



# ABB

## The Company

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.

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.

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.

EN ISO 9001:1994



Cert. No. Q05907

EN 29001 (ISO 9001)



Lenno, Italy – Cert. No. 9/90A

Stonehouse, U.K.



## Electrical Safety

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

## Symbols

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

	<b>Warning</b> – Refer to the manual for instructions
	<b>Caution</b> – 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.

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## 1 INTRODUCTION

The 1492 programmable circular chart recorder measures, displays and records signals from any of the following input types:

- Thermocouple (THC)
- Resistance thermometer (RTD)
- Linear current or voltage
- Non-linear current or voltage from temperature transmitters
- Square law and power root, current and voltage
- Other variables transduced to an acceptable current, voltage or resistance level

The 1492 recorder is available in one-, two-, and three-channel versions with up to 6 output relays allocated to six set points which in turn may be allocated to any channel or channels.

The recorder is microprocessor-based and requires no ranging components. The input mode may be changed by repositioning a link on the printed circuit board and all other changes to instrument operation are effected by a simple programming sequence. Chart revolution time may be programmed in steps of one hour, from a minimum of 1hr/revolution up to 168hr/revolution.

The recorder may be wall- or panel-mounted or fitted into a carrying stand. A post mounting kit is also available.

## 2 PREPARATION

### 2.1 Accessories

The following items are packed with the instrument:

- Door keys
- Pack of charts (10)
- Function label
- Program card

Mounting brackets are supplied ready-fitted to the case.

## 2.2 Checking the Instrument Code Number – Fig. 2.1

Unlock the door.

- ① Pull the door catch forward and down to open the door, hinged at the left hand edge.
- ② Loosen the captive crosshead screw.
- ③ Swing the chassis forward (hinged at the left hand side).
- ④ Check the type number on the serial number label against the Specification Sheet, reference SS/1492.

**Note.** Unless the user has requested a particular program the recorder is despatched with a Company Standard Test Program which is defined on the program card. If this is not suitable for the user's requirements the instrument may be re-programmed. See **PROGRAMMING** on page 22.

- ⑤ Write the function of each channel beneath the appropriate colour on the function label and stick it on the inside edge of the door.

Swing the chassis back into position and tighten the captive screw. Close the door.

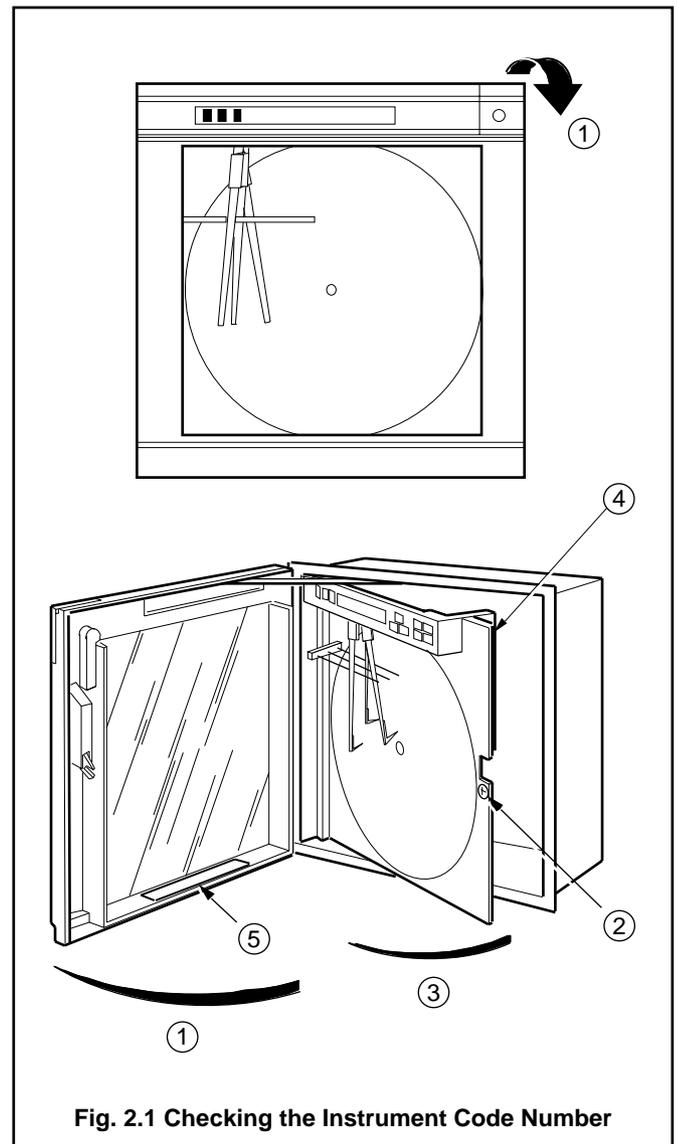


Fig. 2.1 Checking the Instrument Code Number

### 3 INSTALLATION

#### EC Directive 89/336/EEC

In order to meet the requirements of the EC Directive 89/336/EEC for EMC regulations, this product must not be used in a non-industrial environment.

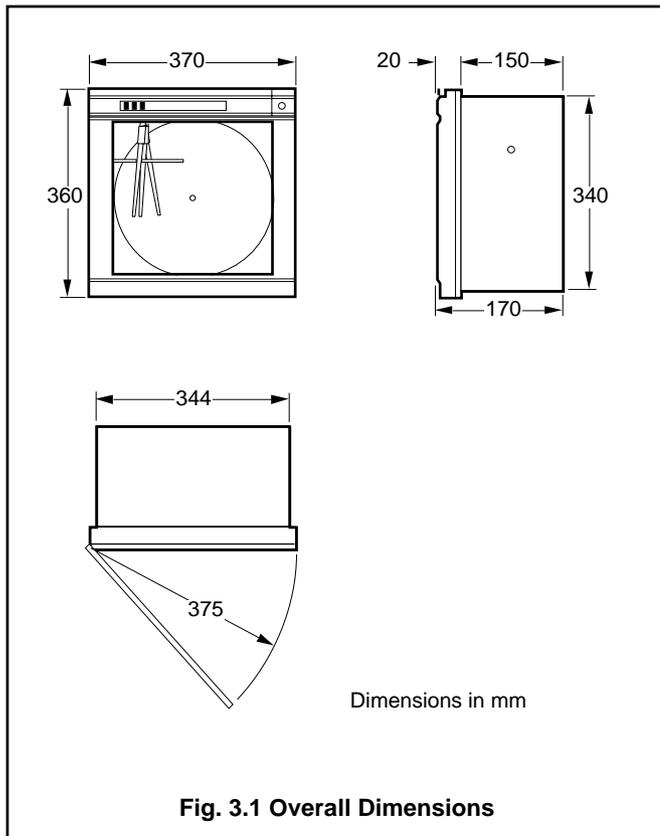
#### 3.1 Siting

Select a location:

- a) As close as possible to the primary sensing device(s).
- b) Free from excessive vibration.
- c) Within the temperature limits of 0 to 55°C and humidity limits of 0 to 80% RH.
- d) Where the instrument's protection rating, IP54, is sufficient.
- e) Away from strong electrical and magnetic fields. If these cannot be avoided, particularly in those applications where 'walkie-talkies' are expected to be used, screened cables within earthed metal conduit must be used.

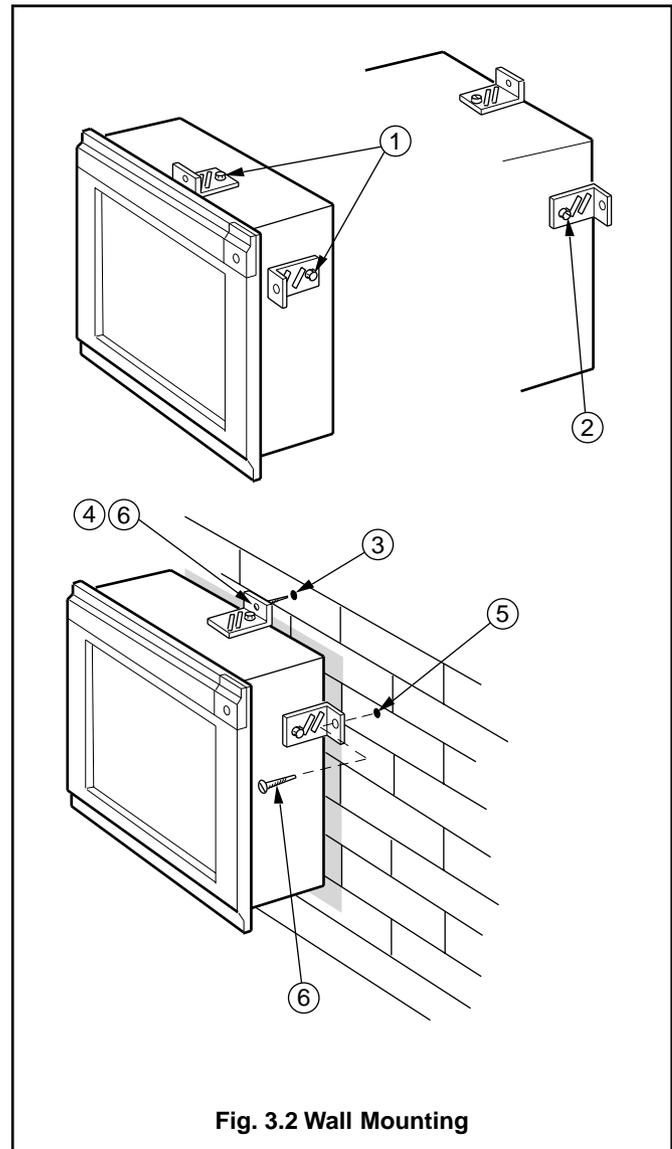
#### 3.2 Mounting – Fig. 3.1

Overall dimensions are shown in Fig. 3.1. The instrument weighs approximately 10.5kg.



#### 3.2.1 Wall Mounting – Fig. 3.2

- ① Remove the three fixing brackets from the top and sides of the case.
- ② Reverse the brackets and refit to the case with the fixing screws located in the holes in the brackets (not the slots). Tighten the screws firmly.
- ③ Mark and drill a mounting hole in the position for the top mounting bracket – the bracket fixing hole is 8mm diameter.
- ④ Temporarily screw the instrument to the wall.
- ⑤ On the wall mark the positions of the remaining fixing holes, ensuring that the instrument is vertical. Drill appropriate holes in the wall.
- ⑥ Fix the recorder firmly to the wall.



### 3.2.2 Panel Mounting – Fig. 3.3

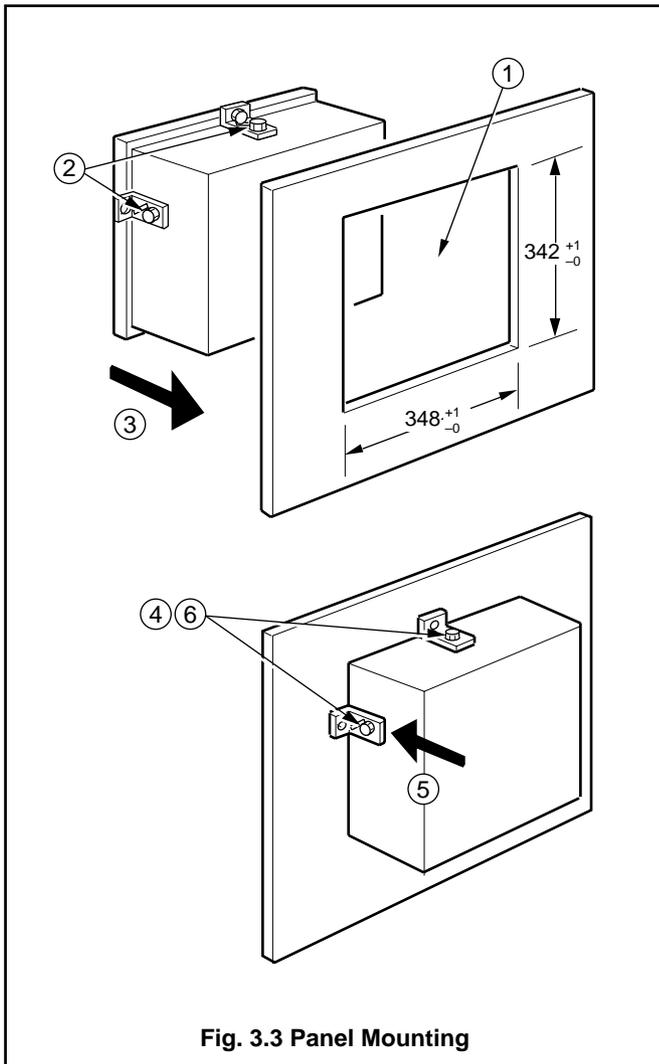
Use a robust panel. The maximum panel thickness is 35mm.

- ① Cut a hole 342 (+1mm –0mm) high and 348 (+1 mm –0mm) wide in the panel. (For multiple installations allow a minimum of 65mm horizontally and 60mm vertically between cut-outs.)
- ② Remove the three fixing brackets and screws from the top and sides.
- ③ Insert the instrument in the cut-out.
- ④ Replace the brackets, locating each fixing screw in the slot appropriate to the panel thickness.
- ⑤ Press the brackets hard against the panel and tighten the fixing screws.

### 3.2.3 Fitting a Carrying Stand

The procedure is similar to that detailed in **Panel Mounting** above (steps ② to ⑤).

**Note.** It may be necessary to remove the cable entry plugs from the instrument's case before inserting it into the stand.



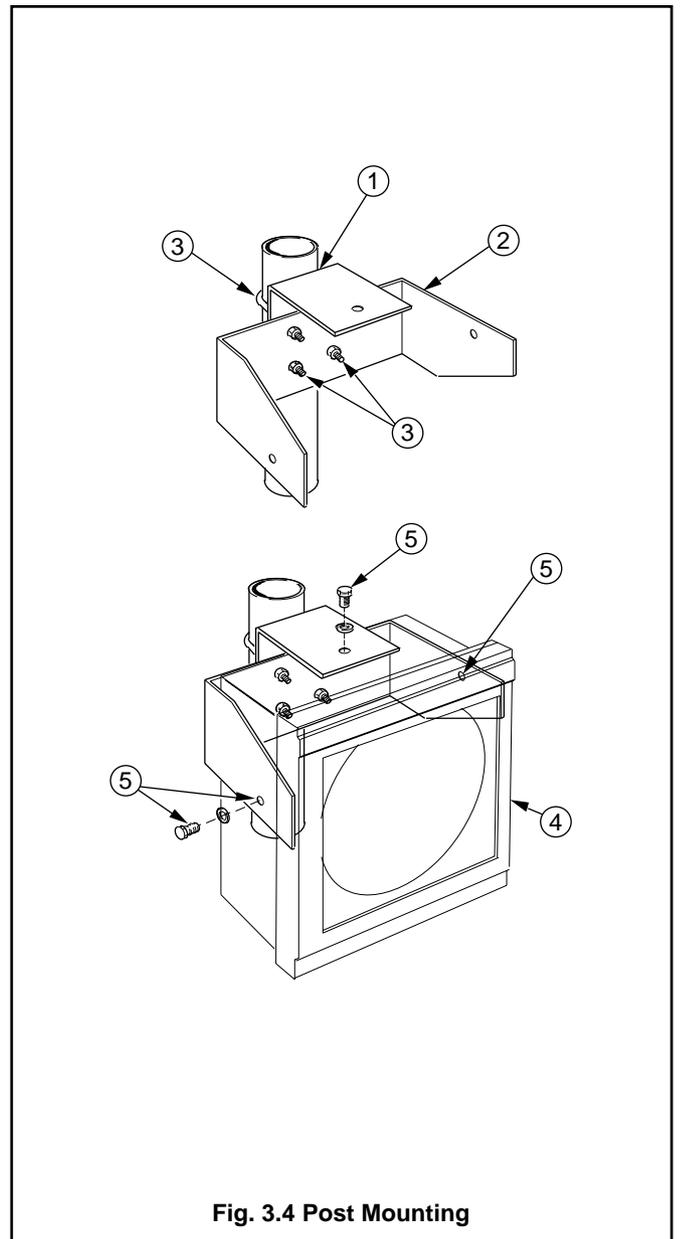
### 3.2.4 Post Mounting – Fig. 3.4

The post mounting kit is designed for mounting the recorder on a 2 inch (2<sup>3</sup>/<sub>8</sub> inch O.D.) vertical post.

- ① Position the mounting bracket against the vertical post.
- ② Assemble the mounting plate to the mounting bracket.
- ③ Use the two 'U'- bolts, four nuts and the four M10 washers supplied to secure lightly the bracket assembly. Position the assembly and evenly tighten the four nuts.

**Caution.** Over-tightening the nuts can cause distortion of the mounting bracket.

- ④ Position the recorder within the bracket assembly.
- ⑤ Secure using the three M6 hexagon-headed screws and washers provided, one at the top and one each side.



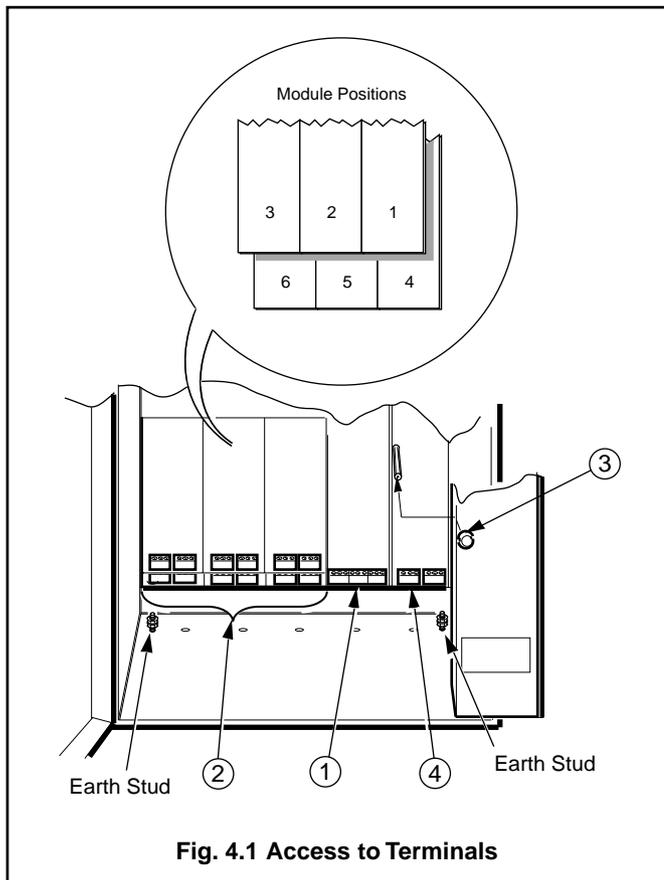
## 4 ELECTRICAL CONNECTIONS

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

1. **CAUTION.** To avoid damage to multichannel recorders, high common mode voltages up to 250V r.m.s. max. must be present on all channels at all times, or not at all.

The maximum channel-to-channel voltage (between any two channels) must not exceed 12.5V or permanent damage to the instrument's input circuitry may occur. To prevent such damage the negative terminals on all inputs are linked – see Figs. 4.3 to 4.6.

For applications where the available 12.5V isolation is required, the link(s) between the relevant channel and the other channel(s) must be removed.



**Fig. 4.1 Access to Terminals**

If inter-channel isolation is required and the channel to channel voltage rises above 12.5V then use of the type 'K' isolated input module is recommended. See section 4.4.

2. If the recorder is to be re-programmed before use, ensure that the programming is complete before making any process signal connections – see Section 8.
3. If the input type on any channel differs from that specified on the program card, see Section 4.3.1.

### 4.1 Access to Terminals – Fig. 4.1

Unlock and open the door, release the chassis and swing it forward – see Fig. 2.1 on page 2.

- ① Identify the signal connections terminal block.
  - ② Identify the module(s) connections terminal block(s) (if fitted)
- To gain access to the power supply connections terminal block:
- ③ Undo the knurled captive screw retaining the protection cover and remove the cover. Take care not to stress the earthing cable connecting cover to case.
  - ④ Identify the power supply terminal block.

### 4.2 Connections, General

- a) The terminals accept cables of up to 2.5mm<sup>2</sup> cross section.
- b) Remove the 20mm diameter cable entry blanking plugs and replace them with cable glands or conduit adaptors to suit the application.
- c) Always route signal leads and power cables separately, preferably in earthed metal conduit. It is strongly recommended that, for signal inputs and relay connections, screened cable is used, with the screen connected to the earth stud(s) – see Fig. 4.1.

Type of Thermocouple	BS4937 Part No.	Compensating Cable		Casing Colour
		+	-	
NiCr/NiAl (K)	4	Cu (white)	Con (blue)	Red
Pt/PtRh (R and S)	1 & 2	Cu (white)	CuNi (blue)	Green
Cu/CuNi (T)	5	Cu (white)	Con (blue)	Red
Fe/Con (J)	3	Fe (yellow)	Con (blue)	Black
Fe/Con (DIN 43710 type L)	-	Fe (blue + red trace)	Con (blue)	Blue
Nicrosil/Nisil (type N)	8	Orange	Blue	Orange

**Table 1 Thermocouple Compensating Cables**

### 4.3 Signal Connections

If a signal input is not connected or is not in use, even temporarily:

**THC and mV inputs** – short-circuit the + and – input terminals on each channel (see Figs. 4.3 and 4.4).

**RTD inputs** – from standard tables obtain the resistive equivalent of the temperature 'Range Zero' (noted on the Program Card) and fit a resistor, approximately equal to or higher than this value, across the input terminals for leads 1 and 2. Link the terminals for leads 1 and 3 (see Fig. 4.5a).

