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4103C/M

100 mm chart recorders

Installation and Operation Manual

invensys
EUROTHERM

EUROTHERM CHESSELL

Declaration of Conformity

Manufacturer's name:	**Eurotherm Recorders Limited**
Manufacturer's address	**Dominion Way, Worthing, West Sussex, BN14 8QL, United Kingdom.**
Product type:	**Industrial chart recorder**
Models:	**4103C (Status level I11 or higher)** **4103M (Status level K12 or higher)**
Safety specification:	**EN61010-1: 1993 / A2:1995**
EMC emissions specification:	**EN50081-2 (Group1; Class A)**
EMC immunity specification:	**EN50082-2**

Eurotherm Recorders Limited hereby declares that the above products conform to the safety and EMC specifications listed. Eurotherm Recorders Limited further declares that the above products comply with the EMC Directive 89 / 336 / EEC amended by 93 / 68 / EEC, and also with the Low Voltage Directive 73 /23 / EEC

Signed: PRJ de la Nougerède Dated: 18-12-96

Signed for and on behalf of Eurotherm Recorders Limited
Peter De La Nougerède
(Technical Director)

CE

IA249986U030 Issue 2 Dec 96

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100 mm Chart Recorder

Installation and Operation Manual

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Safety Notes

1. Before any other connection is made, the protective earth terminal  shall be connected to a protective conductor. The Mains (supply voltage) wiring must be terminated in such a way that, should it slip in the cable clamp, the Earth wire would be the last wire to become disconnected.
2. In the case of portable equipment, the protective earth terminal must remain connected (even if the recorder is isolated from the mains supply), if any of the I/O circuits are connected to hazardous voltages*.

WARNING!

Any interruption of the protective conductor inside or outside the apparatus, or disconnection of the protective earth terminal is likely to make the apparatus dangerous under some fault conditions. Intentional interruption is prohibited.

Note: In order to comply with the requirements of safety standard BS EN61010, the recorder shall have one of the following as a disconnecting device, fitted within easy reach of the operator, and labelled as the disconnecting device.

a. A switch or circuit breaker which complies with the requirements of IEC947-1 and IEC947-3.
b. A separable coupler which can be disconnected without the use of a tool.
c. A separable plug, without a locking device, to mate with a socket outlet in the building.

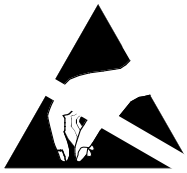
3. The mains supply fuse within the power supply unit is not replaceable. If it is suspected that the fuse is faulty, the manufacturer's local service centre should be contacted for advice.
4. Whenever it is likely that protection has been impaired, the unit shall be made inoperative and secured against unintended operation. The nearest manufacturer's service centre should be consulted for advice.
5. Any adjustment, maintenance and repair of the opened apparatus under voltage, should be avoided as far as possible and, if inevitable, shall be carried out only by a skilled person who is aware of the hazard involved.
6. Where conductive pollution (e.g. condensation, carbon dust) is likely, adequate air conditioning/filtering/sealing etc. must be installed in the recorder enclosure.
7 Signal and supply voltage wiring should be kept separate from one another. Where this is impractical, shielded cables should be used for the signal wiring.
8. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.

* A full definition of "Hazardous' voltages appears under 'Hazardous Live' in BS EN61010. briefly, under normal operating conditions, hazardous voltages are defined as > 30V RMS (42.2V peak) or > 60V dc.

CAUTION

For recorders fitted with analogue outputs.

During recorder initialisation, analogue output terminal voltages can lie anywhere between -1V and +15V inclusive. It should be ensured by the user that any equipment connected to the recorder's analogue outputs cannot be damaged by such voltages.



Static electricity

All circuit boards associated with the recorder contain components which are susceptible to damage caused by static electrical discharge of voltages as low as 60 Volts.

Should it be necessary to handle such circuit boards, appropriate precautions must first be taken to ensure that the recorder, the circuit board, the operator and the work area are all at the same electrical potential.

Recorder labelling

	Refer to the Manual for instructions
	Protective Earth
	This recorder for ac supply only
	This recorder for dc supply only.
	This recorder for either ac or dc supply
	Risk of electric shock

One or more of the symbols below may appear in the recorder labelling.

SECTION 1 INSTALLATION

1.1 UNPACKING THE RECORDER

The recorder is despatched in a special pack designed to give adequate protection during transit. Should the outer box show signs of damage, it should be opened immediately and the recorder examined. If there is evidence of damage, the instrument should not be operated and the local representative contacted for instructions. After the recorder has been removed from its packing, the packing should be examined to ensure that all accessories and documentation have been removed. Once the recorder has been installed, any internal packing should be removed, and stored, with the external packing against future transport requirements.

1.2 INSTALLATION

1.2.1 Mechanical installation

Mechanical installation details are shown in figure 1.2.1

The recorder is inserted through the panel aperture from the front of the panel. With the weight of the recorder supported, the panel clamps should be inserted into one opposite pair of the rectangular apertures (either at the top and bottom or at the right and left sides) of the recorder. The jacking screws should then be tightened sufficiently to clamp the recorder into position.

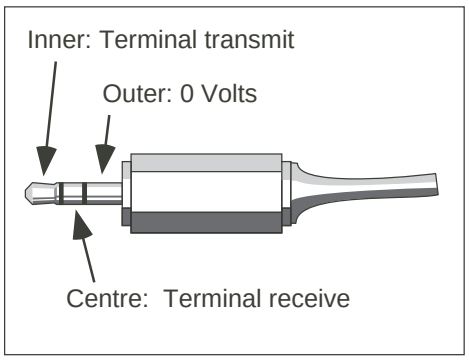
EXCESS FORCE SHOULD NOT BE USED IN TIGHTENING THESE SCREWS, since any resulting distortion of the recorder case may render the recorder inoperative.

1.2.2 Electrical installation

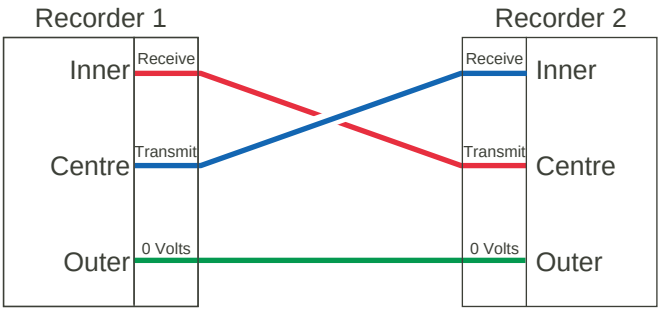
Details for connecting the line supply and for signal wiring are shown in figure 1.2.2. Once the signal and supply voltage cabling is complete, the recorder is switched on using the on-off switch located behind the display unit,

CONFIGURATION TRANSFER WIRING

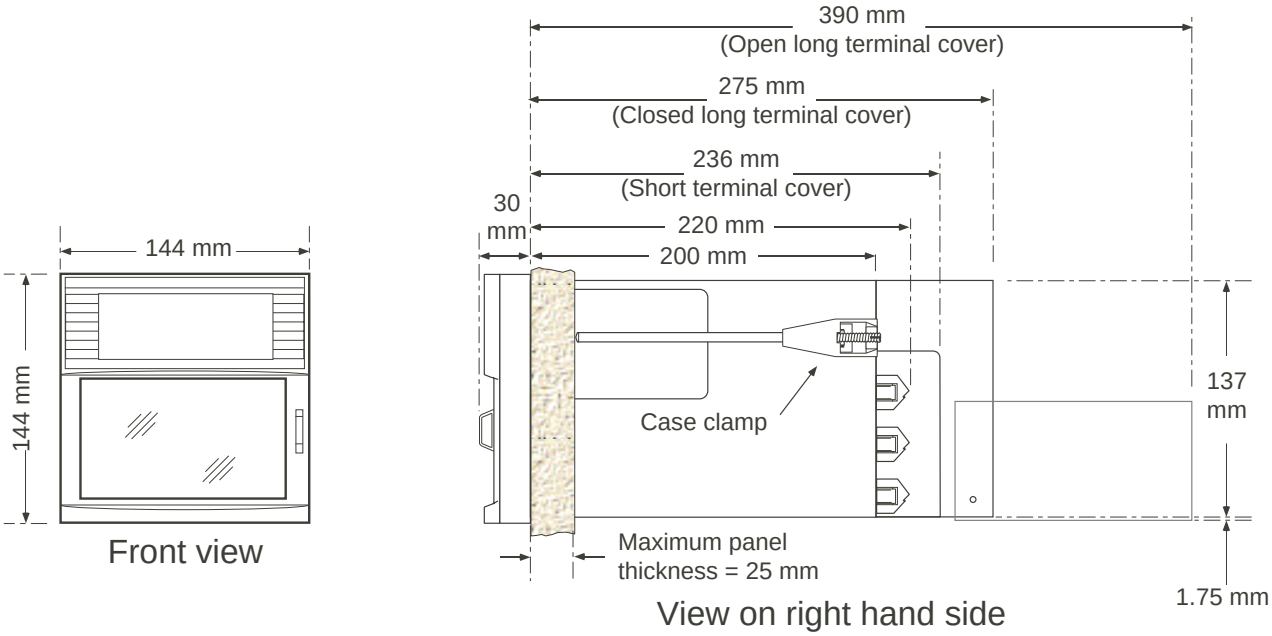
Wiring for the configuration port jack plug is as shown below. See section 4.12 for details of the configuration transfer facility.

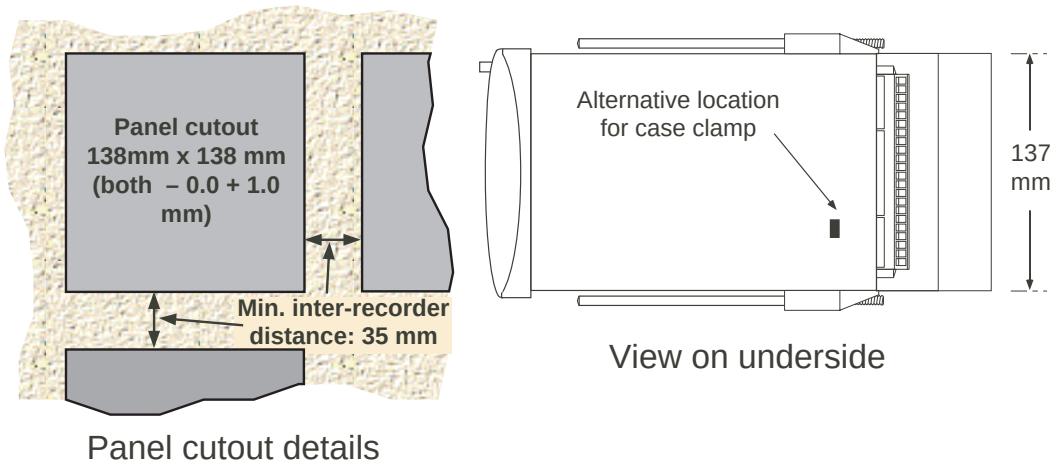


Jack plug wiring for transfer with host computer/dumb terminal



Jack - to - jack wiring for transfer between recorders





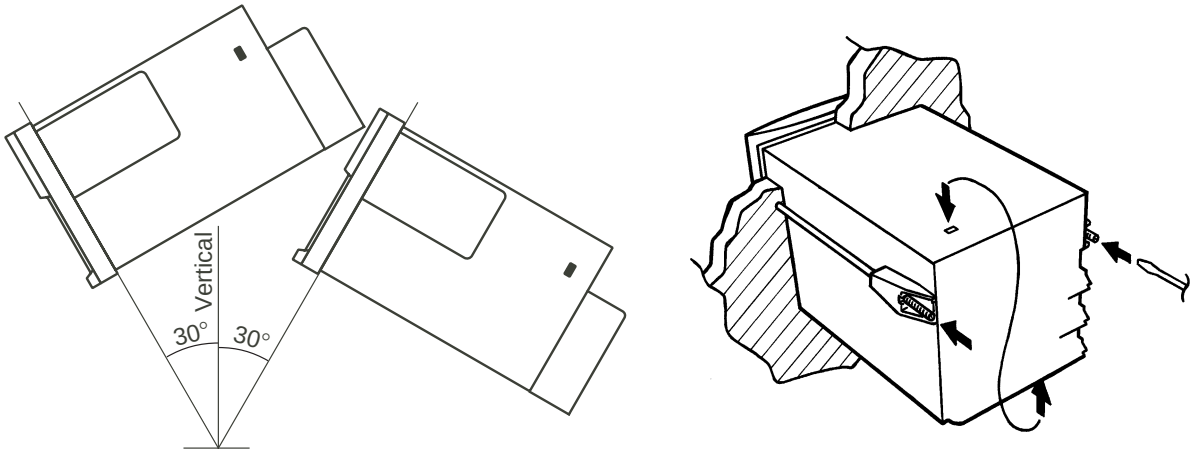
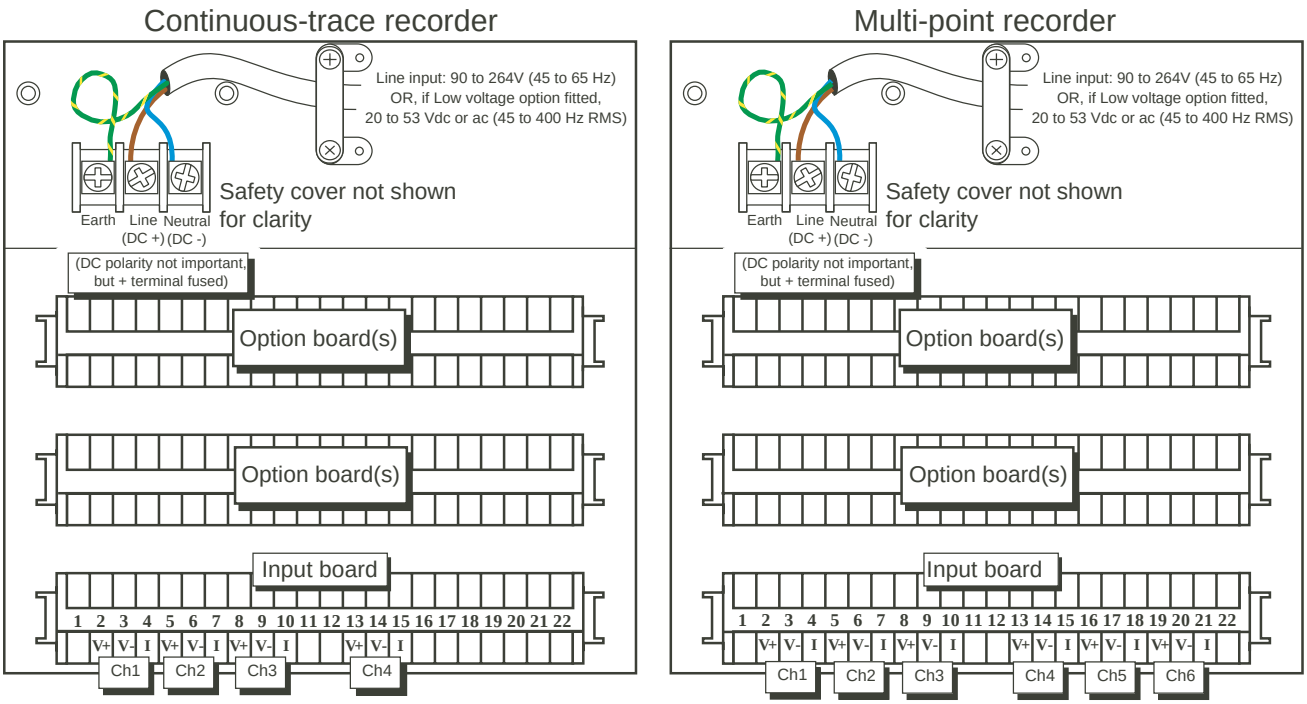
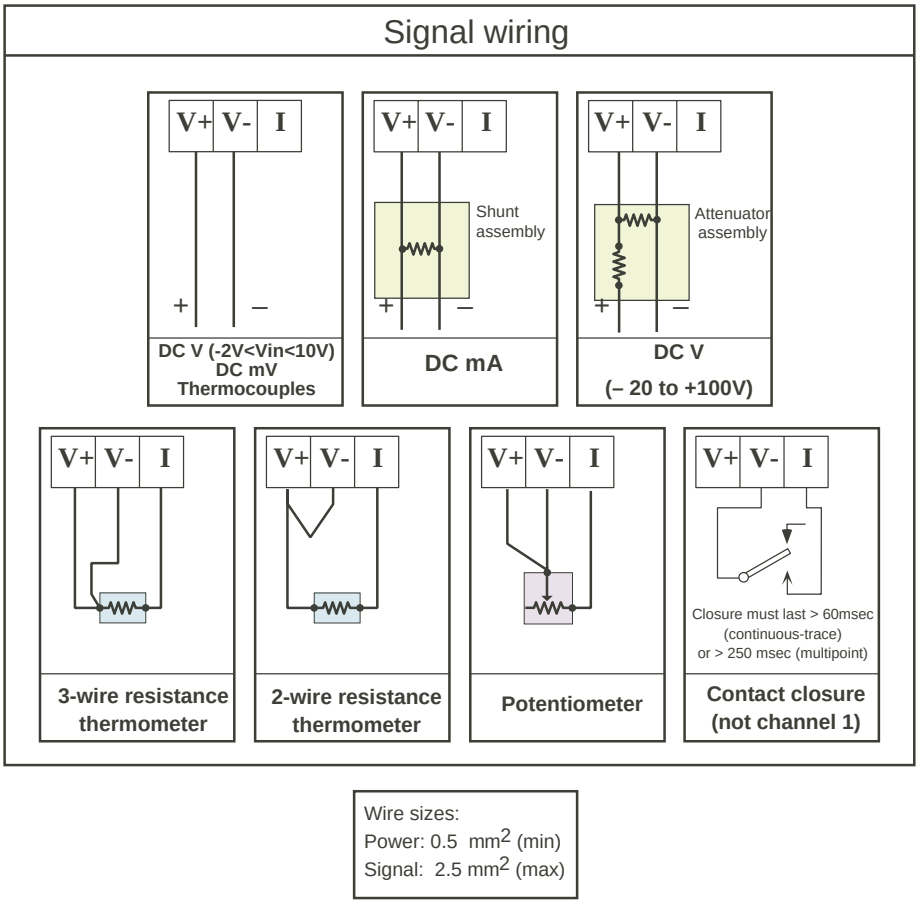


Figure 1.2.1 Mechanical installation





Wire sizes:
Power: 0.5 mm^2 (min)
Signal: 2.5 mm^2 (max)

Figure 1.2.2 Electrical Installation

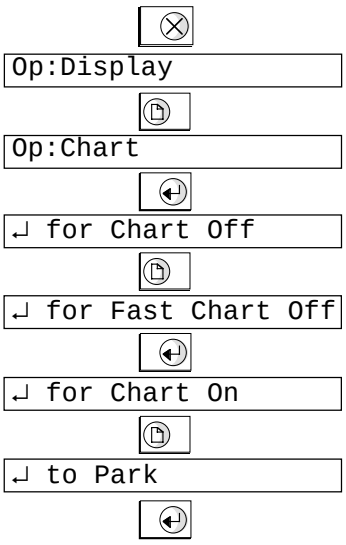
1.3 CHART INSTALLATION

Operate the cancel (x) key to call the first 'Operator page', then operate the page key to call the Operator Chart page

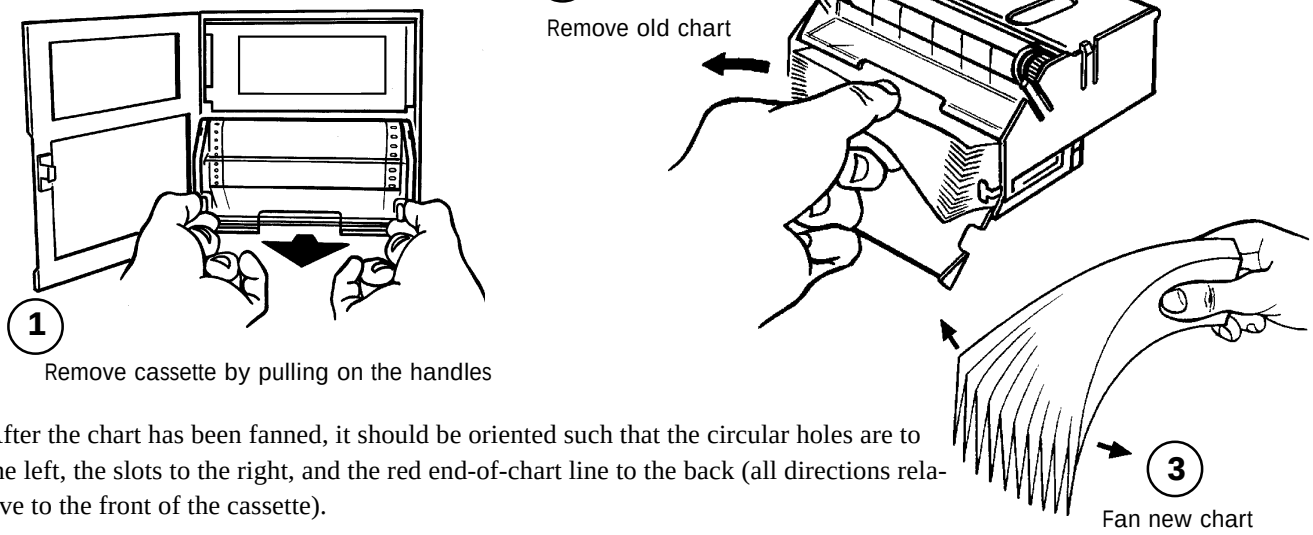
Operate the 'Enter' key (Chart Off), then the page key (Chart Fast OFF). Use the enter key to switch the chart off followed by two operations of the page key, to call the 'Park' page.

