Instruction Manual

IM/7835_13

Hydrazine Monitor

7835

ABB

The Company

EN ISO 9001:2000

Cert. No. Q 05907

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

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The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

Stonehouse, U.K.

0255

The NAMAS Calibration Laboratory No. 0255 is just one of the ten flow calibration plants operated by the Company, and is indicative of our dedication to quality and accuracy.

Electrical Safety

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use'. If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

Symbols

One or more of the following symbols may appear on the equipment labelling:

	**Warning** – Refer to the manual for instructions
	**Caution** – Risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal

	Direct current supply only
	Alternating current supply only
	Both direct and alternating current supply
	The equipment is protected through double insulation

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

CONTENTS

1 INTRODUCTION 2
1.1 General 2
1.2 Sensor Unit 2
1.3 Transmitter Unit 2

2 INSTALLATION 3
2.1 Location and Fixing of Units 3
2.1.1 Sensor Unit 3
2.1.2 Transmitter Units 3
2.2 Sample Requirements 5
2.3 External Pipe Connections 5
2.3.1 Inlet 5
2.3.2 Drain 6
2.4 Electrical Interconnections 6
2.4.1 Sensor Unit 6
2.4.2 The CE Approved Transmitter Unit 6
2.4.3 Transmitter Unit 9
2.5 Ancillary Equipment 11
2.5.1 Recorders 11
2.5.2 Range Indication 11
2.6 Start-up 12

3 OPERATION 13
3.1 Sensor Unit 13
3.2 Setting Flowrates 13
3.2.1 Standard Solution Flowrate 13
3.2.2 Sample Flowrate 14
3.3 Transmitter Unit 14
3.3.1 Description 14
3.3.2 Printed Circuit Board Settings 16
3.3.3 Sample Temperature 17

4 CALIBRATION PROCEDURE 18

5 MAINTENANCE 19
5.1 Chemical Solutions 19
5.1.1 Reagent Solution - 5M (20% w/v) Sodium Hydroxide 19
5.1.2 Standard Solution 19
5.2 Scheduled Servicing 19
5.2.1 Weekly 19
5.2.2 Six-Monthly 19
5.2.3 Yearly 20
5.3 Shut Down Procedures 21
5.3.1 Sensor Unit 21
5.3.2 Transmitter Unit 21
5.4 Unscheduled Servicing 21
5.4.1 Malfunction of the Monitor 21
5.4.2 Calibration Fail Alarm 22
5.4.3 Cleaning the Platinum Anode and Sensor Ceramic 22
5.4.4 Sensor Check 23
5.4.5 Refurbishing the sensor 23
5.4.6 Simple Electronic Check 24
5.4.7 Replacing the Digital Board 24

6 SPARES LIST 25
6.1 Refurbishment Spares. 25
6.2 Strategic Spares. 25

7 SPECIFICATION 26

APPENDIX 27
A.1 Transmitter Unit 27
A1.1 Previous Type Digital Circuit Board 27
A.2 Shut - Down Procedure 27
A.2.1 Transmitter Unit 27
A.3 Spares List 27

1 INTRODUCTION

1.1 General

The Model 7835 is a microprocessor controlled on-line monitor for measuring hydrazine in boiler feedwater. Two ranges are available: 0 to 99.9 and 0 to 999 $\mu g\,kg^{-1}$; range change is automatic.

Two types of instrument are available: a CE approved version and a version without CE approval.

The CE approved version includes the addition of a user's terminal box on the side of the transmitter unit, containing electrical filtering on all inputs and outputs.

The monitors consist of two discrete units, the electronics control section, (transmitter unit) and the liquid handling section, (sensor unit). The units can be mounted side by side or up to 100 meters (325 feet) apart.

1.2 Sensor Unit

The liquid handling section features a constant head unit feeding sample to a sensor which can be refurbished. Reagent solution to raise the pH of the sample is added via a microporous disc. During the calibration sequence a solenoid valve blocks the flow of sample which diverts to the drain, and allows flow of the standard solution. Reagent and standard solutions are held in containers with transparent ends, mounted inside the sensor unit case.

1.3 Transmitter Unit

The microprocessor electronics section performs three main functions: it interprets and displays a reading of hydrazine concentration received from the sensor unit, controls the calibration sequence, and provides the various outputs to remote equipment. The seven segment LED type display indicates the level of hydrazine and also provides information on the operating mode of the instrument, informing the operator when calibration mode is active. Two concentration alarm points are available, which are set by the operation of push-buttons on the monitor front panel. The desired alarm values are displayed when the respective push-button is depressed. The customer programmable information is retained by means of an internal rechargeable battery for up to 10 years. The electronics section is chassis mounted in the transmitter unit case.

On the left hand side of the CE approved transmitter is a terminal box fitted with cable glands for the power input cable, the cable to the sensor unit and cables for alarm signals and other signal outputs. The terminal box lid is secured by six screws.

The transmitter unit, without CE approval, has a provided cable gland fitted to the gland plate on the left hand side of the case for the cable to the sensor unit. The gland plate is also drilled with five other holes which may be enlarged to accept customer's cable glands suitable for the cables carrying the alarm signals and other signal outputs. The maximum gland size is PG21.

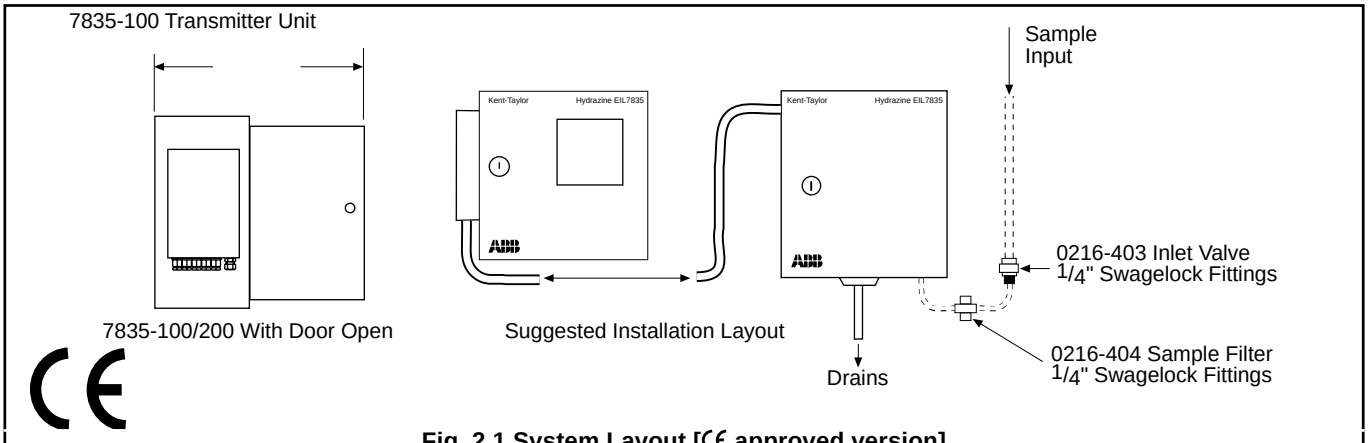


Fig. 2.1 System Layout [CE approved version]

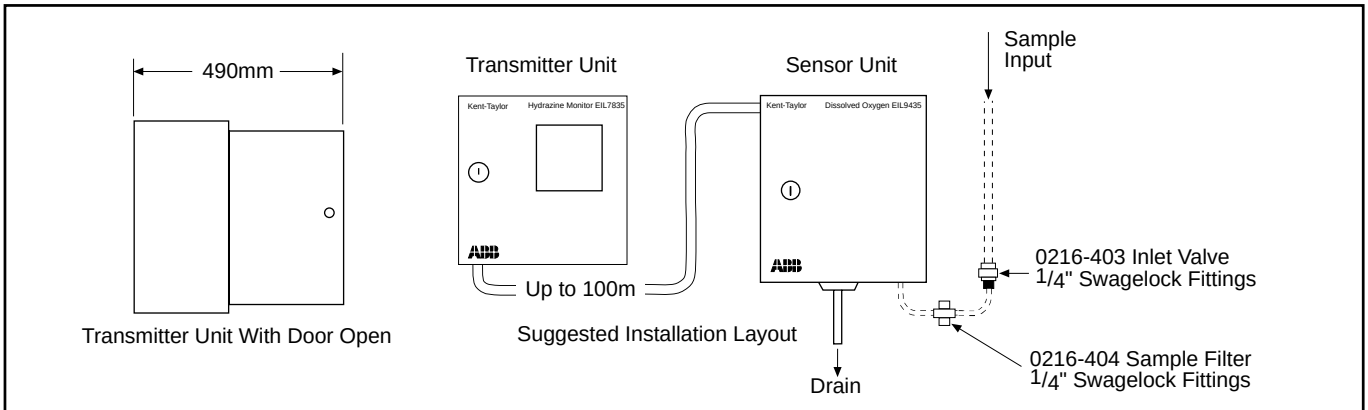


Fig. 2.2 System Layout [Version without CE approval]

2 INSTALLATION

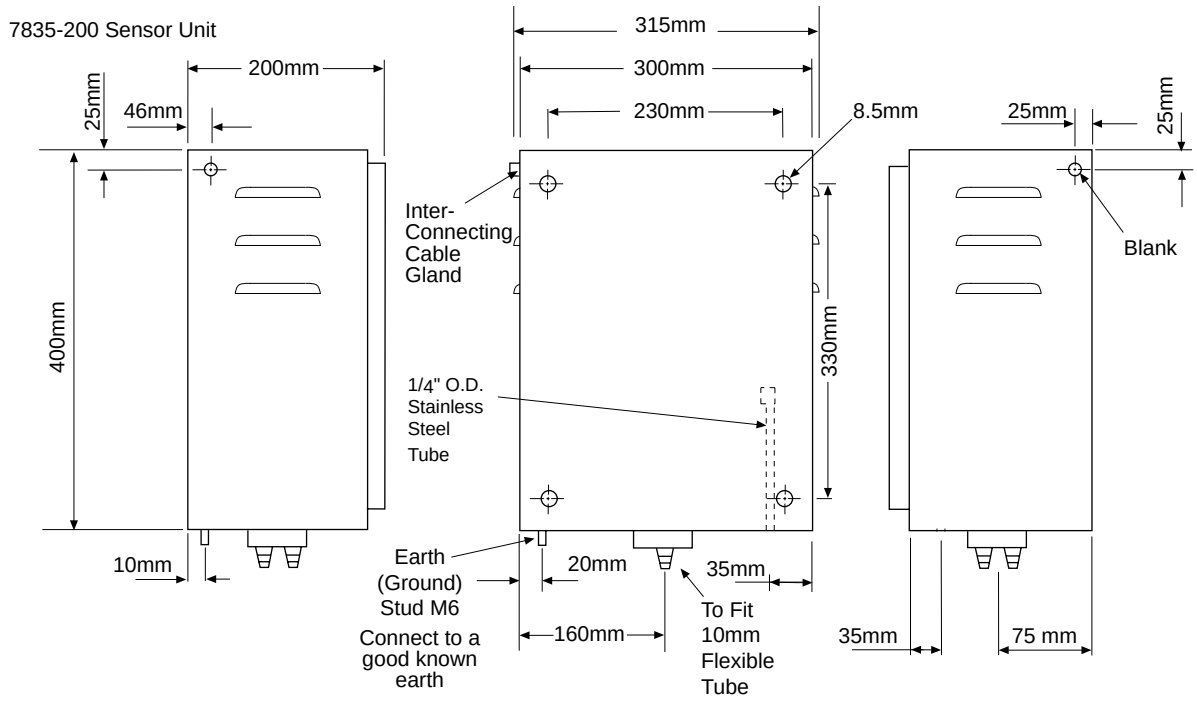


Fig. 2.3 Sensor Unit Dimension and Installation Detail

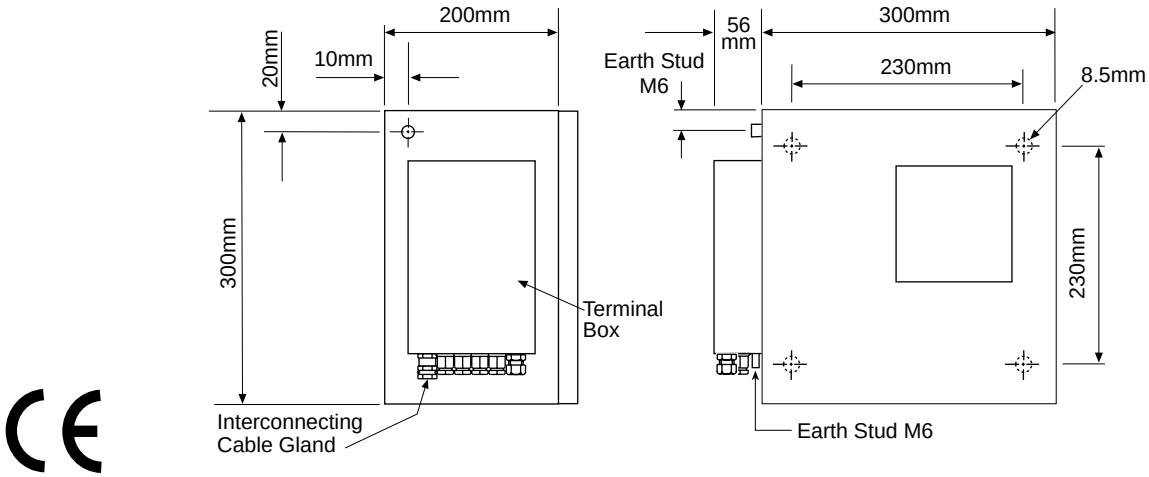


Fig. 2.4 Transmitter Unit Dimension and Installation Detail [CE Approved Version]

2.1 Location and Fixing of Units (Fig. 2.1 and 2.2)

Both units should be mounted in a clean, vibration free situation, avoiding direct radiant heat, sunlight and draughts. Areas likely to have contaminating gases, particularly chlorine, should be avoided.