**V and mA inputs** – it is not necessary to make any connections to the input terminals (see Fig. 4.3).

#### 4.3.1 Selecting the Signal Input Type – Fig. 4.2

Plug-in links on the microprocessor p.c.b. select the input type; voltage, current or temperature (THC or RTD). If the input type differs from that originally stated on the program card, the links must be re-positioned before making any connections and the instrument must be re-programmed.

Open the door, release the chassis and swing it forward – see Fig. 2.1.

With reference to Fig. 4.2:

- ① Identify the three links.
- ② Set the link positions for the required input type on each channel.

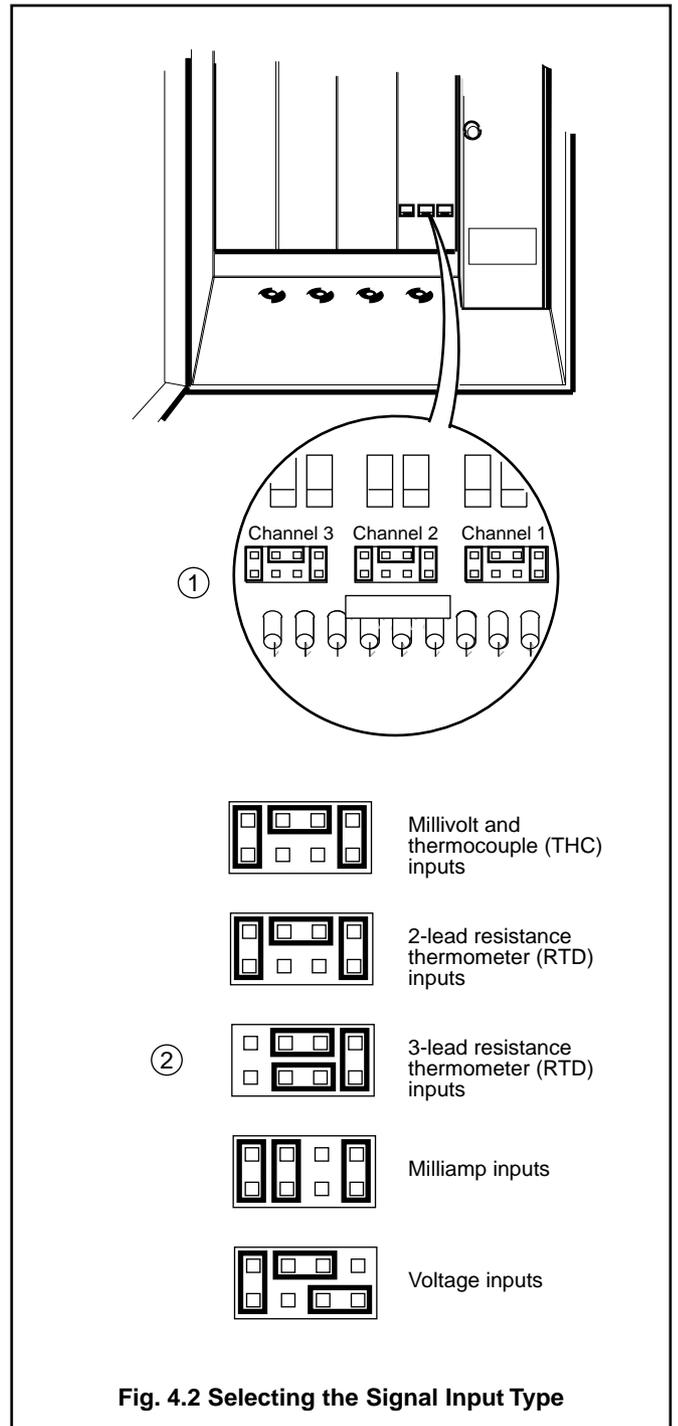


Fig. 4.2 Selecting the Signal Input Type

### 4.3.2 Voltage and Current Inputs – Fig. 4.3

Make connections as shown in Fig. 4.3.

### 4.3.3 Thermocouple (THC) Inputs – Figs. 4.4

Use the correct compensating cable between the THC and the terminals – see Table 1, on page 6.

Make connections as shown in Fig. 4.4.

**Note.** Automatic Cold Junction Compensation (ACJC) is incorporated but an independent external cold (reference) junction may be used if the instrument is programmed for use with thermocouple inputs.

### 4.3.4 3-Lead Resistance Thermometer (RTD) Inputs – Figs. 4.5

The three leads must have equal resistance, not exceeding 50Ω each.

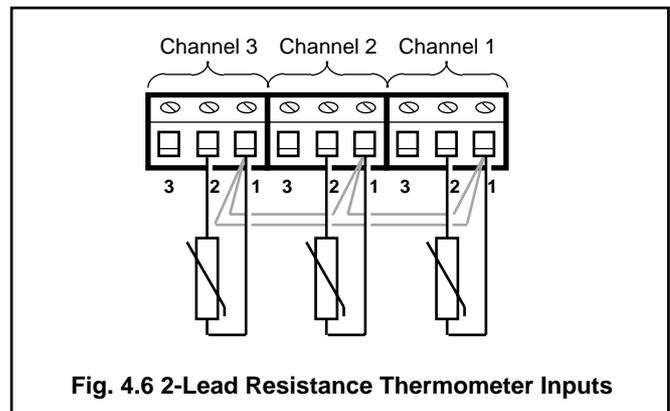
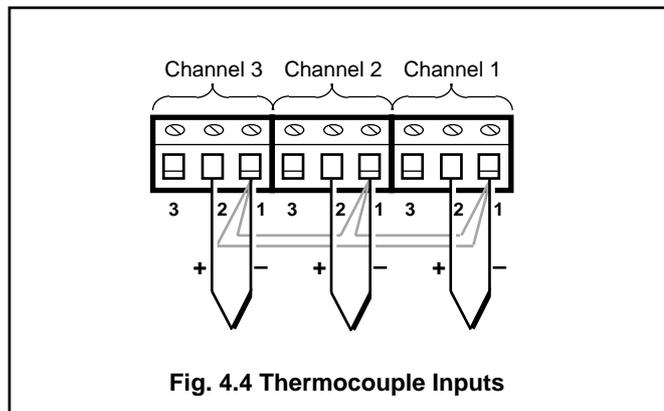
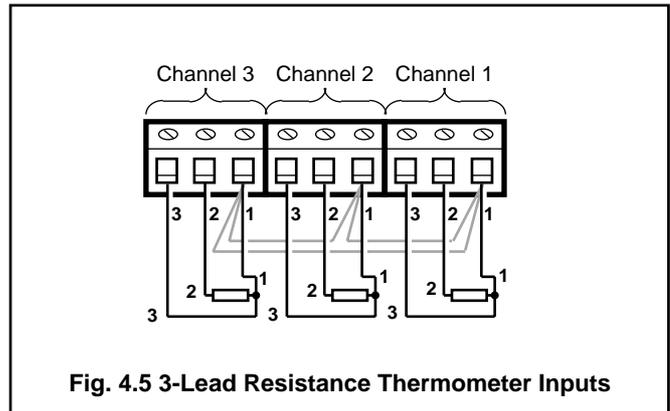
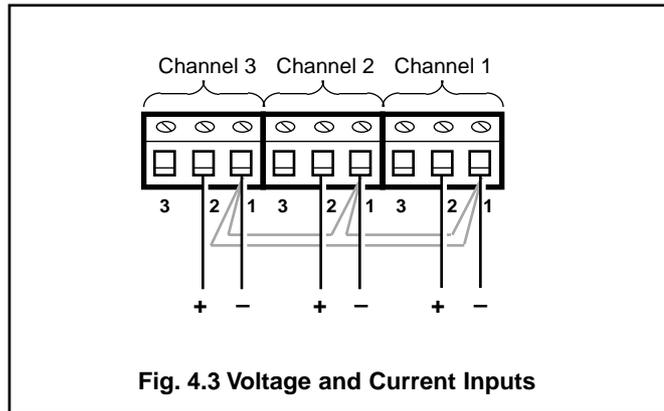
Make connections as shown in Fig. 4.5.

### 4.3.5 2-Lead Resistance Thermometer (RTD) Inputs – Fig. 4.6

#### Notes.

- If long leads are necessary it is preferable to use a 3-lead RTD, see previous section.
- If the lead resistance differs from that specified at the time of ordering, the recorder must be re-calibrated before use – see section 10.
- If the RTD is to be used in a hazardous area a 3-lead RTD **must** be used.

Make Connections as shown in Fig. 4. 6.



#### 4.3.6 Transmitter Power Supply – Fig. 4.7

The transmitter power supply occupies one of the module positions and can provide a common supply for up to three two-wire transmitters as shown in Fig. 4.7. Make connections as shown. Note that the connections shown dotted are made before despatch and must not be disturbed.

Determine the supply to the transmitter power supply module – see Section 4.6.2.

The positioning of two plug-in leads determines either 110V or 230V operation of the transmitter power supply module.

With reference to Fig. 4.7:

- ① Identify the leads.
- ② Position both leads for the mains supply used by lifting each socket body away from the p.c.b. and withdrawing the lead. Lift the alternative socket away from the p.c.b., push the lead in and snap the socket body down onto the p.c.b. to secure and make contact.

**Note.** A transmitter power supply board would not normally be fitted to a d.c. powered instrument.

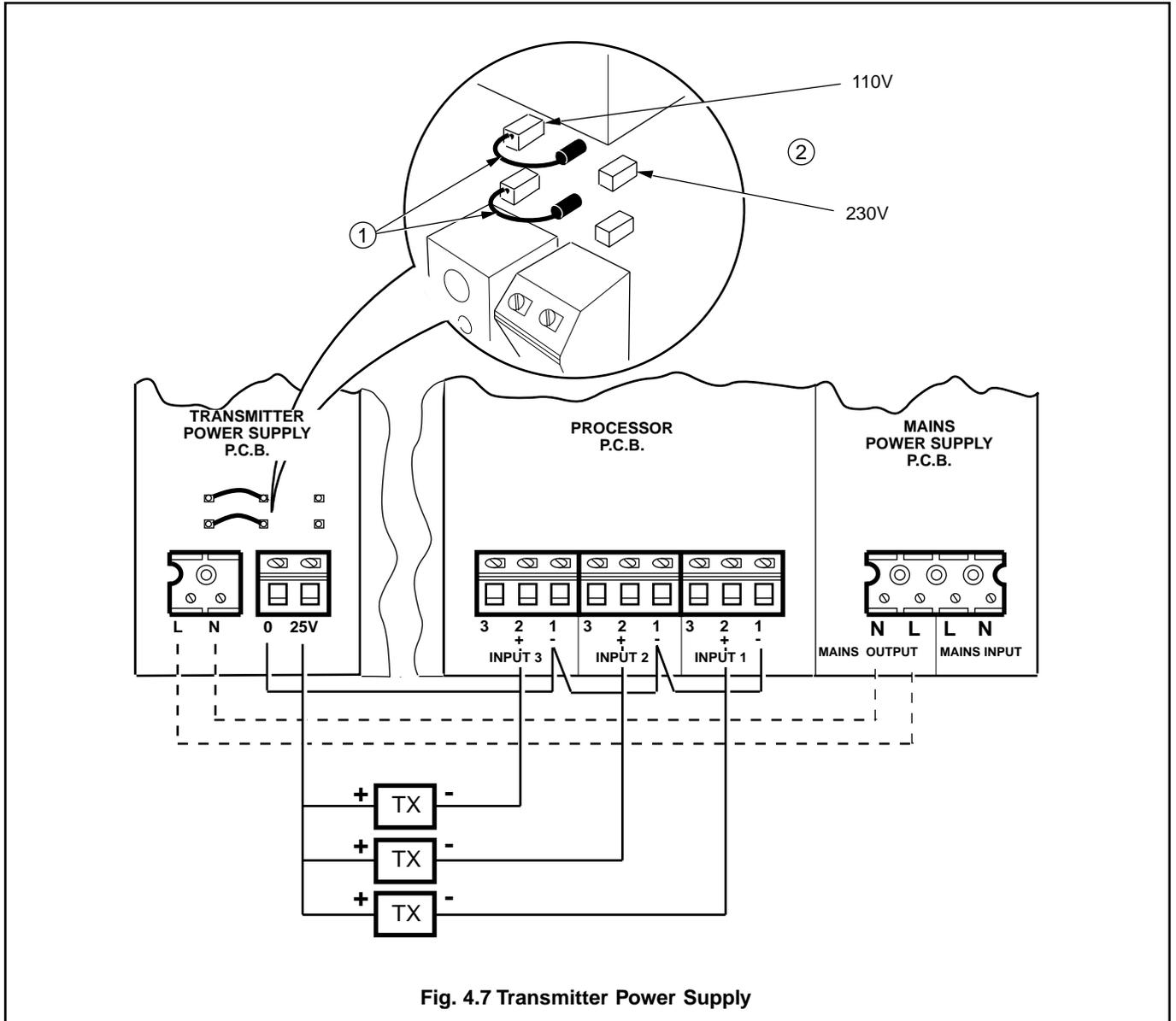


Fig. 4.7 Transmitter Power Supply

#### 4.4 Isolated Signal Connections

Up to two isolated input modules, type K, may be fitted to the recorder, occupying module position 2, for channel 2, and/or position 3 for channel 3 (see Fig. 4.1).

If an isolated input module is to be added, refer to Section 12.2 for fitting instructions.

#### N.B.

Isolated signal input connections must be made to the input module(s) only. The respective input terminals for that channel on the processor board must be shorted out.

When changing a channel to or from an isolated signal input module it is advisable to re-calibrate the recorder as described in Section 10.

If a signal is not connected to an isolated input module, or is not in use, even temporarily, the procedures described in Section 4.3 must be carried out.

The maximum channel-to-channel and channel-to-earth isolation voltage is 2kV.

#### 4.4.1 Selecting the Isolated Signal Input Type – Fig. 4.8

Plug-in links on the isolated signal input module select the input type: voltage, current or temperature (THC or RTD).

If the input type differs from that originally stated on the program card, the links must be re-positioned before making any connections and the instrument must be re-programmed, see Section 8.

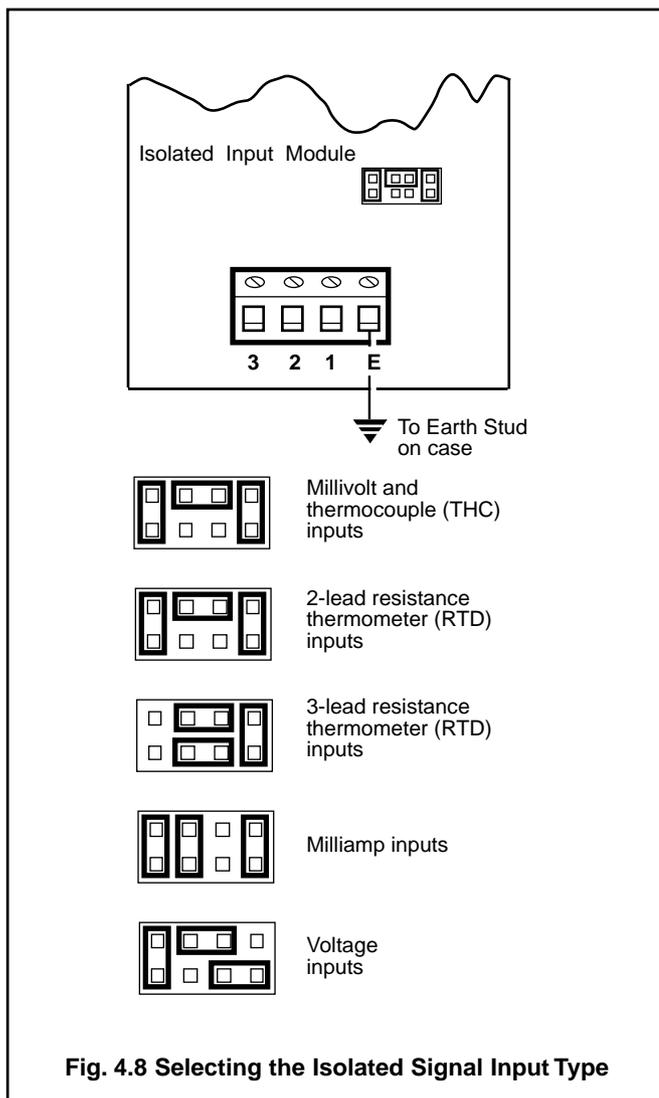


Fig. 4.8 Selecting the Isolated Signal Input Type

Type of Thermocouple	BS4937 Part No.	Compensating Cable		Casing Colour
		+	-	
NiCr/NiAl (K)	4	Cu (white)	Con (blue)	Red
Pt/PtRh (R and S)	1 & 2	Cu (white)	CuNi (blue)	Green
Cu/CuNi (T)	5	Cu (white)	Con (blue)	Red
Fe/Con (J)	3	Fe (yellow)	Con (blue)	Black
Fe/Con (DIN 43710 type L)	–	Fe (blue + red trace)	Con (blue)	Blue
Nicrosil/Nisil (type N)	8	Orange	Blue	Orange

Table 1 Thermocouple Compensating Cables (repeated)

#### 4.4.2 Voltage and Current Inputs – Fig.4.9

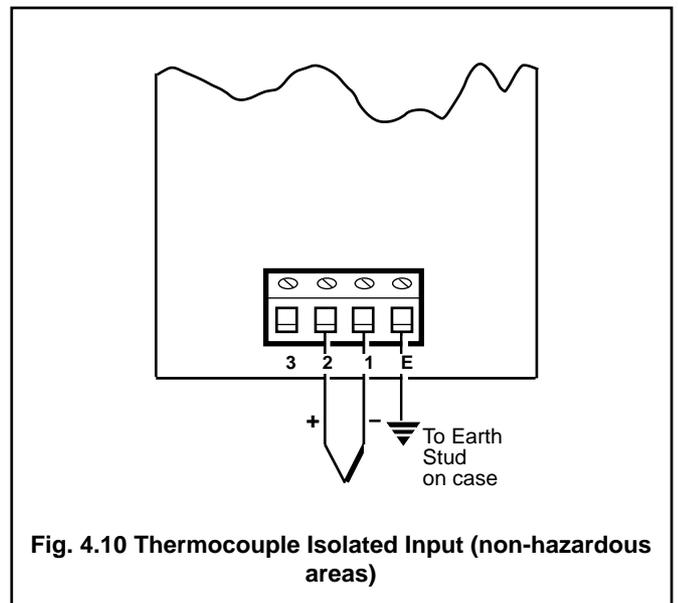
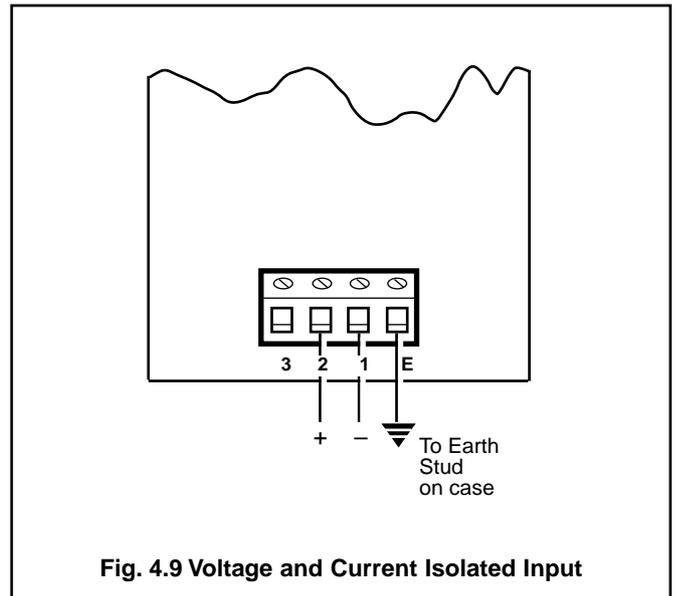
Make connections as shown in Fig.4.9.

#### 4.4.3 Thermocouple (THC) Inputs – Figs. 4.10

Use the correct compensating cable between the THC and the terminals – see Table 1 opposite.

Make connections as shown in Fig. 4.10.

**Note.** Automatic Cold Junction Compensation (ACJC) is incorporated but an independent external cold (reference) junction may be used if the recorder is programmed for use with isolated thermocouple inputs.



#### 4.4.4 3-Lead Resistance Thermometer (RTD) Inputs – Figs. 4.11

The three leads must have equal resistance, not exceeding  $50\Omega$  each.