Operate the Enter key to fan the pens (centre the printhead).

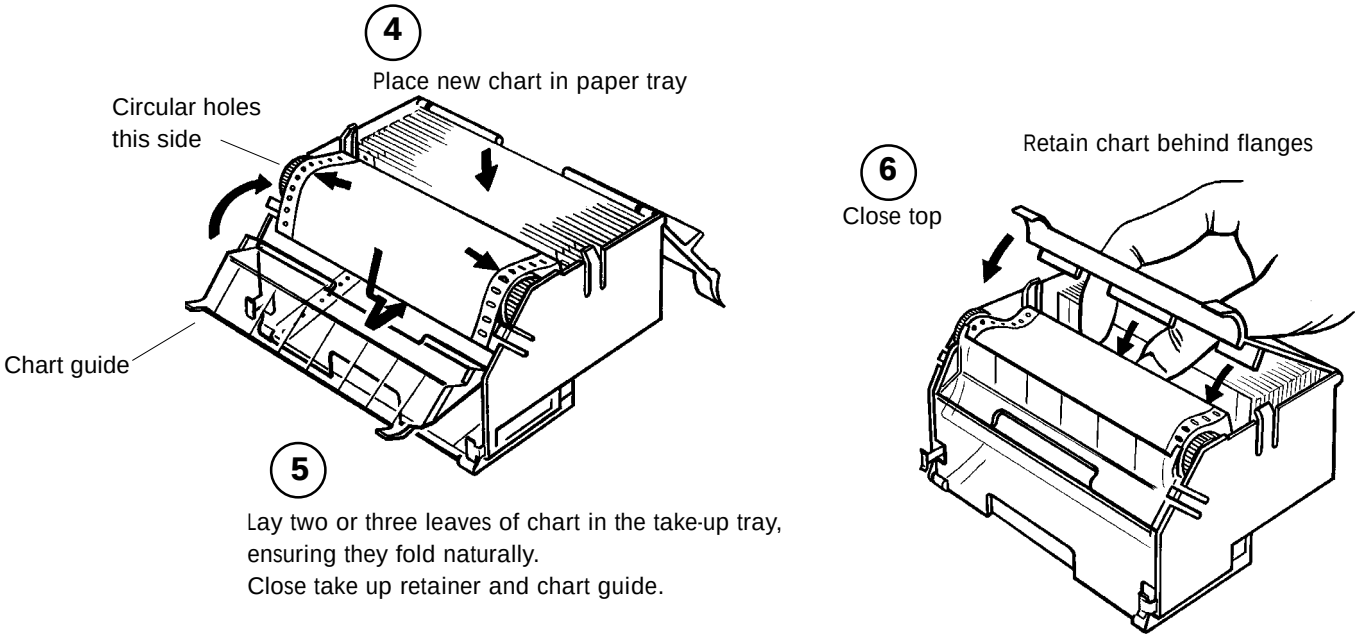
Once the chart has been changed and the cassette returned to the recorder, operate the Page key continuously until the '↵for Chart On' page appears, then operate the 'Enter' key. Carry out the alignment procedure described in section 3.10.



1.3.1 Z-Fold charts

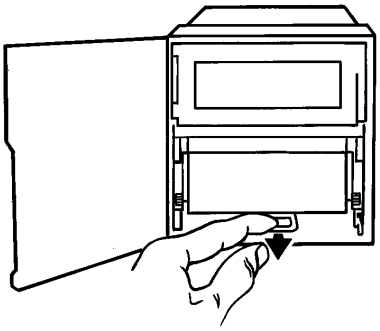


After the chart has been fanned, it should be oriented such that the circular holes are to the left, the slots to the right, and the red end-of-chart line to the back (all directions relative to the front of the cassette).



1.3.2 Roll Charts

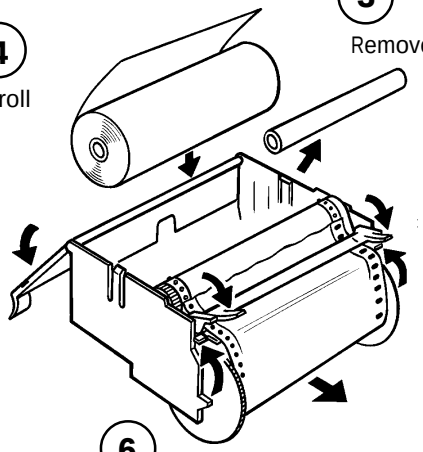
Carry out the'Park procedure described in section 1.3 above. when the chart has been fitted, carry out the alignment procedure described in section 3.10.



1 Remove cassete by pressing down on, then pulling on the retaining clip. (Multi-point recorder shown - continuous trace type similar).

3 Remove inner tube

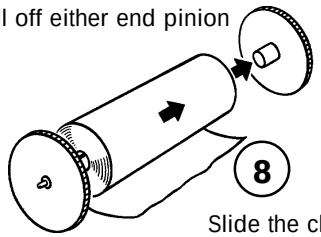
4 Insert new chart roll



2 Open cassette top

5 Open cassette top

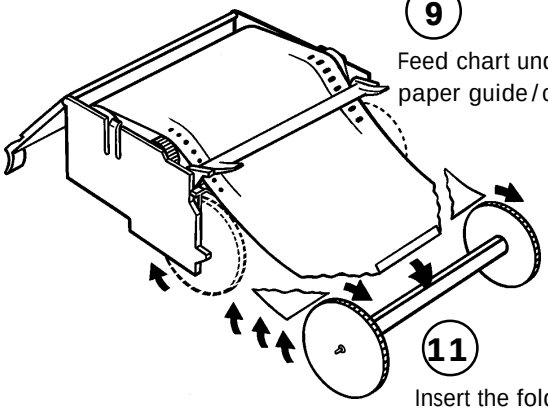
7 Pull off either end pinion



6 Lift 'ears' to eject take-up spool with used chart.

8 Slide the chart off the take-up spool, then push the pinion fully back onto the empty spool.

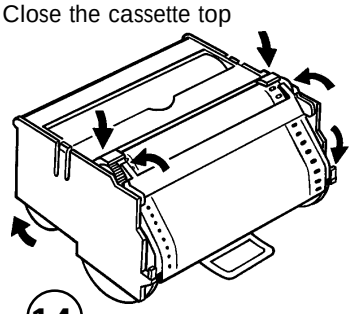
9 Feed chart under paper guide/chart tear-off.



10 Tear the corners off the chart, then fold about 5mm of the point back

11 Insert the fold into the slot, then roll the paper onto the take-up spool, and re-insert the spool into the cassette.

12 Close the cassette top

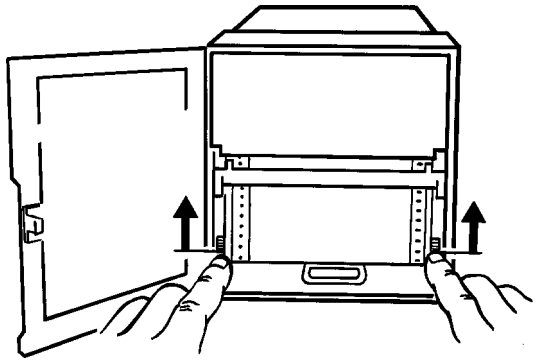


13 Close the paper guide/chart tear off strip, ensuring that the chart is 'square' with the cassette.

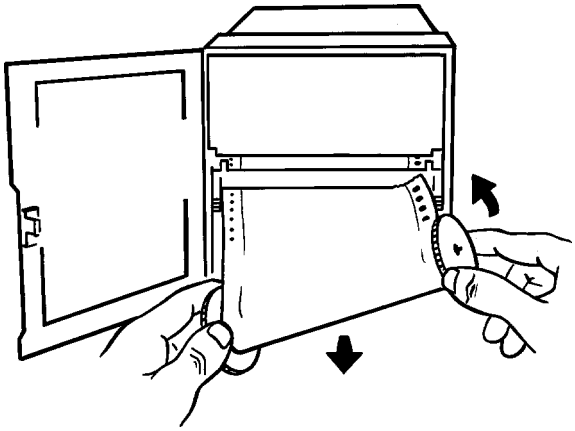
14 Tension the chart.

CHART REVIEW/TEAR OFF

To view or remove a section of chart, lift the 'ears' to eject the take-up spool. Then either return the spool to the cassette, or tear the required section off, and re-fit the chart as shown in '10' onwards above.



First, lift 'ears' to eject chart



Then, review chart, and if required, remove section using the tear-off strip

1.4 CHANGING THE PENS/CARTRIDGE

Note: Care should be taken to avoid pen/cartridge contact with skin or clothing

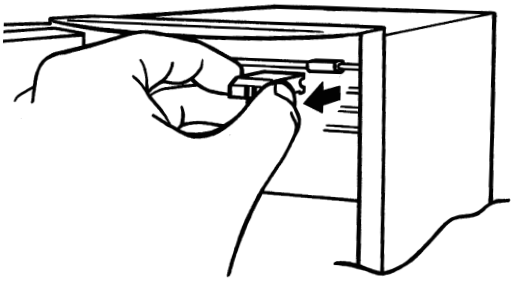
Before changing pens or the cartridge, carry out a pen park as described in section 1.3 above. After fitting the new pens/cartridge, carry out the alignment procedure detailed in section 3.10 below.

1.4.1 Continuous-trace recorders

Open the recorder door, and the display module, both hinged at their left edge.

Pull the pens forwards off their guide bars.

Fit the new pens and operate the 'Enter' key to re-start tracing.



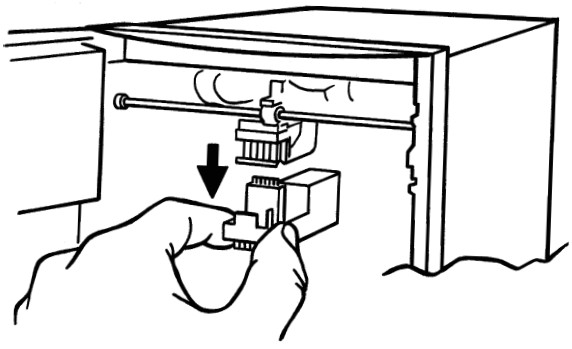
Pull pen forward

1.4.2 Multipoint recorders

Open the door and the display module, both hinged at their left edge.

Remove the chart cassette and pull the exhausted print cartridge 'vertically' downwards out of its holder. Offer up the new cartridge to the printhead, and push it upwards into place.

Return the chart cassette to the chassis, and operate the 'Enter' key to re-start tracing.



Pull cartridge downwards

1.5 PREVENTIVE MAINTENANCE

1.5.1 Maintenance schedule

3-yearly Change battery

1.5.2 Changing the battery

The following procedure applies to recorders fitted with the replaceable coin-cell lithium battery (BR2330 or similar) available from the recorder manufacturer under part number PA261095. Such batteries have been fitted as standard since Status level R25 (Multi-point) and R28 (Continuous-trace) (both November 1999). Recorders manufactured prior to this were fitted with a Nickel-Cadmium battery permanently mounted on a replaceable circuit board (Part No AH249860). If your recorder is fitted with such a board, it should be replaced with the new coin-cell board (AH261096), using kit LA261398. This kit contains full instructions for the replacement.

Configuration is retained during battery replacement. volatile values (e.g. time, date, totaliser and maths values) are also retained providing that the recorder has been powered for at least 1 hour prior to the start of the battery replacement procedure.

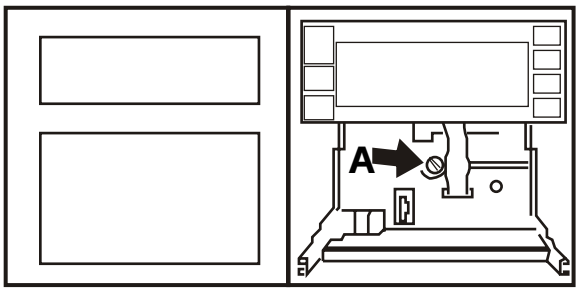
EQUIPMENT REQUIRED

In addition to normal Pozidriv and slotted-head screwdrivers, the following tools are required.

1. Plastic tweezers
2. 'Stubby' or 'offset' Pozidriv screwdriver (optional)

ACCESS TO THE BATTERY BOARD

Open the door of the recorder, and remove the chart cassette and the pens or printhead as described above. isolate the recorder from line power.

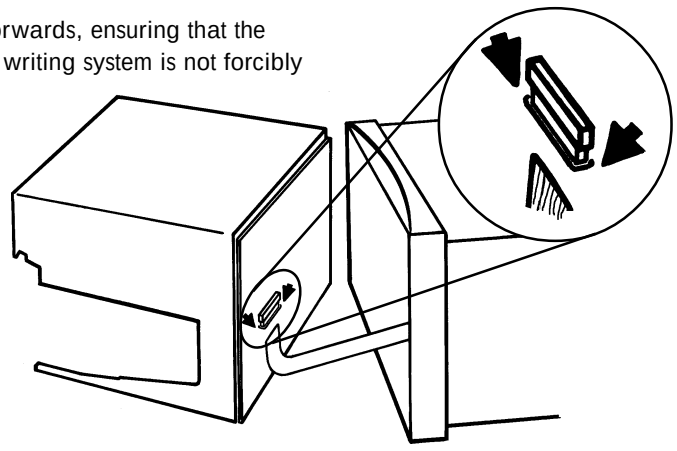


1

Unscrew the jacking bolt A

2

Carefully slide the chassis forwards, ensuring that the flexi cable at the rear of the writing system is not forcibly pulled out of its connector.



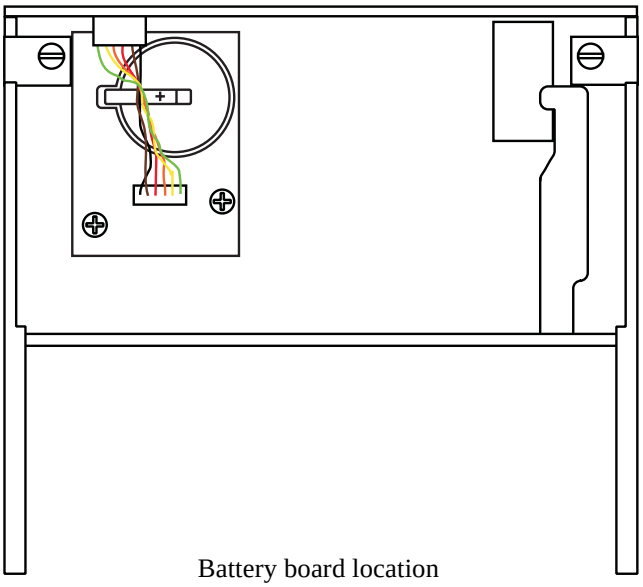
3

Gently push connector 'ears down to release the flexi-cable from its connector.

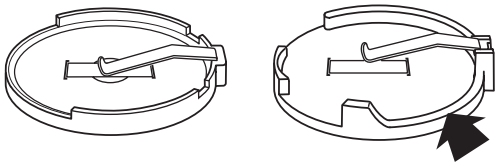
The writing system can now be removed from the case and placed, up-side-down on a static-safe surface.

BATTERY REPLACEMENT

Once access to the board has been gained, this procedure is simply a matter of extracting the battery from its holder, as shown below, and pushing the replacement into place, ensuring correct polarity (+ to top). The battery holder manufacturer changed the design of the holder in mid 2000, as illustrated in the comparison below. The replacement procedure depends on the type of holder fitted. Exhausted batteries can be disposed of with normal refuse



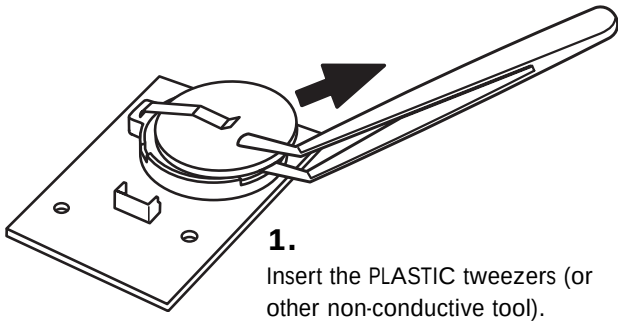
Battery board location



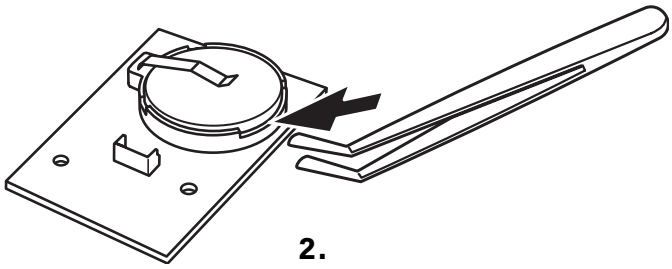
Comparison of old style and new style battery holders

ORIGINAL DESIGN

A PLASTIC or other NON-CONDUCTIVE tool must be used to extract the battery. Use of metal tools will discharge the battery. Plastic tweezers, such as those shown below are available from electronics components distributors.



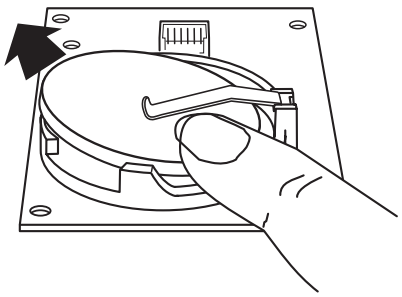
1.
Insert the PLASTIC tweezers (or other non-conductive tool).