The sensor unit should be mounted not more than 10 meters (30 feet) from any associated sample cooler – see Section 2.2. The transmitter may be mounted alongside or up to 100 meters (325 feet) away from the sensor unit.

The holes for wall mounting both units are suitable for 8 mm diameter fasteners and are located as shown in Fig. 2.1. Sufficient space must be left in front of the cases for access, and to the side for making cable connections to the transmitters.

2.1.1 Sensor Unit

The sensor unit consists of a metal case with the pipework carrying the sample mounted on a panel bolted to the back of the case with four M6 captive bolts. Wall mounting is by four 8 mm diameter fasteners on 330 x 230 mm centres – see Fig. 2.3). For access to case mounting holes release the panel at the captive bolts and ease it forwards.

2.1.2 Transmitter Units

The transmitter units consist of a metal case of similar construction to the sensor case, with a chassis unit supporting circuit boards and other electrical sub-assemblies. Wall mounting is by four 8 mm diameter fasteners on 230 x 230 mm centres – see Fig. 2.4 and Fig. 2.5.

…2 INSTALLATION

For access and fitting of the CE approved transmitter proceed as follows, and for the version without CE approval, refer to the instructions in Fig. 2.5:

a) Unlock the door and open fully.

b) To release the escutcheon plate, remove all seventeen screws, and with a small coin or similar tool, turn the four black fasteners by 1/4 turn in either direction.

c) Hold the escutcheon plate with two fingers through the slot at the left side. Ease the plate forward over the range switch knob.

d) Remove the safety earth (ground) bonding leads attached to the metal case.

e) Release the captive screws securing the chassis assembly to the back of the case and ease the chassis forwards.

f) After recording the position of the connection blocks on the circuit boards – see Fig. 2.8, remove the connection blocks from the analog board by applying force outwards from the face of the analog board. To remove the connector from the PSU board, slide the connector sideways towards the vertical edge of the board.

g) Loosen the associated screws to release the three wires from the mains input connector on the PSU Board – see Fig. 2.8.

h) Remove chassis completely and fix case as required.

Note. Before fitting the chassis unit, check that the voltage selector is set to the correct value before connecting the unit to the supply, and refer to Section 2.6 for procedures required before Start-up.

Caution. When replacing the connection blocks, care should be taken to ensure that the blocks are aligned correctly to cover all the associated connecting pins.

i) Offer the chassis to the case and wire the mains connection. Fit the connection blocks onto the circuit boards.

j) Fully replace the chassis unit, secure it with the captive screws, and replace the earth (ground) bonding leads.

k) Position the escutcheon plate and secure it with the four plastic fasteners. Fit all 17 screws.

For access to wall mounting holes remove the chassis unit as follows:

1. Unlock the door and open it fully.
2. To release the escutcheon plate, remove all the 17 screws, and with a small coin or similar tool, turn the four black fasteners 1/4 turn in either direction.
3. Hold the front panel with two fingers through the slot at the left side. Ease the front panel forward over the Range Switch knob.
4. Remove the safety earth (ground) bonding leads attached to the metal case.
5. Release the captive screws securing the chassis assembly to the back of the case and remove the chassis.

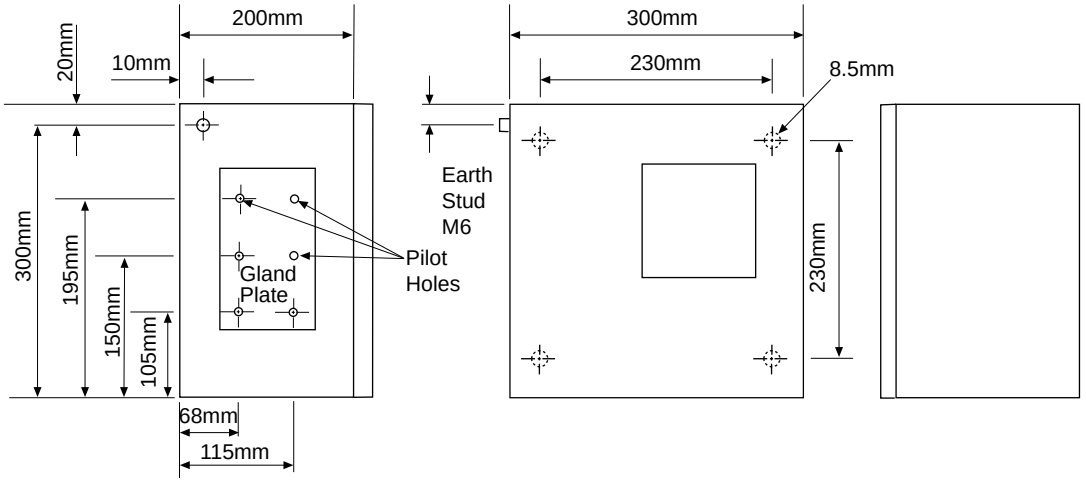


Fig. 2.5 Transmitter Unit Dimension and Installation detail [Version without CE approval]

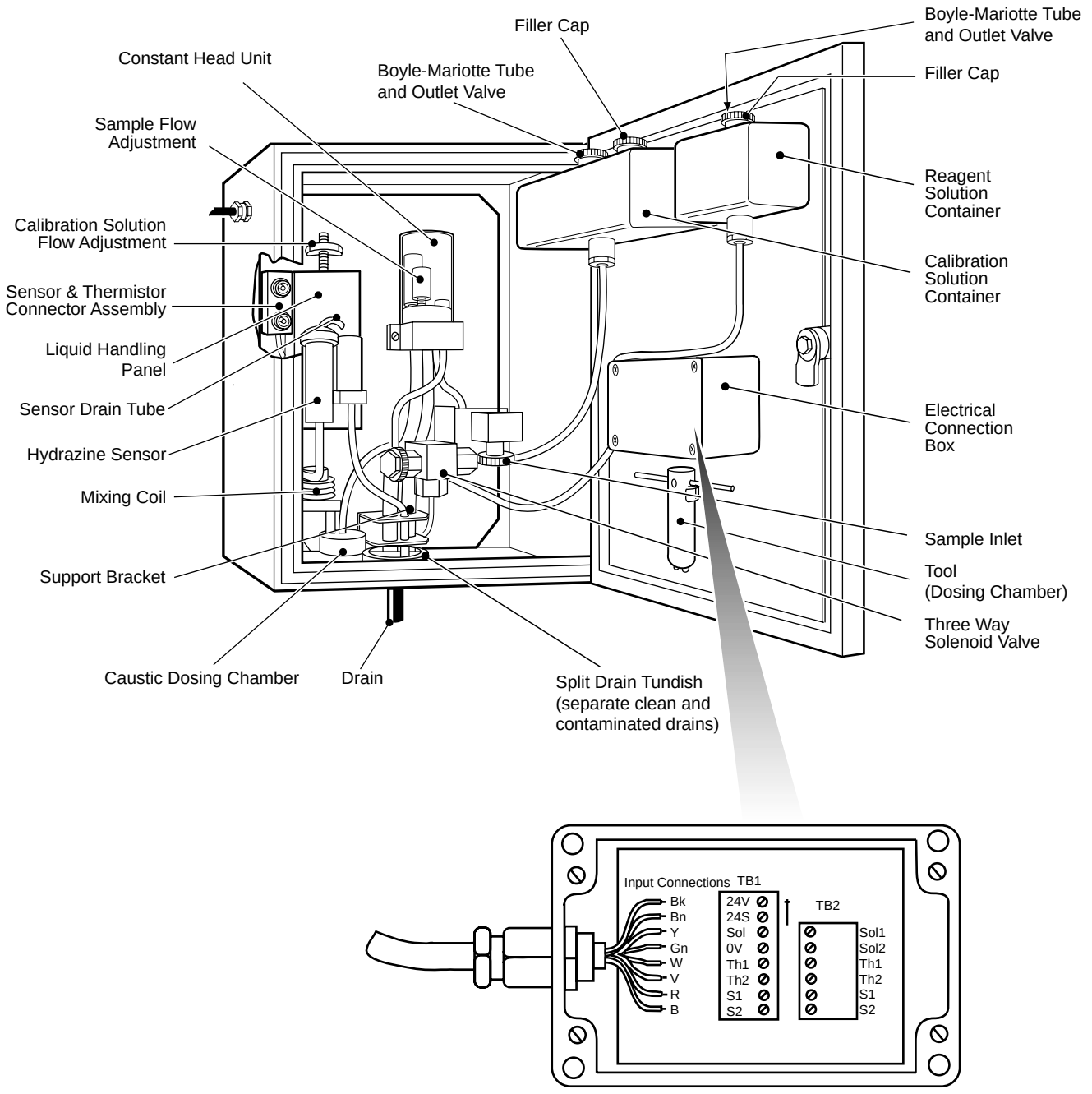


Fig. 2.6 Location of Items and Interconnections in the Sensor Unit

2.2 Sample Requirements

Warning. The maximum pressures and temperatures specified must not be exceeded.

Where pressure reducing equipment is being used, it is recommended that a pressure relief valve is installed between this and the sample inlet to the monitor.

The sample should be brought to the temperature and pressure suitable for measurement – see Section 7.
If necessary, use sample cooling and pressure reducing equipment. If particulate matter is present, such as oxides of iron, an in-line filter is essential. A suitable type is given in Section 6.

2.3 External Pipe Connections

2.3.1 Inlet

Sample should be connected to the sensor unit by means of suitable descaled stainless steel tube, 6.3 mm (1/4 in.) o.d. approximately. Connect this to the sample inlet coupling on the right hand side of the panel via the grommet in the floor of the case.

The inlet tubing should be of sufficient wall thickness to withstand the highest sample pressure and the pipe lengths should be kept short. The inlet pipe should be bent to a right angle outside the case to allow future removal of the liquid handling panel when required.

An isolator valve (not supplied) is necessary in the sample inlet line to the sensor unit.

2.3.2 Drain

The drain from the split tundish at the bottom of the sensor unit case consists of two stub pipe connections suitable for 10 mm ($^3/_8$ in.) bore plastic or rubber tubing. Clean water waste can be taken from one connection, and NaOH dosed waste from the other connection which can be used for pH checking, grab sample collection or directed to a contaminated-water drain.

2.4 Electrical Interconnections

Warning.

- Although certain instruments are fitted with internal fuse protection, a suitably rated external protection device, e.g. fuse or miniature circuit breaker, must also be fitted by the installer.

- Before making any connections, ensure that the power supply and high voltage power operated control circuits are switched off.

- This equipment operates on a.c. mains supply voltage electricity, suitable safety precautions must always be taken to avoid the possibility of electric shock.

2.4.1 Sensor Unit

The Cable Gland for connections within the sensor unit is situated at the top right hand side but may be transferred to the opposite side if this is more convenient – see Fig. 2.1.

A 2 metre length of 8-way overall screened cable is normally supplied for interconnecting the sensor and transmitter units; longer lengths may be ordered separately. The interconnecting cable is routed to a terminal block in a junction box on the inside of the case door – see Fig. 2.6.

Push one end of the cable through the cable gland in the sensor unit case and then the junction box, prepare the cable end and secure it to the terminal block as shown in Fig. 2.6 (note that the screening braid is cut back). Tighten the cable glands. If the gland in the case has been transferred to the left hand side, support the cable using the two cable ties provided.

Connections (see Fig. 2.6) are as follows:

TB1			**Colours**
Terminal	1	24V	Black
	2	24V Sense	Brown
	3	Solenoid Valve	Yellow
	4	0V	Green
	5	Thermistor 1	White
	6	Thermistor 2	Violet
	7	S1, +ve Sensor	Red
	8	S2, - ve Sensor	Blue

Earthing (Grounding)
A stud terminal is fixed to the bottom of the sensor unit for a bus-bar earth (ground) connection.

2.4.2 The CE Approved Transmitter Unit (Fig. 2.7)

To gain access to make the necessary connections remove the six screws from the terminal box lid on the side of the transmitter and remove the lid. Then:

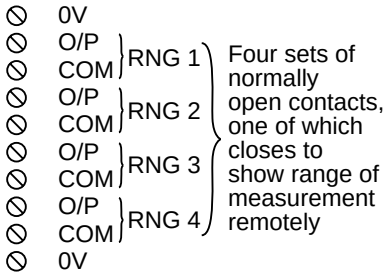
a) Cut the cable from the sensor unit, to a length to reach the transmitter easily to terminate on terminal block TB4 inside the terminal box via the metal cable gland.

b) Push the end of the cable through the metal gland in the base of the terminal box.

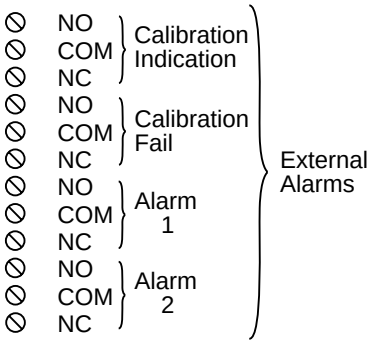
c) Noting that the screening braid terminates at the cable gland and is prepared as shown in Fig. 2.7, prepare the cable end and attach it to the terminal block TB4.