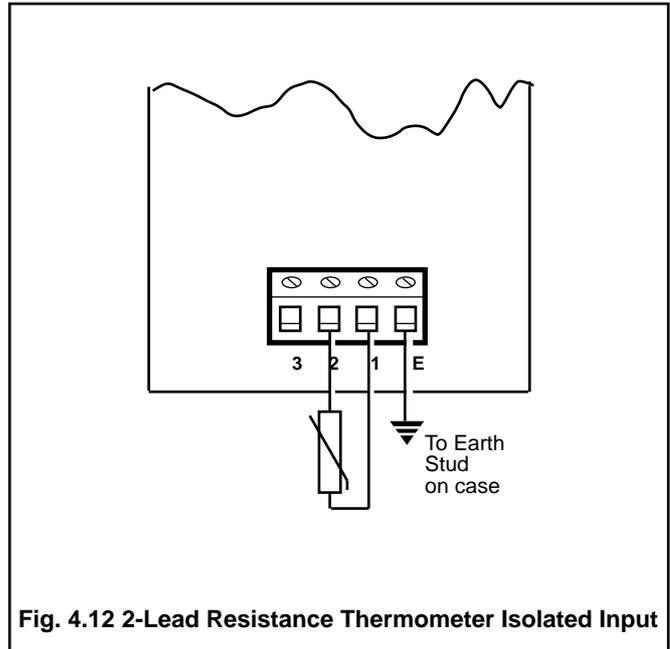
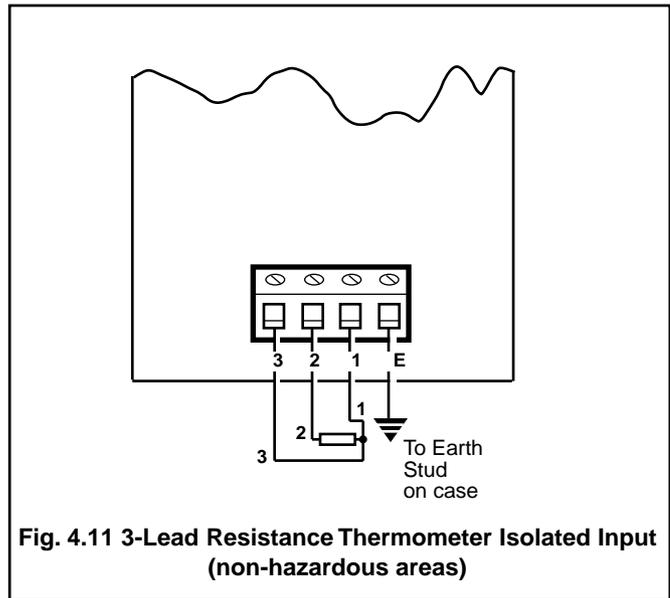
Make connections as shown in Figs. 4.11.

#### 4.4.5 2-Lead Resistance Thermometer (RTD) Inputs – Fig.4.12

**Note.**

- a) If long leads are necessary it is preferable to use a 3-lead RTD, see previous section.
- b) If the lead resistance differs from that specified at the time of ordering, the recorder must be re-calibrated before use, see Section 10.

Make connections as shown on Fig. 4.12.

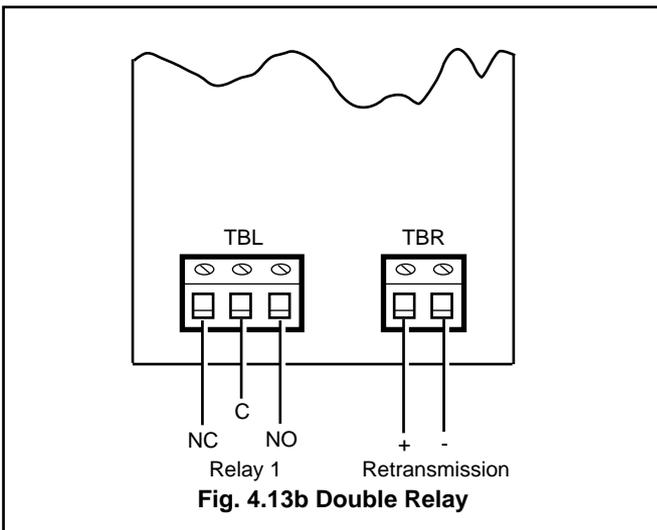
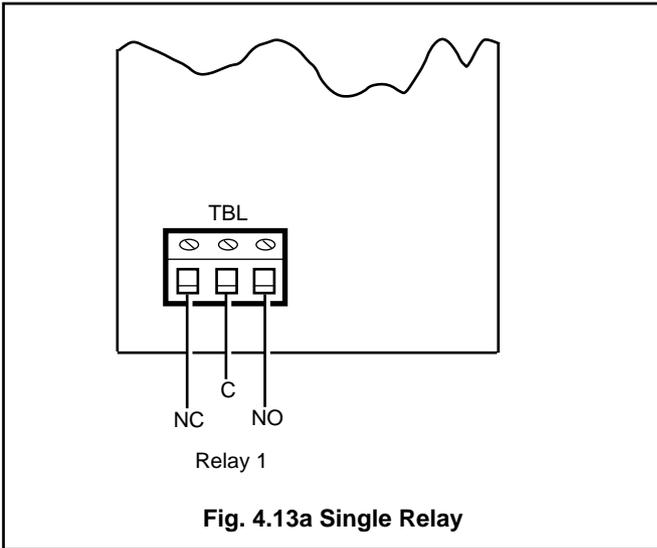


## 4.5 Output Connections

### 4.5.1 Relay Connections – Figs. 4.13a and 4.13b

All relay connections are voltage free; see Section 11 for relay contact ratings. Alarm circuits should be connected to an independent power supply to safeguard alarm operation in the event of power failure. Make connections as shown in Fig. 4.13a or Fig. 4.13b –

NO = contact normally open  
 NC = contact normally closed  
 C = common

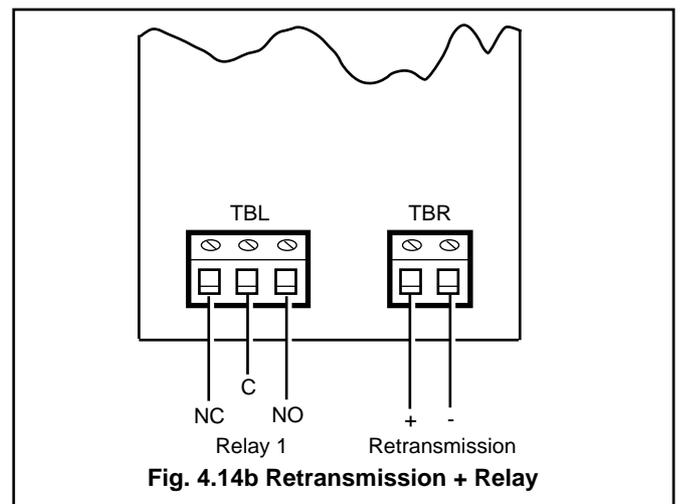
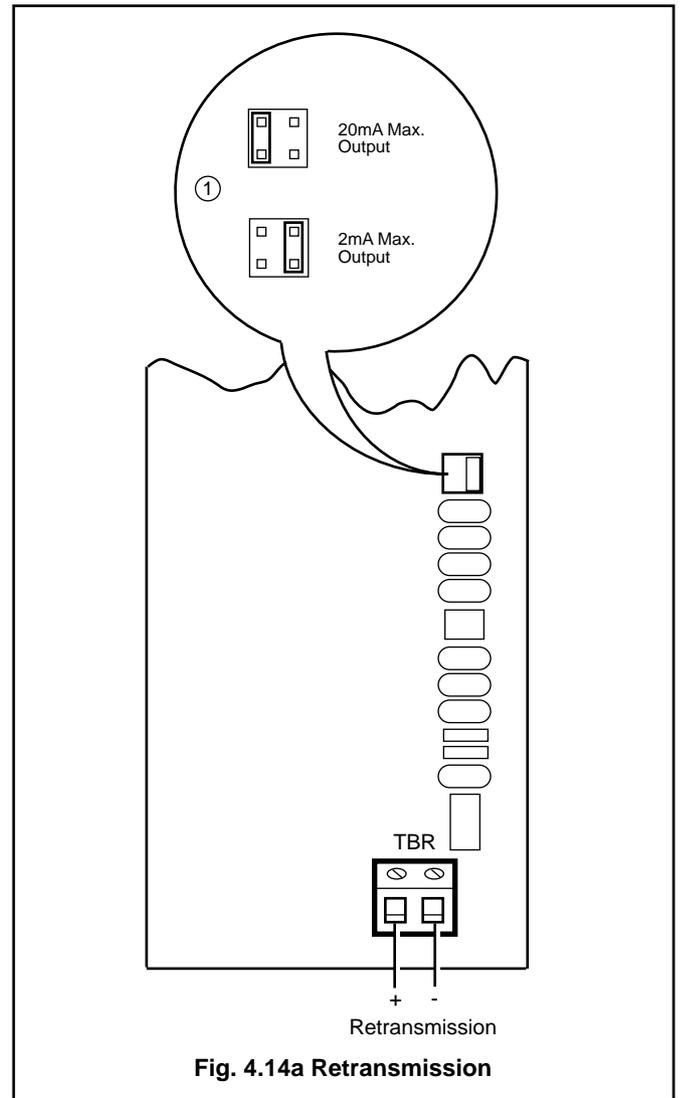


### 4.5.2 Retransmission Connections – Figs. 4.14a and 4.14b

Make connections as shown in Fig. 4.14a or Fig. 4.14b. The maximum output current (2mA or 20mA) is determined by the position of a plug-in link (PL1) – see Fig. 4.14a.

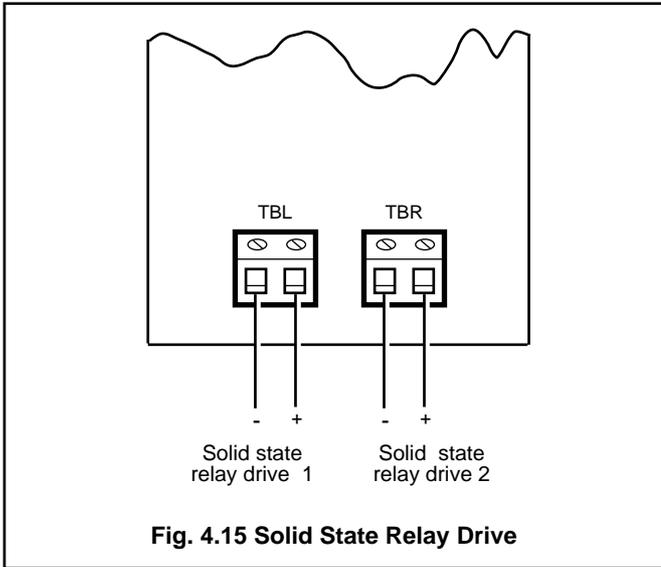
With reference to Fig. 4.14a:

- ① Position the link for the maximum output current required.



#### 4.5.3 Solid State Relay Drive – Fig. 4.15

Where a solid state relay is used, make the relay drive connections as shown in Fig. 4.15. The drive has a rating of 24V @ 30mA.



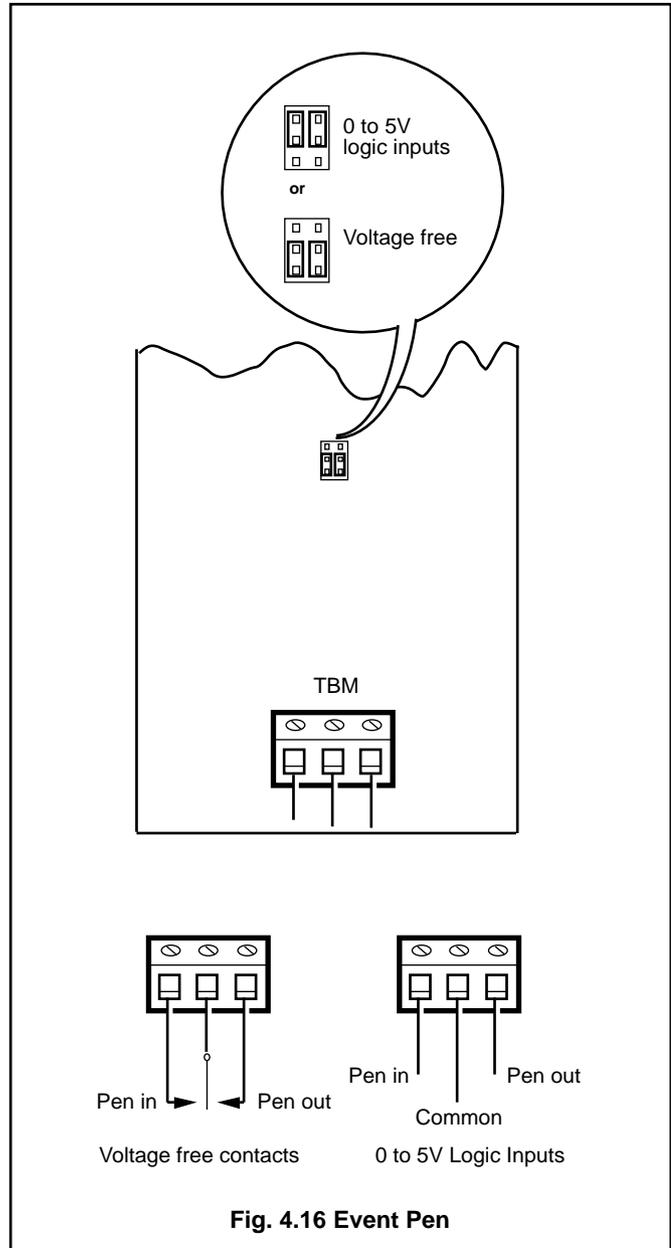
#### 4.5.4 Event Pen – Fig.4.16 (PX105/14 or /15 only)

Make connections to the terminal block on the event pen p.c.b. as shown in Fig.4.16. Check that the plug-link configuration is correct for the input type.

##### Notes.

1. The event pen operates over the outer 5% of the chart width, moving both outwards and inwards from the neutral position (Pen out or Pen in Fig.4.16)
2. For voltage-free contacts, the pen takes up the neutral position when both contacts are open-circuited.

For 0 to 5V logic inputs, the pen takes up the neutral position if both inputs are zero or if both are 5V.



## 4.6 Power Supply

### 4.6.1 Mains Input Voltage Connections – Fig. 4.17

Unscrew the captive knurled fixing screw and remove the protective cover to the extent of the attached earthing cable (see Fig. 4.1).

Connect the mains power cables as shown in Fig. 4.17. Securely connect the power earth cable to the earth terminal stud fitted to the recorder case. To select the mains input voltage refer to Section 4.6.2, following.

Refit the protective cover, ensuring that the earthing cable is securely attached and is within the cover after securing.

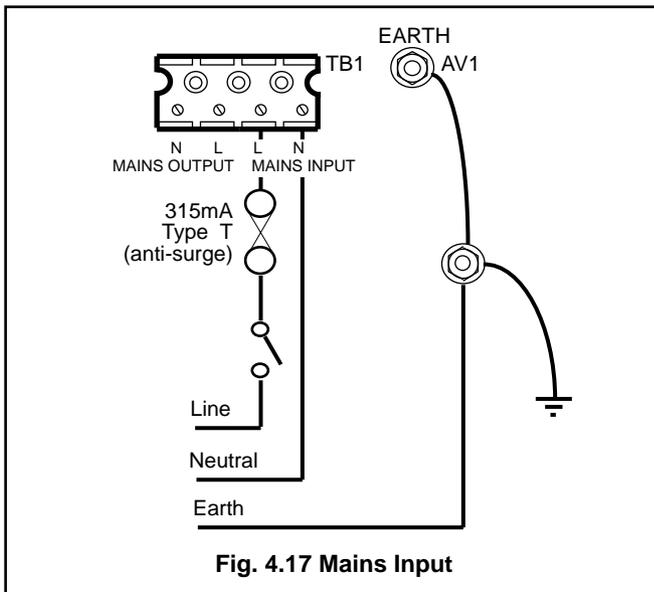


Fig. 4.17 Mains Input

### 4.6.3 D.C. Supply – Fig.4.19

D.C. powered instruments accept a 10 to 30V d.c. supply. Make connections as shown in Fig.4.19.

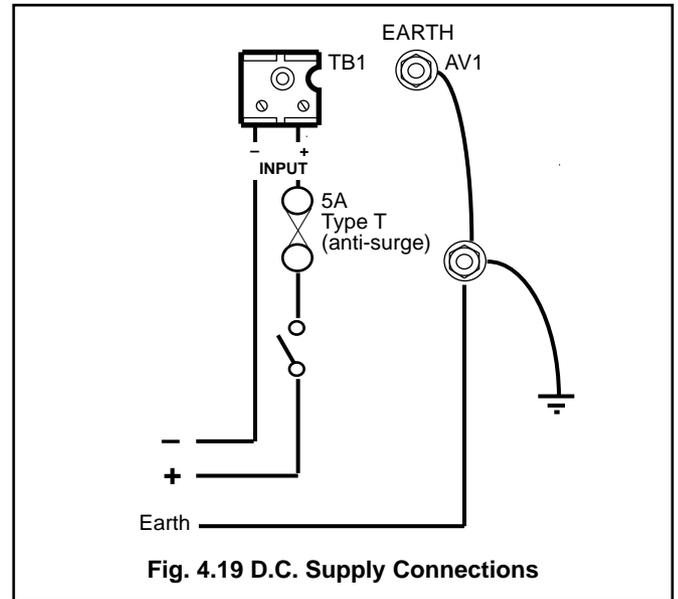


Fig. 4.19 D.C. Supply Connections

### 4.6.2 Selecting the Mains Input Voltage – Fig. 4.18

The mains input voltage (110V or 230V) is selected by re-positioning a plug-in 'handbag' link on the power supply p.c.b.

- 1 Identify the link.
- 2 Position the link for the mains supply voltage used.

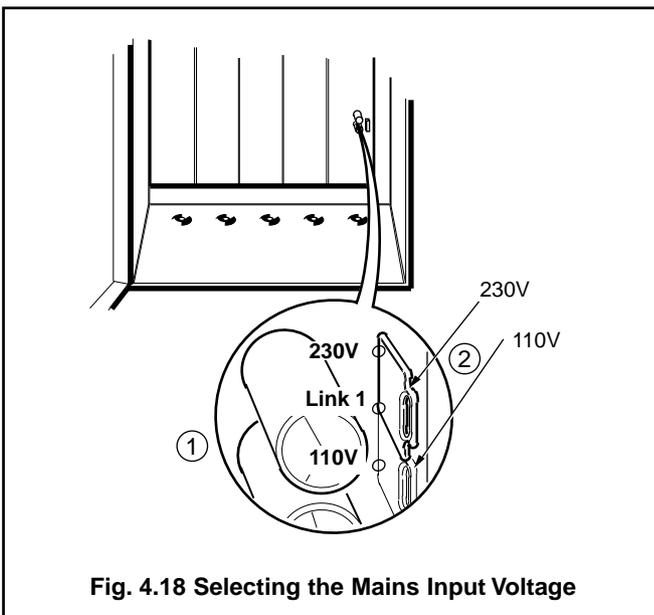


Fig. 4.18 Selecting the Mains Input Voltage

## 5 FAMILIARISATION WITH CONTROLS, DISPLAY AND L.E.D. INDICATION

The tactile membrane switches, display and alarm l.e.d.s are located above the chart. Open the door for access to these controls.

### 5.1 Controls – Fig. 5.1

The controls comprise tactile membrane switches requiring only moderate finger pressure for operation.



'Pen Lift' switch – Used to raise and lower the pens on alternate operations. All the pens move to an automatic referencing position just outside full scale on the chart when raised using the 'Pen Lift' switch.

**Note.** If the 'Pen Lift' switch is not pressed to lower the pens, the pens automatically return to their operating positions after a five minute delay.



'Channel' switch – used to select the channel, or common settings, to be programmed (see Fig. 8.2 on page 23).



'Page Advance' switch – used to advance to the next program page (see Fig. 8.2 on page 23).



'Parameter Advance' switch – used for advancing to the next parameter within a program page or, in **Operating Page 1** (Section 7), for stopping automatic parameter advancement, i.e. for viewing individual measured values.



'Raise' switch – used for increasing a parameter value or stepping-up through a selection of parameters (see **Note 1**).



'Lower' switch – used for decreasing a parameter value or stepping-down through a selection of parameters (see **Note 1**).



'Decimal point' switch – used to adjust the decimal point position during programming of certain parameters.



'Enter' switch – used for storing the programmed function parameters and values into the instrument's non-volatile memory (see **Note 2**).

#### Notes.

- Continued pressure on the 'Raise' and 'Lower' switches causes the rate of change of the displayed value to increase. To make small adjustments press the switches momentarily. Operation of the 'Raise' and 'Lower' switches during programming causes the value or parameter being changed to flash until the 'Enter' switch is pressed. If left flashing for approximately five minutes the display reverts to its original value.
- The 'Enter' switch must be operated each time a parameter or value is changed otherwise, on advancing to the next parameter, the value reverts to that originally displayed.