2.
Grasp the battery and pull it out of its holder

NEW DESIGN

The cutout in the new design of battery holder allows the batteries to be pushed out, as shown. The replacement battery can then simply be pushed into place (+ = top).



SECTION 2 BASIC OPERATION

This section is designed to help you as a new user to understand the display and key operations. After the display and key descriptions, an example configuration is given to show you how to set up an input channel to a known set of parameters, so you can start recording your own traces with the minimum of effort. Only those items which are necessary to get you going are explained; for full information about the Operator and Configuration display see sections 3 and 4 respectively.

2.1 POWER UP

At power up, a power-on message is printed on the chart (not continuous pen recorders unless the annotation option is fitted) showing time and date, instrument name, and chart speed.

```
09:15 29/02/96 Inst 1          1200 mm/hr
```
or
```
09:15 29/02/96 Inst 1          OFFLINE
```
(if the chart drive is switched off)

After initialisation is complete, the display enters what is called a 'background' display, as shown in figure 2.1.

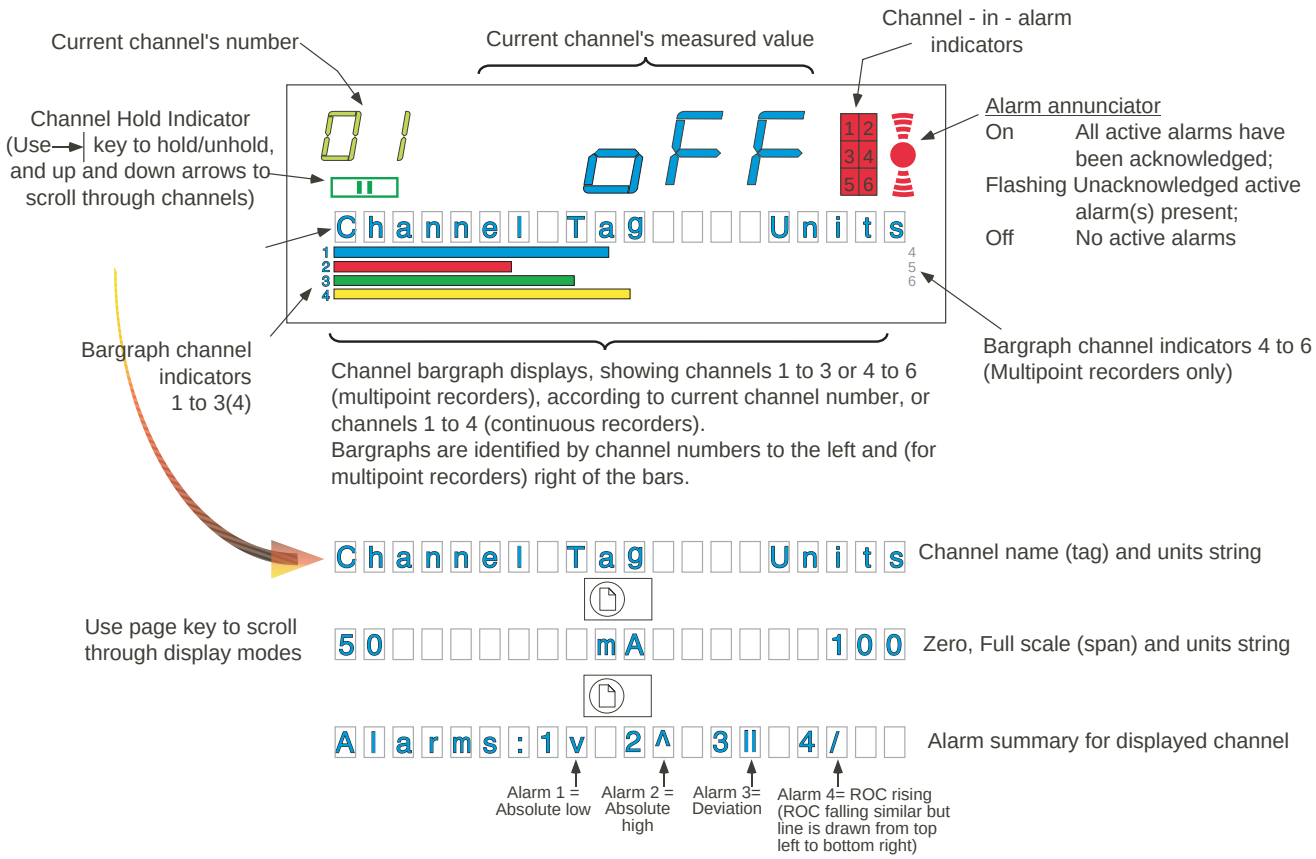
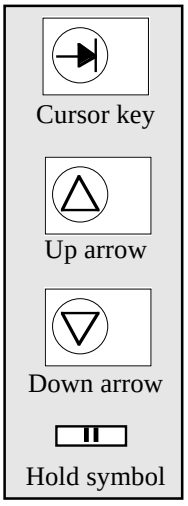


Figure 2.1 Background display

2.2 INTERPRETING THE BACKGROUND DISPLAY

The background display contains the following items, all of which are described below:

1. Current channel number
2. Current channel value
3 Current channel tag (name) and units (or zero/full scale values and units, or alarm status)
4. Bargraph values for channels 1 to 3 or 4 to 6 (multi-point recorder) or channels 1 to 4 (continuous recorder). Bargraphs are blank for channels which are 'Off'.
5. Current alarm status for all channels. Alarm indication for PVs which are not input channels.



2.2.1 Channel number

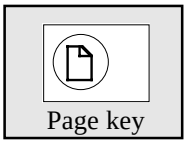
Two green seven-segment characters to the left of the display showing channel number. In normal circumstances, the channels will be displayed one after the other. If required however, any given channel's display can be held permanently on display, by using the cursor key (to the right of the display). When channel hold is in operation, this is indicated by the lighting of the Hold indicator immediately below the channel number display. Other channels can be accessed by using the up/down arrow keys, or by releasing 'Hold' by a further operation of the cursor key.

If the relevant options are fitted, and if the display group has been edited to include them (section 4.6.3), the display also scrolls through derived channels DV01 to DV24, totalisers T1 to T6 and counters C1 to C6. For simplicity, these are given the general name 'Process Variable' (PV). The channel number display for derived variables switches continuously between `'dv`and `'NN'` where NN is the derived variable number (01 to 24)

2.2.2 Channel value

This five character blue display shows the current channel's value. For positive values, all five characters are used; for negative values, the left most character is used to display a minus sign only.

2.2.3 Channel data display



This 20-character display shows one of three sets of data related to the current channel. The page key is used to scroll through the three sets.

1. Tag and units display e.g.: `Furnace1 TempA Deg C`
2. Scale and units display e.g.: `50 Deg C 100`
3. Alarm summary `Alarms:1^ 2^`

For details on alarm symbols see section 3.4.1. For more detail about alarms in general, see section 4.5.2

This display is also used to display Operator and Configuration data, as described below.

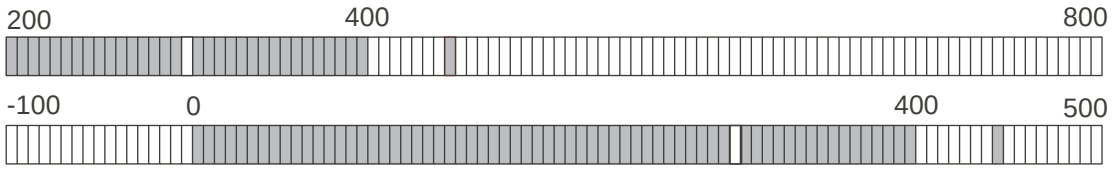
2.2.4 Bar graphs

The bar graphs show three or four channels according to recorder model. The channel numbers associated with these bar graphs are shown by the numerals to the left (1 to 4) and right (4 to 6) of the bars. With multipoint recorders, you get either channels 1 to 3 or channels 4 to 6 on display according to whether the current channel is one to three or four to six, respectively. With continuous recorders, channels 1 to 4 are permanently on display.

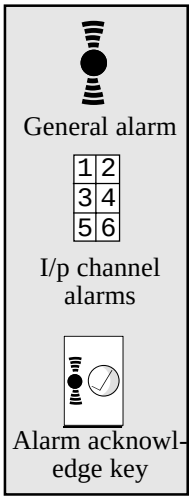
Each bar graph consists of 100 segments, giving a resolution of (High scale - low scale) / 100. For example if your scale is 200 to 800 degrees, each segment represents (800 - 200) /100 = 6 degrees. The bar always grows from zero to its current value, so in the example just given, the bar would start from the left edge of the display (segment 1). If your scale were, say, –100 to +500 instead, the bar would start from segment 17 and grow to the right for positive values or to the left for negative values.

Alarm setpoints are shown on the bargraph by switching on (illuminating) the relevant segment if those around it are off, and vice-versa

The following example shows a reading of 400 degrees on the two scales discussed above with alarm setpoints at 300 and at 450.



2.2.5 Alarm indication



There are two types of alarm indicator, located to the right of the display. One of these indicators is a general alarm which 'animates' when any alarm is triggered. The other is a block of six indicators, one for each input channel.

As fully explained in section 4.5.2, the alarm annunciation varies according to type of alarm, but generally, the indicators will flash for any active alarm which has not been acknowledged, or will be illuminated steadily for acknowledged alarms.

Alarms can be acknowledged at any time by using the Alarm acknowledge key to the left of the display.

2.3 KEY USAGE

The display has a number of keys on each side of it as shown in figure 2.3 below.

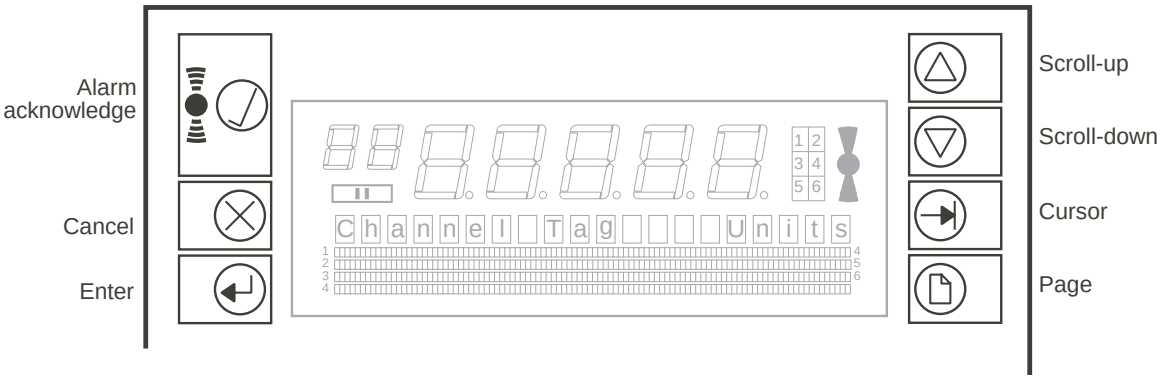


Figure 2.3 Recorder keys

2.3.1 Key functions

Alarm acknowledge

This key acknowledges all active, unacknowledged alarms.

Cancel

This is used

a. To enter the Operator menus from the background display.
b. To cancel all changes made since the last operation of the 'Enter' key (described below).
c. To move you to the next highest menu level.

Enter

This is used

a. To return to the background display from the `Op:Display` page.
b. To initiate changes in the Operator menus (section 3)
c. To confirm changes made to configuration.
d. To enter sub menus (i.e. to go to the next lowest menu level).

Scroll up / down keys

This key is used

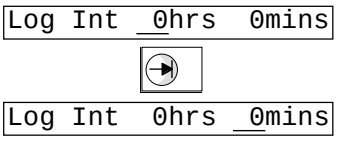
a. to scroll through text characters when entering text strings
b. to enter numeric values
c. to scroll through all menu items associated with a parameter (e.g. thermocouple types)

Cursor

As described in Section 2.2.1 above, the cursor key can be used in background mode to stop the normal scrolling-through of channels' values i.e to display a single channel's value continuously (Channel hold) until the cursor key is operated again.

In operator and configuration pages, the cursor key is used to move the display cursor (underline) from field to field in operator or configuration display pages where there is more than one item whose value can be changed.

For example, the Log interval page (part of chart configuration) has both hours and minutes fields:



Page

The Page key is used

a. to move round the Operator and Configuration top level menu
b. to move round sub menus (e.g. Operator Chart submenu - section 3.3)

2.4 CONFIGURATION EXAMPLE

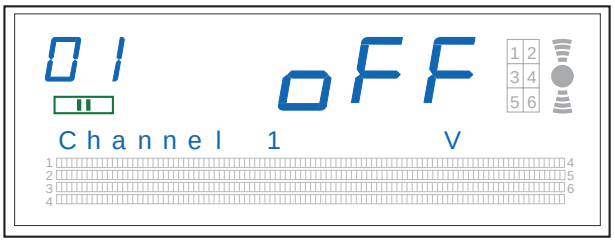
This section gives you a step-by-step guide to the basic configuration of a single channel (Nº2) to an imaginary set of input conditions. If you are new to recorders, it is recommended that you first follow this example, and then modify it to suit your own particular requirements.

2.4.1 Channel inputs/outputs

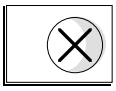
Before starting to configure any part of the recorder, it is essential that you know exactly what you want it to do with the input signal you are supplying it with. For our channel, a list of parameters can be written as follows:

Channel number	2
Input range	0 to 1000 degrees C
Input type	Type J thermocouple
Input break response	Drive high
Trace	On
Tag	Furnace1 tempA
Alarm	Tripped immediately if temperature exceeds 780 degrees C. Remains active until acknowledged. Sounds internal buzzer whilst active.

2.4.2 Entering configuration



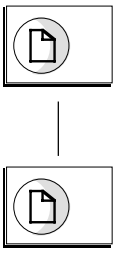
From the background display, operate the Cancel key



The data display area changes to the first of the operator pages and the remainder of the display goes blank.

Op: Display

Repeated operation of the Page key scrolls through the top level operator pages.



Op:Chart

Op:Alarm Summary

Op:Channel 1 Alarm 1

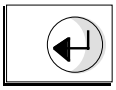
Op: Action

Op:Clock

Op:System Error

Op:Configuration

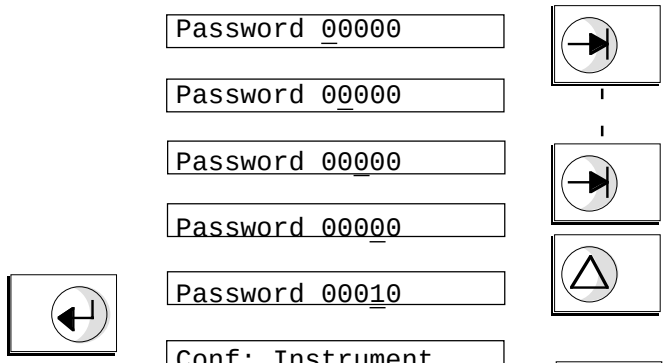
When the configuration page is reached, operate the 'Enter' key



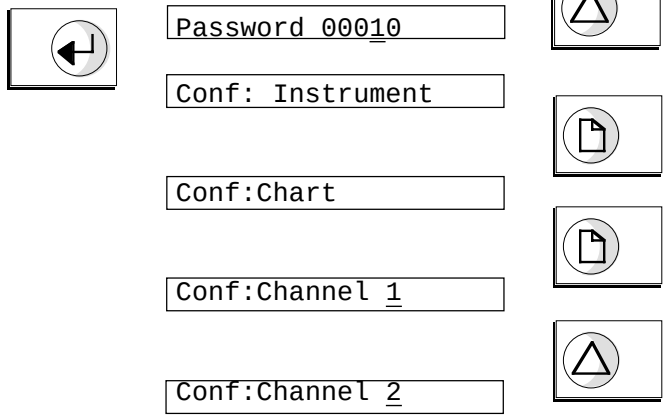
Password 00000

2.4.2 Entering Configuration (Cont.)

Press the cursor key three times, then the up arrow and 'enter' keys.

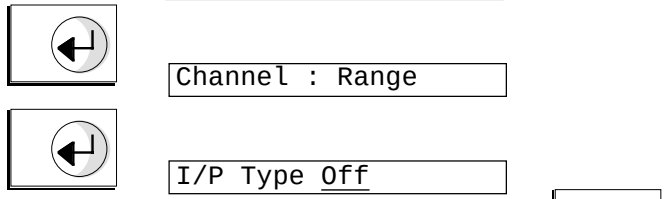


2.4.3 Channel configuration



Operate the Page key twice, to call the top level channel configuration page.

Use the up arrow key to change the channel number to '2' and operate the 'Enter' key.

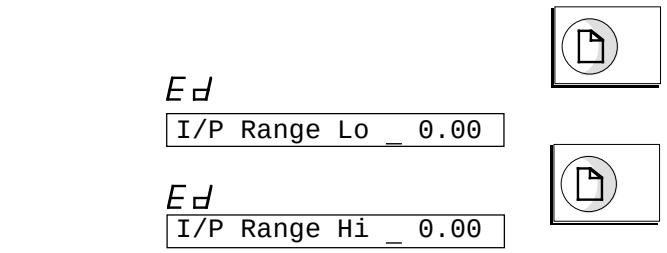


Use the Enter key again to enter 'Range' configuration.

Operate the up arrow key to change 'Off' to 'T/C' (Thermocouple).

The letters 'Ed' appear to remind you that you have made a change which has not yet been entered into the data base.

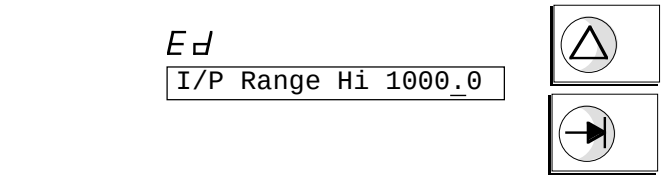
Operate the Page key to call the Range low page.



The low range is 0 as required, so operate the page key again to call the Range High page

Enter the value 1000 as follows:

1. Operate the up arrow key until '1' appears in the display.
2. Operate the cursor key, and repeat step 1, but stopping when '0' appears in the display.
3. Repeat step 2.
4. Repeat step 2.
5 Repeat step 2 but stopping when the decimal point appears.



Note: If you do not enter the decimal point, the recorder will interpret the entry as 100000

2.4.3 CHANNEL CONFIGURATION (Cont.)

Temperature units

Operate the page key to call the input units page

Units are ˚C as required. Other units (˚F, K or R could be scrolled to using the arrow keys)

Operate the page key to call the linearisation type page.

Linearisation type

Use the up arrow key to scroll from Type B through to Type J

Operate the Page key to call the CJC page.

CJC Type

Use the up arrow key to scroll from 'Off' to 'Internal'.