Pass the cables, necessary for the supply, output signals, alarms and remote function, through the plastic glands and connect the cables as follows:

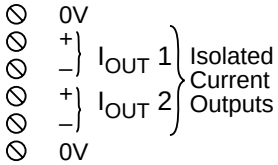
Range Relays (TB1)



Alarm Relays (TB2):



Current Outputs (TB3)



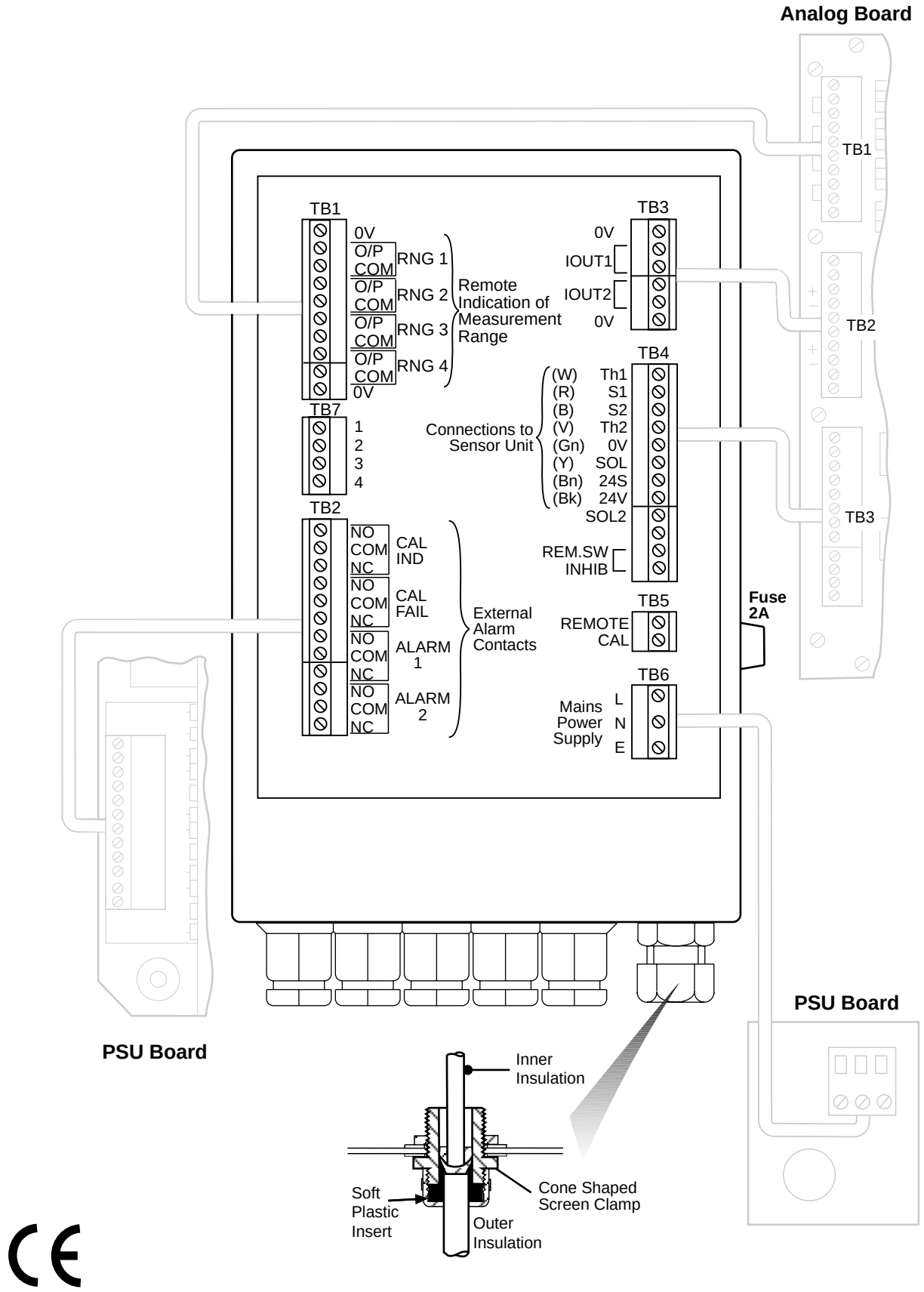


Fig. 2.7 Transmitter Unit Electrical Connections and Internal Interconnections

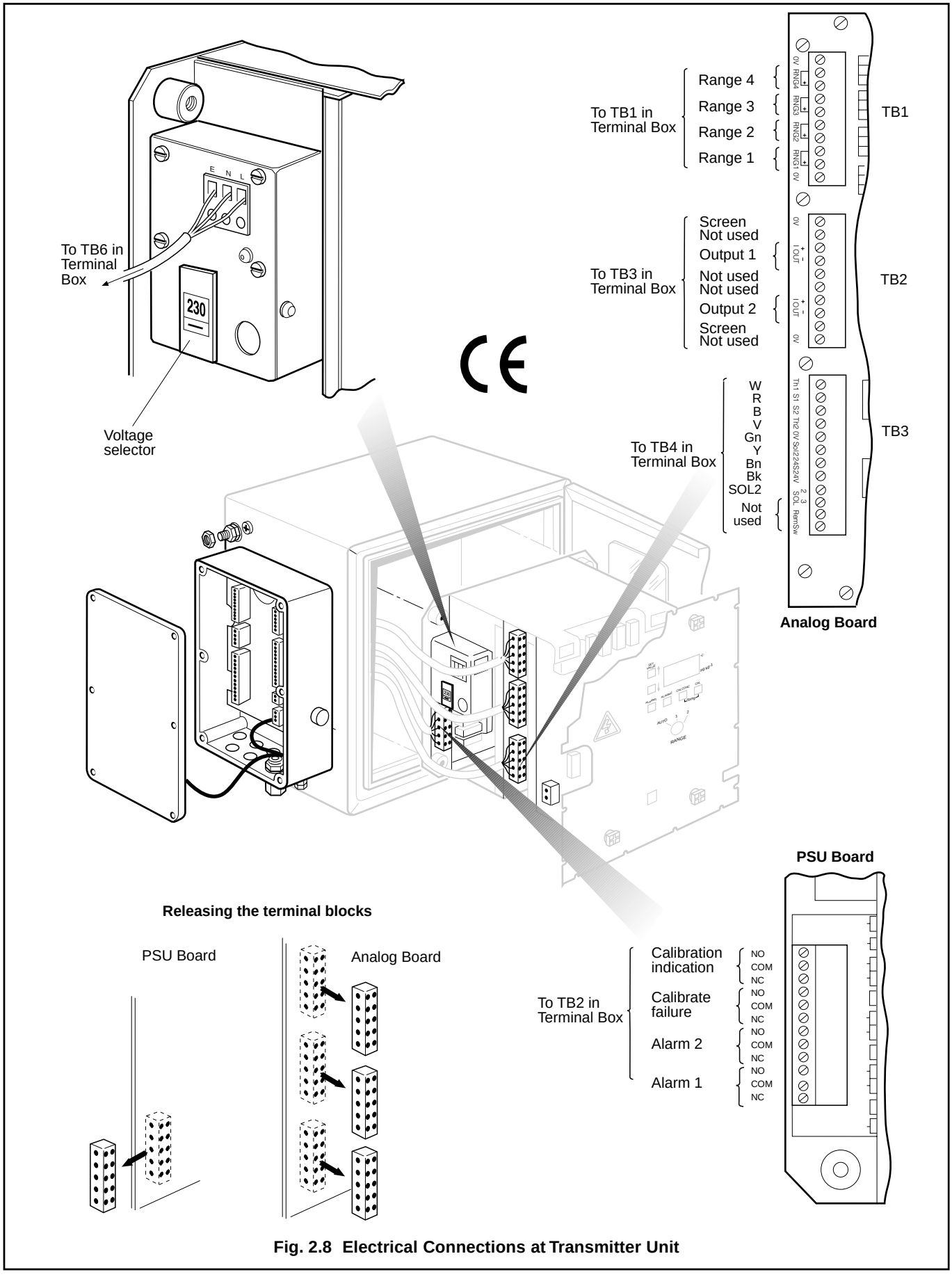


Fig. 2.8 Electrical Connections at Transmitter Unit

Sensor Unit (TB4)

⊘	Th1	(W)	Connections to Sensor Unit
⊘	S1	(R)	
⊘	S2	(B)	
⊘	Th2	(V)	
⊘	0V	(Gn)	
⊘	SOL	(Y)	
⊘	24S	(Bn)	
⊘	24V	(Bk)	
⊘	SOL2		
⊘	Not used		
⊘	Not used		
⊘	Not used		

(TB5)

⊘ ⊘ Not used

Power Supply (TB6)

⊘	L	Line	Mains Power Supply
⊘	N	Neutral	
⊘	E	Earth (Ground)	

(TB7)

⊘ Not Used
⊘ Not Used
⊘ Not Used
⊘ Not Used

Warning. The power supply earth (ground) **must** be connected to ensure safety to personnel, reduction of the effects of RFI interference and correct operation of the power supply interference filter.

A voltage selector is located on the chassis and this must be set to the correct value before connecting the instrument to the supply – see Section 2.1.2 and Fig. 2.8.

Earthing (Grounding)
A stud terminal is fixed to the bottom of the Terminal Box for a bus-bar earth (ground) connection.

Fuse
The mains input fuse is mounted on the side of the terminal box. A spare fuse is provided inside the terminal box.

Caution. Replace the fuse only with the correct value and type: i.e. 2A Quick Blow – see Section 6.

2.4.3 Transmitter Unit (Fig. 2.9)

For the CE Approved Transmitter Unit, see Section 2.4.2

To gain access to make the necessary connections, proceed as follows:

a) Remove the six screws securing the gland plate to the left-hand side of the transmitter case. Fit suitable cable glands to the plate, to take the cables necessary for the supply, output signals, alarms and remote function, if used.

b) Open the transmitter door and remove the escutcheon plate – see Section 2.1.2, paragraphs a,b and c.

c) Cut the cable from the sensor unit to a length to reach the transmitter easily to terminate on terminal block TB3 on the analogue board.

d) Push the end of the cable through the supplied gland in the gland plate.

e) Noting that the screening braid terminates at the cable gland and is prepared as shown in Fig. 2.9, prepare the cable end and attach it to the terminal block TB3. The terminal block may be pulled off the board pins if required.

Caution. The terminal block for sensor unit connection has eight terminals, whereas there are 12 pins on the board. Ensure that the correct eight pins are chosen for connection; these are marked, on the PCB, with a separate 'box' – see the following text and Fig 2.9.

Pass the remaining cables through the glands. Note that Pin 1 of each block is nearest the top of the case. Prepare the cable ends and attach them to the terminal blocks as follows – see also Fig. 2.9.

Digital board (nearest front panel – no connections).

Analog board TB1 (top edge):

PIN				
	1	0V		
	2	NO	R4	Four sets of normally open contacts, one of which closes to show range of measurement remotely.
	3	COM		
	4	NO	R3	
	5	COM		
	6	NO	R2	
	7	COM		
	8	NO	R1	
	9	COM		
	10	0V		

Analog board TB2 (middle):

PIN				
	1	0V		Isolated current outputs
	2	Not used		
	3	+		
	4	–		
	5	Not used		
	6	Not used		
	7	+		
	8	–		
	9	Not used		
	10	0V		

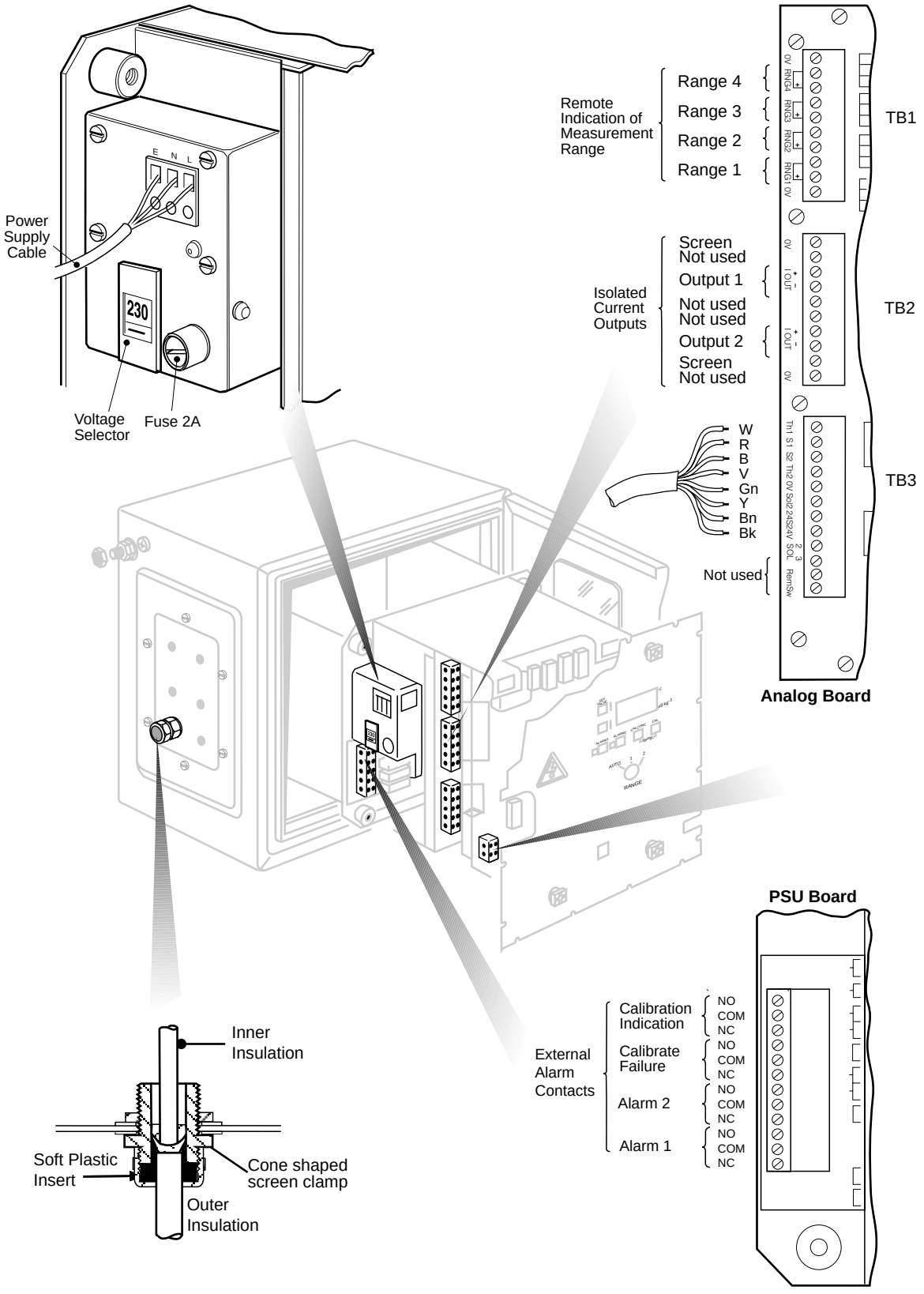


Fig. 2.9 Electrical Connections at Transmitter Unit [Version without CE approval]