### 5.2 Display – Fig.5.1

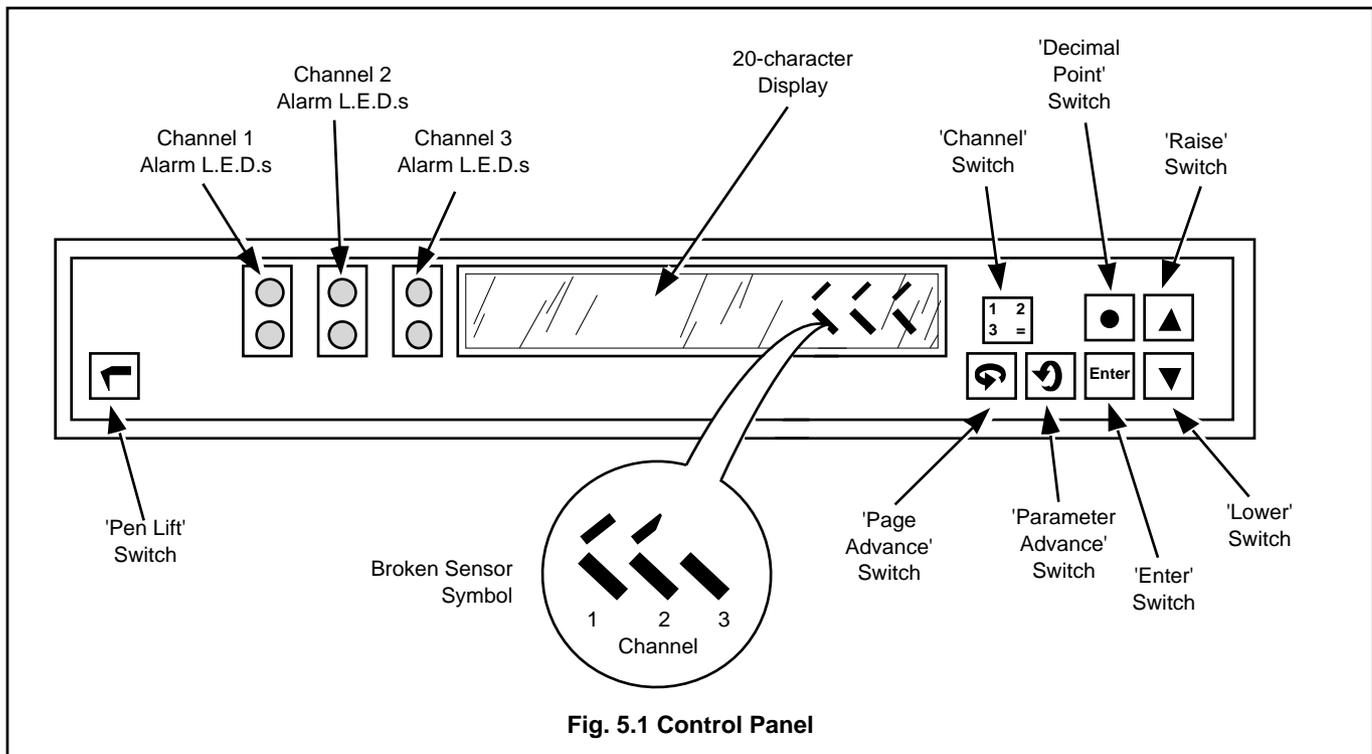
A 20-character 5 x 7 dot-matrix, blue-filtered, vacuum fluorescent display is used for display of all operating and programming parameters.

#### 5.2.1 Broken Sensor

The position of broken sensor symbols on the display identifies the channel affected – see Fig. 5.1.

### 5.3 Alarm L.E.D. Indication – Fig. 5.1

Alarm states are indicated by a vertical pair of red/green l.e.d.s for each pen.



## 6 SETTING UP

### 6.1 Recorder Start-up

**CAUTION.** Ensure that all connections, especially to the earth stud, are made correctly.

Check that:

- a) The input sensors are correctly installed.
- b) The red pen tip coincides with the correct time line on the chart – see step ⑤ below. (To avoid collision the green pen writes approximately 4mm ahead of the red pen and the blue pen writes approximately 4mm behind the red pen, with respect to time.)

**Note.** Only the red pen can follow precisely the time line on the chart, since the other pen traces are at different radii from the common pivot. On instruments fitted with an event pen the event marker draws on the same time line as the red pen.

Switch on the supply to the instrument, any power-operated control circuits and the input signals and wait for the pens to settle. (Pen lifting, referencing and lowering occur automatically when the power is first switched on.) 'TEST IN PROGRESS' is displayed for approximately five seconds to allow for internal referencing. The recorder then reverts to a display of the measured value(s) – see Section 7.1.

### 6.2 Fitting the Chart – Fig. 6.1

Ensure the power supply is on.

- ① Press the 'Pen Lift' switch.
- ② Lift the chart clamp and remove the old chart, if the recorder is already in use.
- ③ Fit the new chart on to the spindle, ensuring that it is beneath all the pen lifter arms.
- ④ Locate the lower edges of the chart in the retaining slots and the upper edge under the control panel.
- ⑤ Rotate the chart on the spindle until it is positioned for correct time recording by the red pen. Use the marker on the chassis as a guide only.
- ⑥ Lower the chart clamp and press on it firmly to ensure that the two locating pins pierce the paper.

If the instrument is already in use press the pen 'Raise/Lower' switch, otherwise proceed to Section 7.

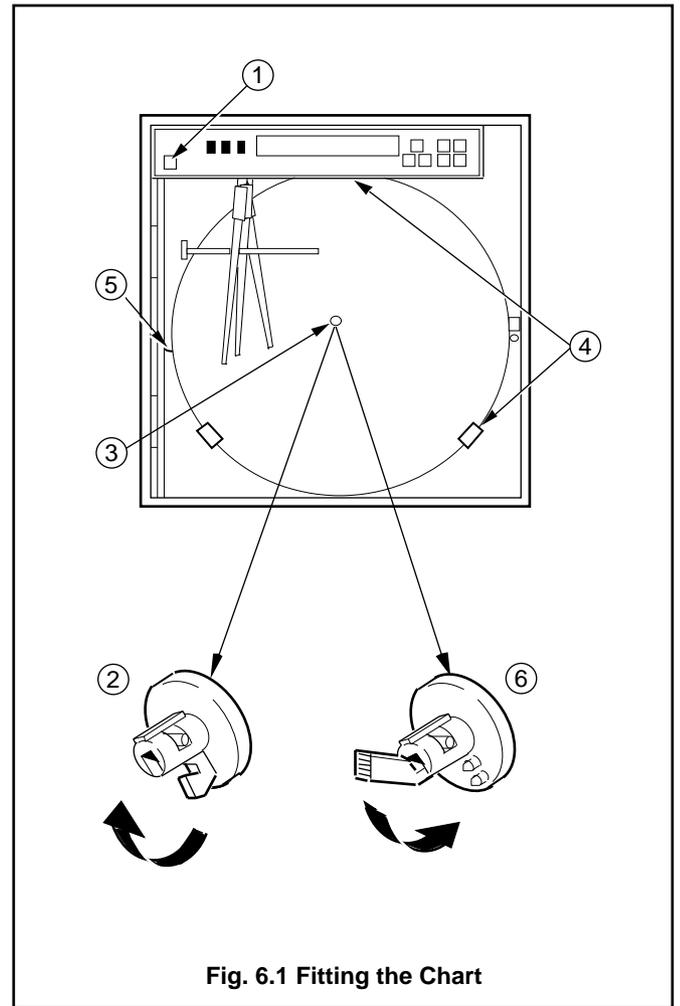


Fig. 6.1 Fitting the Chart

### 6.3 Fitting the Pen Capsule(s) – Fig. 6.2

With the power supply to the instrument turned on operate the 'Pen Lift' switch – see Fig. 5.1.

With reference to Fig. 6.2:

- ① Gently pull each individual pen arm down off the bracket, taking care not to bend the arms.
- ② Remove the spent capsule by sliding it up the pen arm.
- ③ Fit a new capsule to the arm by sliding the 'dove-tail' on the capsule into the slot in the pen arm. Pen arms are identified by the coloured mouldings at the top of each arm; red (No. 1 pen), green (No. 2 pen), and blue (No. 3 pen). The appropriate coloured ink capsule must be used.
- ④ Hold the new pen capsule and gently twist and pull the cap from the pen fibre tip.
- ⑤ Slide the pen arm and capsule assembly on to the appropriate pen arm bracket until it clips into place, ensuring that each arm is positioned just above its own pen lifter bar. The green pen arm fits the pen arm bracket adjacent to the chart, the red pen arm fits the central bracket and the blue pen arm fits the upper bracket.

Press the 'Pen Lift' switch to lower the pens, and ensure that the pens make contact with the chart and, on multi-pen instruments, that they do not collide when the pen lifter is operated and the pens traverse the chart. If collision occurs the pen arms have been bent, or fitted incorrectly, and this damage must be carefully rectified.

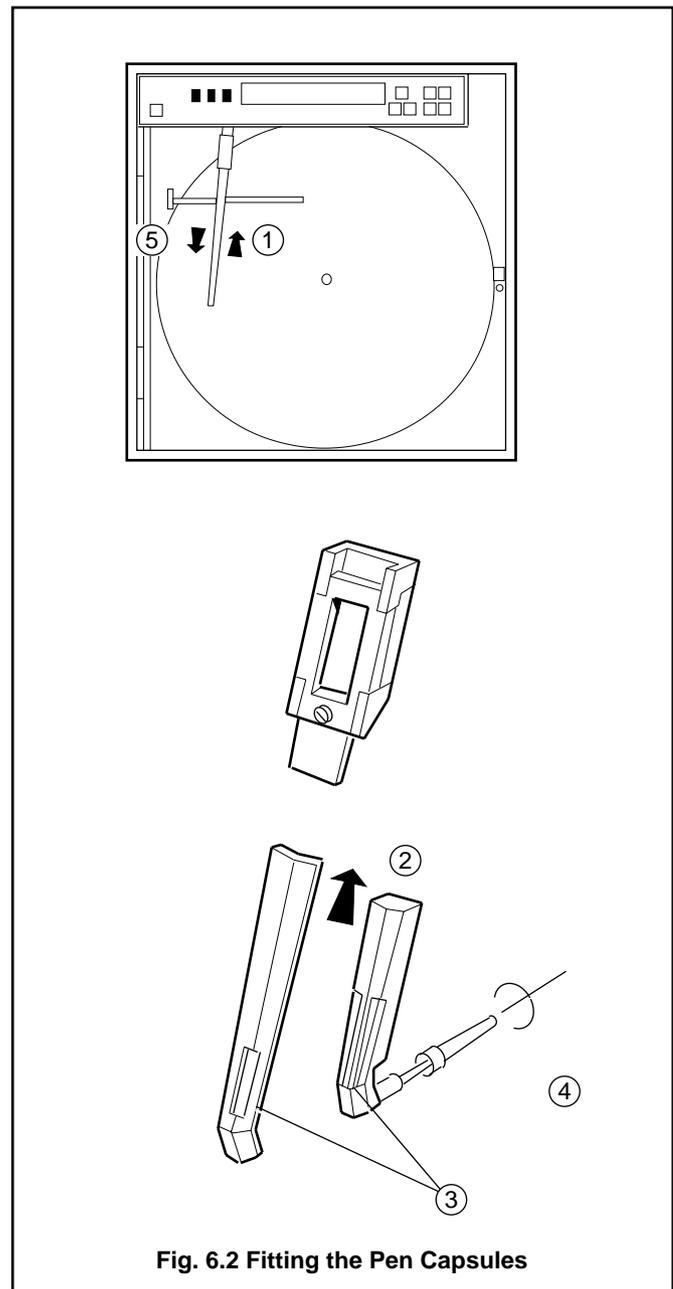


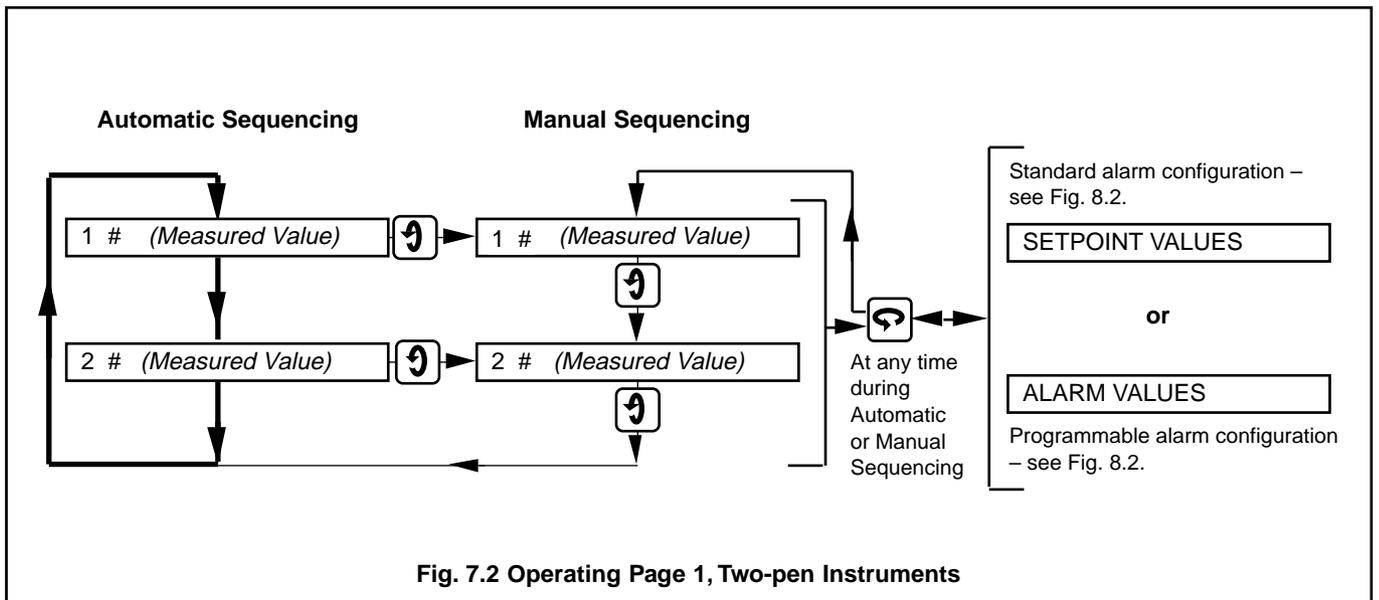
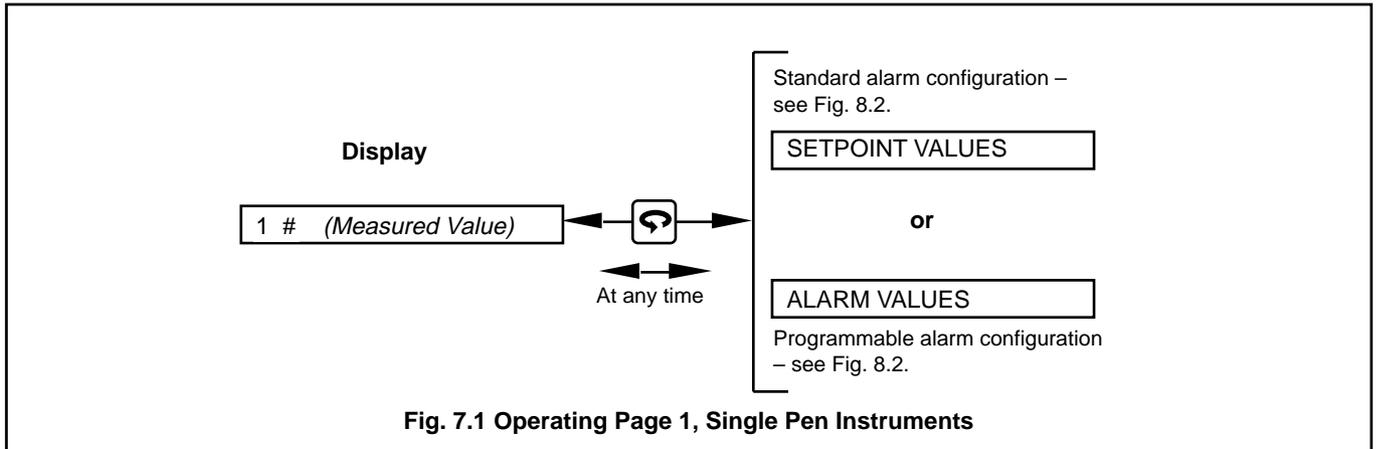
Fig. 6.2 Fitting the Pen Capsules

## 7 OPERATION

In normal operation the measured values for all channels are displayed in an 'auto-advancing' sequence (**Operating Page 1**). Each parameter can be held for viewing by operating the 'Parameter Advance' switch – see Fig. 5.1.

Operating the 'Page Advance' switch selects a second Operating Page (**Operating Page 2**) for viewing or changing the alarm set points. Required changes to the set point values are made using the 'Raise' and 'Lower' switches see Fig. 5.1.

A further series of pages can be selected using the 'Channel' and 'Page Advance' switches if the Security Link is enabled – see Figs. 5.1, 8.1 and 8.2 on pages 16, 22 and 23.



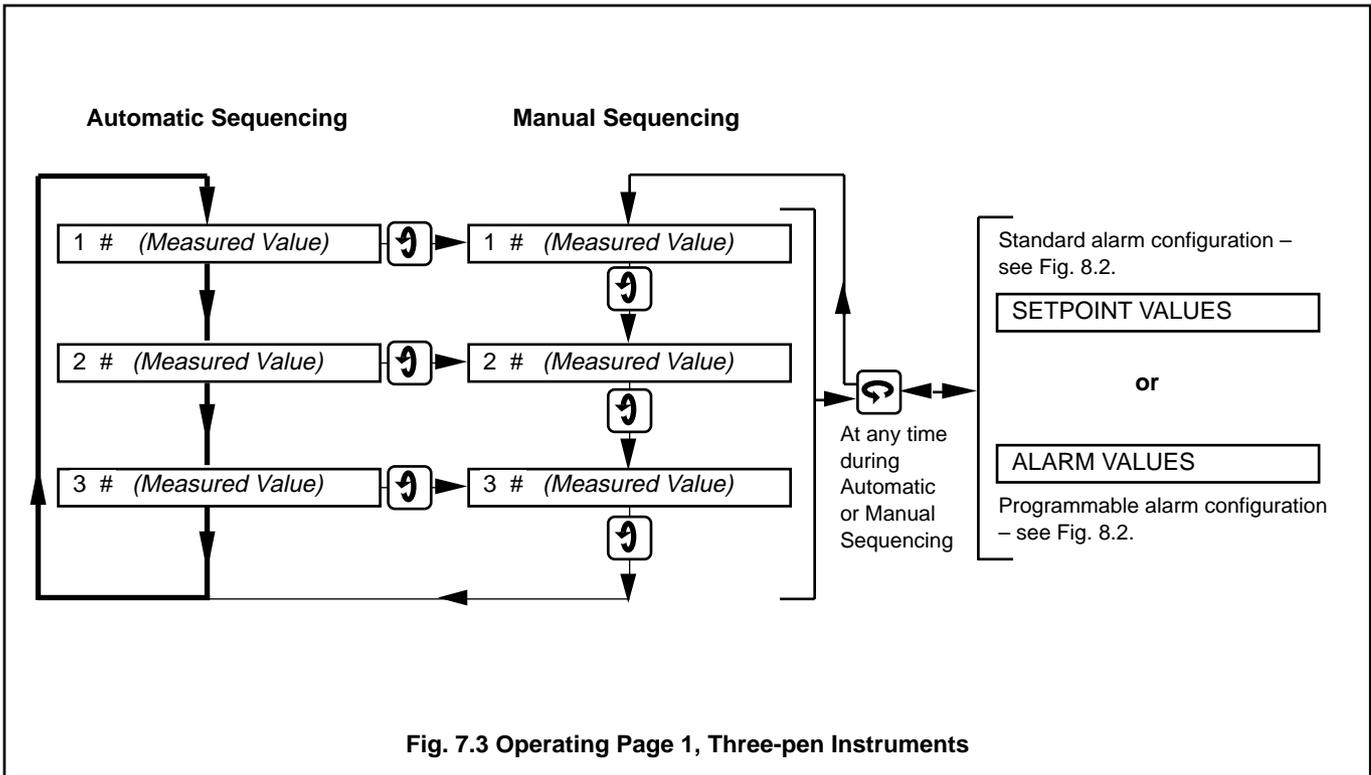
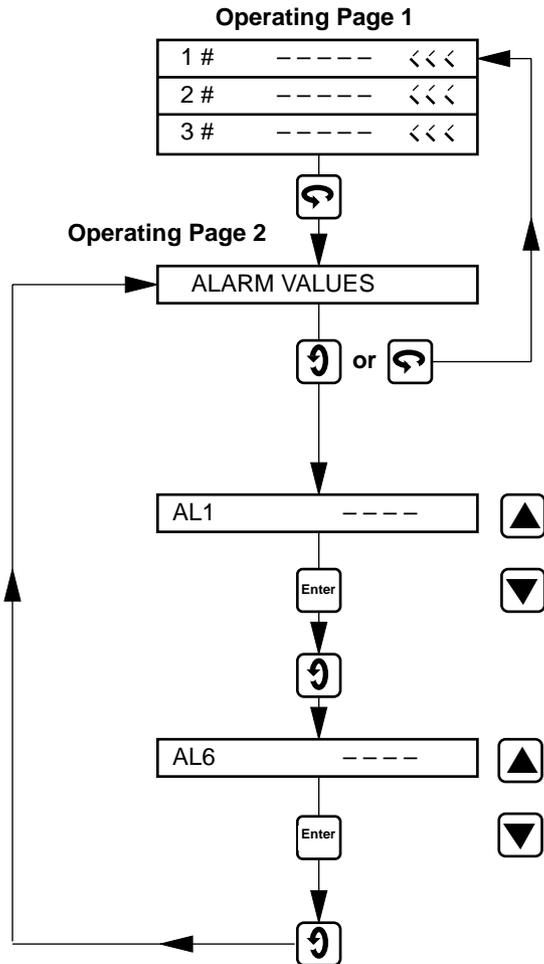


Fig. 7.3 Operating Page 1, Three-pen Instruments

7.1 Operating Page 1  
 7.2 Operating Page 2  
 7.2.1 Programmable Options



Where ALARM CONFIG PROG has been selected in the PROG COMMON SETTINGS page (Fig. 8.2) then AL1 to AL6 is displayed.

Advance to Operating Page 2.

Advance to next parameter or return to top of Operating Page 1.

**N.B.** To return to the top of Operating Page 1 at any time, operate the 'Page Advance' switch

**Alarm 1**

Set the value at which the alarm is to operate. Units displayed will be those related to the channel to which the respective alarm has been allocated in the ALARM SET UP page – see Fig. 8.2.

Store.

Advance to next parameter.