Scale page

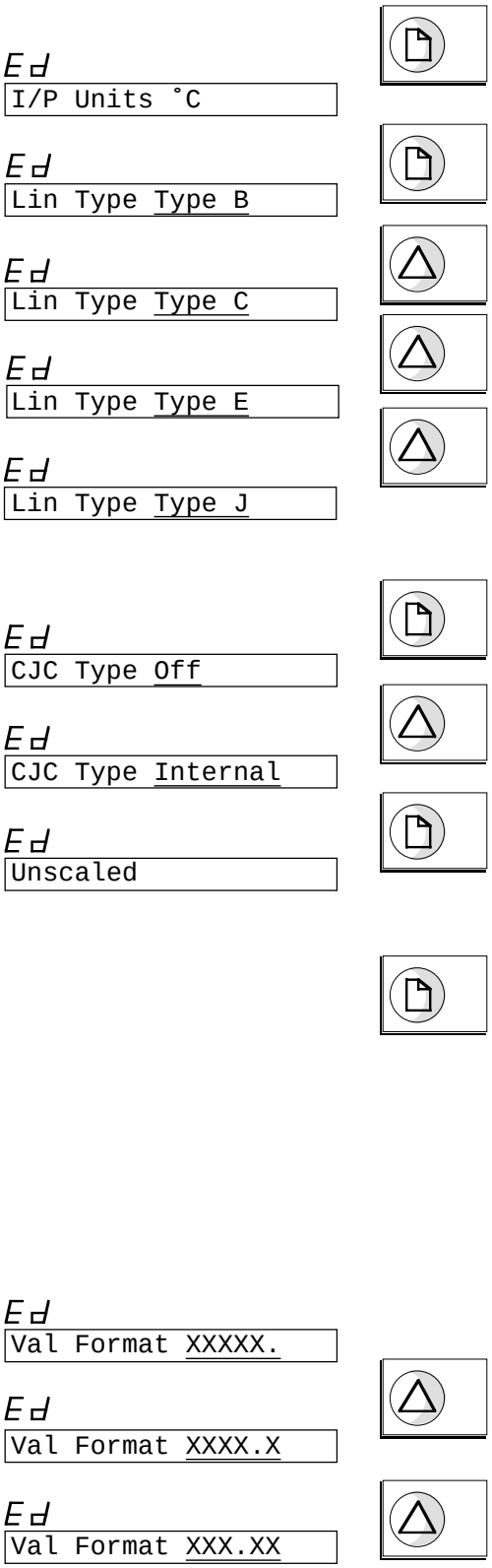
Use the page key to call the scaling page. As our scale range is the same as the input range, we can leave it 'Unscaled' and continue by operating the Page key.

Scaling is used where an input signal (e.g. mA) is used to represent another type of input (e.g. litre/min), or where, a potentiometer wiper voltage may be required to appear as, say, 0 to 100% instead of Volts.

Value Format

This page allows us to set the position of the decimal point for display.

Use the up arrow key to move the decimal point to our required position (two decimal places).



2.4.3 CHANNEL CONFIGURATION (Cont.)

Input Break Response

Use the Page key twice to call the Break Response page. This page allows us to set Drive high, such that if the wiring to the thermocouple breaks, the pen will move to the right-hand edge of the chart and trace at Full Scale, thus making it obvious that there is a problem.

Offset

Used to add a fixed value (in engineering units) to measurements.

Tag

This page allows entry of a 14-character text string to describe the channel. The tag appears at the display and in logs.

Use of the up and down arrow keys allows us to scroll through the available character set for whichever of the 14 characters is currently underlined. The cursor key is used to move the underline along the string to the next position to be edited.

When tag editing is complete, operate the Enter key, followed by the Cancel key, to re-call the Channel Config page

This completes the Channel Range configuration. We now need to go to Channel Alarm configuration, then Channel Trace.

Alarm type

From the *Channel :Range* page, operate the page key to call the *Channel : Alarm* page.

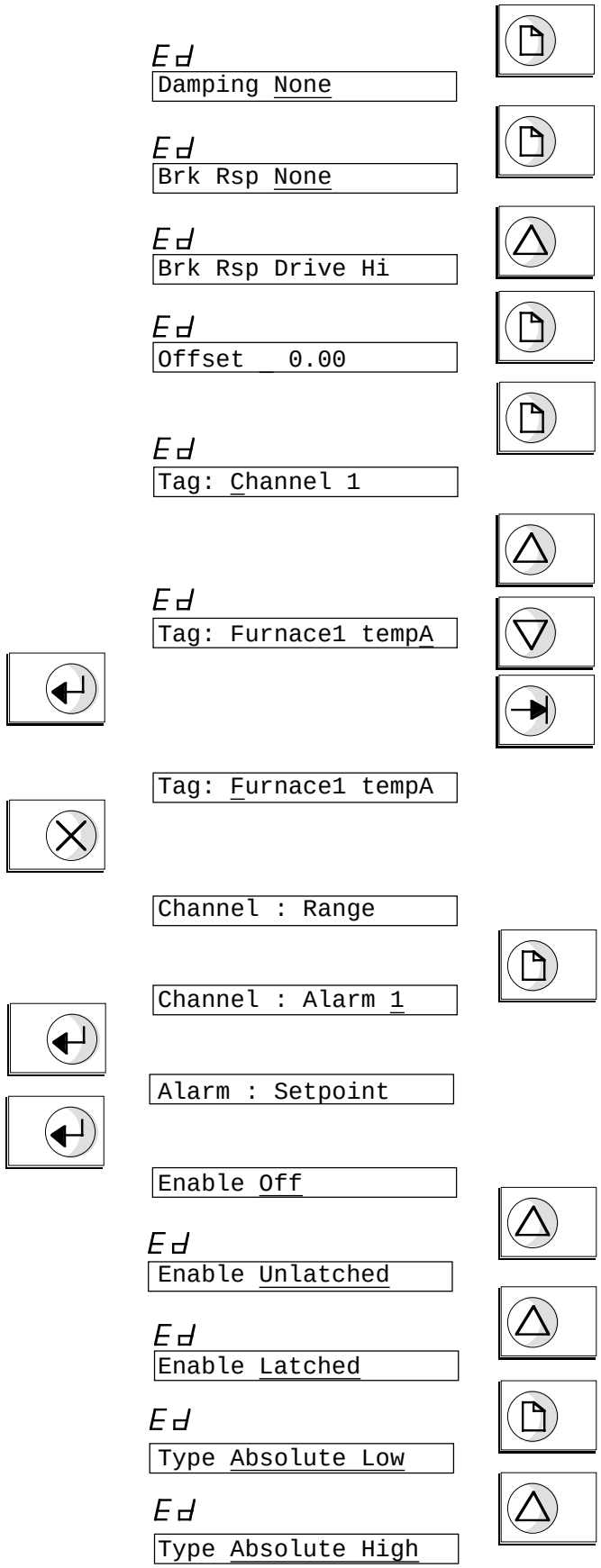
By default, alarm 1 is already selected, and we will use this for convenience.

Use the Enter key to call the Setpoint page, then again to call the enable page.

Use the up arrow key to scroll through 'Unlatched' to 'Latched'. ·See section 4.5.2 for a description of different types of alarm.

Use the Page key to call the alarm type page. By default, 'Absolute Low' appears at the display.

Operate the up arrow key to select 'Absolute High'.



2.4.3 CHANNEL CONFIGURATION (Cont.)

Alarm Threshold (Setpoint)

Operate the Page key to call the Threshold page.

Use the up arrow and cursor keys to set the threshold to 780.00, using the technique described for input range (section 2.4.3 above).

In this case the decimal point is in the right place and does not need to be entered.

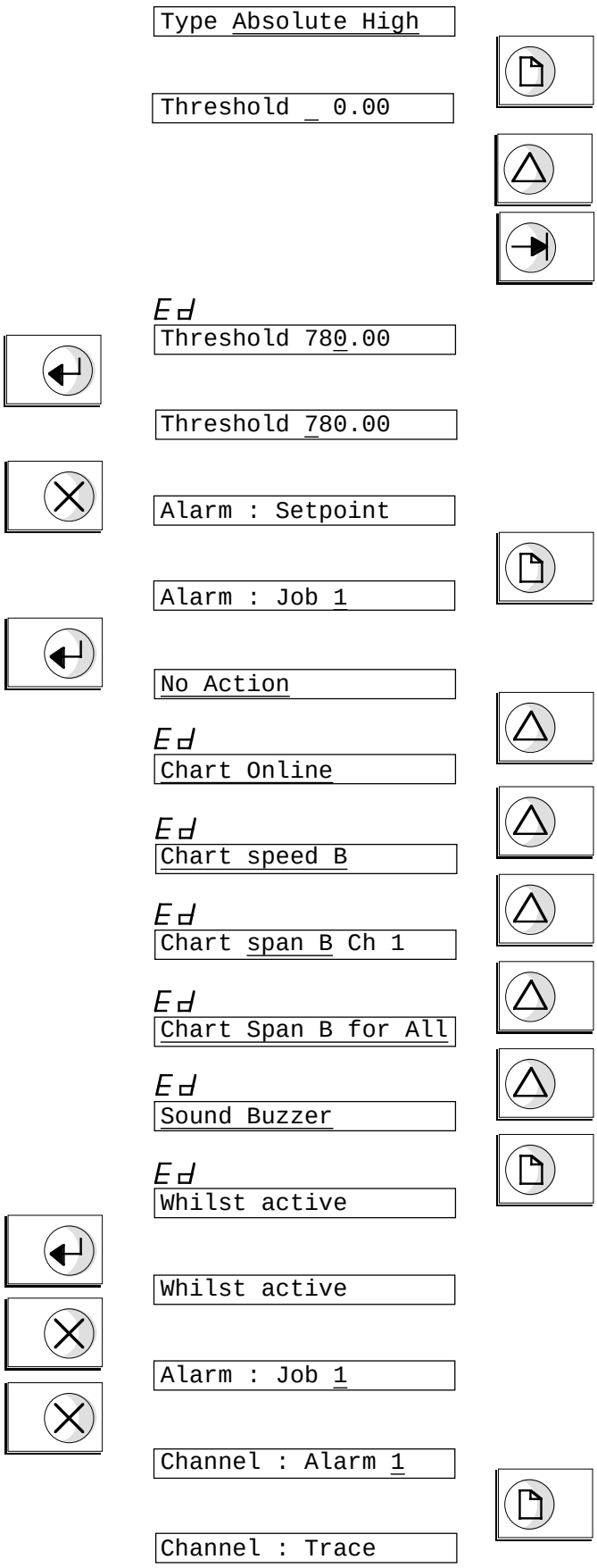
Operate the Enter key to confirm the setting, then the Cancel key to return to the *Alarm : Setpoint* page.

Use the Page key to call the Alarm Job 1 page, and operate the Enter key.

Use the up arrow key repeatedly to scroll through the available jobs, until 'Sound Buzzer' appears, then operate the page key.

The 'Whilst Active' action is as required, and our alarm configuration is now complete, so if we like, we can operate the Enter key to enter the changes made so far. Operate the Cancel key twice to return to the *Channel : Alarm 1* page.

Use the Page key to call the *Channel : Trace* page



2.4.3 CHANNEL CONFIGURATION (Cont.)

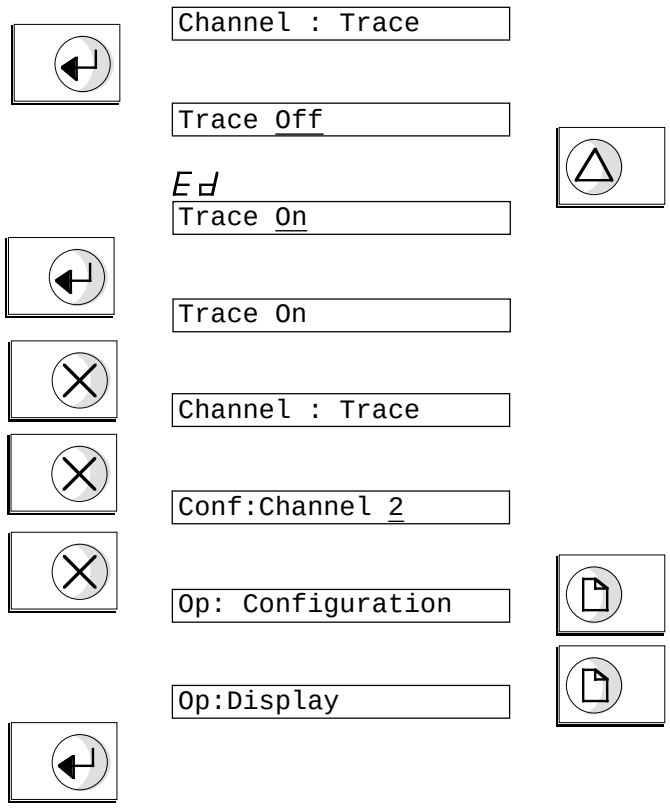
Checking that the trace is ON

Use the Enter key to call the trace on/off page

If the trace is off, use either arrow key to scroll to 'On'.

Use the Enter key to confirm the changes, then the Cancel key repeatedly, until the Operator menus are reached.

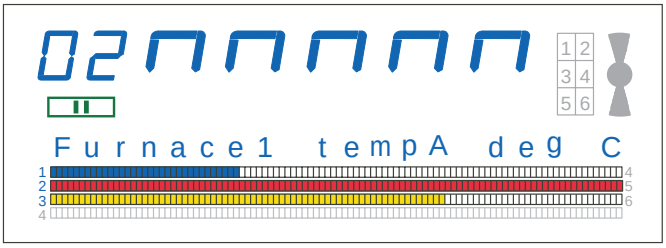
Use the page or cancel key repeatedly until the 'Op: display' screen is displayed, then press the Enter key to return to the background display.



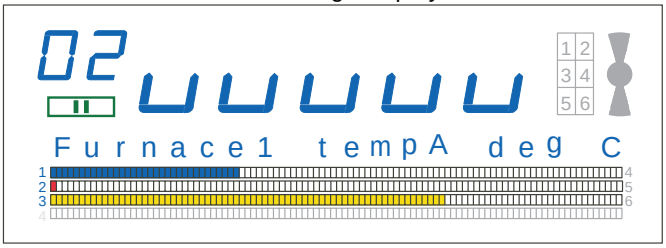
Since your input signals will almost certainly be different from those described above, the recorder will display its over or under range display.

To cure this you must re-enter the configuration menus and set all your channels to suit your particular input signals.

If you want to do more than the very basic configuration given above, details are to be found in section 4 of this manual, or in the option or memory card manual, as appropriate.



Over range display



Under range display

SECTION 3 OPERATOR MENUS

3.1 INTRODUCTION

This section describes the operator menu structure of the basic recorder. For details of Options, see either the Options Manual or the Memory Card Manual, as appropriate.

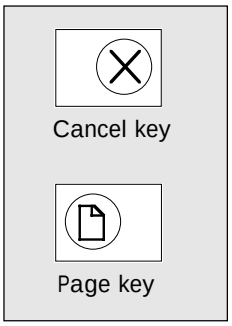
3.2 TOP LEVEL OPERATOR MENUS

As described in section 2, the recorder goes into 'background mode' on power-up, showing the value of a channel or other process variable, as configured. In order to enter the operator menus, the 'Cancel' (X) key is used. This brings the following to the display:

```
Op:Display
```

This allows a return to the background display using the enter key or entry to other Operator pages, using the 'Page' key. The other Top level operator pages (excluding options) are:

```
Op:Chart
Op:Alarm Summary
Op:Alarm setup
OP:Action
Op:Clock
Op:System error
Op:Configuration
OP:Calibrate chart
```



3.3 CHART SUBMENU

This allows the operator to carry out the following functions, unless his access is restricted as described in Section 4.13

1. Switch the chart drive on and off
2. Park the printhead / fan the pens, for the replacement of consumables
3. Advance the chart 8 cm.
4. Select chart speed A or B (Actual chart speeds A and B are set up in Chart configuration - section 4).
5. Edit and print two messages of up to 20 characters each.
6. To initiate logging to chart.
7. To print scales on the chart immediately instead of waiting for their normal cycle time to come round.

Operator messages may contain 'embedded sequences' which allow (for example) time and date, or a particular channel's value to be included in the message automatically. See section 4.9.1 for details

3.3 CHART SUBMENU (Cont.)

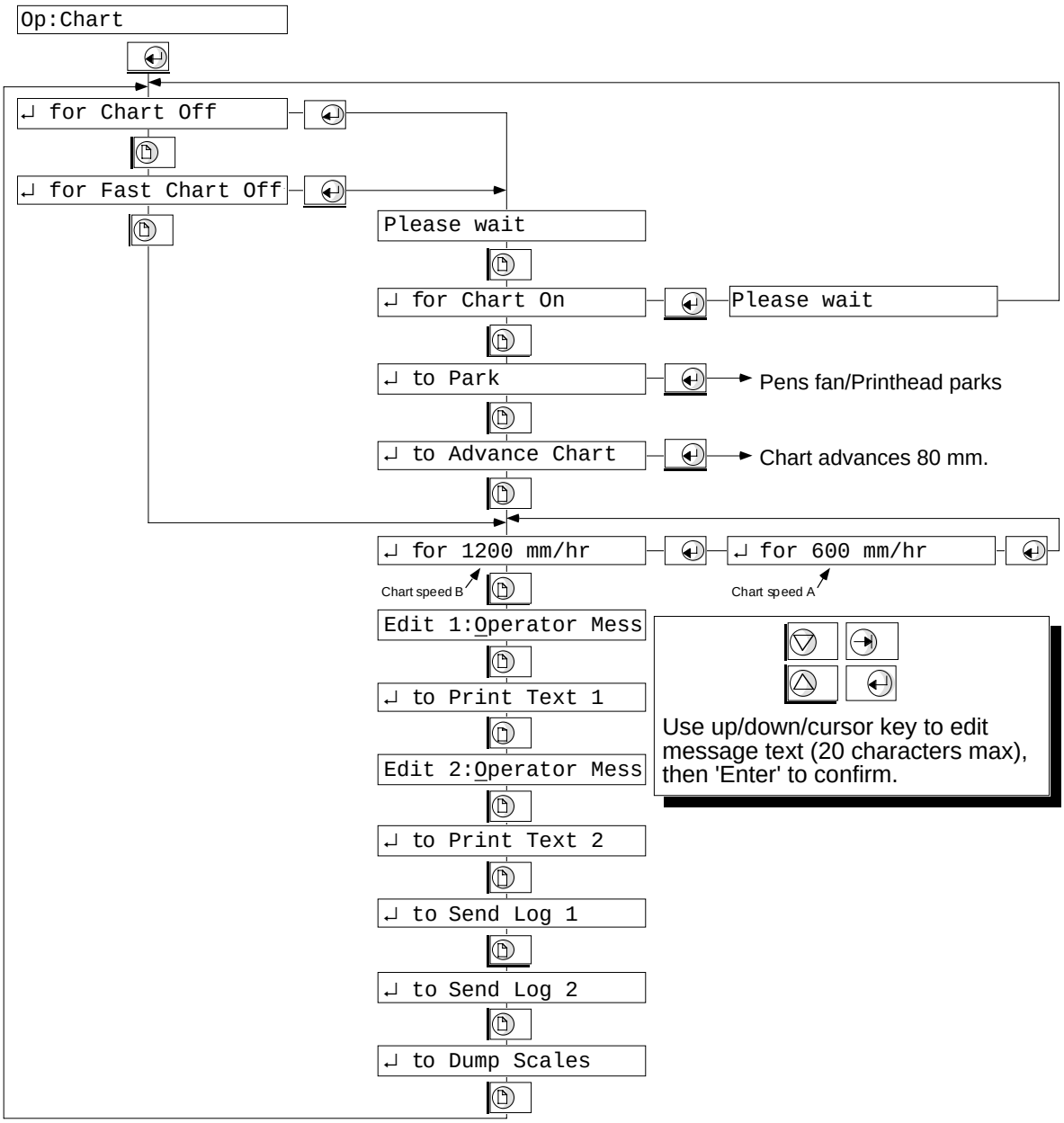


Figure 3.3 Chart Operator Menus

3.3.1 Chart on/off

If access is allowed (section 4.13), the operator can switch the chart drive on and off as required. When off the pens/ printhead can be 'Parked' for replacement. 'Chart off' causes the recorder to print any queued messages and a 'Printer Off' message before switching off. 'Chart fast off' causes the recorder to complete the current line of printing (if any) before switching chart drive off.