Analog board TB3 (bottom edge):

PIN			
1			Connections to sensor unit
2	+	Pre-amp	Thermistor
3	–		
4			
5	0V		
6	Solenoid valve		
7	24V sense		
8	24V		
9	Not used		
10	Not used		
11	Not used		
12	Not used		

PSU board TB3:

PIN			
1	NO	Calibrate Indication	External alarm contacts
2	COM		
3	NC		
4	NO	Calibrate failure alarm	
5	COM		
6	NC		
7	NO	Alarm 2	
8	COM		
9	NC		
10	NO	Alarm 1	
11	COM		
12	NC		

Chassis

Warning. The power supply earth (ground) must be connected to ensure safety to users, reduction of the effects of RFI interference, and correct operation of the power supply interference filter.

A voltage selector is located next to the supply terminals. This voltage selector must be set to the correct value before connecting the instrument to the supply – see Fig. 2.9:

Tidy the cables in the gland plate and fit the gland plate to the transmitter. Tighten the cable gland nuts.

Earthing (Grounding)
A stud terminal is fixed to the left-hand side of the transmitter case for a bus-bar earth (ground) connection.

2.5 Ancillary Equipment

2.5.1 Recorders

The choice of two different isolated recorder output signals enables the instrument to be used with a wide variety of recording and data processing equipment. The load requirements are set out in Section 7 and the positions of the circuit board switches for the various outputs are given in Section 3.3.2. A 2-pen recorder is necessary, pen 1 indicating the hydrazine concentration and pen 2 the instrument range.

2.5.2 Range Indication

The remote range indication relays, connected at TB1 in the Terminal Box, can be used in several different arrangements to suit the requirements of the installation. The relays can, for example, be wired directly into the PLC or data logger, but if a recorder is used, a method of indicating the set range is required.

Suitable range indication recorder input can be provided using a resistor network. The network should be connected as shown in the two examples given in Figs. 2.10 and 2.11, and consist of four, 1/4 watt resistors. A suitable resistor network kit is available as given in Section 6. A recorder with suitable voltage and resistance inputs can be provided by the Company. The recorder gives 60% and 70% scale deflection for ranges 1 and 2 respectively.

Other arrangements should be designed to suit the requirements of the system. Ensure that all external equipment is set up and working according to the relevant instructions supplied with it.

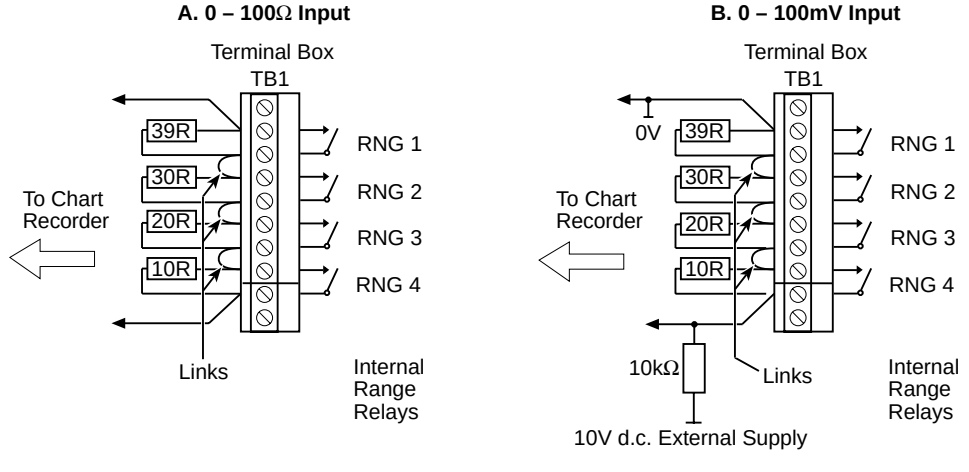


Fig. 2.10 Resistor Network for Remote Range Indication [CE Approved Version]

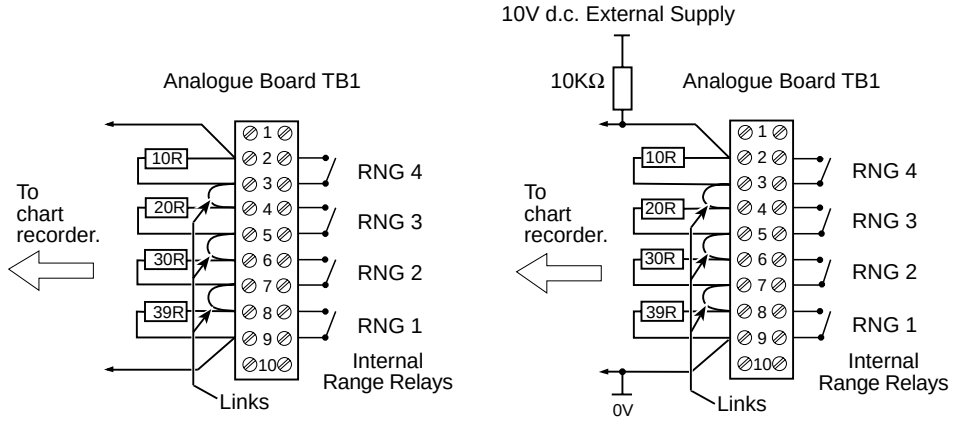


Fig. 2.11 Resistor Network for Remote Range Indication [Version without CE Approval]

2.6 Start-up

Carry out the following procedure:

a) Open the Transmitter unit case door and remove the escutcheon plate if this has not already been done – see Section 2.1.2.

b) Switch the battery switch SW10, on the digital Board, to 'ON' – see Fig. 3.5.

c) Replace the escutcheon plate and secure by pressing in the four plastic fasteners. Fit the 17 screws.

d) Power-up the monitor at the external source and set the range switch to AUTO.

Note. If the display does not change from '888' after approximately 30 seconds, the nickel-cadmium battery has become fully discharged. To remedy this, leave the instrument switched on for approximately five minutes and then press the RESET button, which should change the display to a random value.

If a calibration sequence is initiated at power-up, abort the sequence by pressing and holding CAL for 5 seconds.

e) Assemble the sensor as described in Section 5.4.5

f) Check that the solution flows through the sensor – see Section 3.2.

g) Fill standard and reagent solution containers with appropriate solutions – see Section 5.1.

h) Ensure the outlet valve on the reagent solution container is closed, and remove the reagent tube from the membrane clamp, situated on the top of the caustic dosing chamber.

i) Hold the reagent tube over the tundish and open the reagent container valve. Allow the reagent to flow through the tube to displace any air bubbles.

j) Close the reagent container valve and reconnect the tube to the membrane clamp.

k) Open the reagent container valve, and establish flow through the new disc by clamping the sample inlet tube and applying suction from a plastic syringe to the chamber outlet (top, offset).

l) Replace the outlet tube and remove the clamp.

m) Allow approximately one hour for caustic dosage to be established (the pH of the effluent at the sensor outlet should be at least 10.5).

n) Set up the Transmitter as described in Section 3.3.2.

o) The exact figure for the concentration of the standard solution may be entered into the microprocessor by pressing the CAL CONC button together with the SET VALUE buttons until the display reads the correct figure.

p) Press the ALARM 1 button and SET VALUE until the desired value of the low alarm is shown on the digital display. Repeat this procedure for ALARM 2.

q) Calibrate as detailed in Section 4.

r) The monitor is now in operation, the lamp adjacent to the unit of measurement being illuminated.

s) If desired, turn the range switch to one of the non-auto ranges.

Note. If the display flashes during normal operation or shows anything other than the expected hydrazine level, refer to Table 5.1 for fault finding information.

Table 3.1 Relationship of Sample Temperature to Flow

SAMPLE TEMPERATURE °C	SAMPLE FLOW (ml/min)
5	14.0
6	14.3
7	14.7
8	15.0
9	15.4
10	15.7
11	16.0
12	16.3
13	16.6
14	16.9
15	17.2
16	17.5
17	17.8
18	18.1
19	18.4
20	18.7
21	19.0
22	19.2
23	19.5
24	19.7
25	20.0
26	20.3
27	20.5
28	20.8
29	21.0
30	21.2
31	21.5
32	21.7
33	21.9
34	22.1
35	22.3
36	22.5
37	22.7
38	22.9
39	23.1
40	23.3
41	23.5
42	23.7
43	23.9
44	24.1
45	24.3
46	24.4
47	24.6
48	24.8
49	24.9
50	25.1
51	25.2
52	25.4
53	25.5
54	25.7
55	25.8

3.1 Sensor Unit (Fig. 2.2)

The sensor unit is shown in Fig. 2.2. It consists of a metal case of similar construction to the transmitter case, with the pipework carrying the sample mounted on a panel bolted to the back with four M6 captive bolts.

Sample enters through a grommet in the bottom of the case and travels to a constant head unit via the sample inlet coupling. From there it flows to a solenoid operated changeover valve which, when energised during the calibration sequence – see Section 4, replaces the sample with a standard solution. From the valve, the sample flows through the caustic dosing chamber containing a porous disc through which reagent is added to raise the pH of the sample to 10.5, and on to the mixing coil before passing to the hydrazine sensor.

The hydrazine sensor and its overflow funnel are mounted on a sub-panel whose height relative to the standard solution can be adjusted to provide the correct rate of flow through the sensor. In addition, when the sensor is supplied with sample from the constant head unit, the flow can be adjusted by raising or lowering the overflow tube in the head unit. These flows are preset in the factory, but can be adjusted if necessary – see Section 3.2.

Overflows from the constant head unit and the sensor fall to a tundish in the bottom of the case. Normal operation flow paths are shown in Fig. 3.2 and for the calibration sequence, in Fig. 3.3.

3.2 Setting Flowrates

Warning. This equipment uses chemical solutions in its operation. Suitable precautions must be taken to ensure safe handling.

Caution. This equipment will be damaged if subjected to freezing conditions.

The flowrates of standard solution and sample through the sensor are preset at the factory. However, if it is desired to check these, proceed to the following sections.

3.2.1 Standard Solution Flowrate

This flowrate should be set first.

a) Close the sensor unit sample isolator valve.

b) Fill the standard solution container with standard solution or high purity water. Open the outlet valve at the container. Press the CAL button to energise the solenoid valve and to allow the flow of standard solution. (This starts a 15 minute calibration sequence at the transmitter). Use a 50 ml syringe to draw solution from the sensor drain tube until any air bubbles are removed. Top up the container as necessary.

c) Press the CAL and CAL CONC buttons simultaneously to display temperature and refer to Table 3.1. Wait ten minutes to allow the temperature to stabilise.

Caution. Do NOT rotate the sensor with the top of the unit.

d) Rotate the sensor, using the main body of the sensor, to allow access for a 50ml measuring cylinder under the drain tube outlet.

e) Allow the liquid to drip freely into the 50 ml measuring cylinder. It must not run down the side of the cylinder. If the flow rate is not within ±0.2 ml min^{-1} of the value given in Table 3.1, adjust by loosening the two liquid handling panel securing screws and move the panel up or down (using the thumb wheel) to decrease or increase the flow respectively. Left to right adjustment increases flow. Tighten the screws when the correct flow rate has been achieved.

Note. If the above flow rate check is not achieved within this time operate the CAL button again. Furthermore, CAL FAIL ('CF') may be displayed but should be ignored at this early setting up stage.

f) Allow all the high purity water to drain from the standard solution container.