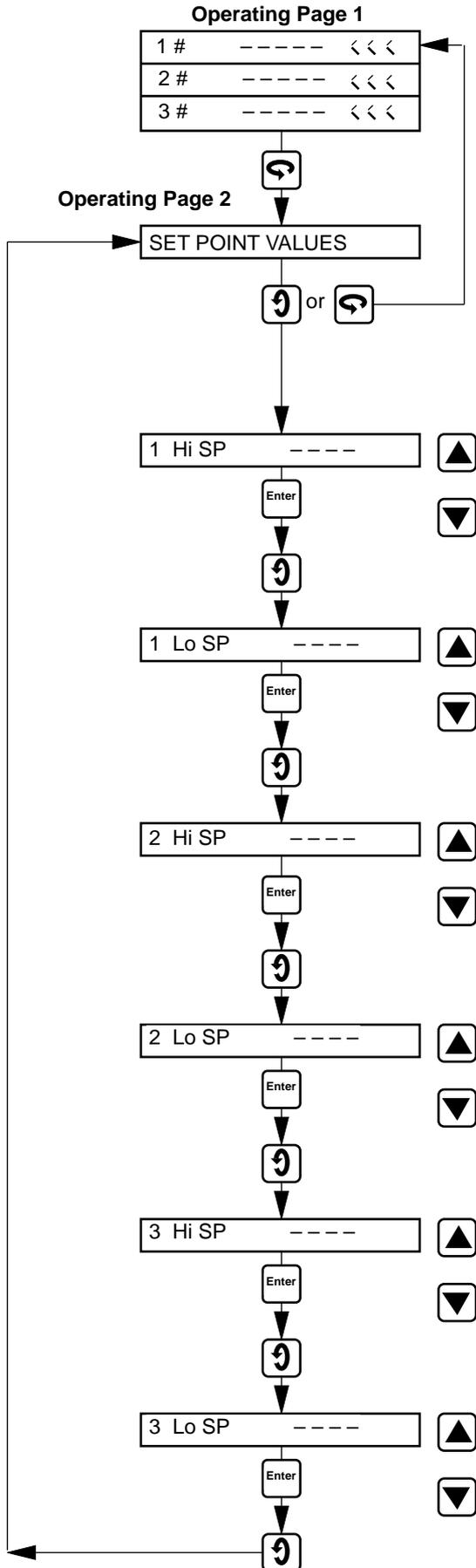
**Alarm 6**

Repeat as above for AL2 to AL6 as required.

Store.

Return to top of **Operating Page 2**

## 7.2.2 Standard Options



Where ALARM CONFIG STD has been selected in the PROG COMMON SETTINGS page then Hi / Lo SP for each channel is displayed.

Advance to Operating Page 2.

Advance to next parameter or return to top of Operating Page 1.

**N.B.** To return to the top of Operating Page 1 at any time, operate the 'Page Advance' switch

### 1 High Alarm Set Point

Set the high level alarm value for channel 1.  
Store.

Advance to next parameter.

### 1 Low Alarm Set Point

Set the low level alarm value for channel 1.  
Store.

Advance to next parameter.

### 2 High Alarm Set Point

Set the high level alarm value for channel 2.  
Store.

Advance to next parameter.

### 2 Low Alarm Set Point

Set the low level alarm value for channel 2.  
Store.

Advance to next parameter.

### 3 High Alarm Set Point

Set the high level alarm value for channel 3.  
Store.

Advance to next parameter.

### 3 Low Alarm Set Point

Set the low level alarm value for channel 3.  
Store.

Return to top of **Operating Page 2**.

## 8 PROGRAMMING

### 8.1 Programming, General

- a) When changing the input type it may be necessary to reposition the input type selection links accordingly – see Section 4.3.1.
- b) Ensure that programming is enabled – see Section 8.2.

### 8.2 Program Security Link – Fig. 8.1

A plug-in link is used to prevent unauthorised programming of the instrument, by preventing access to the Programming Pages – see Fig. 8.2.

With reference to Fig. 8.1:

- ① Identify the link.
- ② Enable or disable the **Program Pages**, as required.

With programming disabled any operation of the 'Channel' switch initiates 'PROGRAM DISABLED' to be displayed for a few seconds.

### 8.3 To Change the Program, Preparation

Open the door, release the chassis and swing it forward – see Fig. 2.1.

Ensure that:

- a) Input links are correctly positioned – see Fig. 4.2 (or Fig. 4.9 for isolated inputs).
- b) External alarm/control circuits are isolated if inadvertent operation during programming is undesirable.

Any changes to the operating parameters are made using the 'Raise', 'Lower', 'Decimal Point' and 'Enter', switches see Fig. 5.1.

Carry out all programming, other than calibration (see Section 10) with the pens lifted. If the pens drop during programming, operate the 'Pen Lift' switch – see Fig. 5.1.

When programming is complete disable the Programming Pages (Section 8.2) and recalibrate the instrument, see Section 10.

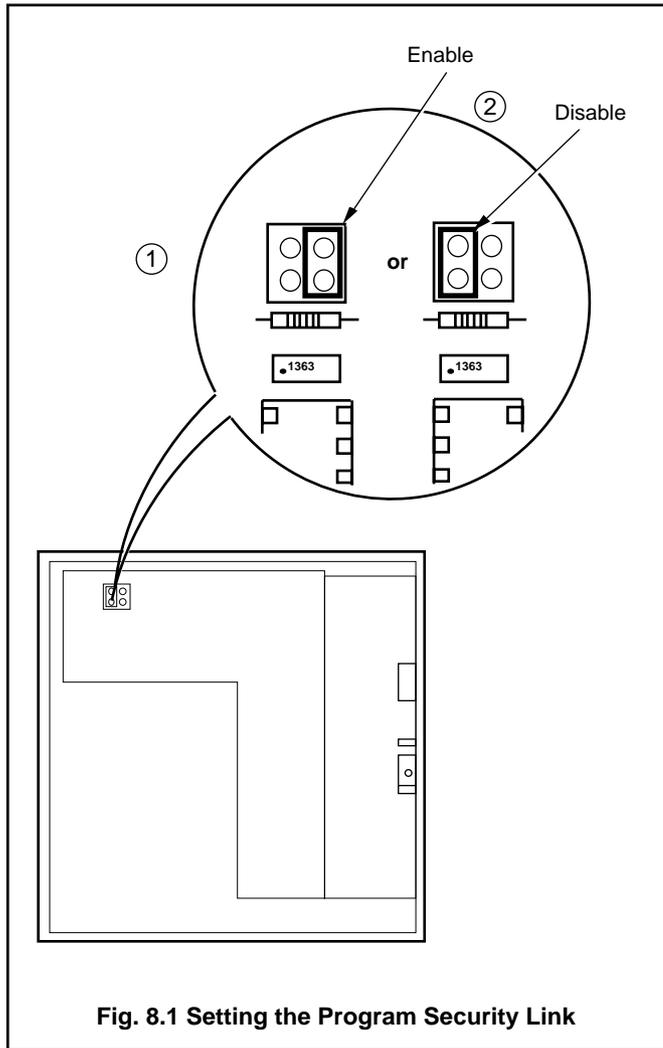


Fig. 8.1 Setting the Program Security Link

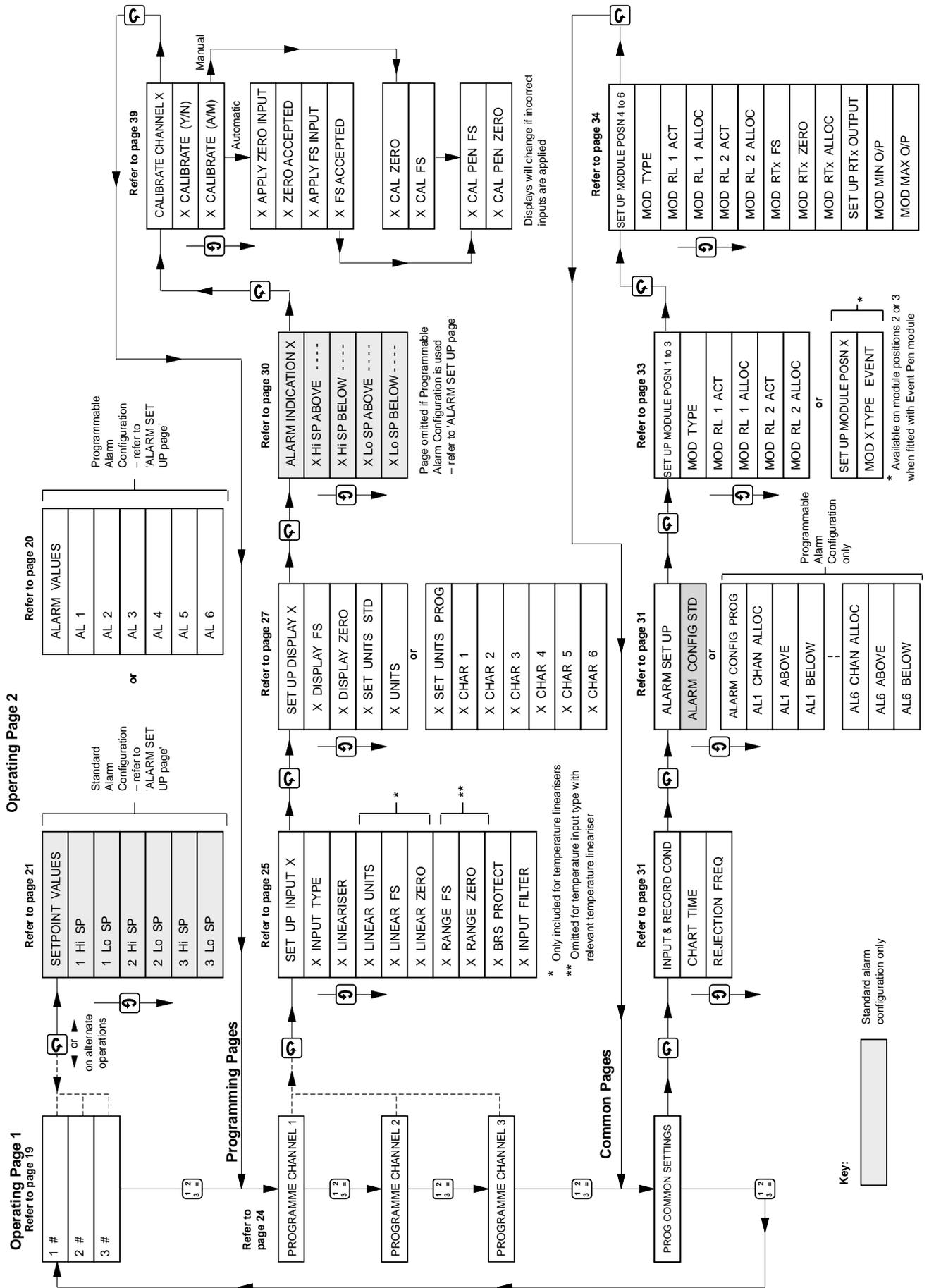
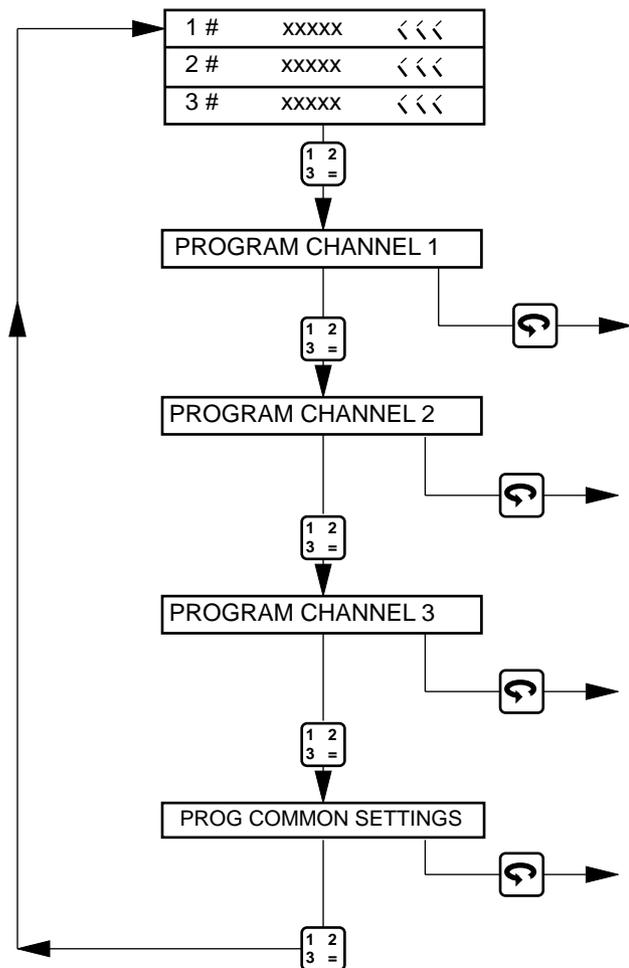


Fig. 8.2 Overall Programme Chart

## 8.4 Access to Programming Pages



### Operating Page 1

Automatic sequencing display of measured values for all channels – see Section 7.1.

Advance to next parameter.

### Program Channel 1

Advance to next parameter to program channel 1.

or

Advance to program channel 2.

### Program Channel 2

Advance to next parameter to program channel 2.

or

Advance to program channel 3.

### Program Channel 3

Advance to next parameter to program channel 3.

or

Advance to program common settings.

### Program Common Settings

Advance to next parameter to program common settings.

or

Return to top of Operating Page 1.

## 8.5 Set Up Input Page

The intrinsic error for zero based ranges is  $\leq 0.25\%$  if the limits detailed in Tables 3 and 4 are observed. If a suppressed zero range is used the error could exceed this figure.

Input Type (Electrical)	Min. Start	Min. Span	Max. Span and Range Value
Millivolts	-999	5.00	1000
Volts	-20.0	0.50	20.0
Milliamps	-99.9	0.50	100.0
Resistance	20.0	20.0	2000

Table 2 Electrical Limits

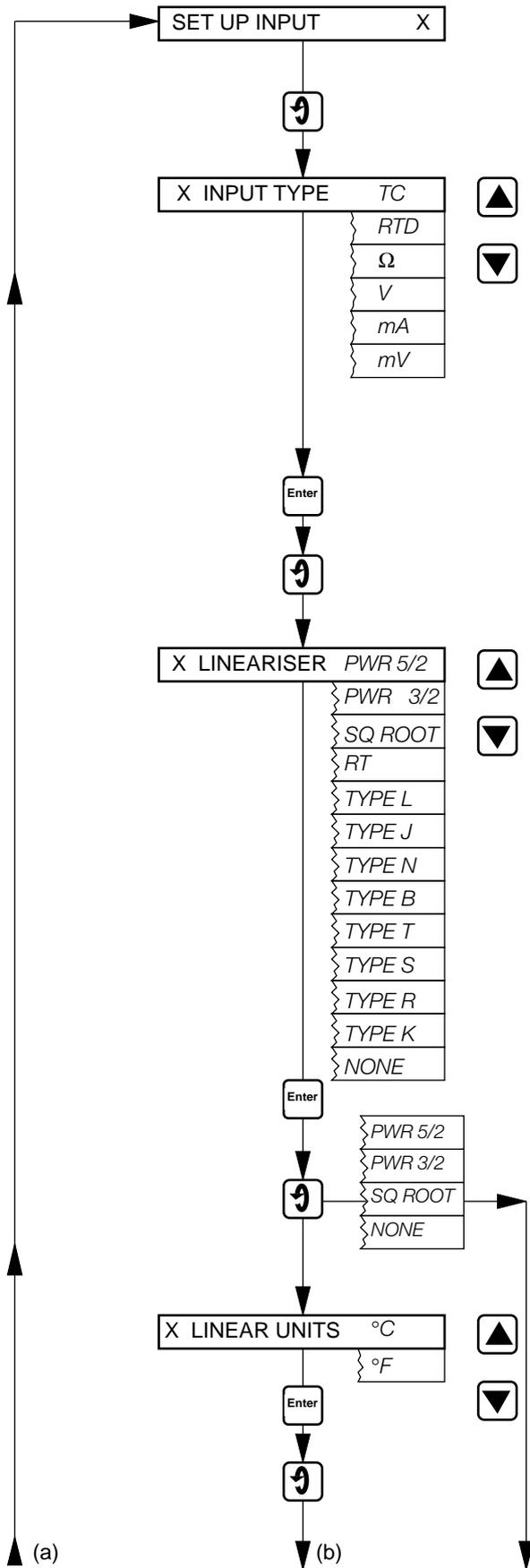
Input Type (Temperature Inputs)	°Centigrade			°Fahrenheit		
	Min. Start Temp.	Min. Span	Max. Temp.	Min. Start Temp.	Min. Span	Max. Temp.
Thermocouples:						
Fe/Con, BS type J and IEC584	-100	100	900	-148	180	1652
Fe/Con, DIN 43710 type L	-100	100	900	-148	180	1652
NiCr/NiAl, BS type K and IEC584	-100	150	1300	-148	270	2372
Pt/PtRh, BS types R & S and IEC584	-18	600	1700	0	1080	3092
Cu/CuNi, BS type T and IEC584	-250	120(+ve)* 170(-ve)**	300	-418	216(+ve)* 306(-ve)**	572
NiCr/CuNi, BS type E and IEC584	-100	100	900	-148	180	1652
Pt30%Rh/Pt6%Rh, BS type B and IEC584	-18	1100	1800	0	1980	3272
NiCrSi/NiSi, BS type N	-200	180(+ve)	1300	-328	324(+ve)	2372
Resistance Thermometer, Pt100 (BS 1904)	-200	50	600	-328	90	1112

\*Minimum span for ranges above zero

\*\*Minimum span for ranges below zero

Table 3 Temperature Limits

## 8.5 Set Up Input Page (continued)



Advance to next parameter.

### Input Type

Ensure that the Input links are in the correct positions for the required input type for the channel (see Fig. 4.2 or Fig. 4.9).

Apply an input signal appropriate to (or compatible with) the input type selected and having an approximate mid-scale value of the range to be programmed below.

Select the required input. The display flashes until the 'Enter'

Store.

Advance to next parameter.

### Lineariser

Select the required lineariser, or NONE, to suit the applied input.

Store.

Advance to next parameter.

### Lineariser Units

Select either °C or °F as required.

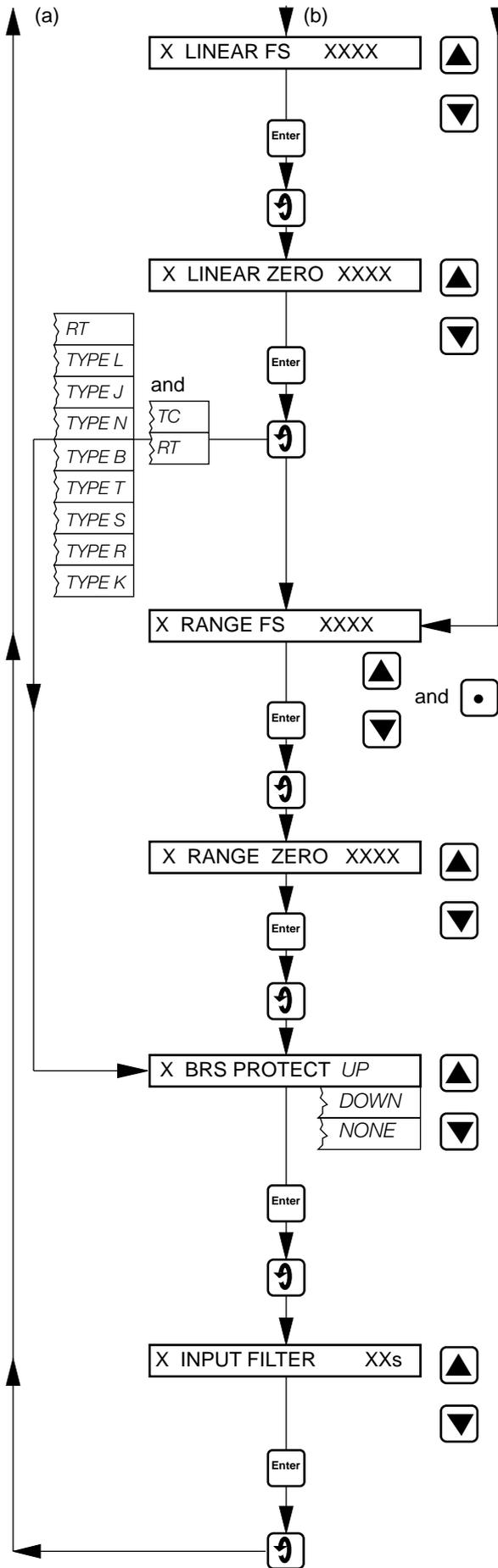
**Note:** If Lineariser Type L has been selected only °C is

Store.

Advance to next parameter.

Continued overleaf

Continued from previous page



**Lineariser Full Scale**

Set the range maximum temperature in °C or °F as selected at LINEAR UNITS on the previous page **within the limits**

Store.

Advance to next parameter.

**Lineariser Zero**

Set the range minimum temperature in °C or °F as selected at LINEAR UNITS on the previous page **within the limits**

Store.

Advance to next parameter.

**Range Full Scale**

Set the highest range value to the maximum number of decimal places possible, e.g. 20.0 instead of 20. For instruments fitted

Store.

Advance to next parameter.

**Range Zero**

Set the lowest range value – the decimal point is set

Store.

Advance to next parameter.

**Broken Sensor Protection**

Select the broken sensor protection indication to 'UP' for upscale, 'DOWN' for downscale or to 'NONE'. In the event of a broken sensor occurring the pen will move as programmed up-

Store.

Advance to next parameter.