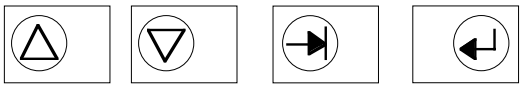
CHART ADVANCE

Chart Advance can be used for several purposes such as ensuring the chart is feeding correctly after replacement, or to leave an obvious gap in the chart tracing between batches etc. Chart drive must be Off.

3.3.2 Operator messages

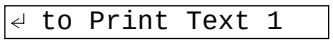
Operator messages can be used (for example) to enter batch information on the chart. The text is freely editable, and may contain one or more 'Embedded sequence' each of which causes the current value of a particular variable (e.g. time, date, value of channel N etc.) to be automatically included in the message when printed (see section 4.9.1).

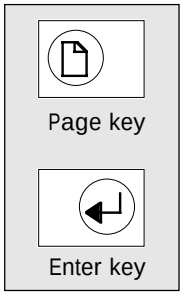
Text entry is accomplished using the field scroll (up and down arrow) keys to scroll through the character set until the correct letter or symbol is displayed. Characters are selected for editing using the cursor key (right arrow). The 20-character message can be longer than the window, the cursor key being used at the rightmost character to access the 'hidden' part of the string. Once all the required text has been entered, the 'Enter' key is used to confirm.



Field scroll keys (Up and down arrows) | Cursor | Enter

Once the message is complete, it can be printed on the chart by operating the 'Page' key to call the page, then the 'Enter' key to initiate printing.





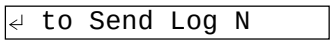
3.3.3 Logs

When delivered from the factory, Log groups 1 and 2 contain all the recorder's input channels, During 'Group' configuration (section 4.6.1) these items can be deleted individually, and (if the relevant options are fitted), derived variables, totalisers and counters can be added so that only the required PVs are logged.

The log format can be set up to include tags or not as required.

OPERATOR INITIATION

The contents of either log group can be printed on the chart at any time by the operator from the display page:



(where N = 1 or 2)

JOB INITIATION

Log 1 group and log 2 group can be sent to neither, either or both chart and memory card (if fitted) using 'jobs' as described in section 4.1.5.

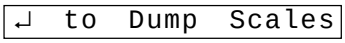
AUTOMATIC LOGGING

If a log interval is configured, the contents of log 1 group will be printed on the chart automatically at that interval.

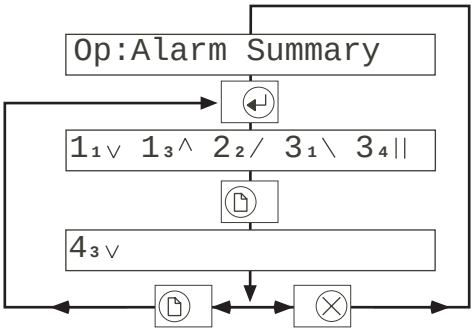
If a memory card archiving option is fitted, then the contents of log 2 group can be sent to the memory card automatically at an 'Archive interval' set up as a part of the memory card configuration.

3.3.4 Scale print (Dump Scales)

Operating the 'Enter key from this page causes the recorder to print all channels' scales on the chart as quickly as it can (annotator option needed for continuous-trace recorders).



3.4 ALARM SUMMARY PAGE



For more details of alarm types and actions see section 4.5.2

This Operator page allows the status of all current alarms to be viewed.

3.4.1 Display interpretation

The alarms appear in channel order, and are flashing if not acknowledged. Each alarm is presented as a channel number (full size), followed by a subscript alarm number (1 to 4) followed by a symbol denoting type (table 3.4.1).

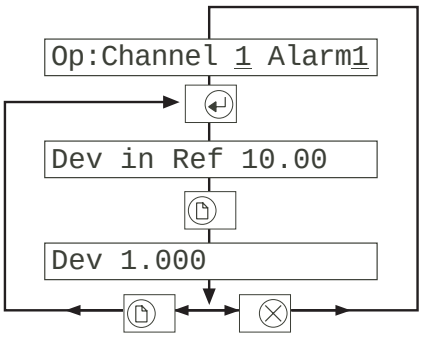
Absolute high
Absolute low
Rate-of-change: Rising
Rate of change: Falling
Deviation in / out

Table 3.4.1
Alarm type symbols

3.5 ALARM SETUP PAGE

This page allows the operator to view the alarm type, threshold settings etc.

If access is allowed (Section 4.13) the operator may adjust the threshold settings



Use up/down arrows and cursor to select channel number and alarm number.

View alarm type:
Abs high,/low, ROC rise/fall or Deviation in/out.
Edit setpoint if necessary using arrow up/down keys.

Deviation value for Deviation alarms
Period for Rate-of-Change alarms

Figure 3.5 Alarm setup page

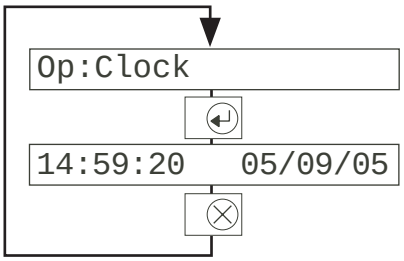
3.6 ACTION

This page allows the 'Enter' key to be used as an event trigger (Section 4.11). The label which appears, and the defining of the action to be carried out as latching or not latching is set up in the Operator Action part of configuration (Section 4.7).

As despatched from the factory, the label is 'Ack All', it is non-latching and its jobs list is to acknowledge all alarms

3.7 CLOCK

This page allows the user to view the current system time and date.



Date format (DD/MM/YY or MM/DD/YY) set up in Clock configuration (Section 4.8.2)

Figure 3.7 Operator clock display page

3.7.1 Back-up battery

The system date and time, and any volatile maths or totaliser values are maintained under power-off conditions, by a replaceable coin-cell battery. For typical recorder usage, such as those described below, this battery will last for over two years. A replacement procedure is given in section 1.5 (Preventive Maintenance) above.

TYPICAL USAGE EXAMPLES

1. The recorder is powered continuously, except for an annual period of four weeks, during which it is switched off.
2. The recorder is powered up each morning, then off again eight hours later.

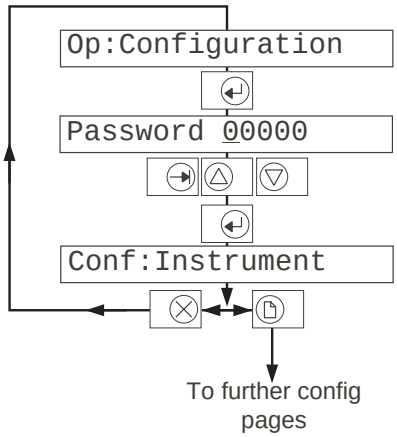
3.8 SYSTEM ERROR

This page allows the user to view any system errors which have occurred. If the relevant options are fitted, the following errors can be reported. If more than one is active, the Page key is used to scroll through the list:

Bad Remote CJ Temp
Writing system fail
Disk overdrive (archiving buffer full)
Battery Failure
Clock failure
EEPROM DB Cleared
Battery-backed RAM cleared
Memory Card Battery Low
Memory Card Battery Flat
DV Run Time Error

3.9 CONFIGURATION

Operation of the Enter key from this page followed by a password, allows the user access to the configuration pages described in Section 4.



The password set to 00010 by manufacturer, but it can be edited in Instrument Configuration.

If set to 00000, Configuration pages are entered directly without having to enter a password.

Figure 3.9 Entry to configuration

3.10 CALIBRATE CHART

This page allows the pens/printhead zero and span positions to be set to chart zero and span. On initiation, the pen/printhead draws a 'vertical' line on the chart where it thinks zero/span is. If incorrect, the position can be adjusted using the up arrow key to move the trace slightly to the right, or the down arrow to move it to the left.

For multipoint recorders, if the traces appear 'noisy' and text is difficult to read, see section 4.14.2 for 'Backlash' adjustment.

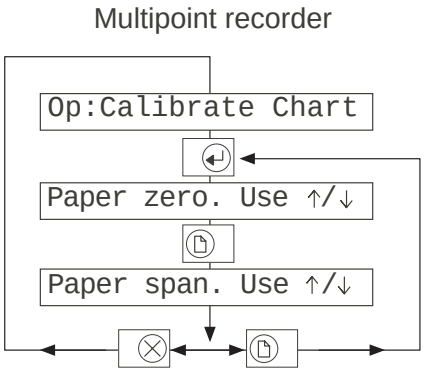


Figure 3.10a Chart calibration pages (multipoint recorders)

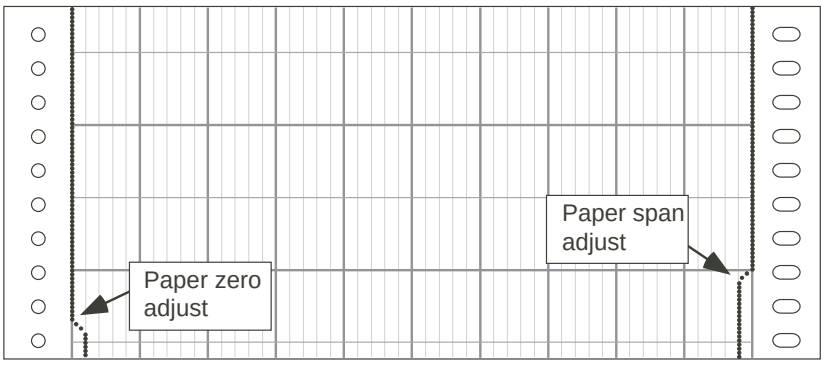


Figure 3.10b Zero and span adjustments (Simulated chart sample)

3.10 CALIBRATE CHART (Cont.)

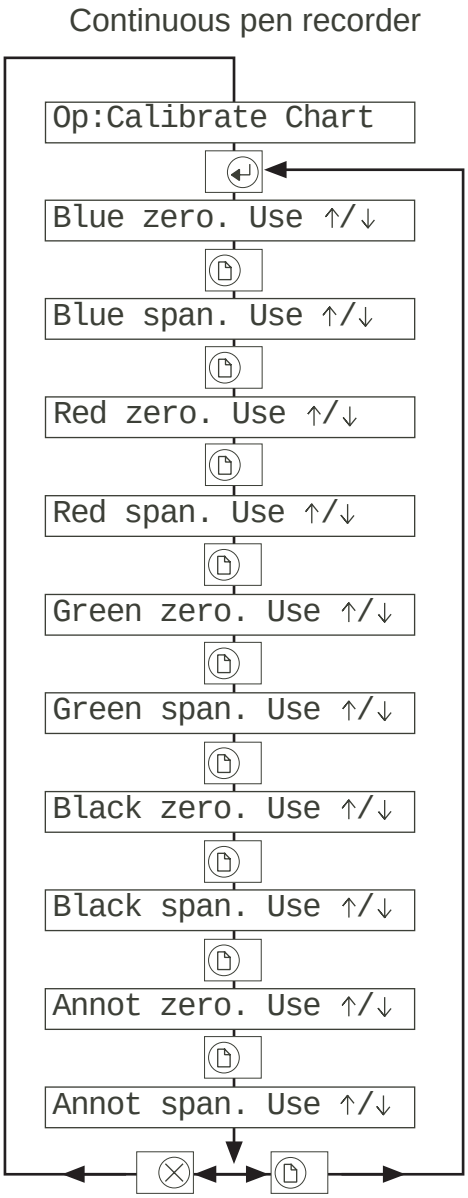


Figure 3.10c Chart calibration pages (continuous recorders)

This page is deliberately left blank

3.11 OPERATOR MENUS SUMMARY

Use 'Page' key to move from page to page.

Use 'Enter' key to enter 'Page', to confirm changes or to return to PV display.

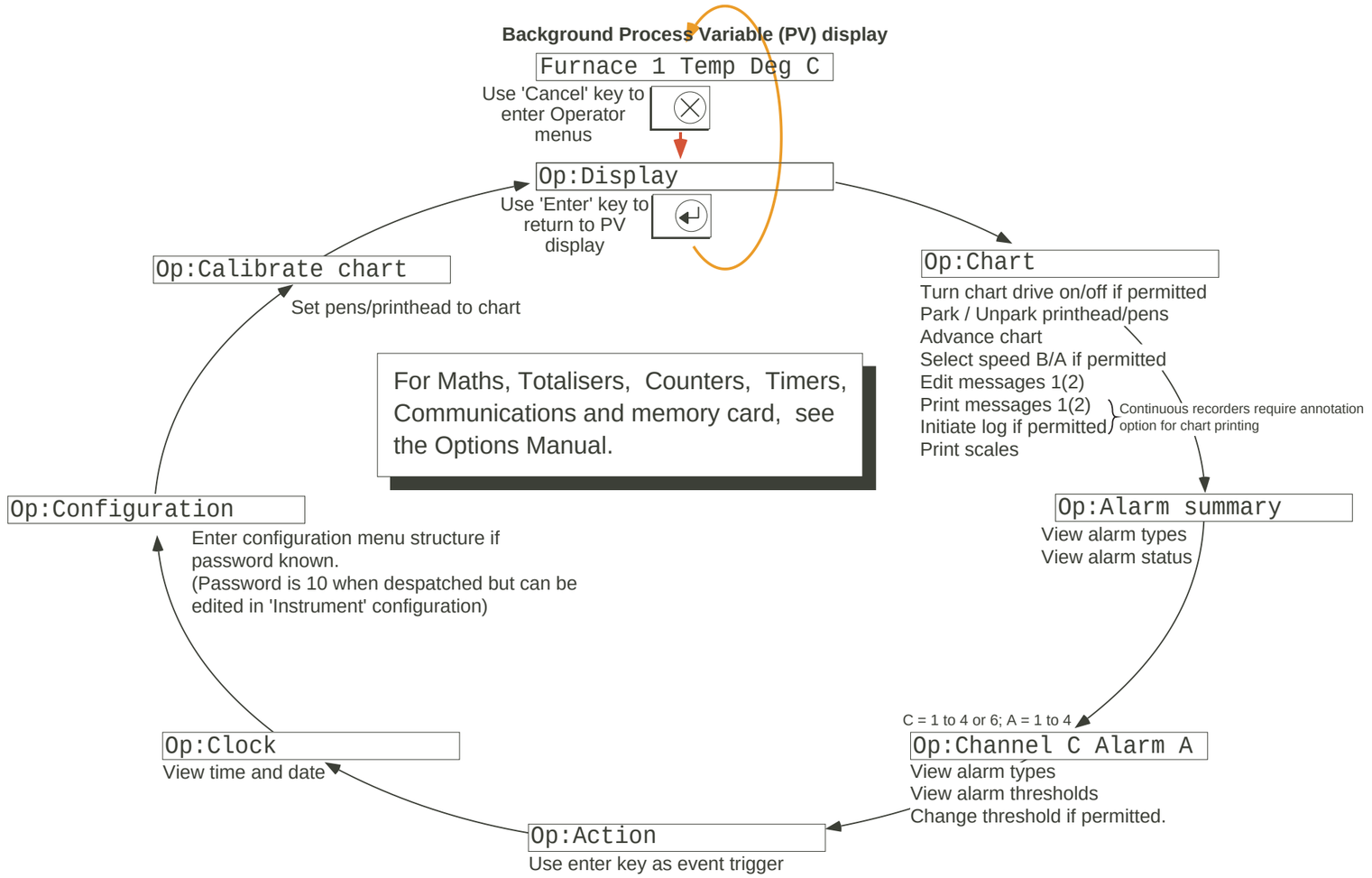
Use Up and Down arrows to scroll through underlined items in page.

Use 'Cancel' key to ignore changes, to return to a higher level, or to enter operator menus from PV display.

OPERATOR PERMISSIONS

For security purposes, it is possible for the recorder to be configured (SECTION 4.13) such that operator access to the items listed below is disabled i.e. they cannot be changed from the Operator menus. (Y/N indicates whether the item appears in the menus as despatched from the factory). Continuous-trace recorders require annotator or memory card options for some items.

Chart	Change speed from A to B	Y
	Switch on / off line	Y
Messages	Edit/Print	N
Alarm	Adjust setpoints (thresholds)	N
Log	Initiate	Y



This page is deliberately left blank

SECTION 4 CONFIGURATION

Notes:
1. In order to help new users, a configuration guide appears as section 2 of this manual. This guide gives step-by-step instructions to allow the configuration of a single input channel to be carried out.
2. A configuration tool to run on a PC, is available from the manufacturer to speed configuration, and text entry in particular.

4.1 INTRODUCTION

The configuration of the recorder is divided into the following categories (ignoring options - see section 4.1.3)

1	Instrument	6	Clock
2	Chart	7	Messages
3	Channel	8	Alarm Messages
4	Group	9	Events
5	Operator action	10	Configuration Transfer

In addition to the above, Diagnostics and Operator Access are included in the configuration menus.

The above categories are listed in the order in which they appear when the page key is being used, but it is not necessary to carry out the configuration in that order. In order to help you find your way around the table 4.1 overleaf relates 'what you can do' with 'where you do it' and where in the manual you can find details of it.

4.1.1 Password

In order to prevent unauthorised access to the recorder's configuration, a password protection system operates. When despatched from the factory, this password is set to 00010, but this can be modified as a part of the Instrument configuration described in section 4.3

Setting the password to a 00000 subsequently allows direct access from the operator menu without further need for a password.

4.1.2 Text entry

A number of items (messages, tags, units strings etc.) require text to be entered or modified. Text entry is achieved by using the 'Cursor' key to move the underline to the character to be edited, and then using the up and down arrow keys to scroll through the character set until the required letter, number or symbol appears. This process is repeated for all the characters in the text string.

With Operator messages and Instrument tag, the text string goes beyond the end of the 'window'. Once the end of the visible part of the string has been reached, further operations of the cursor key will shift the message to the left, character by character, allowing the hidden part of the string to be edited.