3.2.2 Sample Flowrate

Warning. The sample is dosed with sodium hydroxide and the concentration, although low at first, increases if any spillage is left to evaporate. Take care to dispose of the outflow safely.

a) Open the sample isolator valve to the sensor unit. Normal operation flow paths are shown in Fig. 3.2 and for the calibration sequence in Fig. 3.3.

b) The flow rate of sample (from the constant head unit) through the sensor can now be checked. Ensure that sample is flowing through the sensor, i.e. CAL is not displayed and the solenoid valve is de-energised. Read the temperature of the sample and refer to Table 3.1. Wait ten minutes for the temperature to stabilise. Measure the flow rate with a measuring cylinder as described in Section 3.2.1 above. If the flow rate is not within ±0.2 ml min^{-1} of the value given in the table, adjust by rotating the overflow tube in the constant head unit. Anti-clockwise adjustment increases flow.

c) Relocate the drain tubes in the drain tundish.

3.3 Transmitter Unit

3.3.1 Description

Electronics chassis (Figs. 2.8 and 2.9)

The chassis contain three circuit boards:

Digital board - nearest the escutcheon plate, contains the central processor unit, together with the controls and the display.

Analogue board - middle, contains the analogue input and current output circuits.

P.S.U board - rear, the power supply and relay board.

Refer to Fig. 3.1 for an indication of signal and power flows between these boards.

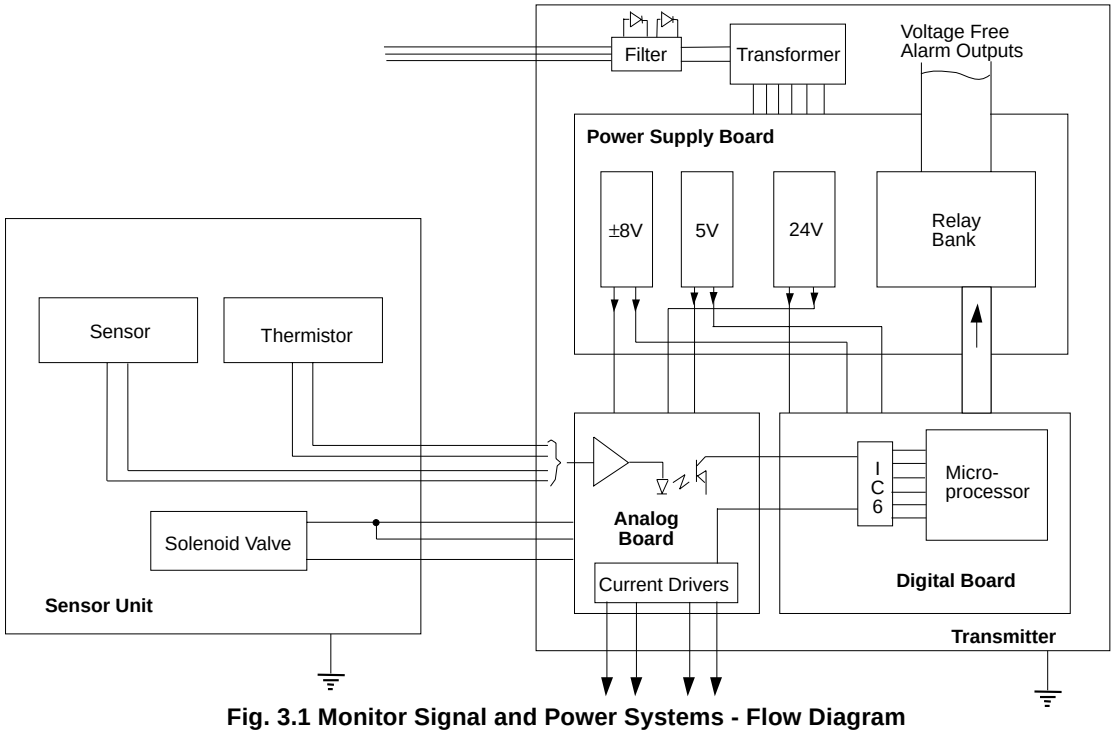


Fig. 3.1 Monitor Signal and Power Systems - Flow Diagram

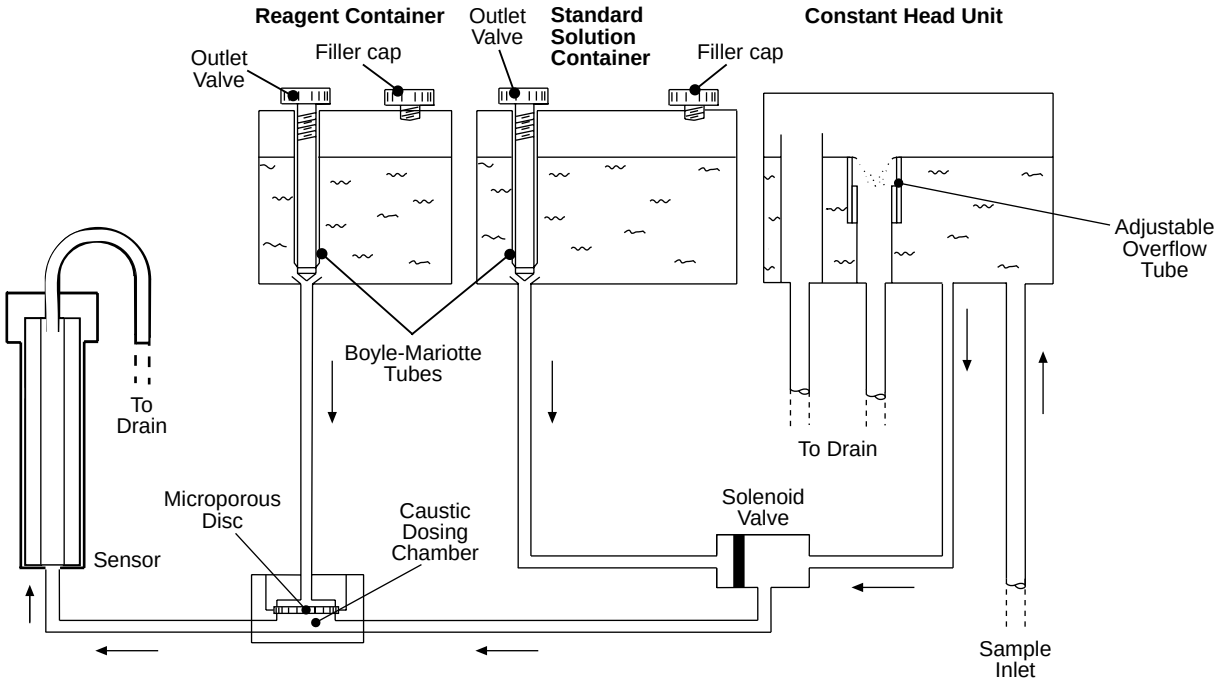


Fig. 3.2 Sample System during Normal Operation - Flow Diagram

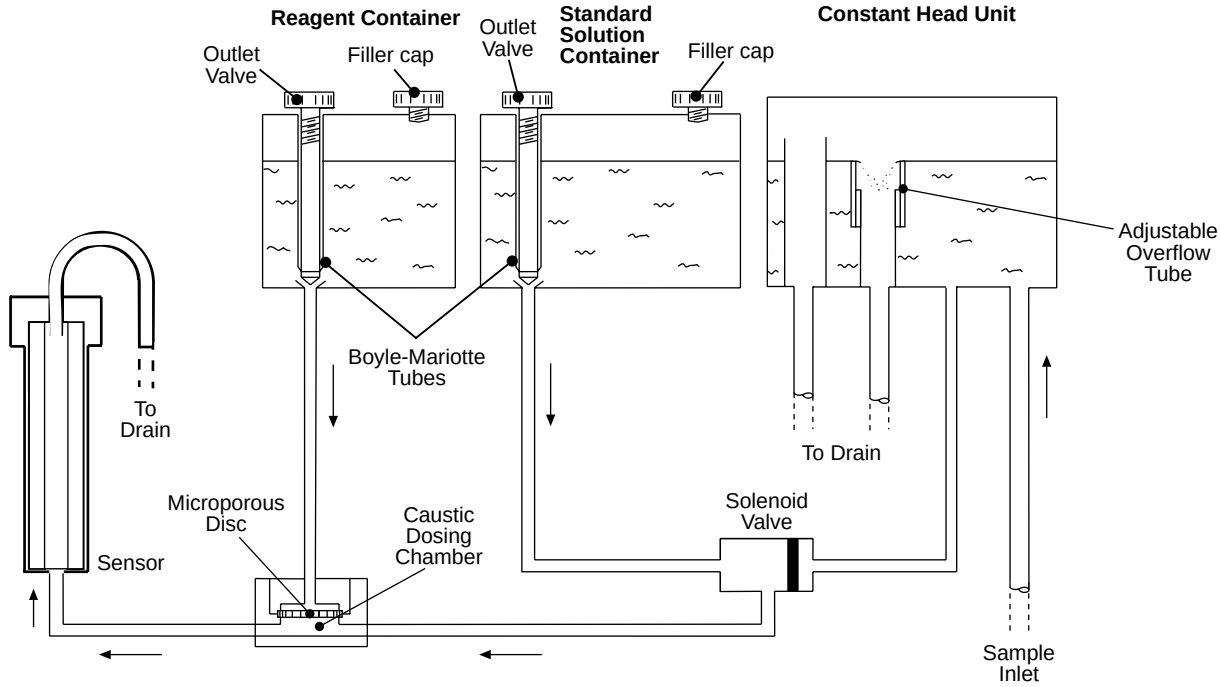


Fig. 3.3 Sample System during Calibration Phase - Flow Diagram

4 CALIBRATION PROCEDURE

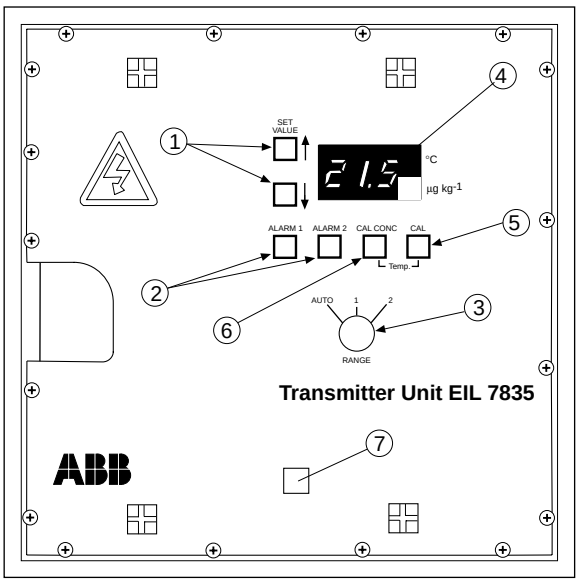


Fig. 3.4 Transmitter Controls

Controls (Fig. 3.4)
The controls are mounted on the front circuit board in the chassis and protrude through holes in the escutcheon plate. The chassis is secured to the escutcheon plate by four plastic fasteners, and the escutcheon plate is secured to the transmitter container with 17 screws.

A 3-digit red LED display 4 shows the temperature, or hydrazine level in micrograms per kilogram; a lamp in the display, adjacent to the relevant legend on the panel, indicates which measurement is being shown.

The controls have the following functions:

RANGE switch: ③ (Three position AUTO, 1 and 2)
Positions 1 and 2 are the manual ranges corresponding to 0 to 999 and 0 to 99.9 respectively.
At AUTO the monitor automatically switches to a range suitable for the hydrazine level being measured.

SET VALUE ① These buttons increase or decrease the value displayed on the digital indicator; used for setting the alarm and concentration of the standard solution.

ALARM 1) ② **ALARM 2**) Used to set the values at which the alarm relays operate.

CAL ⑤ When this button is pressed a calibration sequence operates as described. Pressing the button for five seconds during calibration aborts the sequence.

CAL CONC ⑥ This button allows the exact value of the standard solution to be set into the monitor, to which the output is automatically adjusted during the calibration sequence.

TEMP ⑤ ⑥ Pressing both CAL and CAL CONC buttons together displays the sample temperature in °C. The '°C' lamp adjacent to the main display also illuminates.

RESET ⑦ Used to regain control of the instrument in the unlikely event of malfunction due to high power supply transients, etc. (The button is not visible when the cabinet door is closed). The RESET button must be pressed after any switch position on SW1 on the digital board is changed. Refer to Section 3.3.2.

3.3.2 Printed Circuit Board Settings

Digital circuit board (Fig. 3.5)

Function Switch SW1
A series of eight on/off switches in a dual-in-line package is read by the microprocessor and provides controlling functions for the alarms, output current and calibration.

> **Note.** SW1 switch positions are only read by the microprocessor when the unit is powered up or after pressing RESET. After changing any settings the RESET button must be pressed.

Analogue Circuit Board
Analogue Outputs
Two identical isolated current outputs are available at terminals IOUT1 (+ ve), IOUT1 (- ve) and IOUT2 (+ve), IOUT2 (- ve) of TB3 in the terminal box. Both outputs may be set to one of three current ranges by means of switches SW1-1 and SW1-2 on the digital board. In each case the upper current limit corresponds to the full scale reading of the measuring range as displayed on the front panel. The switches can be set as given in Table 3.2.

Table 3.2* Analogue Output Current Selections at SW1 on the Digital Board

Output Current	SW1.1	SW1.2
0-10mA	ON	ON
0-20mA	OFF	OFF
4-20mA	OFF	ON

*****If SW1.1 is set to ON and SW1.2 to OFF, no meaningful output is produced.

The output is linear up to a concentration of 500 µg kg^{-1} but linearity changes slightly above this figure. The analogue current output and the display both represent the measured concentration, but the front panel display flashes continuously when 500 µg kg^{-1} concentration is exceeded, indicating that the readings are slightly less accurate.