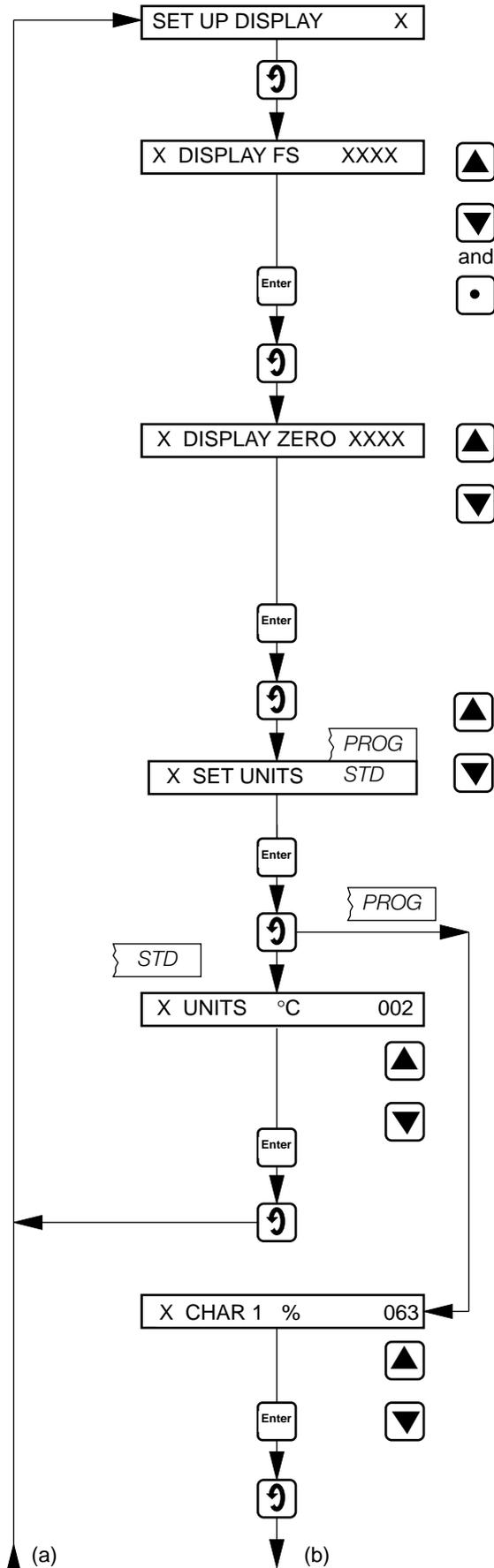
**Input Filter**

If the input is noisy it may be necessary to modify the instrument response to fast signals. Filter time is programmable from 0 to 60s in 1s steps. The value to be entered must be

Store.

Return to top of **Set Up Input** page.

## 8.6 Set Up Display Page



Advance to next parameter.

### Display Full Scale

Set the required display value represented by the maximum input signal.

**Example.** If a 2.02 to 7.34 mV input represents a temperature range of 50 to 180°C set 180.0. Available adjustment range -999 to 3300.

Store.

Advance to next parameter.

### Display Zero

Set the value for the variable represented by the minimum input signal.

**Example.** From the above set 50.0. The decimal point is set

Store.

Advance to next parameter.

### Set Units

Select 'PROG' to customise a six-digit unit of measurement,

Store.

Advance to next parameter.

### Units

Set the code number selected from Table 6, corresponding to the required display units. The actual display units are visually

Store.

Advance to next parameter.

### Character 1

Set the code number corresponding to the first character of the customised six-digit unit of measurement selected from the

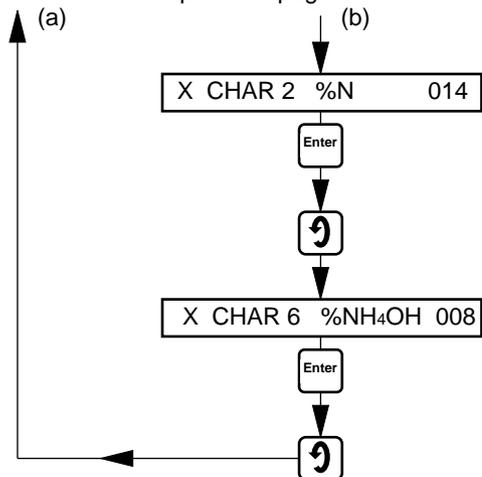
Store.

Advance to next parameter.

(a) Continued overleaf

(b)

Continued from previous page



**Character 2**

Repeat the previous step for the second character.

Store.

Advance to next parameter.

**Character 6**

Select characters 3 to 6 by the same method.

Store.

Return to top of **Set Up Display** page.

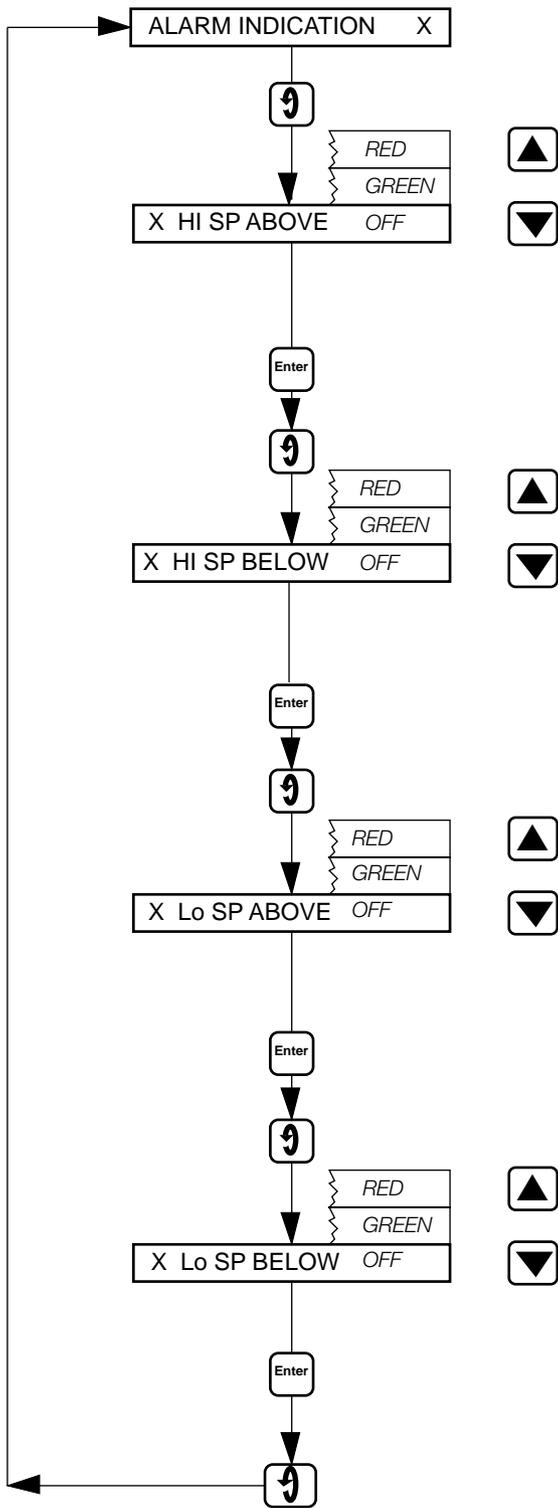
Code	Symbol								
000	Space	020	T	040	n	060	7	080	Σ
001	A	021	U	041	o	061	8	081	μ
002	B	022	V	042	p	062	9	082	ø
003	C	023	W	043	q	063	%	083	ö
004	D	024	X	044	r	064	&	084	Å
005	E	025	Y	045	s	065	,	085	π
006	F	026	Z	046	t	066	-	086	θ
007	G	027	a	047	u	067	:	087	°
008	H	028	b	048	v	068	#	088	m2
009	I	029	c	049	w	069	\	089	m3
010	J	030	d	050	x	070	/	090	S2
011	K	031	e	051	y	071	.	091	2
012	L	032	f	052	z	072	~	092	3
013	M	033	g	053	0	073	=	093	4
014	N	034	h	054	1	074	α	094	5
015	O	035	i	055	2	075	β	095	6
016	P	036	j	056	3	076	Δ	096	2
017	Q	037	k	057	4	077	δ	097	3
018	R	038	l	058	5	078	Ω	098	4
019	S	039	m	059	6	079	ρ	099	in

**Table 4 Character Set**

Code	Unit	Display	Code	Unit	Display
001	(no unit)		081	millimetres of mercury	mm Hg
002	°Celsius	°C	082	metres of mercury	m Hg
003	°Fahrenheit	°F	083	inches of mercury	in Hg
004	Kelvin	K	084	feet of mercury	ft Hg
005	differential °C	δ°C	085	pounds/sq. in	psi
006	differential °F	δ°F	086	pounds/sq. in	lb/in2
007	% relative humidity	%RH	087	newtons/sq. metre	N/m2
008	percent	%	088	kilonewtons/sq. metre	kN/m2
009	parts/million	ppm	089	pascals	Pa
010	parts/billion	ppb	090	kilopascals	kPa
011	microvolts	μV	091	megapascals	MPa
012	millivolts	mV	092	kilograms/sq. cm	kg/cm2
013	volts	V	093	newtons	N
014	kilovolts	kV	094	grams	g
015	microamps	μA	095	kilogram	kg
016	milliamps	mA	096	ounces	oz
017	amperes	A	097	pounds	lb
018	ohms	Ω	098	% saturation	% sat
019	kilohms	kΩ	099	millilitres	ml
020	megohms	MΩ	100	litres	l
021	milliwatts	mW	101	gallons	gal
022	watts	W	102	millimetres	mm
023	kilowatts	kW	103	metres	m
024	megawatts	MW	104	kilometres	km
025	voltamps	VA	105	British thermal units/hour	btu/h
026	kilovoltamps	kVA	106	seconds	sec
027	reciprocal ohms	mho	107	minutes	min
028	siemens	S	108	hours	hr
029	microsiemens/cm	μS/cm	109	hertz	Hz
030	millisiemens/cm	mS/cm	110	kilohertz	kHz
031	microsiemens/metre	μS/m	111	megahertz	MHz
032	millisiemens/metre	mS/m	112	% sulphuric acid	% H2SO4
033	potential hydrogen	pH	113	% sulphur monoxide	%SO
034	micrograms/kilogram	μg/kg	114	% sulphur dioxide	%SO2
035	milligrams/kilogram	mg/kg	115	% carbon monoxide	%CO
036	micrograms/litre	μg/l	116	% carbon dioxide	%CO2
037	milligrams/litre	mg/l	117	% oxygen	%O2
038	litres/day	l/d	118	% nitric oxide	% NO
039	litres/hour	l/h	119	% nitrogen peroxide	% NO2
040	litres/minute	l/m	120	% nitrogen	% N2
041	litres/second	l/s	121	% hydrogen	%H
042	megalitres/day	MI/d	122	% hydrochloric acid	%HCl
043	megalitres/hour	MI/h	123	% fruit acid content	brix
044	megalitres/minute	MI/m	124	nephelometric turbidity units	NTU
045	megalitres/second	MI/s	125	% obscuration	%OBS
046	gallons/day	gal/d	126	kilolitres	kl
047	gallons/hour	gal/h	127	kilogallons	kgal
048	gallons/minute	gal/m	128	megalitres	MI
049	gallons/second	gal/s	129	megagallons	Mgal
050	cubic metres/day	m3/d	130	cubic metres	m3
051	cubic metres/hour	m3/h	131	kilo-cubic metres	km3
052	cubic metres/minute	m3/m	132	mega-cubic metres	Mm3
053	cubic metres/second	m3/s	133	cubic metres per second	CUMEC
054	cubic feet/day	ft3/d	134	joules	J
055	cubic feet/hour	ft3/h	135	kilojoules	kJ
056	cubic feet/minute	ft3/m	136	megajoules	MJ
057	cubic feet/second	ft3/s	137	tonnes	T
058	standard cubic ft/min	SCFM	138	kilotonnes	kT
059	kilograms/day	kg/d	139	megatonnes	MT
060	kilograms/hour	kg/h	140	British thermal units	btu
061	kilograms/minute	kg/m	141	cubic feet	ft3
062	kilograms/second	kg/s	142	kilo-cubic feet	kft3
063	tonnes/day	T/d	143	mega-cubic feet	Mft3
064	tonnes/hour	T/h	144	coulombs	C
065	tonnes/minute	T/m	145	revolutions per minute	rpm
066	tonnes/second	T/s	146	grams/litre	g/l
067	pounds/day	lb/d	147	grams/hour	g/h
068	pounds/hour	lb/h	148	grams/day	g/d
069	pounds/minute	lb/m	149	millilitres/minute	ml/m
070	pounds/second	lb/s	150	millilitres/hour	ml/h
071	imp. tons/day	ton/d	151	% dissolved oxygen	%dO2
072	imp. tons/hour	ton/h	152	% dissolved carbon dioxide	dCO2
073	imp. tons/minute	ton/m	153	millimolar	mM
074	imp. tons/second	ton/s	154	molar	M
075	millibars	mbar	155	parts/million hydrogen sulphide	ppmH2S
076	bars	bar	156	% hydrogen sulphide	%H2S
077	millimetres water gauge	mm WG			
078	metres water gauge	m WG			
079	inches water gauge	in WG			
080	feet water gauge	ft WG			

Table 5 Display Units Codes

## 8.7 Alarm Indication Page



**Alarm Indication** page is not displayed when 'ALARM CONFIG PROG' in 'ALARM SET UP' page on the 'PROG

Advance to next parameter.

### High Alarm Set Point Above

Select the colour of l.e.d. to be illuminated above the high set

Store.

Advance to next parameter.

### High Alarm Set Point Below

Select the colour of l.e.d. to be illuminated below the high set

Store.

Advance to next parameter.

### Low Alarm Set Point Above

Select the colour of l.e.d. to be illuminated above the low set

Store.

Advance to next parameter.

### Low Alarm Set Point Below

Select the colour of l.e.d. to be illuminated below the low set

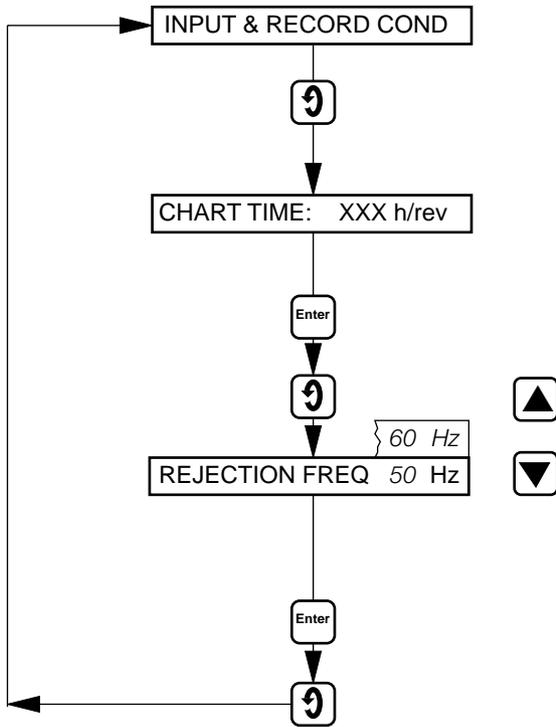
Store.

Return to top of **Alarm Indication** page.

### 8.8 Calibration Page

For full calibration details refer to Section 10.

### 8.9 Input and Recording Conditions Page



Advance to next parameter.

#### Chart Time

Set the chart speed in hours per revolution selected from the Store.

Advance to next parameter.

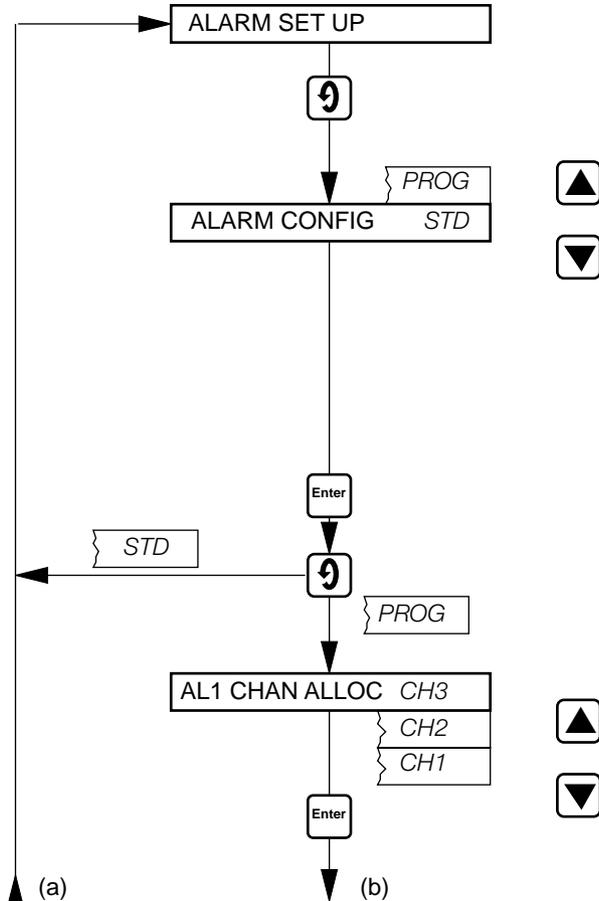
#### Rejection Frequency

Rejection Frequency eliminates interference at mains

Store.

Return to top of **Input and Recording Conditions** page.

### 8.10 Alarm Set Up Page



Advance to next parameter.

#### Alarm Configuration

If 'ALARM CONFIG STD' on the 'ALARM SET UP' page in the 'PROG COMMON SETTINGS' page is selected then Hi SP / Lo SP for each channel is displayed. If 'ALARM CONFIG PROG' is selected then AL1 to AL6 is displayed.

Select STD if a standard alarm configuration of two alarms per channel is required. Select PROG if more than two alarms per

Store.

Advance to next parameter.

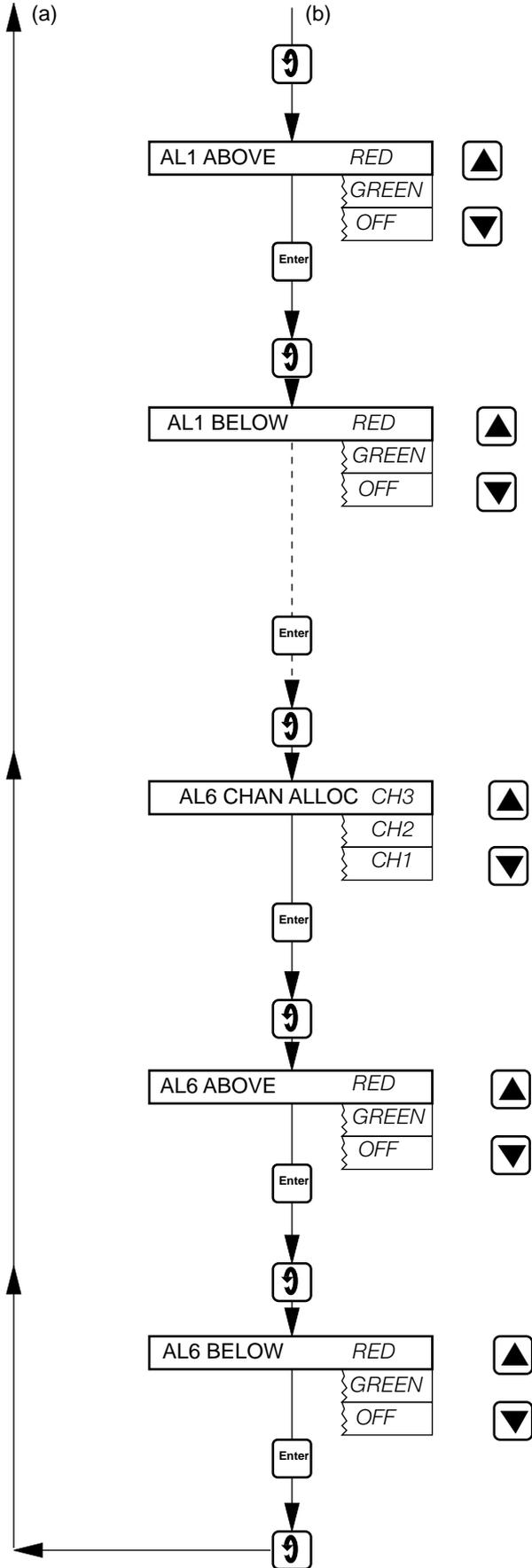
#### Alarm 1 Channel Allocation

Select the channel number to which the alarm set point is to be

Store.

(a) Continued overleaf

Continued from previous page



Advance to next parameter.

**Alarm 1 Above**

Store.

Advance to next parameter.

**Alarm 1 Below**

Select the colour of l.e.d. to be illuminated below the set point.

**Repeat the above steps for the remaining five alarm set**

Store.

Advance to next parameter.

▲

Store.

Advance to next parameter.

▲

Store.