Character set

The characters available are:
A to Z, a to z, Ä ä à ç ê è é Ö ö ô Ü ü ù β Σ µ Ω δ # $ % & ( ) * + , - . / : ; < = > _ £ ° 0 to 9 ² ³ ! ❝ ❜ [\ ] ^ ❛ { | } ~ Ç â å ë ï î ì Å É æ Æ ò û ÿ ¢ ¥ á í ó ú ñ Ñ a o ¿ ¡ « » α Γ π σ τ ϕ θ ∞ ∈ ∩ ≡ (Space)

4.1 INTRODUCTION (Cont.)

Parameter etc. to be edited	Configuration page name	Where to look
Adaptive recording	Chart	Section 4.4.7
Adjust input	Adjust	Section 4.14
Alarm Jobs	Channel: Alarm: Jobs	Section 4.5.2
Alarm Messages (enable/disable)	Alarm messages	Section 4.9
Alarm Parameters	Channel : Alarm : Setpoint	Section 4.5.2
Break response	Channel : Range	Section 4.5.1
Cassette type	Chart	Section 4.4.1
CJC (remote) channel	Instrument	Sections 4.3.3, 4.3.4
CJC type selection	Channel : Range	Section 4.5.1
Channel colour	Channel : Trace	Section 4.5.3
Channel parameters	Channel: Range	Section 4.5.1
Channel scroll list	Group	Section 4.6
Channel span	Channel : Trace	Section 4.5.3
Channel trace on off	Channel : Trace	Section 4.5.3
Channels displayed	Group	Section 4.6
Chart speeds/units	Chart	Sections 4.4.2, 4.4.3
Clock setting	Clock	Section 4.8
Configuration read/write	Transfer	Section 4.12
Damping	Channel : Range	Section 4.5.1
Date setting/format	Clock	Section 4.8
Decimal point position	Channel : Range	Section 4.5.1
Displayed channels	Group	Section 4.6
Dwell period	Channel : Alarm: Setpoint	Section 4.5.2
Event sources / jobs	Events	Section 4.11
External CJ temp	Channel: Range	Section 4.5.1
Hysteresis	Channel : Alarm: Setpoint	Section 4.5.2
Input adjust	Adjust	Section 4.14
Input range	Channel : Range	Section 4.5.1
Input scaling	Channel : Range	Section 4.5.1
Input type	Channel : Range	Section 4.5.1
Instrument tag	Instrument	Section 4.3.5
Language	Instrument	Section 4.3.2
Line thickening	Channel : Trace	Section 4.5.3
Linearisation type	Channel : Range	Section 4.5.1
Log contents	Group	Section 4.6
Log interval	Chart	Section 4.4.4
Messages	Messages	Sections 3.3.2, 4.4.5, 4.9, 4.10
Offset compensation	Chart	Section 4.4.8
Operator action key	Operator action	Sections 3.6, 4.7, 4.11
Operator permissions	Access	Sections 3.9, 4.13
Password	Instrument	Sections 3.9, 4.1.1, 4.3.2
Pen offset compensation	Chart	Section 4.4.8
Pen zero/span setting	Calibrate chart	Section 3.10, 4.14.2
Print mode	Chart	Section 4.4.5
Reference	Channel : Alarm : Setpoint	Section 4.5.2
Remote CJ	Instrument	Sections 4.3.3, 4.3.4
Restore configuration	Transfer	Sections 1.2.2, 4.12
Save configuration	Transfer	Sections 1.2.2, 4.12
Shunt Value	Channel : Range	Section 4.5.1
Tag	Channel : Range	Section 4.5.1
Text entry/embedding	Various	Sections 3.3.2, 4.5.1, 4.9
Text only print mode	Chart	Section 4.4.5
Text priority print mode	Chart	Section 4.4.5
Time set	Clock	Section 4.8
Trace priority print mode	Chart	Section 4.4.5
Value format	Channel : Range	Section 4.5.1

Table 4.1 Configuration breakdown

4.1.3 Options

In order to simplify this manual, option descriptions are included in the Options Manual and the Memory card manual supplied, if appropriate, with your recorder.

Note: The above does not apply to the Annotation Option of the continuous trace recorders, as this manual describes the functions of the multipoint version of the recorder which naturally includes annotation functions. If your recorder does not include an annotator, the relevant sections should be ignored.

4.1.4 Logs

Note: logs are not applicable to Continuous trace recorders, unless the annotation and / or memory card options are fitted.

Logs are alphanumeric reports showing the current values of a number of process variables. Logs can either be printed on the chart, or if the appropriate archiving option is fitted, they can be sent to a memory card. As despatched from the factory, the two log groups each contain all input channels fitted to the recorder. To include option PVs such as totalisers, derived channels etc. the user can edit the log groups as described in Group Configuration (section 4.6.1) Group configuration also allows the log 'format' to be defined i.e. include PV tag?, include instrument Tag?

Logs can be initiated

a. automatically at fixed time periods (section 3,.3.3)
b. from the operator menu (Op:Chart - section 3.3.3)
c. by job action - see section 4.1.5

Note: When logging automatically,

Log1 prints its group contents on the chart at one of two logging intervals (A or B), set up in Chart Configuration (section 4.4.4). Normally log interval A is used; interval B being selected by job action (section 4.1.5).

If a memory card archive option is fitted, Log2 saves its group contents to the memory card at one of two archive intervals (A or B), set up in Memory Card Configuration (Options manual). Normally archive interval A is used; interval B being selected by job action (section 4.1.5).

4.1.5 Jobs

Jobs cause the operation of the recorder to change as the result of an initiating trigger which can be an alarm going active, an event input, a totaliser reaching a previously specified value and so on. A list of actions and 'modifiers' is given in figure 4.1.5 below.

A modifier defines when the relevant action is to occur (e.g. While active, While inactive).

4.1.5 JOBS (Cont.)

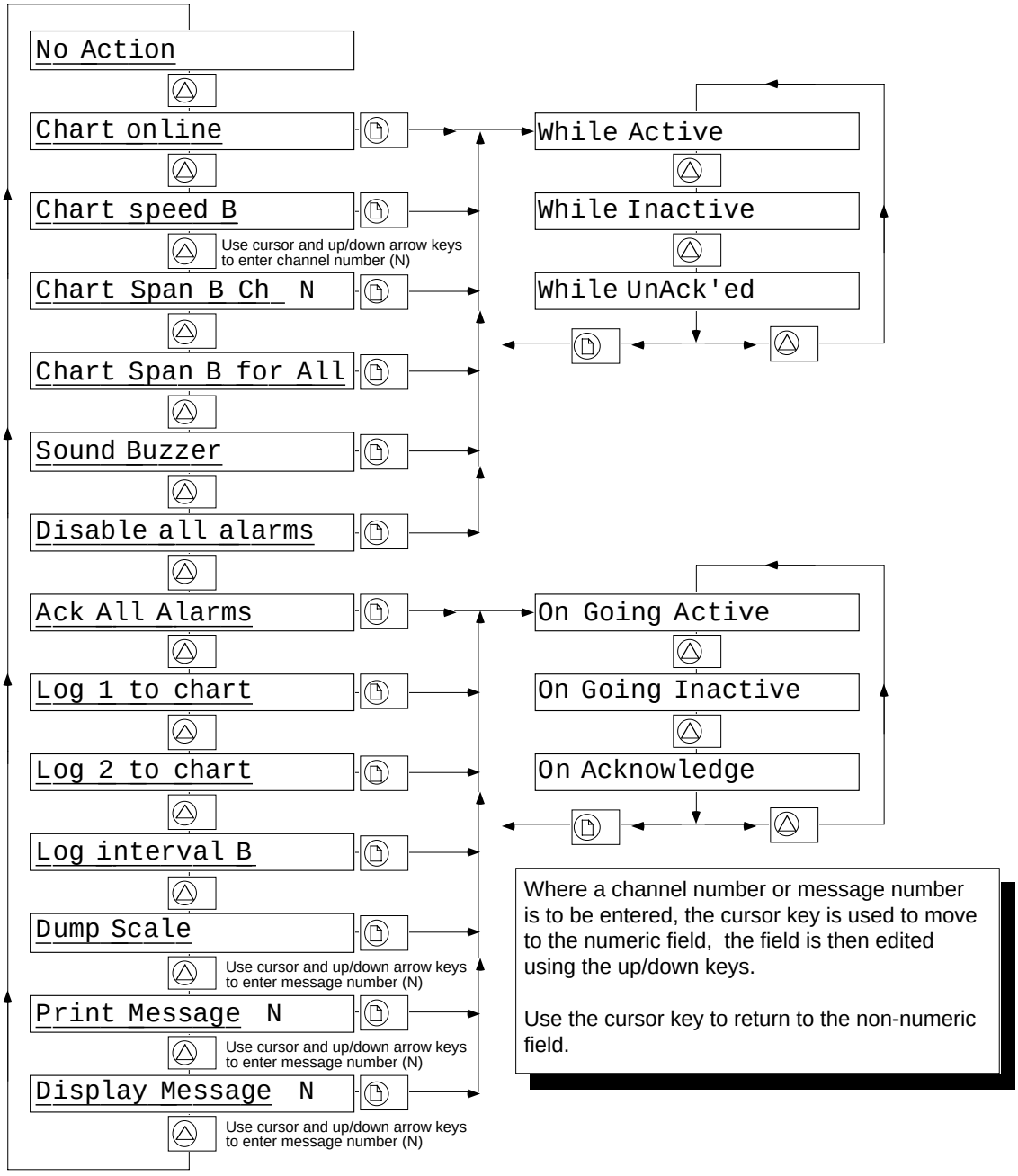


Figure 4.1.5 Jobs and modifiers

4.2 CONFIGURATION TECHNIQUES

Configuration menus are treated in the same way as operator menus, with the page and enter keys being used to select a parameter, and the arrow keys being used to edit it. To return to a higher menu level the cancel (x) key is used. Figure 4.2 below shows the alarm setpoint sub-menus in an attempt to illustrate these techniques.

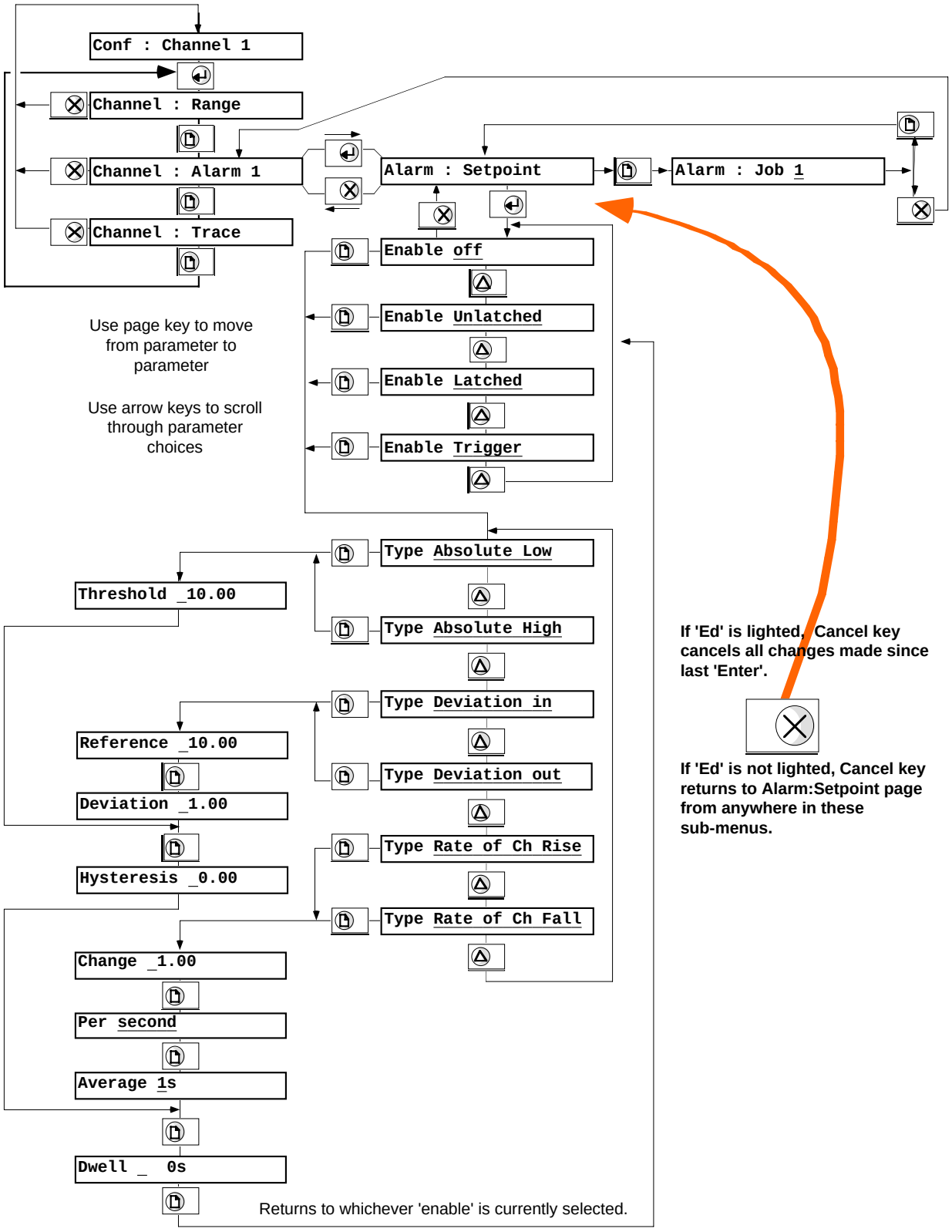


Figure 4.2 Configuration techniques

4.3 INSTRUMENT CONFIGURATION

Instrument configuration allows:

1. The setting of a new password
2. The setting of a different language for subsequent displays and chart printing
3. Configuration of remote cold junction input

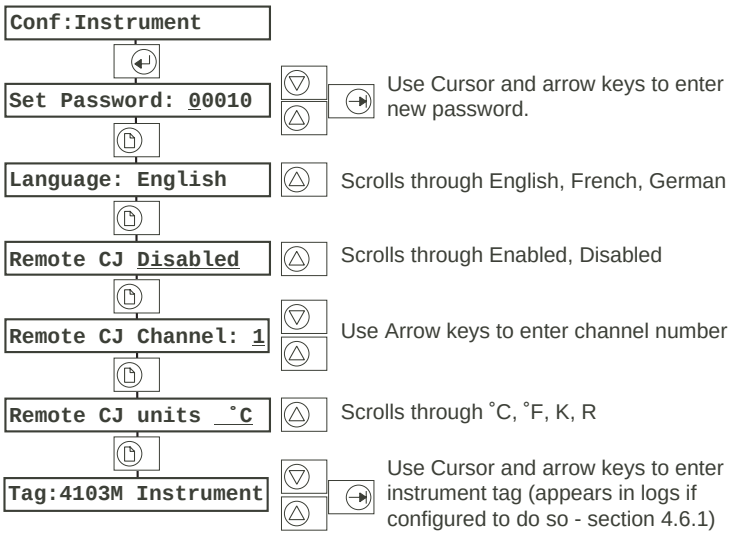


Figure 4.3 Instrument Configuration pages

4.3.1 Password

The password can be any five-character (max.) string, entered using the cursor and arrow keys as described in section 4.1.2. You can set the password to 00000 to disable password protection, thus allowing access to the configuration menus without further need of a password.

4.3.2 Language

English, French or German can be selected as the language for subsequent operations.

4.3.3 Remote CJ Channel

When 'Enabled', any input channel can be selected for use as a remote cold junction measuring channel. In such a case, the selected input type, range, linearisation etc. must be set up in the channel configuration (section 4.5) for the selected channel. The temperature units set up in the channel's configuration must match those set up in 'Remote CJ Units' described immediately below.

Once a remote CJ channel has been configured, any other input channel can use it as a 'Remote' CJ input, if so configured.

4.3.4 Remote CJ units

Scrollable through °C, °F, Kelvins or Rankine, the remote CJ units must match the units configured for the Remote CJ channel.

4.3.5 Instrument tag

A 20-character max. descriptive tag can be entered. See section 4.1.2 for text entry techniques.

4.4 CHART CONFIGURATION

Chart configuration allows the following to be set up:

1. Cassette type (recorders manufactured after late November 1997 only)
2. Chart speeds A and B for selection by the operator or by job
3. Log intervals A and B for logging Process Variables automatically on the chart (continuous trace recorders need annotation option). Interval B selected by Job action.
4. Trace mode
5. Interpolation, Adaptive recording and (optional) Pen Offset Compensation (Continuous-trace recorders only)
6. Chart message disable. (Allows individual chart message printing to be disabled) (For continuous-trace recorders, the Annotation option must be fitted.)

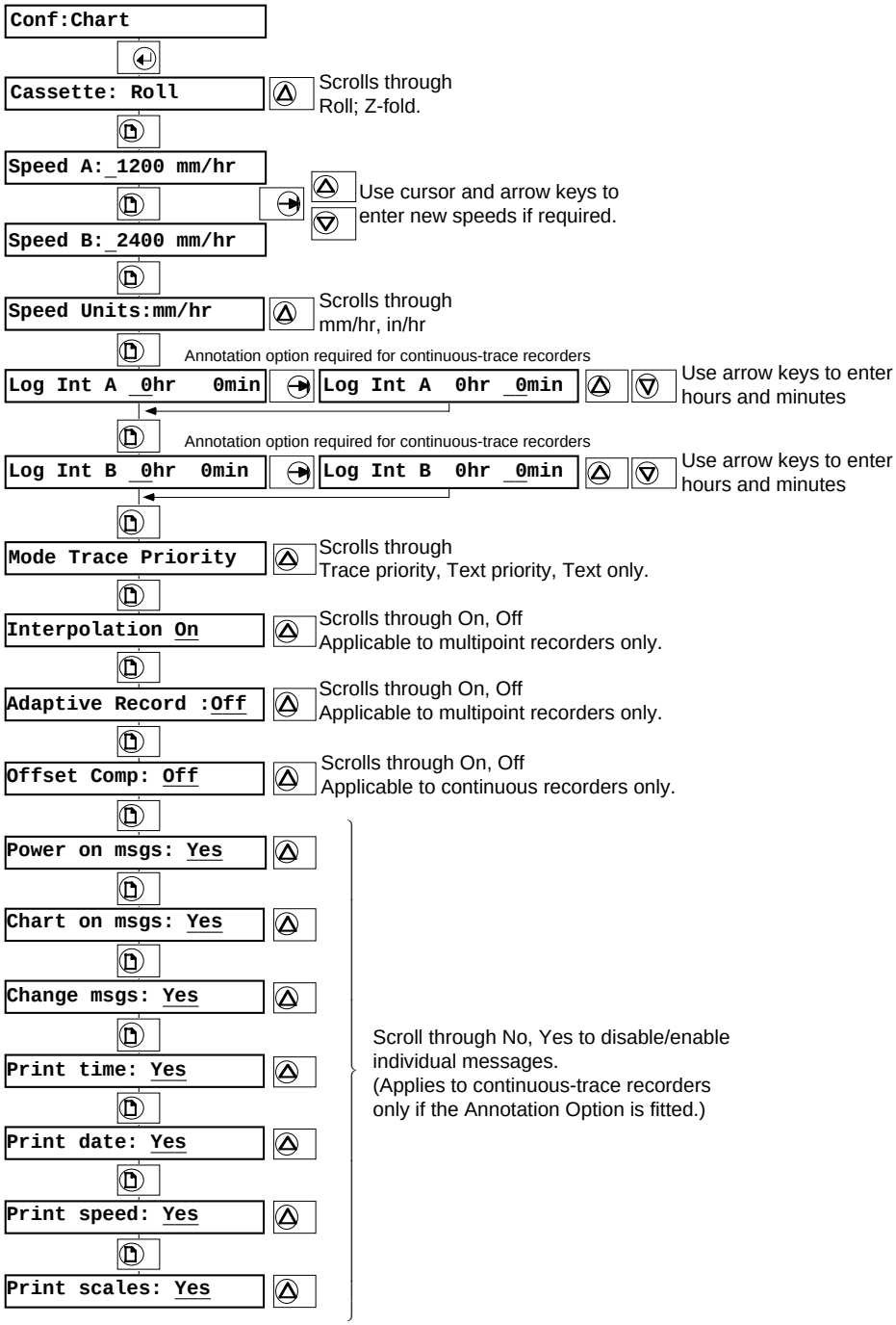


Figure 4.4 Chart configuration pages

4.4.1 Cassette Type

Allows Roll or Z-fold to be selected as cassette type. Setting must match actual cassette type, or time-accuracy may not be maintained, or the chart drive will be noisy.

4.4.2 Chart speeds A and B

Two chart speeds can be set up here, for selection either by the operator from the operator menus or by job as the result of a trigger. Chart speeds lie between 0 and 1200 mm/hr (multipoint) or between 0 and 36,000 mm/hr (continuous).

> Note: For continuous-trace recorders with Pen Offset Compensation applied, the minimum chart speed is typically 13mm/hr, depending on the complexity of the configuration. See section 4.4.8 for further details.

4.4.3 Chart speed units

Chart speed units can be selected as mm/hr or in/hr.