5 MAINTENANCE

Alarm Outputs
Two hydrazine level alarm control relays are provided, one low and one high, each having one pair of changeover contacts rated at 2A 250 V a.c. (noninductive). These alarm relays operate when actuated at the programmed alarm level.

To set the alarm level, the ALARM 1 and SET VALUE buttons are pressed until the desired value of the low alarm is shown on the digital display. This procedure is repeated for the high alarm with ALARM 2 and SET VALUE buttons – see Fig. 3.4.

The terminal connections for the alarms are made on the PSU Board (Fig. 2.9) or at TB2 in the terminal box (Fig. 2.7) for the CE version transmitter. In 'normal' operation the relay coil is energised causing the NO and COM contacts to close when the displayed hydrazine level is outside the limits of the relevant alarm setting.

When set to 'fail-safe', by means of switches SW1 to 7 and SW1 to 8 of the function switch on the Digital Board, the relay coil is energised during normal non-alarm relay states and is de-energised upon recognition of an alarm condition. Thus if the power source fails both external alarms are flagged indicating a malfunction.

SW1.7 is for Alarm 2 (high): SW1.8 is for Alarm 1 (low)
SW 'OFF' is FAIL-SAFE: SW 'ON' is NORMAL

Two other sets of internal relay contacts are provided. One set changes over during a calibration sequence and the other set changes over to indicate failure to calibrate.

3.3.3 Sample Temperature

The temperature of the sample water is continuously monitored by means of a thermistor housed in the sensor flowcell, and hydrazine measurement is automatically compensated for variations in sample temperature and flow within the set range – see Table 3.1.

If the temperature of the sample rises above 55°C, the display reads 'hot' and the current outputs remains at the last known values, returning to normal measurement when the temperature again falls below 55°C.

If the sample temperature falls below 5°C, hydrazine concentration is still displayed, but a fixed automatic temperature compensation appropriate to 5°C is applied.

The thermistor is also used to measure the temperature of the sample which is displayed by pressing both the CAL CONC and CAL buttons simultaneously. The temperature is required to determine the necessary sample flow from Table 3.1 when setting-up the instrument.

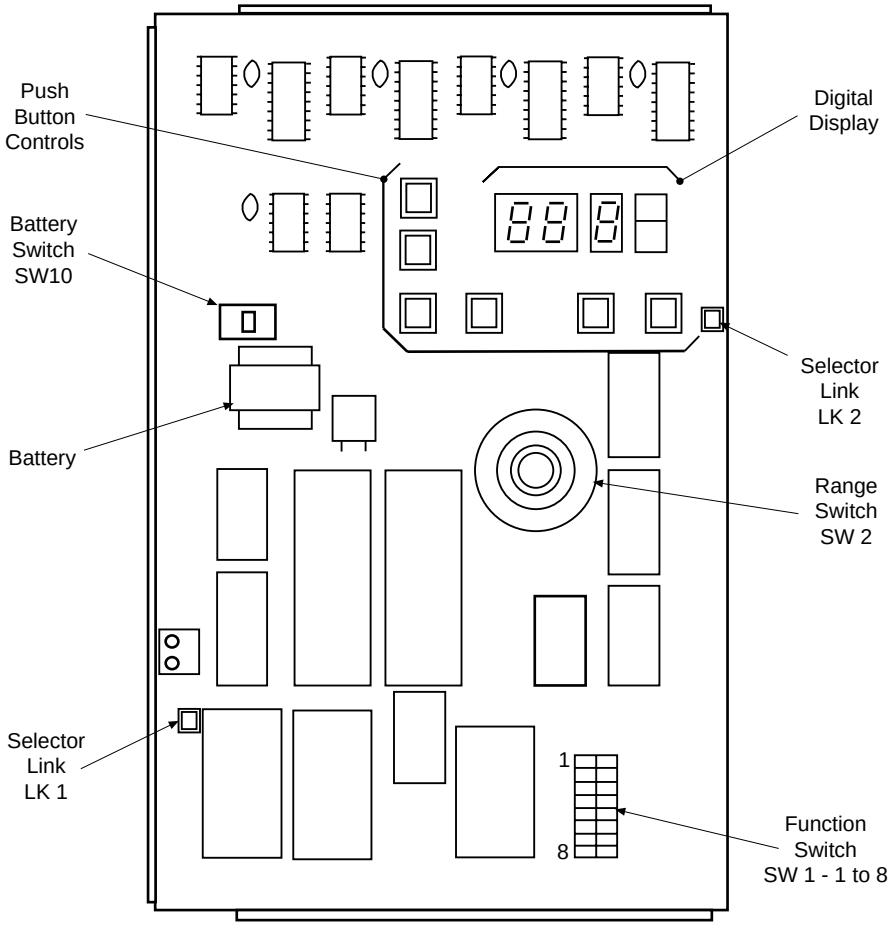
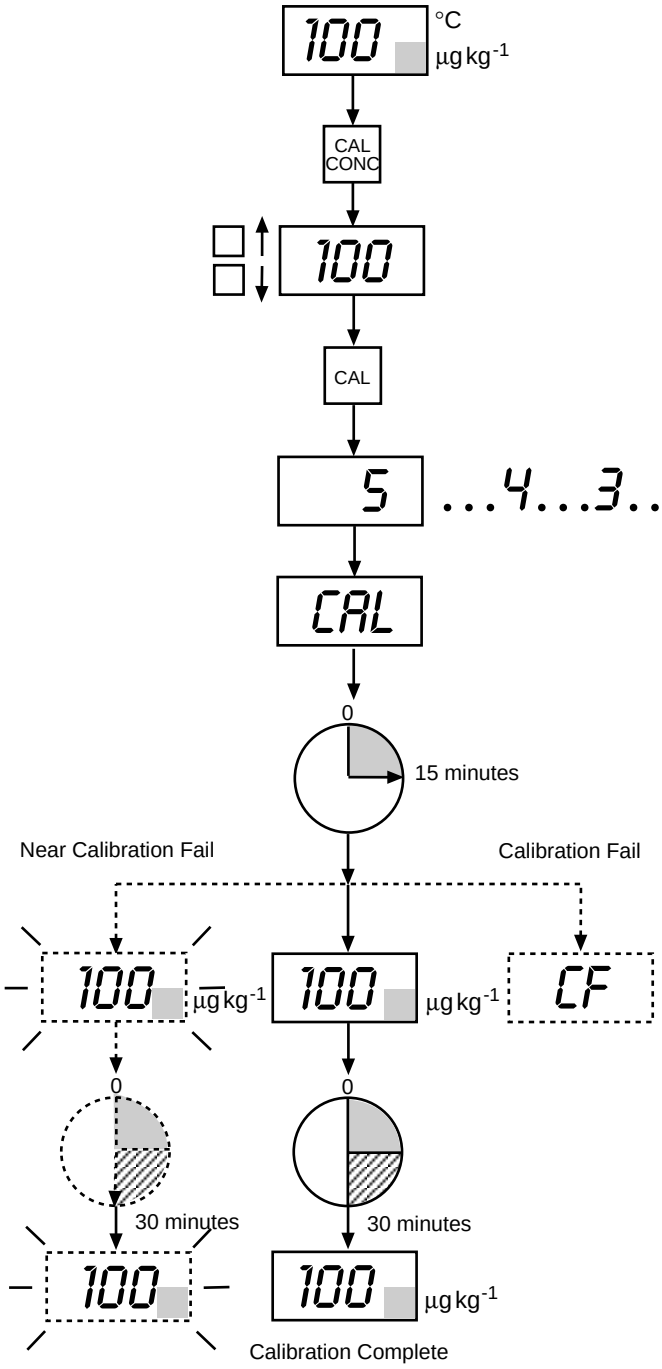


Fig. 3.5 Location of items on Digital Board

...5 MAINTENANCE

Depending upon operating conditions, a calibration should be performed every one to four weeks.
Rinse out the standard solution container with a little fresh standard solution before filling, and open the outlet valve from the container.



The display is indicating the Hydrazine Level.

PRESS 'CAL CONC' to check calibration value entered.

Use ↑ and ↓ SET VALUE buttons to adjust if necessary.

PRESS and hold 'CAL' button through the following display countdown.

Countdown sequence prevents a calibration sequence starting if CAL is accidentally pressed momentarily.

Release the CAL button. Display changes to 'CAL'.

All alarm functions are disabled and the CAL relay for remote CAL indication is energized.
The current outputs are maintained at the existing value.

NEAR CALIBRATION FAIL is indicated when all display information flashes. This is a warning that the sensor is failing and will soon need replacing.

'CF' displayed indicates a Calibration Failure and the CAL FAIL alarm relay is energized. The sensor needs replacing.

A SUCCESSFUL CALIBRATION is indicated by the display returning to a steady display of the hydrazine reading.

a) On completion of calibration, close the outlet valve from the standard solution container.

b) Pull the tube off the standard solution side of the solenoid valve and let it dip into the drain tundish.

c) Open the outlet valve on the container and allow the standard solution to drain to waste.

d) Remove the standard solution container and rinse with high purity water. Replace in the sensor unit.

5.1 Chemical Solutions

Warning. Sodium Hydroxide is extremely caustic and must be handled with great care. Wear gloves and eye protection.

The reagents and standard solutions given are required to maintain the monitor in operation. Solutions should be stored in plastic bottles and where possible should be freshly made.

5.1.1 Reagent Solution - 5M (20% w/v) Sodium Hydroxide

The solution used to fill the reagent container is made up as shown below; consumption is approximately 250 ml in two to four weeks.

a) Weigh out 2.5 (±0.1) g EDTA and transfer to a 500 ml measuring flask (a little high purity water may be used to help this transfer).

b) In a separate vessel, weigh out 100 (±1) g sodium hydroxide, NaOH, pellets (analytical reagent grade) and dissolve in approximately 300 ml high purity water in a plastic container. Allow this solution to cool.

c) Transfer this solution to the measuring flask, shake well to dissolve the EDTA and make up to the mark with more high purity water.

5.1.2 Standard Solution

Warning. Hydrazine Sulphate is an irritant to skin and eyes. Avoid breathing the dust. Wear gloves, eye protection and a dust mask when handling this substance.

The hydrazine concentration of the standard solution should be chosen at a convenient level - typically 30 or 80µg kg–1. Other concentrations can be used if required.

Note. Hydrazine solutions deteriorate with time: the stock solution should be replaced at monthly intervals. Dilute standard solutions should be freshly prepared.

Prepare a stock solution of 1000 mg l^{-1} hydrazine as follows:

a) Weigh out 4.058 (±0.001) g analytical reagent grade hydrazine sulphate, N_2H_4,H_2SO_4, and dissolve in approximately 800 ml high purity water.

b) Transfer to a 1 litre volumetric flask and make up to the mark with more high purity water.

c) Dilute the stock solution to provide the required standard solution for the particular measuring range, usually 30 or 80µg kg^{-1}.

5.2 Scheduled Servicing

The procedure outlined is a guide to the maintenance requirements of the monitor. Much depends on the particular installation and sample conditions.

5.2.1 Weekly

a) Check level of reagent container. When level is near the bottom of the container remove from panel, empty contents, rinse with high purity water and refill with reagent. Clean up any spillages and do not top-up container.

Warning. It is vital that good housekeeping in this respect is maintained and that all leaks of potentially aggressive chemical solutions receive attention as soon as possible, and spillages are cleaned up.

b) Carry out a calibration as described in Section 4.

5.2.2 Six-Monthly

a) Replace tubing if stained or age hardened – see Section 5.2.3.

b) Replace the porous disc as follows:

i) Close the sample isolator valve to the monitor.

Warning. The reagent is extremely caustic and must be handled with great care. Wear gloves and eye protection.

ii) Close the outlet valve on the reagent solution container and remove the reagent tube from the membrane clamp, situated on the top of the caustic dosing chamber – see Fig. 2.6.

iii) Remove the two sample tubes from the chamber, unscrew the bracket and remove the chamber from the panel.

iv) Locate the lugs of the tool provided, in the recesses in the membrane clamp on top of the caustic dosing chamber, and unscrew the membrane clamp. Retain the ‘O’-ring located in the recess of the clamp.

c) To remove the old disc, stab it with the end of a screwdriver and dispose of it safely. Rinse the chamber and fit a new ‘O’ ring (part number 0211 068) and disc. Fit the membrane clamp and ‘O’ ring (part number 0211 120), and tighten the clamp.

d) Fit the chamber to the panel and connect the sample inlet tube.

e) Hold the reagent tube over the tundish, and open the reagent outlet valve to allow the reagent to flow through the tube to displace any air bubbles.

f) Close the reagent outlet valve and connect the reagent tube to the top of the caustic dosing chamber.

g) Open the reagent outlet valve.

h) Block the chamber sample inlet and establish flow through the new disc by applying suction from a plastic syringe to the chamber outlet (top, offset).

i) Connect the sample inlet tube to the chamber (side).

j) Allow approximately an hour for caustic dosage to be established (the pH of the effluent at the sensor outlet should be at least 10.5).

k) Calibrate as described in Section 4.

5.2.3 Yearly

Sensor unit retubing (Fig. 2.6 & 5.1)

Replace all the tubing in the sensor unit using the internal retubing kit – see Section 6. At the same time, empty both the standard solution and reagent containers and replace the three O-rings on each; two on the valve and one on the filler cap.

It is recommended that all tubes are removed and replaced as in the following procedure.

Warning. This unit contains caustic and other solutions which must be handled with care. Wear gloves and eye protection.

Caution. Retubing should only be carried out using the above kit. Modifications to the tubing could affect critical flow paths within the monitor.