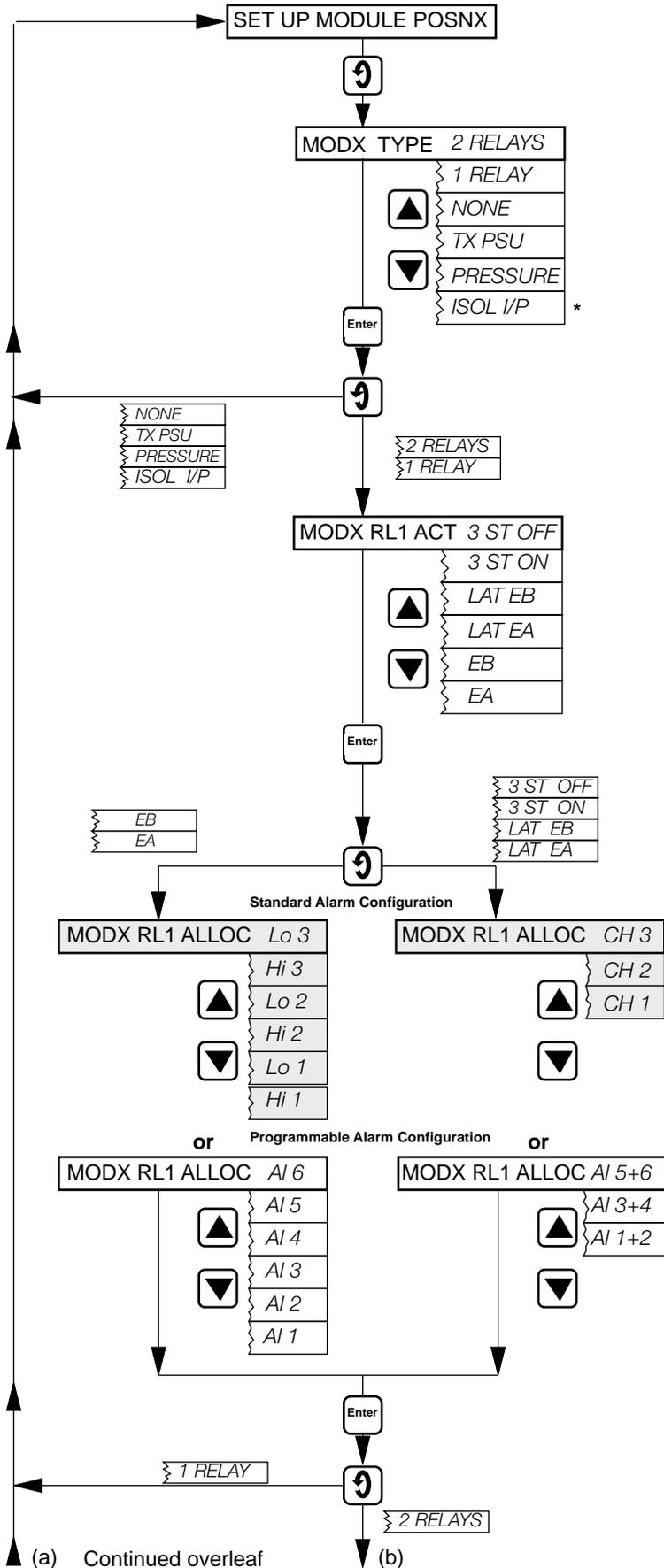
Advance to next parameter.

▲

Store.

Return to top of **Alarm Set Up** page.

**8.11 Set Up Module Page**  
**8.11.1 Module Positions 1,2 and 3**



(a) Continued overleaf

(b)

**Set Up Module Position 1,2 and 3.**

**Note.** On single pen instruments no modules can be

Advance to next parameter.

**Module Position 1,2 and 3, Type**

Select the module type fitted in module position 1,2 or 3 – see Fig. 4.1.

\* This module type is not available for module

Store.

Advance to next parameter.

**Module Position 1,2 and 3, Relay 1 Action**

Select the relay 1 action required:

- '3 ST OFF' – 3-state off between set points
- '3 ST ON' – 3-state on between set points
- 'LAT EB' – latch below setpoints
- 'LAT EA' – latch above setpoints
- 'EB' – energised below setpoint
- 'EA' – energised above setpoint.

See Section 12 for more detailed information on alarm set points.

Store.

Advance to next parameter.

**Module Position 1,2 and 3, Relay 1 Allocation (Standard Alarm Configuration)**

For 'EA' or 'EB' alarm action:

- Allocate the alarm to a high or low setpoint.
- For '3 ST OFF', '3 ST ON', 'LAT EB' or 'LAT EA':

**Module Position 1,2 and 3, Relay 1 Allocation (Programmable Alarm Configuration)**

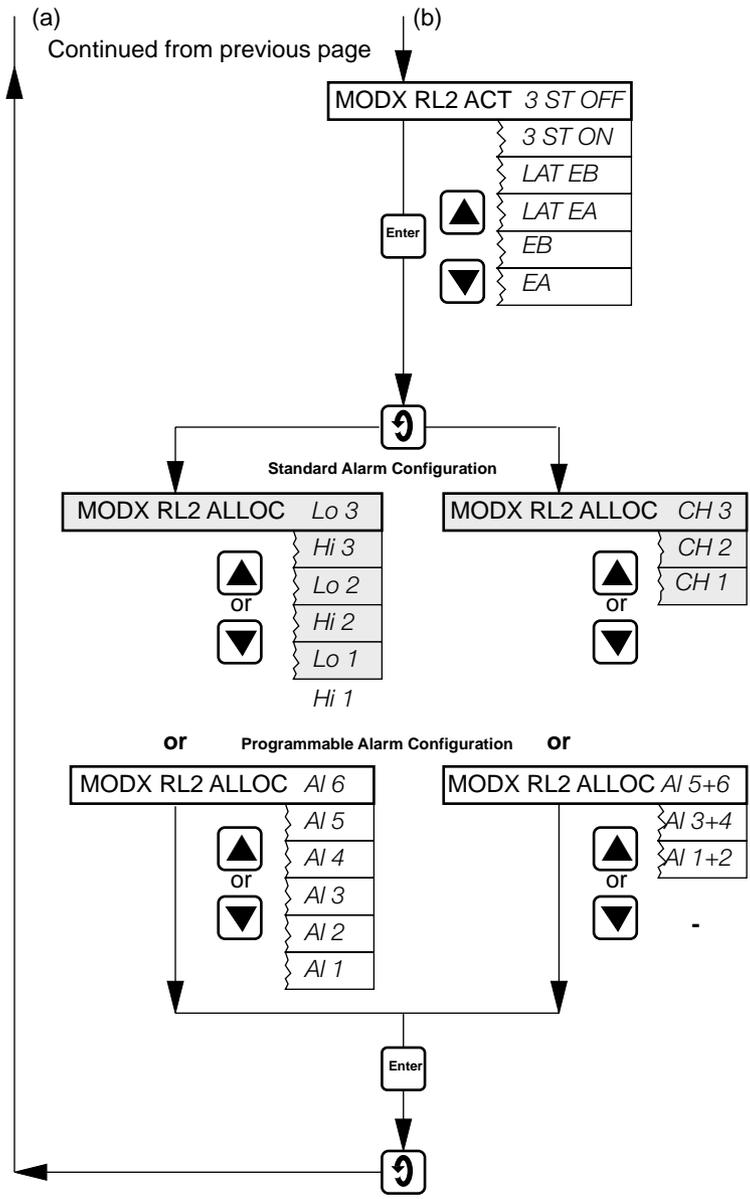
For 'EA' or 'EB' alarm action:

- Allocate the relay to an alarm point.

For '3 ST OFF', '3 ST ON', 'LAT EB' or 'LAT EA':  
 Allocate the relay to an alarm point pair.

Store.

Advance to next parameter.



**Module Position 1,2,3, Relay 2 Action**  
Repeat as for **Module Position 1,2,3, Relay 1**

Store.

Advance to next parameter.

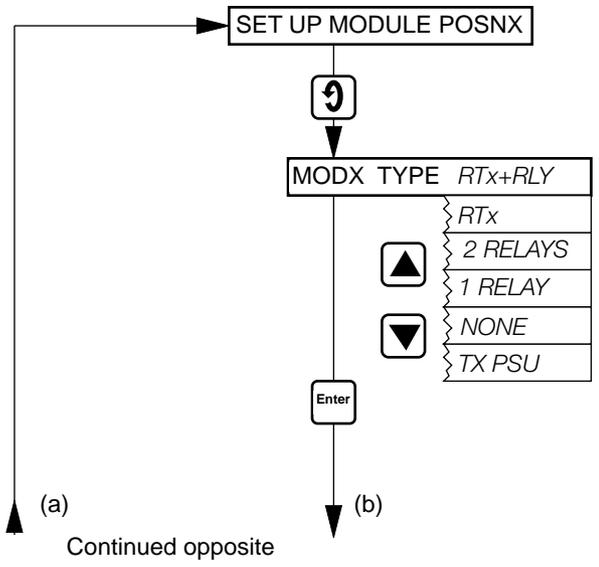
**Module Position 1,2,3, Relay 2 Allocation (Standard Alarm Configuration)**  
Repeat as for **Module Position 1,2,3, Relay 1 Allocation (Standard Alarm Configuration)**, on

**Module Position 1,2,3, Relay 2 Allocation (Programmable Alarm Configuration)**  
Repeat as for **Module Position 1,2,3, Relay 1 Allocation (Programmable Alarm**

Store.

Return to top of **Set Up Module** page.

**8.11.2 Module Positions 4, 5 and 6**



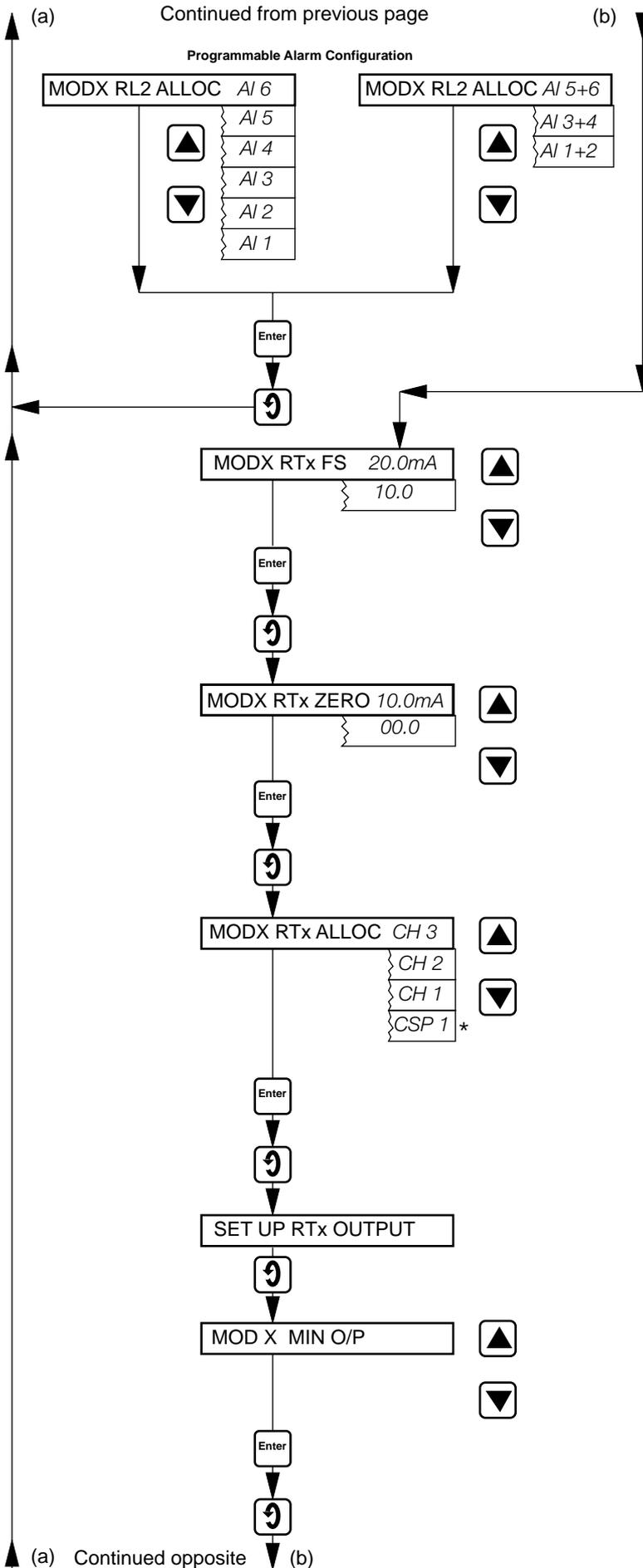
**Set Up Module Position 4,5 and 6.**

Advance to next parameter.

**Module Position 4,5 and 6, Type**  
Select the module type fitted in module position

Store.





**Module Position 4,5,6, Relay 2 Allocation (Programmable Alarm Configuration)**

For 'EA' or 'EB' alarm action:  
Allocate the relay to an alarm point.

For '3 ST OFF', '3 ST ON', 'LAT EB' or 'LAT EA':  
Allocate the relay to an alarm point pair.

**Note.** AI 1 > AI 2, AI 3 > AI 4, AI 5 > AI 6.

Store.

Advance to next parameter.

**Module Position 4,5,6,Retransmission Full Scale**

Set the maximum value required for the retransmission signal, adjustable in 0.1mA

Store.

Advance to next parameter.

**Module Position 4,5,6,Retransmission Zero**

Set the minimum value required for the retransmission signal, adjustable in 0.1mA

Store.

Advance to next parameter.

**Module Position 4,5,6, Retransmission Allocation**

Select the channel to which the retransmission signal is to be allocated. \*Control Set Point 1 may be selected on recorders with PID facility. This parameter is not displayed for single

Store.

Advance to next parameter.

**Set Up Retransmission Output**

Advance to next parameter.

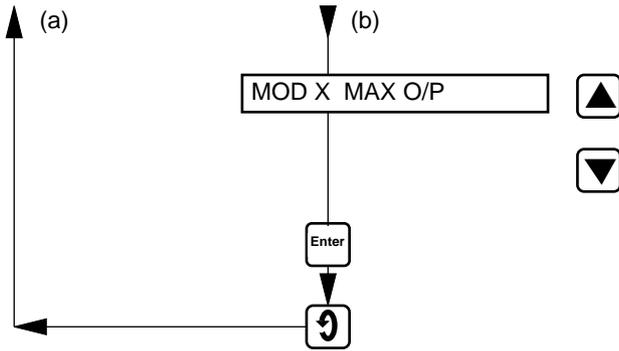
**Module Position 4,5,6 Retransmission Minimum Output**

Connect a 0 to 20mA milliammeter to the appropriate module output connection and adjust the milliammeter displayed value to coincide with the retransmission minimum

Store.

Advance to next parameter.

Continued from previous page



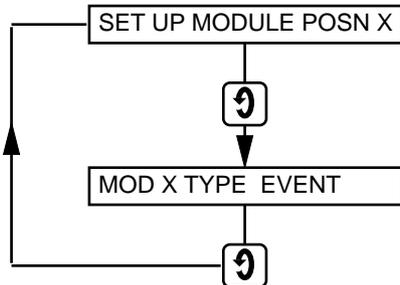
**Module Position 4,5,6, Retransmission Maximum Output**

Adjust the millimeter displayed value to coincide with the retransmission maximum signal specified above.

Store.

Return to top of **Set Up Module** page.

**8.11.3 Module Position 2 or 3 (Event Pen Module)**



**Set up module position 2  
Set up module position 3**

Advance to next parameter

**Module 2 Type  
Module 3 Type**

This display cannot be changed.

Return to top of **Set Up Module** page

**8.11.4 Event Pen Ranges**

If a 1492 recorder with an event pen is using a standard chart, i. e. with a writing width of 105mm, the range and display full scale values for the variable pens must be set as described below:

**Zero-based ranges**

On the input page set **Range Full Scale** and/or **Lineariser Full Scale** to 96% of the full scale input value.

On the Display page, set **Display Full Scale** to 96% of the variable represented by the full scale signal input.

**Offset-zero ranges**

Calculate the **Range Full Scale** and **Display Full Scale** settings by using the actual input or display span values rather than full scale; i.e. **Range Full Scale** would be 0.96 (input full scale – input min.) + input min.

**Example.** For an input of 4 to 20mA corresponding to a temperature range of 100 to 300°C from a type K thermocouple:

$$\begin{aligned} \text{Lineariser Full Scale} &= 0.96 [300 - 100] + 100 \\ &= 192 + 100 \\ &= 292 \end{aligned}$$

$$\begin{aligned} \text{Range Full Scale} &= \text{mV equivalent of } \left[ \frac{292 - 100}{300 - 100} \right] \times 16 + 4 \\ &= \left[ \frac{11.876 - 4.095}{12.207 - 4.095} \right] \times 16 + 4 \\ &= \left[ \frac{7.781}{8.112} \right] \times 16 + 4 \\ &= 0.9592 \times 16 + 4 \\ &= 15.35 + 4 \\ &= 19.35 \text{ mA} \end{aligned}$$

The above alternative setting procedures for **Range Full Scale** and **Display Full Scale** are not necessary if a chart with a writing width of 100mm is used.

## 9 SIMPLE FAULT FINDING

If the recorder does not appear to be working satisfactorily carry out the checks in the following table before contacting the Service Organisation.

Are all the connections made correctly?
Is there power to the instrument?
Is there a signal at the input terminals?
Does an external relay fail to de-energise? If so see Section 9.1, following.

### 9.1 Arc Suppression Capacitors – Fig. 9.1

Arc suppression capacitors are fitted across the contacts of the alarm/control relays. If these contacts are used to operate external relays, the capacitor leakage current may be sufficient to prevent the external relay from de-energising. If so, switch off the power supply and external alarm circuits. Identify the appropriate relay module – see Figs. 4.14a, 4.14b and 4.15b. Remove the four screws retaining the p.c.b. and **carefully** unplug it.

#### CAUTION.

The connection pins at the top of the p.c.b. are very fragile and care must be taken not to bend or damage them.

Unsolder the appropriate capacitors as shown in Fig. 9.1 and refit the module.

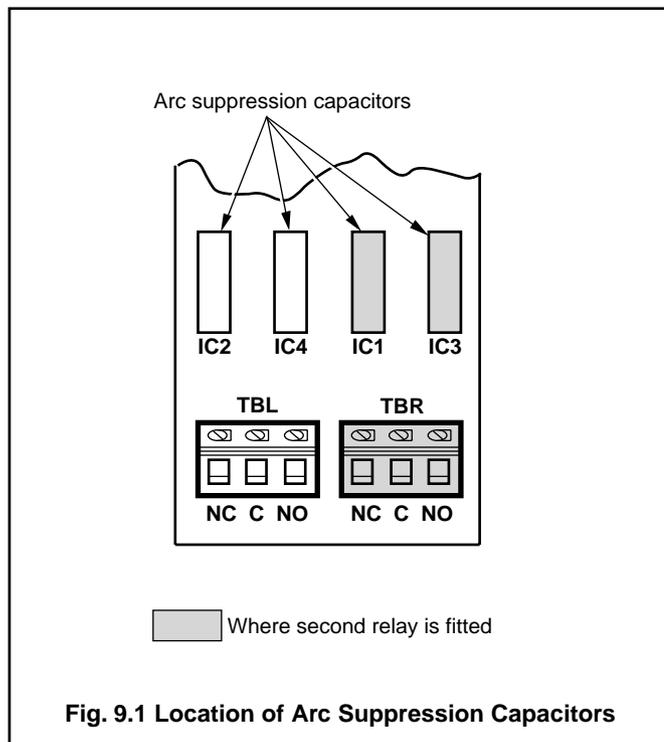


Fig. 9.1 Location of Arc Suppression Capacitors

## 10 CALIBRATION

The recorder should be calibrated annually or following a change to instrument operation. The pen arm length must be checked, and adjusted if necessary, before making any electrical adjustments.

### 10.1 Calibration, General

Switch off the power supply. Connect the instrument to a signal source or resistance box of known accuracy, suitable for simulation over the entire input range, to the input terminals – see Section 4.3.

For **thermocouple inputs**, connect the millivolt source using appropriate compensating cable – see Table 1.

For **2-lead resistance** thermometers the resistance box may be connected at the sensor end of the leads or the lead resistance added to calibration values – see Section 10.3.

For all other inputs connect using copper wire.

Switch on the power supply.

### 10.2 Pen Arm Length Adjustment

If the pen arm length is incorrect the pen does not record the correct time at all positions on the chart.

- With reference to Fig. 8.2, select the Input and Recording Conditions Page, make a note of the **Chart Time** and then reset it to 168hr/rev. Store using the 'Enter' switch.
- Ensure that the pens are touching the chart and that the time line marker on the chassis indicates the correct time line on the chart – see Fig. 6.1.
- Increase the channel 1 input signal from zero to full scale, within a period of 10 seconds, to draw an arc on the chart. For temperature inputs apply the equivalent millivolt or resistance values obtained from standard tables.

If the trace does not follow the time line the error must be corrected by adjusting the pen arm length as follows:

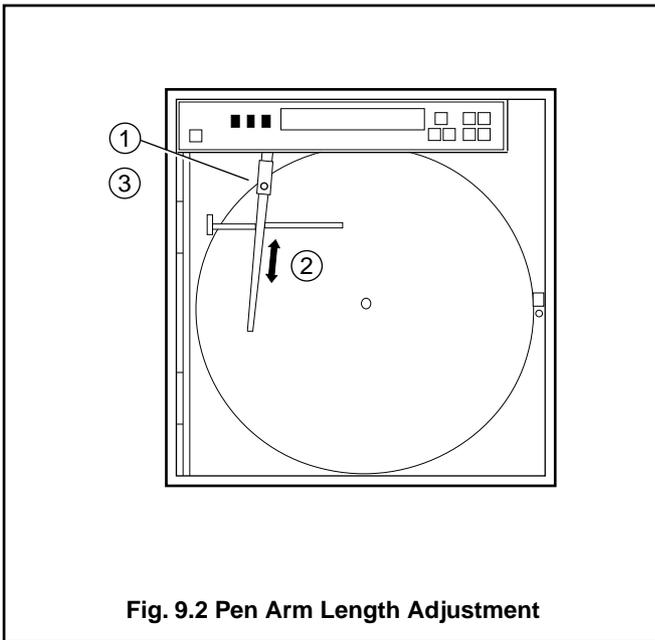
With reference to Fig. 9.2:

- Slacken the clamp screw.
- Slide the pen arm in or out of the moulding, as necessary.
- Retighten the clamp screw on completion.