4.4.4 Log intervals A and B

Two log intervals can be entered here for the automatic periodic printing of log group 1 on the chart. The cursor key is used to move from 'hrs' to 'mins' fields, and the up/down arrow keys to enter the required value. An entry of 0 hours, 0 minutes stops automatic logging to chart. For log content and format, see Group configuration - section 4.6. Interval B is selected by job action.

Continuous-trace recorders require the annotation option for logging to chart.

4.4.5 Print mode

This section is not applicable to continuous-trace recorders unless the annotation option is fitted.

Two types of 'message' can be printed on the chart *viz* Cyclical and Demand.

CYCLICAL MESSAGES

Scales (with tags and engineering units), chart speed, time and date are printed at such a rate as to ensure that at least one is visible to the operator at any one time. Cyclic messages can be disabled individually as described in section 4.4.9 below.

DEMAND MESSAGES

Alarm, event and change messages are generated asynchronously. Two operator and 20 other messages can also be printed on demand (operator messages only) or as a result of job action. Logs, though not strictly speaking messages, are also included in this category.

MODES

The way in which the above types of message are treated depends on the print mode selected. At chart speeds of up to 900 mm/hr the recorder can operate in any one of the three modes described below, when printing on the chart.

At speeds above this, all messages are lost if the recorder is in Trace priority mode. In Text Priority, logs always break the trace and are printed as required. Demand messages are held until the print queue is 70% full when they are printed on the chart in Break Trace mode. Cyclic messages are lost. Text only mode is independent of chart speed and is therefore not affected.

4.4.5 PRINT MODE (Cont.)

1. TRACE PRIORITY
Both message types can be printed, but the trace is not interrupted (hence this mode is sometimes called overprint mode). All demand messages are queued until printed. If the print queue overflows, 'Message Lost' is printed on the chart.

2. TEXT PRIORITY.
Cyclic messages are printed in Trace Priority mode.

Demand messages are printed in 'Trace priority' mode (i.e. traces are not interrupted) as long as the print queue is less than 70% full in which case, message printing takes priority and the traces are broken.

Logging always breaks the trace

If the queue overflows, 'Message lost' is printed on the chart.

3. TEXT ONLY
This mode is intended for report generation and alarm logging. All cyclic messages are inhibited, and only logs and Demand Messages are output, with the chart being advanced as quickly as is possible whilst maintaining print quality. If the print queue overflows, 'Message Lost' is printed on the chart.

4.4.6 Interpolation

At high chart speeds, it can be difficult for the user to follow quickly-changing traces on the chart. With interpolation 'On', the recorder draws a dotted line on the chart between successive dots to show the trend more clearly. Figure 4.4.6 shows the effect (exaggerated for clarity).

When interpolation is enabled, it affects all channels.

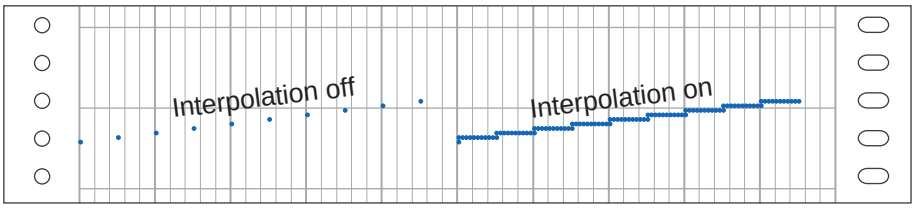


Figure 4.4.6 Interpolation

4.4.7 Adaptive recording

At slow chart speeds, it is possible that a spike or other brief disturbance in the measured signal will be picked up by the input circuit between chart increments, and they will thus not appear on the chart (even though they might trigger an alarm). With adaptive recording enabled, if a sudden change in the input signal is detected, the recorder will put an extra dot on the chart without the chart being moved. This means that even at the slowest chart speeds, fast signals can still be traced on the chart.

When adaptive recording is enabled, it applies to all channels.

4.4.8 Pen offset compensation option

For continuous-trace recorders, the pen tips are separated in the 'time' axis of the chart by 2 mm. This means that simultaneous events different channels will appear to be separated on the chart by 2 mm per pen. Pen offset compensation causes the traces of channels 1, 2 and 3 to be delayed by an amount, dependent on the chart speed, such that simultaneous events appear to be simultaneous on the chart.

When invoked, or at power up, chart on or after a change in chart speed, pens 1 to 3 trace at the left edge of the chart until the relevant time period (equivalent to 2 mm. of chart per pen) has expired.

The minimum chart speed for recorders with offest compensation applied is approximately 13 mm/hr, though with complex configurations (e.g. a number of maths pack rolling averages), the minimum chart speed will be higher. If the selected chart speed is below this minimum, offset compensation is automatically switched off, and a message '`W/S Failure`' is displayed. Increasing the chart speed (section 4.2.2 above) to above the minimum will cause offest compensation to become active again.

4.4.9 Chart messages disable

For multi-point recorders (or for continuous trace recorders fitted with the annotation option), each of the messages listed below can be disabled on an individual basis.

The default settings are 'Yes', i.e the messages are printed on the chart unless set to 'No' in the chart configuration menu.

The messages are:
Power on message
Chart on message
Change (e.g. chart speed) message
Time-of-day message
Date message
Chart speed message
Channel scales

4.5 CHANNEL CONFIGURATION

Channel configuration is in three parts: Range, Alarms and Trace.

4.5.1 Range configuration

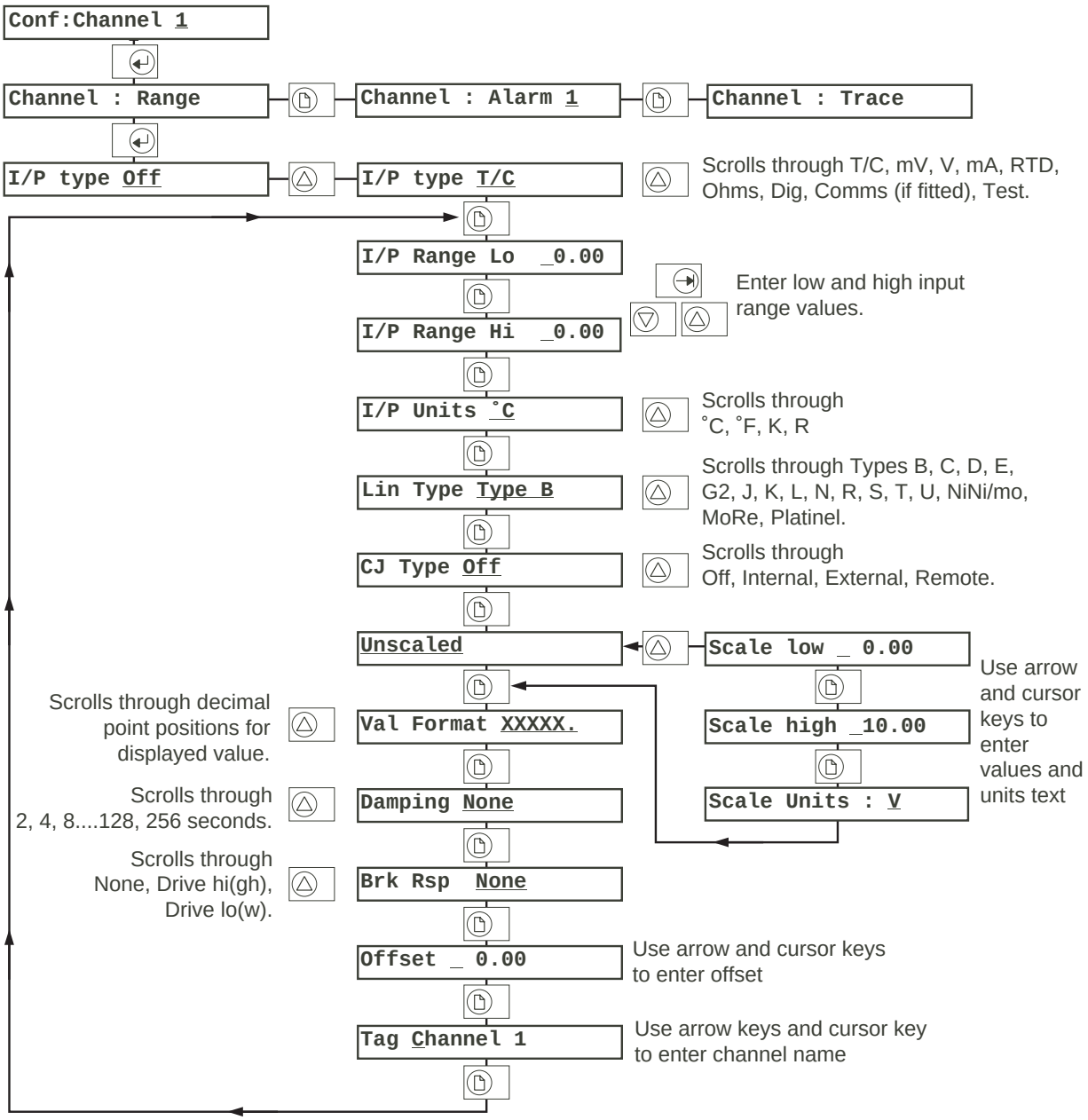


Figure 4.5.1b Channel range configuration pages for thermocouple inputs

This sub section allows the setting up of the following:

1. Input type, range and units
2. Linearisation type
3. Scaling
4. Value format (decimal point position)
5. Input damping
6. Input break response
7. Channel tag (identifier or descriptor)
8. CJ type for thermocouple inputs
9. Shunt value for mA inputs
10. Open/Closed text strings for digital inputs

4.5.1 RANGE CONFIGURATION (Cont.)

Figure 4.5.1b above, shows the configuration menu for Input Type = thermocouple. Other input types are similar, and any parameters unique to a particular input type are indicated in the accompanying descriptions.

Input type

Allows an input type of Thermocouple (T/C), mV, V, mA resistance temperature detector (RTD), Ohms, Digital input, Comms (if fitted) or 'Test' to be selected. The appearance of some subsequent display pages is dependent on this selection.

Input Range

The low and high settings should match the lowest and highest values which the recorder will have applied to its inputs. This allows the recorder to select the best (i.e. most accurate) electronic range for your input. The up arrow and cursor keys are used to enter the value (including the decimal point).

These pages do not appear for Digital or Comms (if fitted) inputs, or if the selected Input Type is 'Test'.

Shunt Value

For mA input type only, allows a shunt value to be entered (normally 100 or 250Ω). The entered value must match that of the fitted shunt.

Input units

This page appears only for thermocouple and RTD inputs and allows ˚C, ˚F, K(elvins) or R(ankine) to be selected.

Linearisation type

The linearisation types (if any) which appear on the scroll list depend on the Input Type selected. The complete list is:
Linear, square root, $x^{3/2}$, $x^{5/2}$,
Thermocouple types B, C, D, E, G2, J, K, L, N, R, S, T, U, Ni/NiMo, MoRe, Platinel,
RTD types PT_{100}, Pt_{1000}, Ni_{100}, Ni_{1000}, JPT_{100}, $Pt_{100}A$, $Cu_{10.}$

CJC type

For thermocouple inputs only, allows Off, Internal, External or Remote to be selected as cold junction type.

Internal uses the recorder's internal temperature sensor to apply cold junction compensation.

External is used where the cold junction of one or more thermocouples is maintained at a known temperature. When 'External' is chosen as CJC type, operation of the Page key calls a further page where the known temperature is to be entered.

Remote uses a temperature sensor connected to a separate input channel to measure the cold junction temperature of one or more remote thermocouples. This allows copper cable to be used from the remote location to the recorder, instead of high cost compensation cable. The input channel for the CJ temperature measurement is defined in 'Instrument' configuration (Section 4.3.4).

4.5.1 RANGE CONFIGURATION (Cont.)

Unscaled

This allows the input to be scaled (e.g. 4 to 20 mA input = 0 to 100%). The scaling low and high values are entered using the cursor and up arrow keys as for input values. The Scale units are entered using the text entry technique described in section 4.1.2, above.

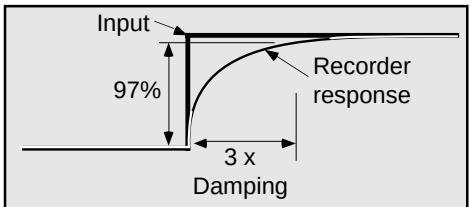
Value Format

Allows the decimal point position to be chosen for the process value. The up/down arrow keys are used to move the decimal point from XXXXX. to .XXXXX

Damping

For 'noisy' slowly changing signals, damping can be used to filter noise so that the underlying trend can be seen more clearly. The arrow keys allow selection of 2, 4, 8, 16, 32, 64, 128 or 256 seconds.

It is not recommended that damping be used on quickly changing signals.



Effect of damping on step change in input signal

Break Response

For lower ranges only (i.e. thermocouples and voltages less than 1V) the recorder can be made to respond in a known way if a break in the input circuit is detected.

Break response can be set to
a. None (trace drifts with input wiring acting as an aerial)
b. Drive hi (trace is placed at the right hand edge of the chart)
c. Drive lo (trace is placed at the left hand edge of chart)

Open / Closed

For Input Type digital, the PV display consists of a text string or an open/closed representation. The strings to appear under open (logic low) and closed (logic high) conditions can be scrolled through using the up/down arrow keys.

These text strings are: Open, Close,__-__, _____, In, Out, Hi, Lo.

Test Waveforms

When Input Type is selected as 'Test', the following test waveforms can be selected both for tracing on the chart and for display (PV and bargraph):

Triangle 5 hrs, 40 mins
Sine 5 hrs, 40mins

Tag

This allows a 14-character descriptive name (tag) to be associated with each channel. This tag is used both for display and for logging. See section 4.1.2 for text entry techniques.

4.5.2 Alarm configuration

Up to four alarms can be configured for each channel. For absolute and deviation alarms, a hysteresis value can be entered to prevent spurious triggering should the process value 'hover' around the alarm threshold. For all types of alarm, a Dwell period can be configured, and if the alarm clears within this period, the alarm is ignored. Each alarm can initiate up to two jobs, as described in section 4.1.5 above.

Setpoint configuration

Allows you to set up alarm type, threshold value, hysteresis etc. Figure 4.5.2a shows display pages for absolute alarms. For deviation and rate-of-change alarms, some of the display pages will be different from those shown.

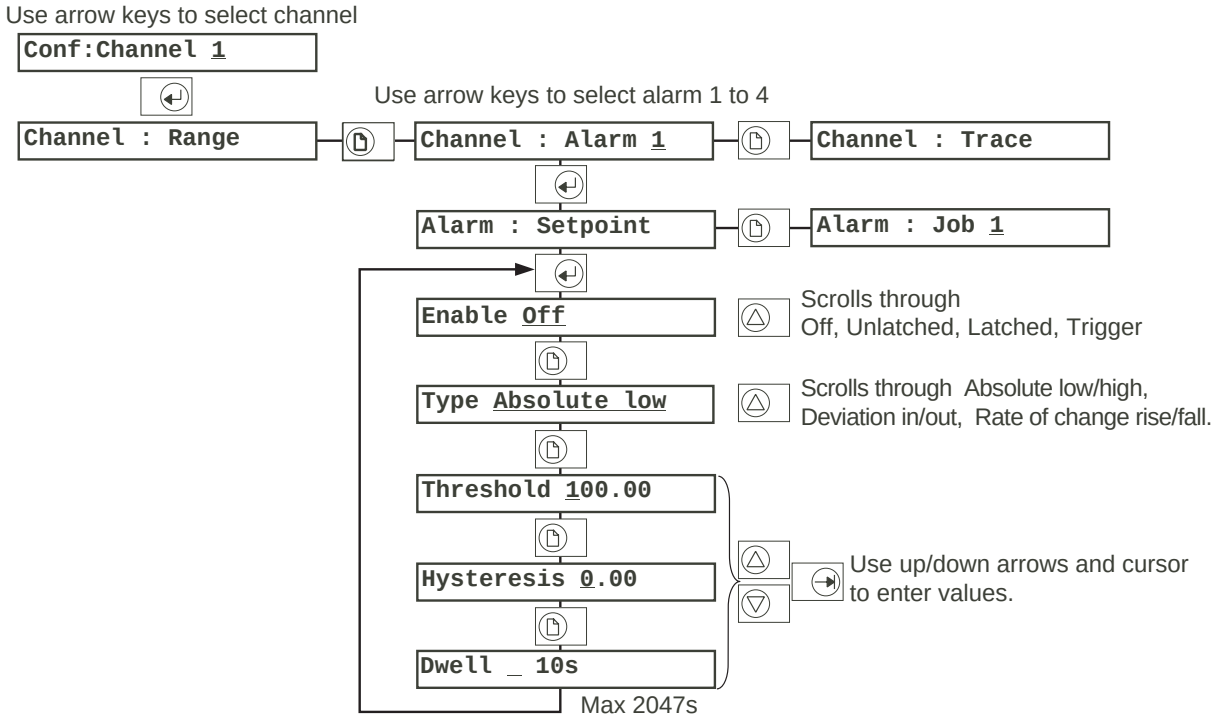


Figure 4.5.2a Alarm configuration pages: Absolute alarms.

ENABLE

Off, Unlatched, latched or trigger can be selected for the alarm, using the up or down arrow key.

Off	The alarm is disabled
Unlatched	When triggered, the alarm stays active until the triggering source returns to a non-alarm state. Alarm indicators flash until acknowledged, then stay permanently on until the alarm is no longer active. Alarm messages are printed on the chart.
Latched	When triggered, the alarm stays active until it has been acknowledged and the triggering source returns to a non-alarm state. Alarm indicators flash until acknowledged, then stay permanently on until the alarm is no longer active. Alarm messages are printed on the chart. Coninuous jobs remain active only until the source has returned to a non-alarm state (whether or not the alarm has been acknowledged).
Trigger	When triggered, any jobs associated with the alarm are initiated, and for continuous jobs (e.g. change chart speed) continue until the triggering source returns to a non-alarm state. Trigger alarms are not annunciated, nor are alarm messages printed on the chart.

4.5.2 ALARM CONFIGURATION (Cont.)

In the following diagrams, PV values increase from left to right

ALARM TYPES

Absolute alarms

An absolute high alarm becomes active when the PV value rises above the alarm threshold value. The alarm remains active until the measured value falls below (*setpoint - hysteresis*).

An absolute low alarm becomes active when the PV value falls below the alarm threshold value. The alarm remains active until the measured value rises above (*setpoint + hysteresis*)

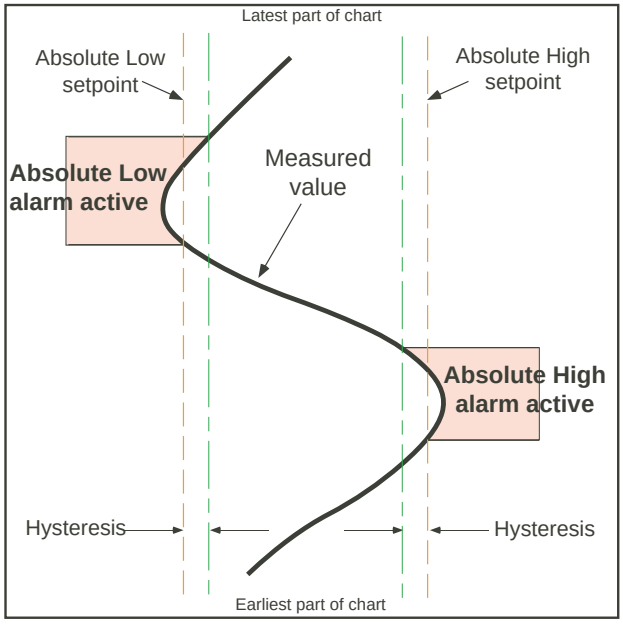


Figure 4.5.2b Absolute alarm definition

Deviation alarms

Deviation alarms require a reference value and deviation value and can have a hysteresis value entered if required.

