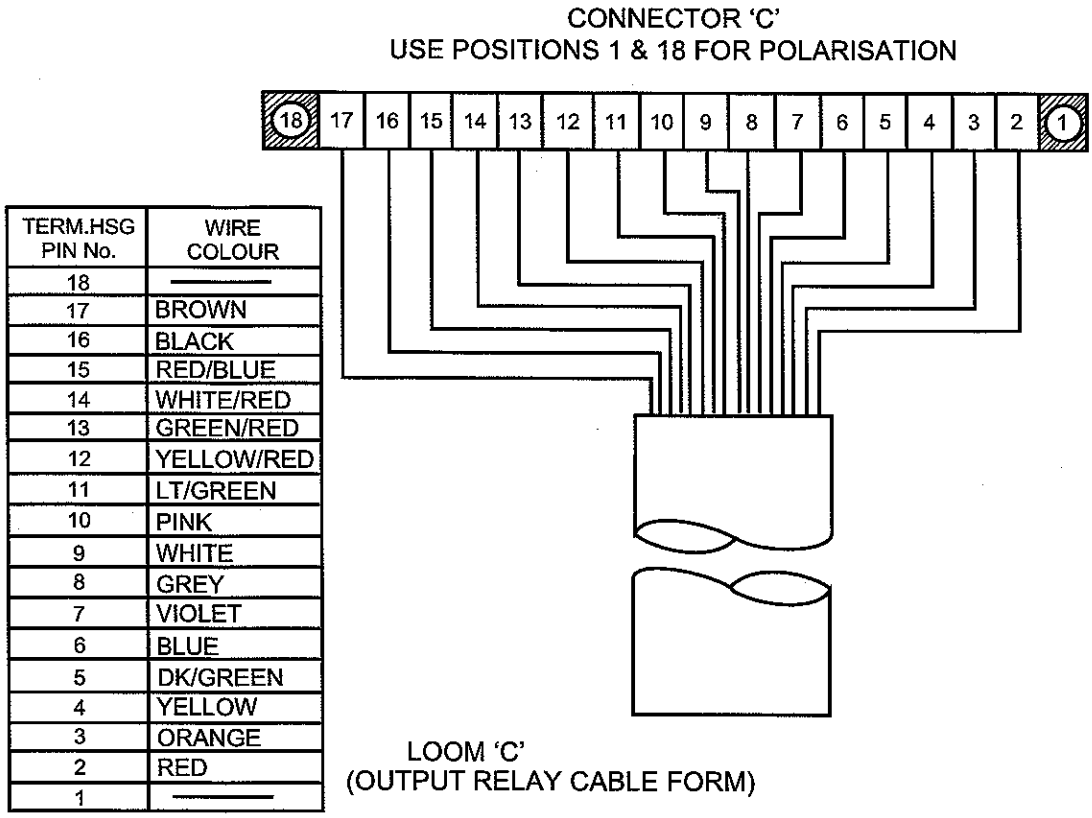


Figure 11a looms A and B schematics



TERM.HSG PIN No.	WIRE COLOUR
18	——
17	BROWN
16	BLACK
15	RED/BLUE
14	WHITE/RED
13	GREEN/RED
12	YELLOW/RED
11	LT/GREEN
10	PINK
9	WHITE
8	GREY
7	VIOLET
6	BLUE
5	DK/GREEN
4	YELLOW
3	ORANGE
2	RED
1	——

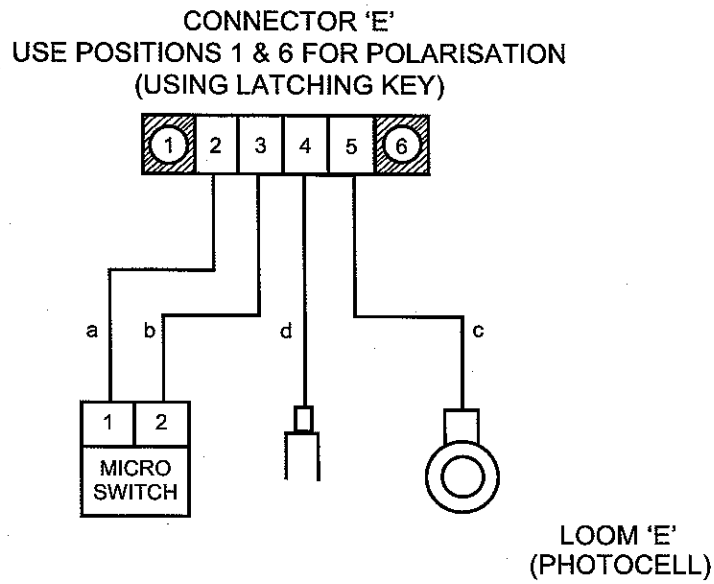


Figure 11b Looms C and E Schematics

PRINCIPAL PART NUMBERS

Oil Mist Detector Mark 5 with Language Label	Part Number
English	53561-221
French	53561-222
German	53561-223
Spanish	53561-224
Portuguese	53561-225
Russian	53561-226
Chinese	53561-228

Manual - Language	Part Number
English	59811-141
French	59811-142
German	59811-143
Spanish	59811-144
Russian	59811-146
Chinese	59811-148