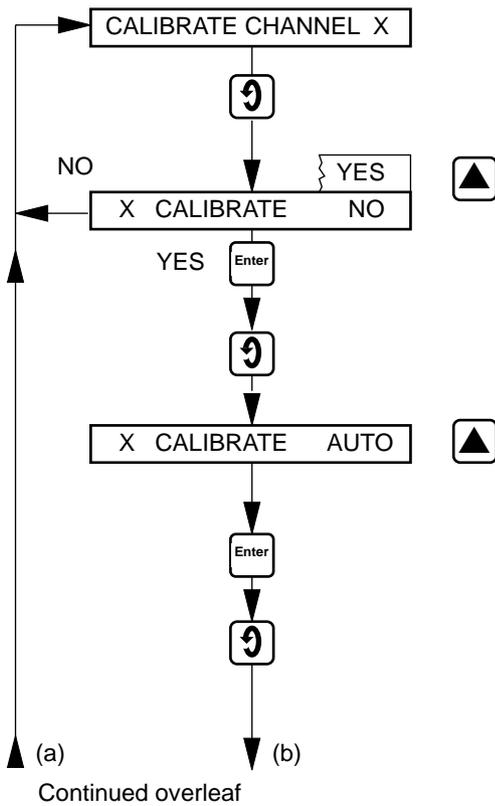
Make similar adjustments to the green and blue pen arms, as applicable. Ensure that the green pen records approximately 4mm ahead of the red pen and the blue pen records approximately 4mm behind the red pen (with respect to time) over the full chart width.

**Note.** Only the red pen can follow precisely the time line on the chart, since the radii of the other pens draw different loci. On instruments fitted with event marker the event pen draws on the same time line as the red pen.

Reprogram the original chart time noted at a), above and store using the 'Enter' switch.



### 10.3 Calibration Page (Automatic Procedure)



#### Calibrate Channel

Advance to next parameter.

#### Calibration

Select 'YES' to calibrate the instrument.  
Store.

Advance to next parameter.

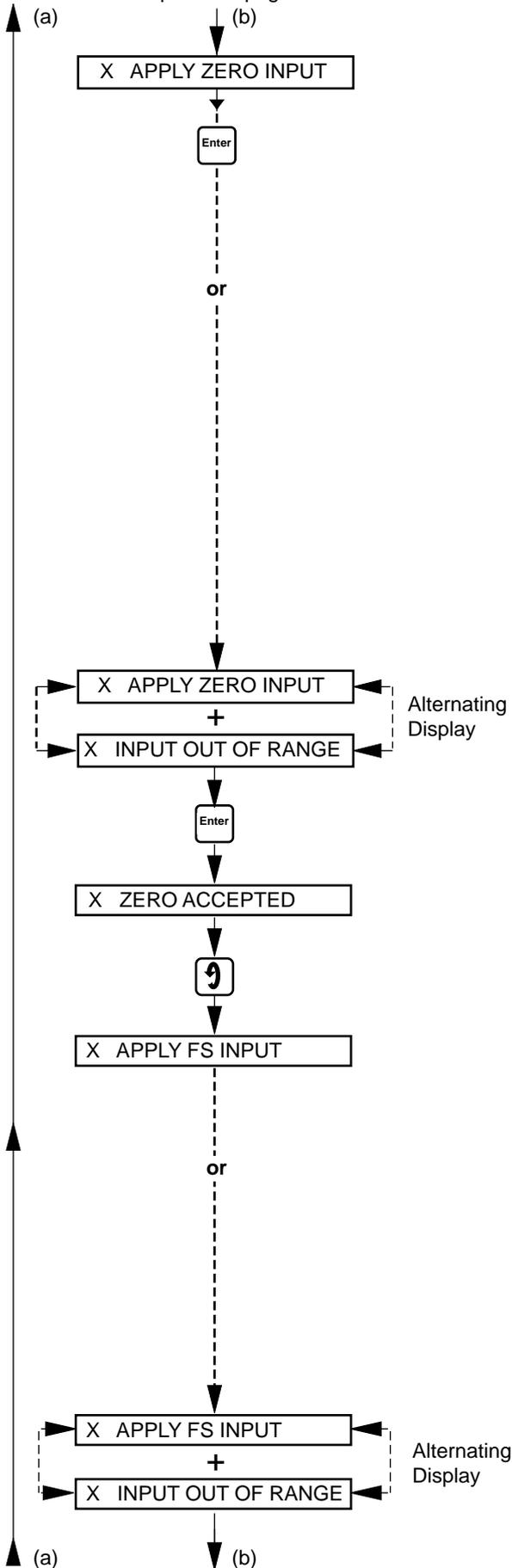
#### Calibration Mode (auto or manual)

Select automatic calibration mode. For manual calibration mode refer to Section 10.4 on page 42.

Store.

Advance to next parameter.

Continued from previous page



Continued on opposite page

### Apply Zero Input

The channel number flashes in this display until the correct input signal is applied and the 'Enter' switch is operated.

### Range Zero Calibration

#### Electrical Inputs:

apply a signal equivalent to **Input Range Zero**.

#### Resistance thermometer Inputs:

apply a signal input equivalent to **Lineariser Zero** using resistance values obtained from standard tables. For 2-lead RTDs, ensure that the resistance source is either connected at the sensor end of the leads or that the total lead resistance is added to the value for range zero.

#### Thermocouple Inputs:

**measure** the ambient temperature at the output terminals of the signal source (calibrator). From thermocouple tables obtain the millivolt equivalent of this temperature (a) and that for the **Lineariser Zero temperature** (b) – see page 26. Subtract (a) from (b) and set the signal source to the resultant value. (The voltage is negative if the range zero temperature is below the measured ambient temperature).

Note. If the applied signal level is outside acceptable zero range limits, the displayed message alternates between 'APPLY ZERO INPUT' and 'INPUT OUT OF RANGE'. If such a condition occurs check and reset the applied signal level.

Store.

### Zero Input

The applied input is within acceptable limits for zero calibration.

Advance to next parameter.

### Range Full Scale Calibration

For instruments with event pen see Section 8.11.4 on page 37.

#### Electrical Inputs:

apply a signal equivalent to **Input Range Full Scale**.

#### Resistance thermometer Inputs:

apply a signal input equivalent to **Lineariser Full Scale** using resistance values obtained from standard tables. For 2-lead RTDs, ensure that the resistance source is either connected at the sensor end of the leads or that the total lead resistance is added to the value for range full scale.

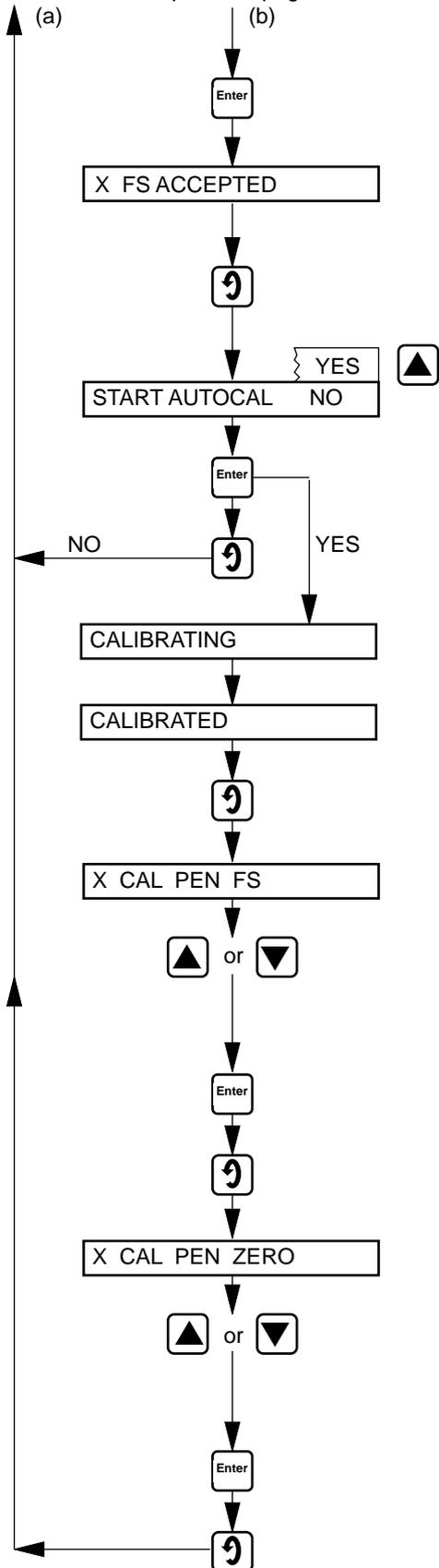
#### Thermocouple Inputs:

**apply** an input (c) – (a) where (c) is the millivolt equivalent of the **Lineariser Full Scale temperature** obtained from standard tables.

Note. **If the** applied signal level is outside acceptable full scale range limits, the displayed message alternates between 'APPLY FS INPUT' and 'INPUT OUT OF RANGE'. If such a condition occurs check and reset the applied signal level.

Range **Full Scale calibration**, and hence the measured value displayed during normal operation (see Operating **Page 1**), is **carried out** automatically.

Continued from previous page



Store.

### Full Scale Input

The applied input is within acceptable limits for full scale calibration.

Advance to next parameter.

### Automatic Calibration

Select 'YES' to initiate automatic calibration.

Store.

Advance to next parameter.

'CALIBRATING' is displayed for a few seconds during the automatic calibration procedure.

'CALIBRATED' is displayed on completion of the calibration process.

Advance to next parameter.

### Pen Full Scale Calibration

The pen is automatically positioned at full scale. If there is an error, i.e. pen not at full scale on the chart, ensure that the pen is touching the chart and use the 'Raise and Lower' switches to set pen full scale on the chart. For instruments fitted with event pen see Section 8.11.4 on page 37.

Store.

Advance to next parameter.

### Pen Zero Calibration

The pen is automatically positioned at the zero position. If there is an error, i.e. pen not at zero on the chart, ensure that the pen is touching the chart and use the 'Raise and Lower' switches to set pen zero on the chart.

Store.

Return to top of **Calibration Page**.

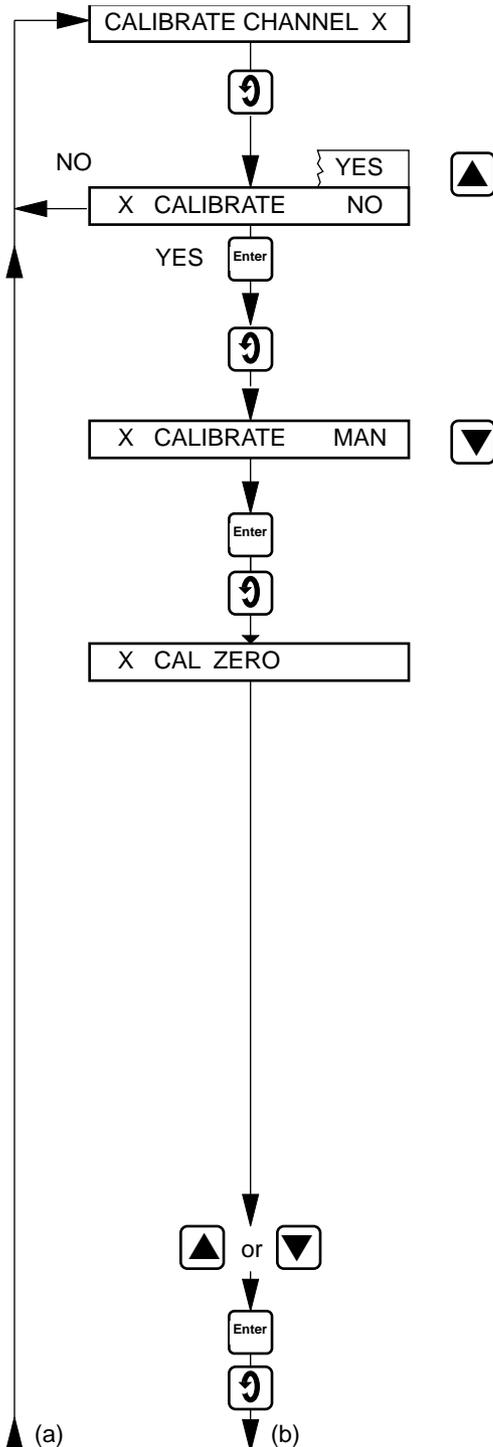
### 10.4 Calibration Page (Manual Procedure)

The procedures detailed in this section are for manual calibration at the normal range zero and full scale limits. However the manual calibration procedure also facilitates calibration of the instrument at selected points within the range other than zero and full scale.

As a general rule, spot calibration values should be:

- <50% of range span value when using **Calibrate Range Zero** parameters
- >50% of range span value when using **Calibrate Range Full Scale** parameters

This facility is particularly useful when optimum accuracy is required at 'spot' values within the range, e.g. for eliminating thermocouple errors by connecting the thermocouple to the instrument and keeping it at a constant temperature for the spot calibration.



(a) Continued opposite (b)

#### Calibrate Channel

Advance to next parameter.

#### Calibration

Select 'YES' to calibrate the instrument

Store.

Advance to next parameter.

#### Calibration Mode (auto or manual)

Select manual calibration mode. For automatic calibration mode refer to Section 10.3 on page 39.

Store.

Advance to next parameter.

#### Calibrate Range Zero

##### Electrical Inputs:

apply a signal input equivalent to **Input Range Zero**.

##### Resistance Thermometer Inputs:

apply a signal input equivalent to **Lineariser Zero** using resistance values obtained from standard tables. For 2-lead RTDs, ensure that the resistance source is either connected at the sensor end of the leads or that the total lead resistance is added to the value for range zero.

##### Thermocouple Inputs:

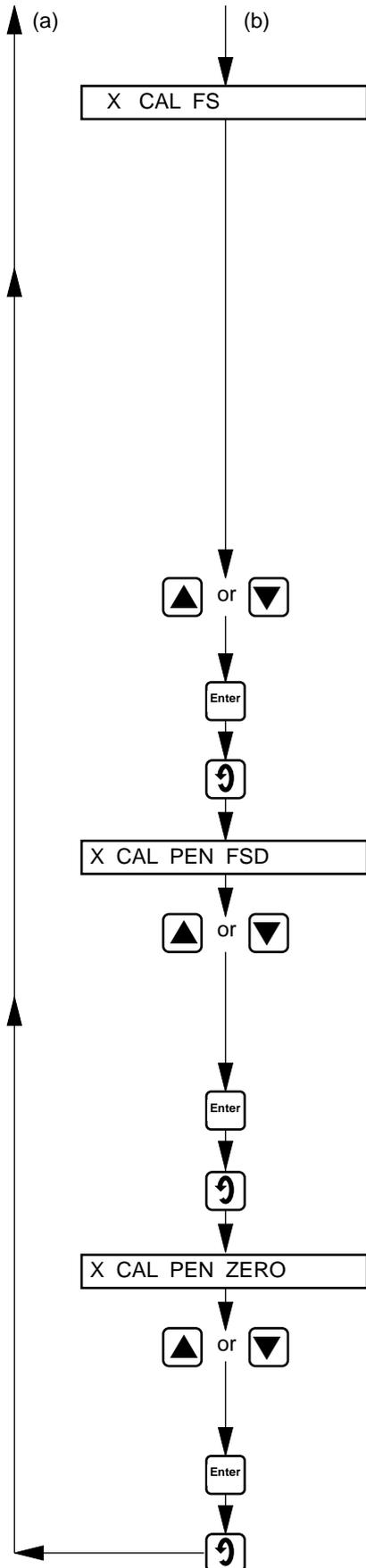
measure the ambient temperature at the output terminals of the signal source (calibrator). From thermocouple tables obtain the millivolt equivalent of this temperature (a) and that for the **Lineariser Zero** temperature (b) – see page 26. Subtract (a) from (b) and set the signal source to the resultant value. (The voltage is negative if the range zero temperature is below the measured ambient temperature).

**Note.** The displayed units are engineering units.

Set the value required. The decimal point position is set automatically.

Store.

Advance to next parameter.



**Calibrate Range Full Scale**

For instruments fitted with event pen see Section 8.11.4 on page 37.

**Electrical Inputs:**

apply a signal input equivalent to **Input Range Full Scale**.

**Resistance Thermometer Inputs:**

apply a signal input equivalent to **Lineariser Full Scale**, use resistance values obtained from standard tables. For 2-lead RTDs, ensure that the resistance source is either connected at the sensor end of the leads or that the total lead resistance is added to the value for range full scale.

**Thermocouple Inputs:**

apply an input (a) – (c) where (c) is the millivolt equivalent of **Lineariser Full Scale** temperature obtained from standard tables.

Set the value required. The decimal point position is set automatically.

Store.

Advance to next parameter.

**Pen Full Scale Calibration**

The pen is automatically positioned at full scale. If there is an error, i.e. pen not at full scale on the chart, ensure that the pen is touching the chart and use the 'Raise and Lower' switches to set pen full scale on the chart. For instruments fitted with event pen see Section 8.11.4 on page 37.

Store.

Advance to next parameter.

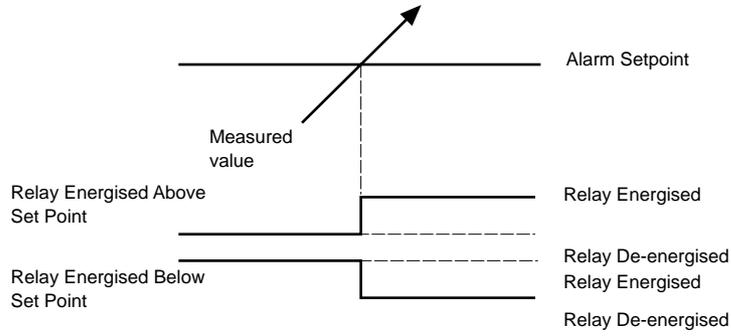
**Pen Zero Calibration**

The pen is automatically positioned at the zero position. If there is an error, i.e. pen not at zero on the chart, ensure that the pen is touching the chart and use the 'Raise and Lower' switches to set pen zero on the chart.

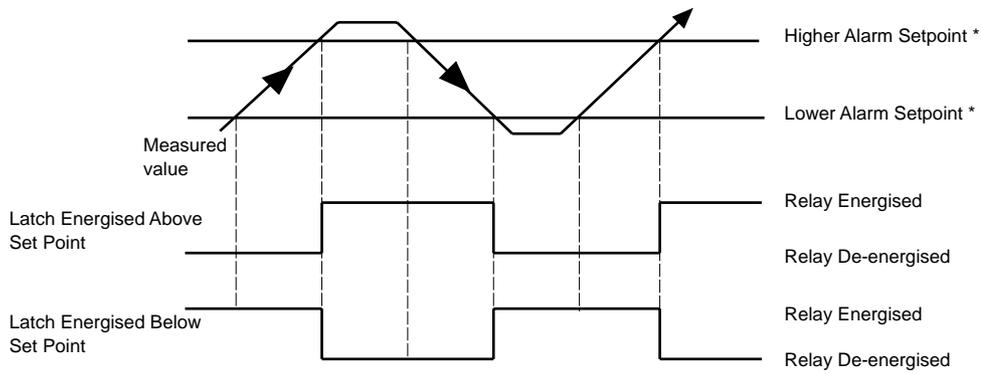
Store.

Return to top of **Calibration Page**.

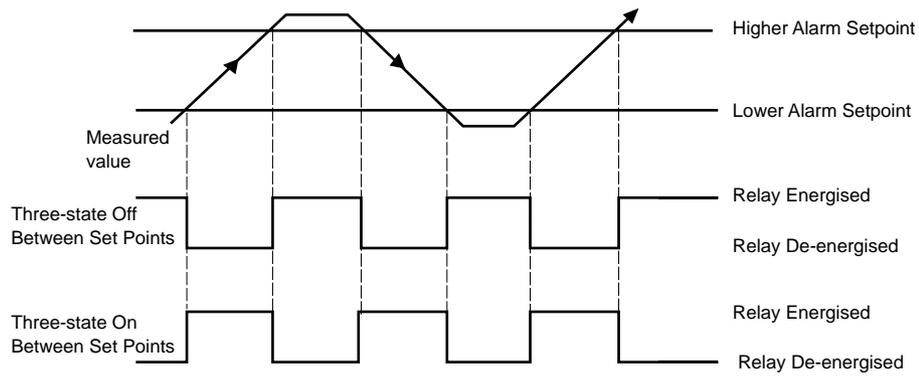
**11 APPENDICES**  
**11.1 Alarm Actions**



**Fig.12.1 On/Off**



**Fig. 12.2 Latch**



**Fig. 12.3 Three-State**

# PRODUCTS & CUSTOMER SUPPORT

## Products

### Automation Systems

- *for the following industries:*
  - Chemical & Pharmaceutical
  - Food & Beverage
  - Manufacturing
  - Metals and Minerals
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  - Pulp and Paper

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- *Drive Systems*
- *Force Measurement*
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- *Circular Chart, Strip Chart and Paperless Recorders*
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- *Systems Integration*

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- *Temperature*
- *Level*
- *Interface Modules*

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- *Actuators*
- *Positioners*

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- *ammonia, nitrate, phosphate, silica, sodium, chloride, fluoride, dissolved oxygen and hydrazine analyzers.*
- *Zirconia oxygen analyzers, katharometers, hydrogen purity and purge-gas monitors, thermal conductivity.*

## Customer Support

We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

### United Kingdom

ABB Limited  
Tel: +44 (0)1480 475321  
Fax: +44 (0)1480 217948

### United States of America

ABB Inc.  
Tel: +1 215 674 6000  
Fax: +1 215 674 7183

#### Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification.

Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:

1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

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