Clean up any chemical spillages as work proceeds.

a) Close the sample isolator valve and allow the sensor unit liquid handling system to drain.

b) Place absorbent tissue at the bottom of the case to soak up any spillages.

c) Close the outlet valve on the reagent container.

d) Noting the arrangement in the support bracket, remove the sensor overflow drain tube and constant head unit feed tube and two drain tubes.

e) Cut 0212 156 (460 mm) in half and fit to constant head unit drain stubs. Feed tubing down through support bracket.

f) Fit 7835 229 (1st of 2) to constant head unit outlet and solenoid valve.

g) Fit 0212 154 to sensor overflow drain stub and feed through support bracket.

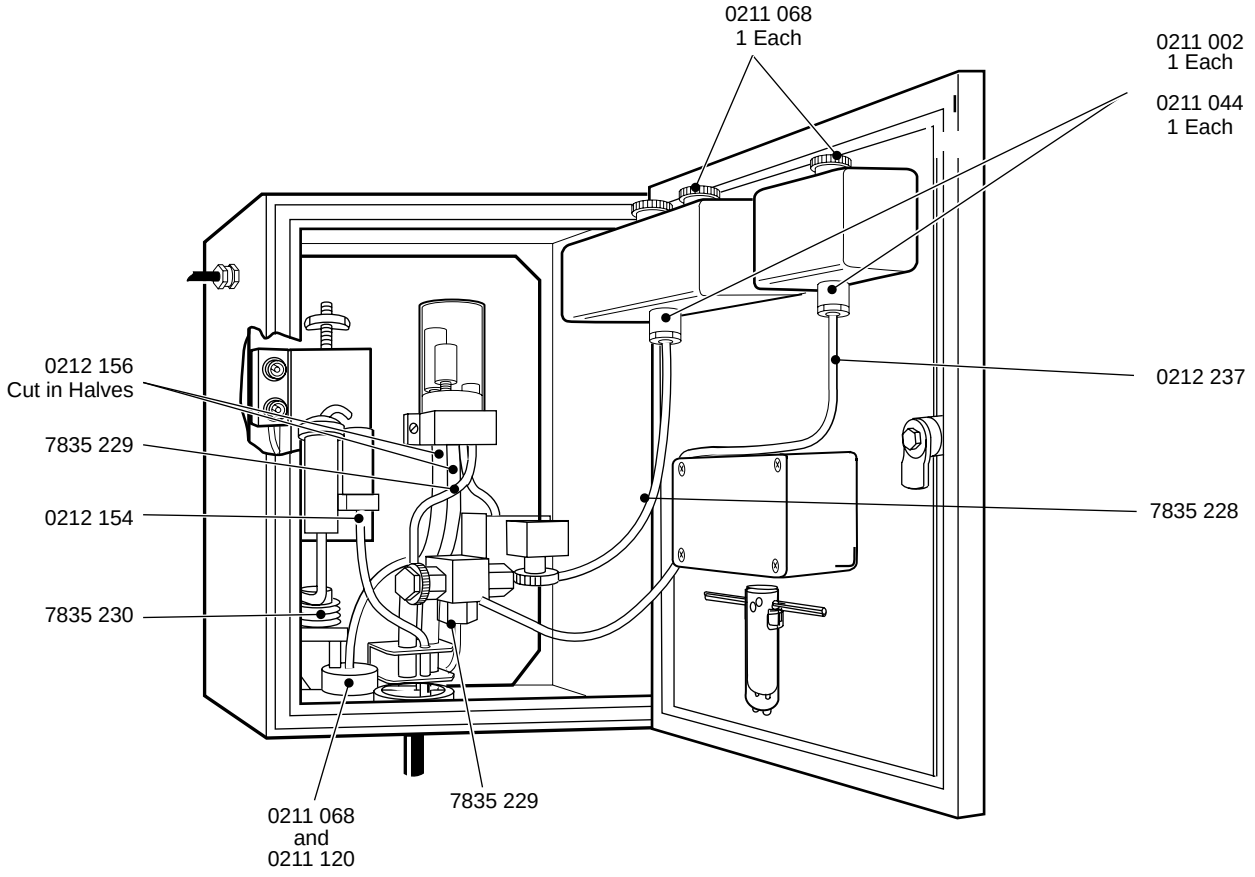


Fig. 5.1 Location of Flexible Tubing Items and 'O'-Rings in Sensor Unit

h) Cut all three drain tubes to a length of about 50 mm below the bracket to leave angled ends.

i) Remove the mixing coil from the base of the sensor and from the caustic dosing chamber outlet, unwinding it from the coil former. Connect 7835 230 to the caustic dosing chamber outlet and lead it behind the coil former. Wind on closely, and without twisting, four complete turns and locate the tube in the coil former slot. Connect to the sensor base.

j) Remove the tube between the caustic dosing chamber and the solenoid valve and replace with 7835 229 (second of two).

k) Remove the tube between the standard solution container and the solenoid valve. Replace with 7835 228 but leave container end unconnected.

l) Disconnect the reagent solution tube from the caustic dosing chamber and hold over the tundish. Then disconnect the tube at the container end and allow to drain. Replace with 0212 237, but leave container end unconnected.

m) Remove the two solution containers, drain and rinse.

n) Open the outlet valve of the standard solution container and remove the stem completely. Remove the outlet union with a 20 mm A/F spanner.

o) Use a smooth blunt needle to remove external and internal O-rings from the union and external O-ring from the stem.

p) Replace with 0211 044, 0211 002 and 0211 068 respectively (supplied in the retubing kit). Replace the union and then the stem.

q) Fit the tube from the solenoid valve.

r) Fit the container onto the pillars. Tighten the screws.

s) Repeat the above for the reagent solution container; loop the tube from the filter behind the standard solution tube and over the electrical connection box.

t) Refurbish the sensor as required. Follow the procedure given in Section 5.4.5.

u) Follow the procedures given in Section 2.6, from paragraph (f) onwards.

5.3 Shut Down Procedures

5.3.1 Sensor Unit

If the monitor is to be shut down for longer than 1 week, carry out the following procedure:

a) Turn the sensor plugs, located on the side of the liquid handling panel, a half turn anticlockwise and disconnect them by pulling them from the sockets.

Warning. The gel in the hydrazine sensor contains silver oxide and sodium hydroxide. It is caustic and stains skin and clothing.

b) Carefully pull the hydrazine sensor out of its mounting clips on the sub-panel.

c) Holding the sensor over the drain tundish, pull off the sample inlet tube and let the sensor drain. Leave the end of the inlet tube dipping into the tundish.

d) Carefully dismantle the sensor and wash the components thoroughly in high purity water to remove all traces of gel. Dry and reassemble.

e) Replace the sensor in its mounting clips.

Warning. The reagent is extremely caustic and must be handled with great care. Wear gloves and eye protection.

f) Close the outlet valve on the reagent container, carefully pull the tube off the caustic dosing chamber and remove the reagent container. Either empty the contents into a storage container or discard, rinse out the container and replace in the sensor unit.

g) Clean the porous disc by attaching a piece of tubing to the caustic dosing chamber outlet (top, offset) and place the other end in a beaker of high purity water. Close the chamber inlet (side). Attach a large syringe (e.g. 50 ml) to the reagent inlet (top centre) and draw the water through the disc. Repeat this several times.

h) Reassemble the panel, clean up any spillage and then close the door.

5.3.2 Transmitter Unit

Isolate the electrical supply to the unit. In the case of power loss, the programmed data is retained for up to 10 years.

5.4 Unscheduled Servicing

5.4.1 Malfunction of the Monitor

The monitor can indicate that abnormal operation is taking place by means of signals on the digital display. These are listed in Table 5.1.

Any unpredictable problems may be due to the standard or reagent solutions, and the flowrate of these solutions should always be checked. If any doubts exist regarding the integrity of these solutions, they should be replaced with freshly prepared solutions in the early stages of the fault finding investigations. The accuracy of the monitor is governed by the condition of all the solutions involved which may be incorrectly made, or contaminated.

Mechanical components involved with the liquid handling should be systematically checked for leaks or blockages, because they change the chemical conditions around the electrode. By far the majority of any problems are found to be associated with the chemistry and the liquid handling section.

5.4.2 Calibration Fail Alarm

Calibration problems, normally indicated by a CALIBRATION FAIL alarm, indicate that the output of the sensor is less than 9.5 µA at 25°C on an 80 g kg^{-1}. standard solution. The microprocessor calculates the corresponding minimum outputs for other solution values. The problem is likely to be resolved through one or more of the following checks:

a) Check that the red and blue sensor plugs are fully inserted into the red and blue sockets respectively.

b) Standard solutions should always be suspected and a fresh solution may solve the problem. Check that the solenoid valve is energised (a loud click is produced when the calibration is initiated) and that the standard solution is flowing through the sensor.

c) Check that the standard solution value entered into the monitor is correct for the solution used.

d) Check the sodium hydroxide solution dosing by measuring the pH of the sample flowing through the sensor; it should be at least 10.5.

e) Check that the two electrodes are clean. The silver cathode can only be cleaned when the sensor is refurbished. The platinum anode can be cleaned when required – see Section 5.4.3 and Section 5.4.4.

f) Check the condition of the gel in the sensor. In normal operation the life is usually between three to six months. The gel should have even colour, even consistency, and no signs of separation or drying out. If the gel shows signs of being very liquid and leaks out of the sensor, the sensor should be refurbished – see Section 5.4.5.

g) The shelf life of the gel before use can vary, but should be up to one year provided that the syringe cap is tightly fitted and, as in point 6 above, must have even colour, even consistency and no signs of separation or drying out.

h) Remove any air trapped in the flow paths with a syringe and then check the flow rates of both the standard solution and the sample as given in the manual.

i) Check the sample temperature reading on the display against a thermometer reading of the sample.

If there are discrepancies between monitors and independent laboratory results, the points in b, c, d and h should be investigated.

Electronic problems are unlikely, but the operation of the electronics can be checked using a µA source to simulate the output from the sensor. For details of this procedure, see Section 5.4.6.

5.4.3 Cleaning the Platinum Anode and Sensor Ceramic (Fig. 5.2)

a) Switch off sample flow to the monitor.

b) Loosen the rubber bung on the top of the sensor and carefully withdraw the platinum anode from the centre of the ceramic tube.

c) Insert the brush, supplied in the sensor kit, down the bore of the ceramic tube (which should still contain some sample); rotate gently and withdraw.

Warning. Avoid any spillage of acid and take care not to allow any acid to touch the rubber bung.

d) Clean the platinum anode by immersing it in a test tube containing 50% nitric acid for a few minutes.

e) Rinse the electrode in high purity water and return it to the sensor

Table 5.1 Fault Finding Indications on Display

FAULT	POSSIBLE CAUSE
Display reads 'CAL'	Normal reading when calibration taking place - no action required.
Display flashes (reading)-OFF-(reading)-OFF	Sample concentration has risen above 500µg/kg: output less accurate.
Display flashes continuously	Near Calibration Fail - Sensor (or system) requiring attention soon – see Section 5.4
Display reads 'CF'	Calibration Fail - Sensor giving insufficient current output - attend to sensor (or system) immediately – see Section 5.4.
Display reads 'hot'	Sample temperature has risen above 55°C - check cause.

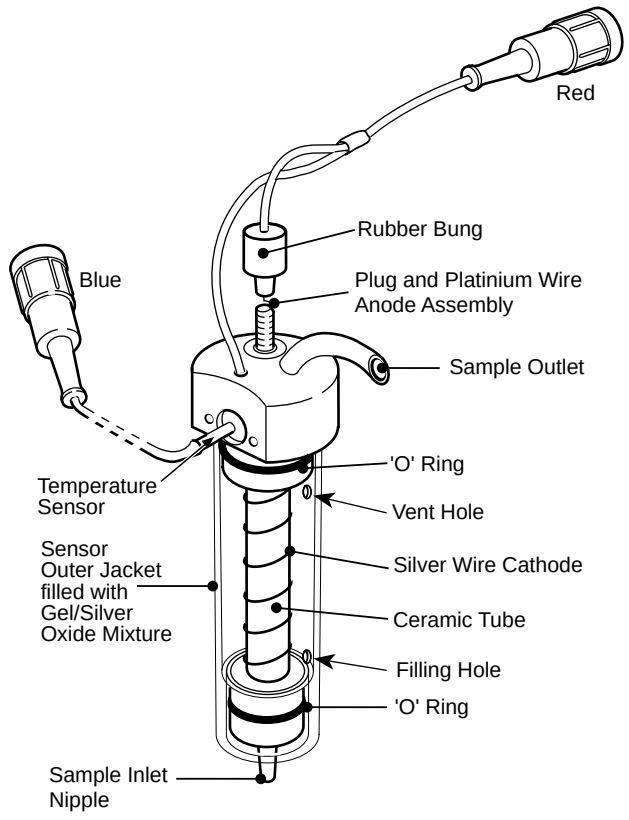


Fig. 5.2 Hydrazine Sensor

5.4.4 Sensor Check

Before giving attention to the sensor, ensure that the fault condition is not due to incorrect sample and calibration flow rates caused by an air bubble in the sensor or flow line. Air removal may be effected by lifting the platinum electrode slightly by the rubber bung and allowing some liquid to escape, carrying any bubbles with it. Alternatively, a syringe may be connected to the sensor outlet and slight suction applied.

5.4.5 Refurbishing the sensor

A good indication of whether the sensor needs refurbishing is the state of the gel in the outer jacket. If the gel appears to have dried out, separated or become liquid, then the sensor requires refurbishing.

The following procedures should restore the sensor to full life.

Sensor disassembly (Fig. 5.2)

a) Close the sample isolator valve and allow the constant head unit to empty.

b) Turn the sensor plugs, located on the side of the liquid handling panel, a half turn anticlockwise and disconnect them by pulling them from the sockets..

c) Carefully pull the hydrazine sensor out of its mounting clips on the sub-panel.

Warning. The gel in the hydrazine sensor contains silver oxide and sodium hydroxide. It is caustic and stains skin and clothing.

d) Holding the sensor over the drain tundish, pull off the sample inlet tube and let the tube and sensor drain. Leave the end of the inlet tube dipping into the tundish.

e) Carefully dismantle the sensor as detailed below, and wash the components thoroughly to remove all traces of gel.

f) Clean the ceramic and the platinum anode as shown in Section 5.4.3.

Warning. Avoid any spillage of acid, and take care to keep all electrical connectors free of acid.

g) If not already done, remove the outer jacket of the sensor.

h) If the silver cathode is tarnished or blackened, dip a cotton wool bud in 50% nitric acid and run this over the wire to restore it to its original matt silver colour. Rinse thoroughly with high purity water.

i) Rinse the cotton wool bud and safely dispose of it.

j) Loosen the rubber bung on the top of the sensor and carefully withdraw the platinum anode from the centre of the ceramic tube.

Warning. Clean up any spillage of the caustic solution.

k) Soak the ceramic tube for one hour in 2% sodium hydroxide solution, rinse with high purity water and then reassemble the sensor.

Sensor assembly (Fig. 5.2)

a) Replace the platinum anode.

b) Holding the white closure cap tightly in place on the filling syringe, snap the syringe plunger into position and then remove the white closure cap.

c) Place the blue Luer fitting on the syringe nozzle.

Warning. The gel contains silver oxide and sodium hydroxide. It is caustic and stains skin and clothing.

d) Slowly inject the filling gel through the bottom filling hole in the outer jacket of the sensor until it reaches the top vent hole.

e) Remove the syringe and replace its closure cap.

f) Push the sensor into the clips on the sub-panel – the clips incorporate small protrusions which cover the filling and exit holes in the outer jacket.

g) Connect the tube from the mixing coil to the bottom of the sensor.

Note. Take care to hold the sensor firmly at the top so that the centre portion is not pushed out when the tube is connected.

h) Plug the red and blue sensor connectors into their respective coloured sockets on the liquid handling panel.

5.4.6 Simple Electronic Check

In the unlikely event that a problem is encountered with the monitor, a μA source and a resistance box may be used to test the transmitter.

A Sensor Simulator is available to make an overall check on the functioning of the transmitter unit.

The simulator, which connects to the analogue board, produces a μA output to emulate the hydrazine sensor signal and also provides the necessary resistance to simulate thermistor values. Consult the simulator manual for full details of its use, or connect a μA source plus a resistance box to the transmitter.

Note. The monitor calibration signals are established by read-only software and cannot be changed by users. A simulated calibration must therefore be carried out as indicated below.

Proceed as follows:

a) Open the sensor unit door and locate the electrical connection box mounted on the door (see Fig. 2.6).

b) Open the connection box and disconnect the sensor and thermistor connections at TB2 as follows:

S1:	+ve Sensor	(R)
S2 :	- ve Sensor	(B)
Th1:	Thermistor 1	(Y)
Th2 :	Thermistor 2	(Bk)

c) Connect the appropriate wires of the μA source and resistance box to TB2 as follows:

μA Source +ve:	S1
μA Source -ve:	S2
Resistance box:	Th 1
Resistance box:	Th 2

d) Set the appropriate resistance value corresponding to the thermistor resistance at the nominal sample temperature, e.g.

20°C =12k5 Ω

e) Select the nominal calibration value to 80 g kg^{-1}.

f) Set the μA source to 25 μA.

g) Initiate a calibration sequence by pressing the CAL button.

h) After 15 minutes the display reads the selected concentration value.

i) With different μA values, the monitor range can be checked. The relative values are as follows:

Note. When the electronic systems are operating correctly, the displayed concentration value should be within 5% of the selected value.

μA	**μg kg-1**
3.125	10
6.250	20
12.500	40
18.750	60
25.000	80
31.250	100

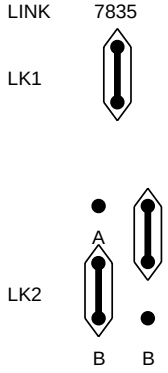
5.4.7 Replacing the Digital Board

Early versions of the Hydrazine Monitor were fitted with a digital board, Part No. 7835 180.

This consisted of a standard 9435 180 board (Issues 1 to 5) and was fitted with a dedicated software EPROM for use in the 7835 Hydrazine Monitor. This board has now been replaced with a new type, Part No. 9435 180 Issue 6 (or later) which is common to other Company Monitors.

When fitted to the 7835 Monitor, it is necessary to configure the board correctly using two sets of provided links, LK1 and LK2. See Fig. 3.5.

Link positions on the Model 7835 must be as follows:



When fitting the present digital board as a replacement for an original board, the rotary range switch requires adjustment to reduce the number of operating positions as follows:

a) Remove the operating knob .

b) Rotate the ring on the body of the switch to limit the number of positions to 3.

c) Replace the operating knob.

7 SPECIFICATION

The following spare items may be ordered from this Company quoting the Part Number listed below.

6.1 Refurbishment Spares.

One Years Requirements.

Part No.	Description	No. Reqd.
7830 061	Cell recharge Kit	4
7835 060	Internal PVC Retubing Kit	1
7835 284	Microporous Disc	2
7835 367	Membrane Clamp (Caustic Dosing Chamber)	2
0211 068	'O'-ring for above	2
0211 120	'O'-ring for above	2

6.2 Strategic Spares.

Rarely Requiring Replacement.

Part No.	Description	No. Reqd.
9435 180	Digital circuit board complete with controls and digital display *	1
7835 170	Analogue circuit Board	1
9435 160	Power Supply Circuit Board	1
0233 835	8-Way Cable (Specify length reqd.)	1
0231 536	Fuse, 2 A Quick Blow 20 x 5 mm	1
0232 971	Illuminated Push Switch	1
7835 385	Hydrazine Sensor	1
0232 062	Solenoid Valve	1
7835 210	Constant Head Assembly	1
7835 355	Standard Solution Container	1
7835 350	Reagent Solution Container	1
7835 364	Nipple (Outlet from Reagent Solution Container)	1
7835 272	Nipple (Outlet from Standard Solution Container)	1
0211 068	'O'-ring for Caustic Dosing Chamber	1
0211 002	'O'-ring for Standard and Reagent Solution Containers above	1
0211 044	'O'-ring for Standard and Reagent Solution Containers above	1
0211 012	'O'-ring for Standard and Reagent Solution Containers above	1
7835 368	Caustic Dosing Chamber	1
7835 375	Thermistor & Sensor Connector Mounting Bracket Assembly	1
7835 226	Electrical Lead Assembly for Sensor	1
0216 403	External Sample Input Valve	1
7835 430	Tool for replacing Microporous Disc	1
0216 404	Sample Filter, 1/4 in. fittings, 60 microns	1
9435 040	Resistor kit for Remote Range Recorder	1
9439 950	Sensor Simulator	1

*__Note__. The PCB ordered previously as 7835-180 is now labelled 9435-180 Issue 6 (or later), as this transmitter digital board is also common to the 9435 Dissolved Oxygen and 8036 Sodium Monitors, with links inserted to suit the particular monitor.

7 SPECIFICATION

Range:	0 to 99.9, 0 to 999 $\mu g\,kg^{-1}$ with automatic range change.
Accuracy:	5% of reading or $\pm 2\ \mu g\,kg^{-1}$. whichever is the greater for hydrazine concentrations up to 500 $\mu g\,kg^{-1}$ Better than 10% of reading above 500 $\mu g\,kg^{-1}$
Response time:	90% of a step change in less than 3 minutes.
Stability:	5% of reading or $\pm 2\ \mu g\,kg^{-1}$. per week whichever is the greater.
Outputs:	Two isolated current outputs in the range 0 to 10, 0 to 20 or 4 to 20 mA. Impedance: 1 kohm maximum.
Remote Range Indication:	Two voltage free contacts rated 125 V a.c., 0.4 A noninductive.
External Alarms:	Two normal or fail-safe, high and low concentration alarms. Calibration Mode indication. Calibration Fail indication. All voltage free, 250 V, 2 A noninductive.
Calibration:	Manual initiation of automatic calibration sequence. Every one to four weeks depending on operating conditions.
Battery Backup	10 years.

Installation Information

Sample temp:	5 to 55°C
Sample flow:	25 to 500 $ml\,min^{-1}$
Sample pressure:	15 millibar minimum.
Ambient temp:	0 to 55°C
Dimensions of sensor unit:	300 mm wide x 400 mm high x 200 mm deep.
Mounting for sensor unit:	Four holes 8.5 mm diameter. 230 mm horizontal 330 mm vertical
Weight of sensor unit:	11 kg.
Connections to sensor unit:	Sample inlet 6.3 mm ($^1/_4$ in.) O.D. compression fitting. Sample waste 10 mm flexible. Atmospheric drain.
Sample line material:	Stainless Steel
Electrical:	Via gland cable size 7 to 10.5 mm Maximum core size: mains: 32/0.2 mm signal: 24/0.2 mm.
Dimensions of transmitter unit:	300 mm wide x 300 mm high x 200 mm deep. CE Approved: 356 mm wide x 300 mm high x 200 mm deep.
Mounting for transmitter unit:	Four holes 8.5 mm diameter, 230 mm horizontal, 230 mm vertical.
Weight of transmitter unit:	11 kg. CE Approved: 12 kg.
Electrical connection:	Via gland plate to fit glands as required. CE Approved: Via glands in terminal box as required.
Power supply requirements:	Volts 115/230 50/60 Hz 100 VA.
Power supply tolerances:	Voltage: +10%, –20% Frequency: minimum – 47 Hz maximum – 65 Hz.
Case protection of transmitter unit:	IP55.
Maximum distance between sensor and transmitter unit:	100 metres.

APPENDIX

A.1 Transmitter Unit

A1.1 Previous Type Digital Circuit Board
(7835 180 - prior to Issue 6, as marked)

This digital board was fitted to earlier versions of the monitor and is now superseded by the board described in the main text of this manual. The principle difference is the extension of the volatile memory on the existing version. User programmable information on the earlier version is only retained for up to ten hours in power down conditions. Users of monitors with the earlier version board need to undertake additional tasks on a different board layout to the information given in the main text.

The tasks are as follows:

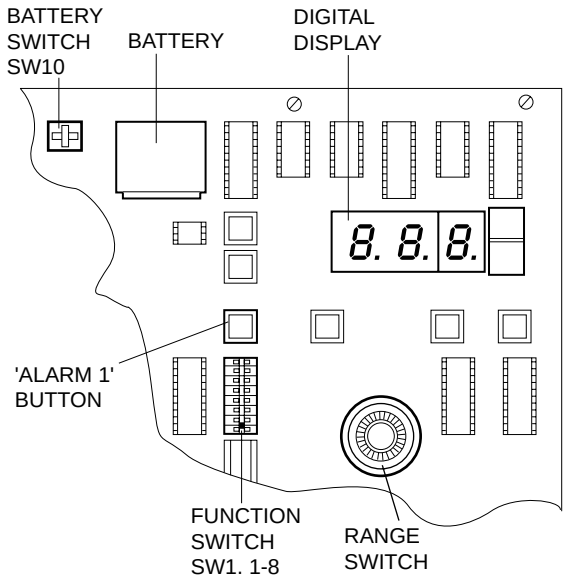


Fig. A1 Part of 7835 180 Digital PCB (Prior to Issue 6)

Setting digital circuit board

Function switch (SW1)
This is situated just below the ALARM 1 push button, and is a series of eight dual-in-line switches – see Fig. A1. This switch is functionally similar and set as described in the main text.

Battery switch (SW10)
This is located at the top of the board. See Fig. A1. This switch is functionally similar and operated as described in the main text. However, SW10 must be switched to the 'OFF' position when the mains supply is switched off for periods greater than 24 hours, to prevent damage to the Nickel-Cadmium battery.

Other switches and controls
These are located as shown in Fig. A1, and are functionally similar and operated as described in the main text.

Cold start
This occurs on restoring the mains supply after any of the following events:

a) The battery switch (SW10) has been switched off.

b) The mains supply has been lost for more than ten hours.

In both cases the data in the volatile memory is lost. This means that during 'Cold Start' the microprocessor reads the default values set by the positions on SW1. 'Cold Start' requires a calibration procedure to be carried out as given in the main text.

Note. After event 'b' it may be necessary to press RESET five minutes after restoring the mains supply.

Warm start
This occurs on restoring the mains supply after it has been lost for less than ten hours.

The data in the volatile memory is maintained. This means that the monitor returns to normal operation maintaining the data values entered previously.

A.2 Shut - Down Procedure

A.2.1 Transmitter Unit
Undertake the procedure as follows:

a) Open the unit and gain access to the digital board by releasing the four plastic fasteners and seventeen screws securing the escutcheon plate.

b) Set the battery switch (SW 10) to 'OFF'.

c) Replace the escutcheon plate and secure with the fasteners and screws.

A.3 Spares List
Substitute the new Digital Circuit Board complete (part number 9435 180) as a replacement for the previous type. Follow the procedures given in the main text in Section 3.3 and Section 5.4.7.

NOTES