'Deviation out' alarms are active

a. when the PV value rises above (*Reference + Deviation*), and remains above {(*Reference + deviation*) - *hysteresis*}, or
b. when the PV value falls below (*Reference - Deviation*) and remains active until the PV value rises above. (*Reference - Deviation*) + *Hysteresis.*

'Deviation in' alarms are the inverse of the above, as shown in the sketch below.

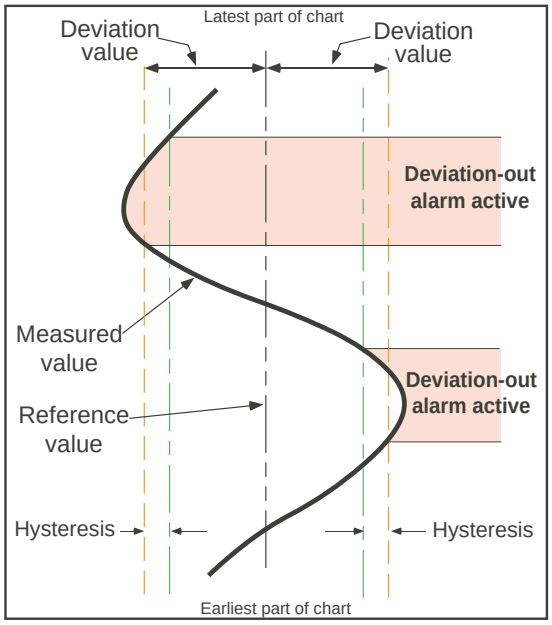


Figure 4.5.2c 'Deviation out' alarm definition

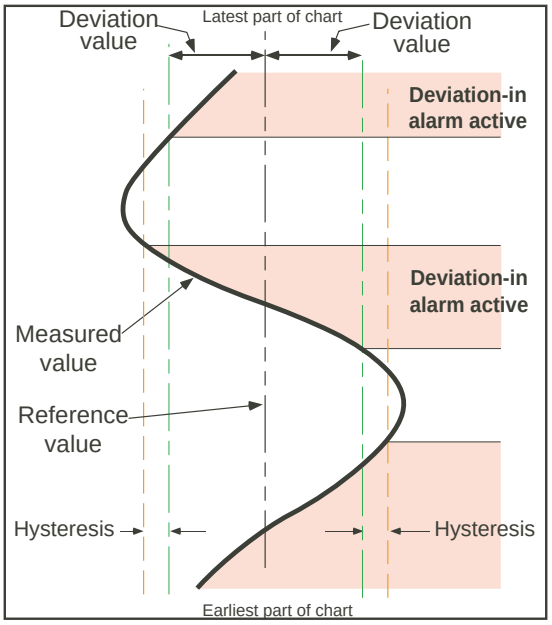


Figure 4.5.2d 'Deviation in' alarm definition

4.5.2 ALARM CONFIGURATION (Cont.)

Rate-of-change alarms

With rate-of-change alarms, a value, a time period and an averaging period have to be configured. In the accompanying sketch, the Value is 200 litres and the Time Period is one minute.

The alarm is triggered if the PV changes by more than the configured Value in less than the configured Time Period (i.e. more than 200 litres/minute in the sketch)

The averaging period can be used to change the sensitivity of the alarm, such that noise spikes or normal oscillations in the input signal do not trigger false alarms.

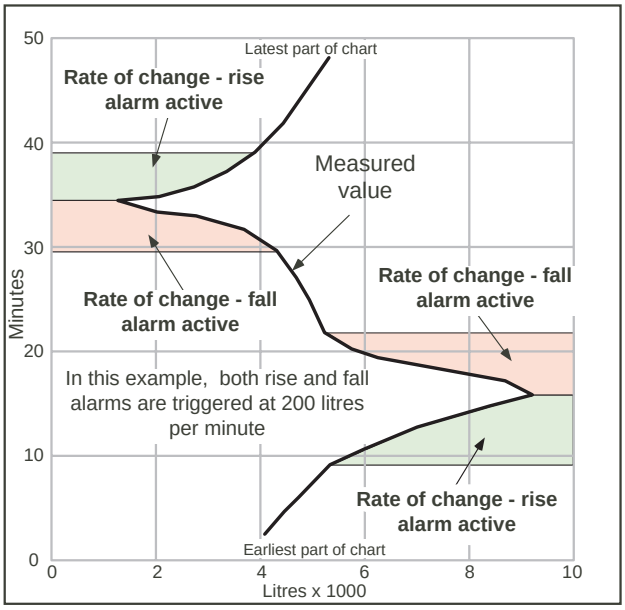


Figure 4.5.2e Rate-of-change alarm definitions

4.5.2 ALARM CONFIGURATION (Cont.)

Alarm parameters

THRESHOLD
Sometimes called 'setpoint', this is the trip point for absolute alarms, entered using the up and down arrow keys.

REFERENCE
For Deviation alarms, this sets a 'central' value on each side of which the Deviation Value (see immediately below) is to operate. The value is entered using the up and down arrow keys.

DEVIATION
For Deviation alarms only, this is a value each side of the reference value, within which a Deviation IN alarm is active, and outside which a Deviation OUT alarm is active. See figures 4.5.2c and 4.5.2d.

CHANGE
For Rate-of-Change alarms only, this allows a value (D) to be entered using the up/down arrow keys. If the change in the channel value (ΔPV) over the specified time period T (see below) is greater than D ($\Delta PV/T > D$) then the alarm is tripped.

PER
For Rate-of-Change alarms, allows a time period to be selected for the above change value. The up arrow key allows 1 second, 1 minute or 1 hour to be selected as the period.

AVERAGE
Allows a period of 0 to 9 seconds to be entered for Rate-of-Change alarms. This has the effect of preventing spurious alarms being triggered by transient changes in the PV value.

HYSTERESIS
Allows a 'deadband' to be entered for absolute and deviation alarms, to prevent alarms being continuously triggered if the process variable value hovers around the trip point. The value is entered using the up/down arrow keys.

DWELL
This feature allows the triggering of any alarm to be delayed for a period configurable up to 2047 seconds. If the alarm source returns to a non-alarm state during the Dwell period, the alarm is ignored. The dwell period is entered using the up/down arrow keys.

Alarm jobs

As shown in figure 4.5.2a above, the jobs page is reached by operating the page key from the Alarm : Setpoint page. Two jobs can be set up for each alarm, and the actions they can carry out are as shown in the Jobs description in section 4.1.5

4.5.3 Trace configuration

This section of configuration allows you to:

a. Set Trace on-off
b. Select trace colour
c. Set line thickening on/off
d. Set spans A and B for the channel

Figure 4.5.3 shows typical Channel Trace pages

Trace

Scrollable through Off and On.

Colour

The colours available depend on the recorder model.

For continuous-trace recorders, the colours are blue, red, green and black. If the annotation option is fitted, violet is also available. Without the annotation option, channels cannot be identified by any means other than their colour, so if you change colours from their defaults, it is recommended that a note to that effect should be made for future reference, preferably written on the chart. Default colours are: Channel 1 = blue, Channel 2 = red, Channel 3 = green; Channel 4 = black.

For multipoint recorders, the following colours can be selected: violet, blue, green, brown, red and black. The channels' tags and scales are printed on the chart in the same colour as the trace, allowing ready identification.

Line thickening

With line thickening enabled, an extra-wide trace (3 x standard width) is produced to aid long-distance viewing. If line thickening is used for protracted periods, a reduction in the life of the pen can be expected.

Span A / Span B

This allows two spans (A and B) to be selected for the trace so that a certain part of the trace can be magnified under certain circumstances (e.g. when the channel goes into alarm).

For example you may wish to record a process warming up from say 20˚C to its operating temperature of 700˚C, and then to look more carefully at any small variations. In order to do this for channel 1, Span A could be set to 0 to 900˚C and span B to 600 to 800˚C. An alarm could then be set up to trigger at say, 600˚C with an associated job: 'Span B for 1' 'whilst active'.

If Span A/Span B are left 'Unspanned', the input range will be used for chart span.

4.5.3 TRACE CONFIGURATION (Cont.)

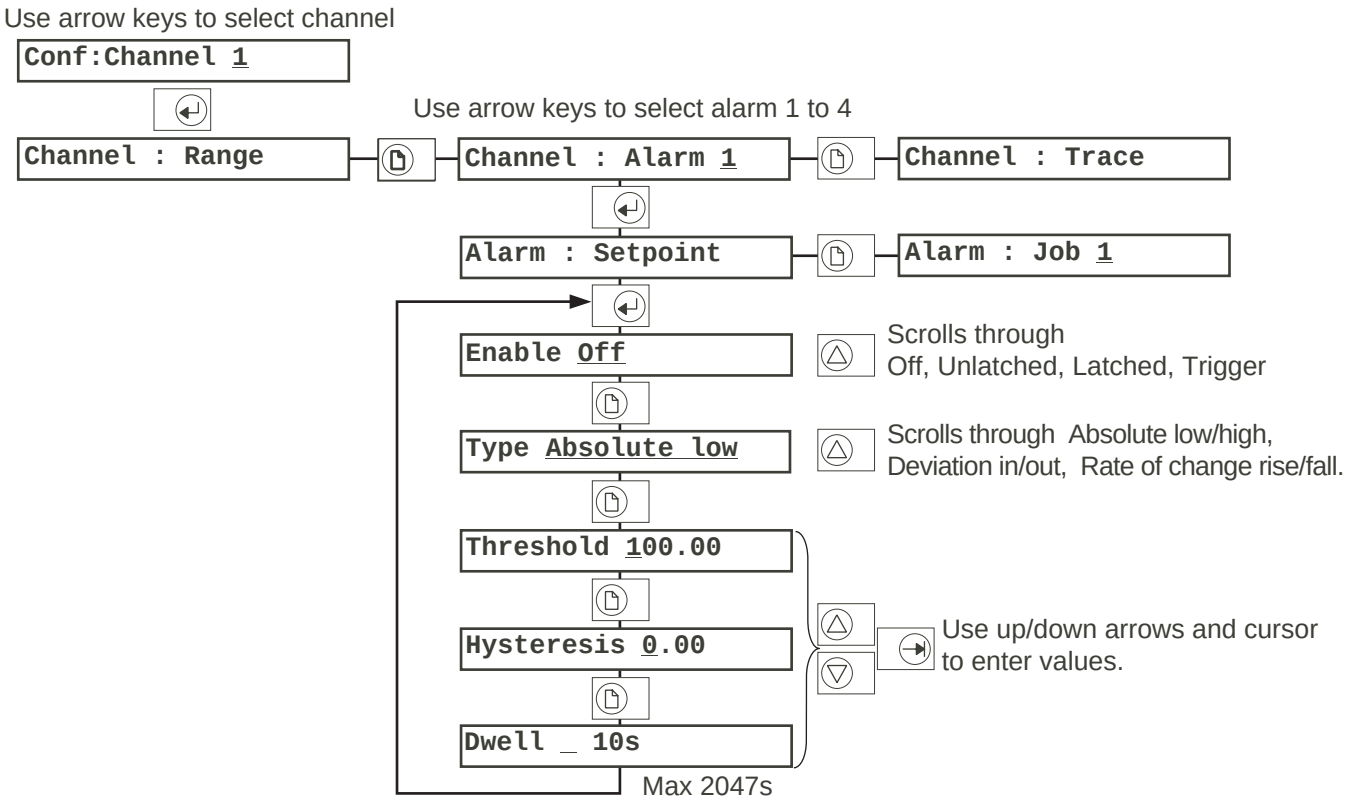


Figure 4.5.3 Channel Trace pages.

4.6 GROUP CONFIGURATION

This allows the contents and format of up to four groups to be set up: Log1, Log 2, DV, and display.

Notes:
1. Log1 and log 2 are available with continuous-trace recorders only if the annotator and/or memory card option is fitted For continuous-trace recorders without annotator or memory card, Conf:Group pages do not appear.
2. DV group appears only if the maths option is fitted.

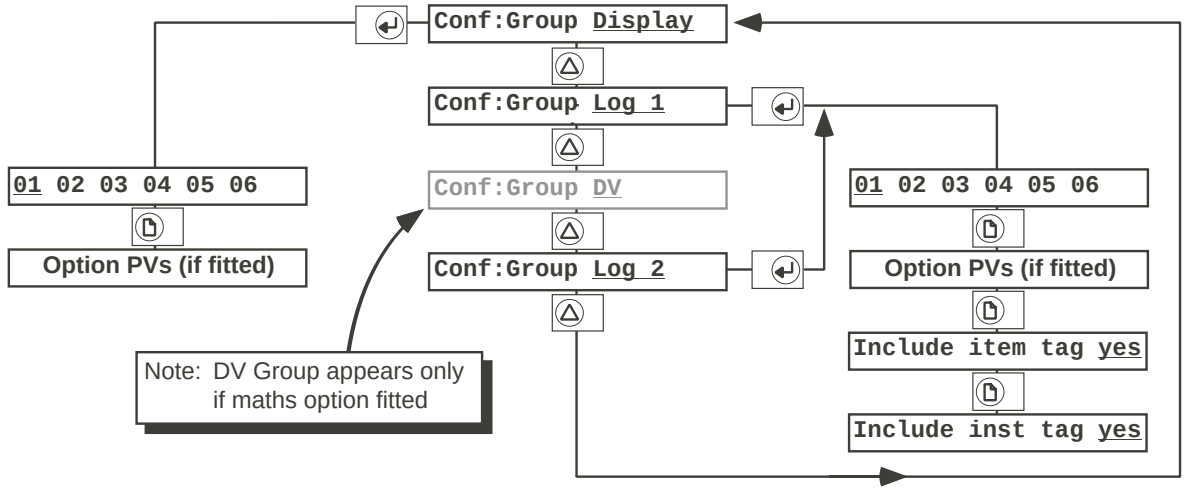


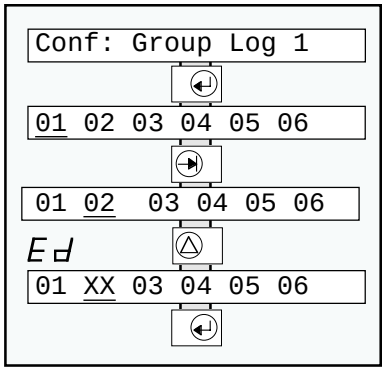
Figure 4.6 Group Configuration pages

4.6.1 Log groups 1, 2

Two log groups are available for sending tabular data to the chart, or to memory card (if fitted). Both log groups can be printed on the chart by operator action (section 3.3.3) or by job action (section 4.1.5). Log group 1 can be sent to chart and log group 2 can be sent to the memory card (if fitted) automatically, at fixed intervals as described below.

Two logging intervals (A and B) can be set up in Chart configuration (Section 4.4.4) to allow automatic printing of log group 1 on the chart. If the memory card option is fitted, archive intervals A and B can also be set up (see options manual) to cause automatic archiving of log group 2).

LOG CONTENTS
Initially, the log group contains all input channels (4 or 6 according to model). In order to edit the list, the cursor key is used to move the underline to the item to be added, and the arrow keys used to change its status from included (PV number shown) to excluded (XX shown). The example shows how to delete channel 2 from log group 1.



Adding an item uses exactly the same procedure, with the 'XX' being replaced by the PV number.

LOG FORMAT
Allows channel tag and /or instrument tag to be included in the log groups 1 and 2. See section 4.5.1 for channel tags, and section 4.3.5 for instrument tag.

4.6 GROUP CONFIGURATION (Cont.)

4.6.2 DV Group

Allows a number of items to be grouped together for action by a Derived Variable (e.g Group Average). See the Options manual for full details

4.6.3 Display Group

The Display group is similar to the Log groups described above, except that it determines which PVs appear in the scroll list at the display instead of which PVs are printed on the chart or sent to memory card.

4.7 OPERATOR ACTION CONFIGURATION

This defines the text string (↵ to ------)which appears in the Operator Action page (section 3.6), and whether the trigger is to be latching or non-latching. When used from the Operator Action page, the 'Enter' key acts as a trigger to an 'internal event', and can initiate upto two jobs. see section 4.11 (Internal events) for more details

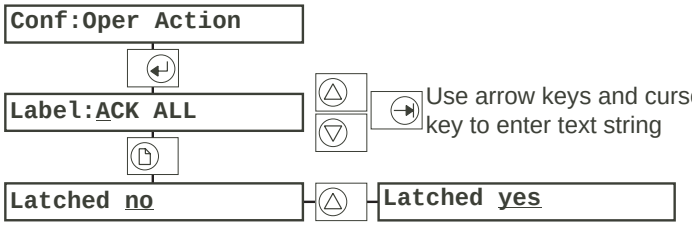


Figure 4.7 Operator action configuration

4.8 CLOCK CONFIGURATION

This part of the recorder's configuration allows you to set the current time and date, and the date format. The time and date are maintained, under power-off conditions, by a coin-cell as described in section 3.7.1

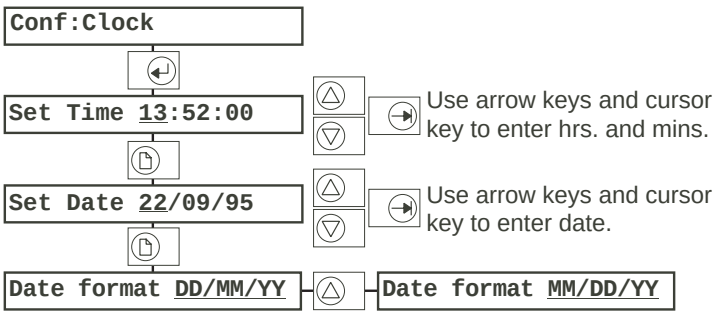


Figure 4.8 Clock configuration pages

4.8.1 Set Time

Use the up/down keys to set the hours as required. Use the cursor key to underline the minutes field, then the arrow keys to set minutes to the next whole minute. The seconds are set to zero and the clock starts on operation of the enter key.

4.8.2 Set Date

Use the up/down and cursor keys to set the current date

4.8 CLOCK CONFIGURATION (Cont.)

FORMAT

Use the up arrow key to scroll through Day/Month/Year and Month/Day/Year as date formats. It should be noted that if a valid date has not been set up, date format change will not work.

4.9 MESSAGE CONFIGURATION

This part of the configuration allows up to 20 messages to be entered, for display and/or to be printed on the chart as the result of operator or Job action. Entered using the text entry method described in section 4.1.2, these messages can include 'embedded sequences' as described below, including the operator messages described in section 3.3.2.

The following description concerns the multipoint version of the recorder. The continuous -trace recorder needs the annotator option, and in this case, all the messages are printed in violet.

4.9.1 Embedded sequences

Message text is freely editable, and may contain one or more 'Embedded sequence' each of which causes the current value of a particular variable (e.g. time, date, value of channel N) to be automatically included in the message when printed. The sequences are embedded using < and > as delimiters to separate them from one another and from normal text.

Although the message is limited to 20 characters at the display, the embedded sequences will expand fully on the chart or at the memory card if fitted. The available sequences, which must be entered as shown, are as follows:

ONE PART SEQUENCES

<TIME>	Embeds the current time in hh:mm:ss format
<DATE>	Embeds the current date in the format (DD/MM/YY or MM/DD/YY) defined in clock configuration (section 4.8)
<OP1>	Embeds operator message Nº1. If this itself contains embedded sequences, these are not expanded.
<OP2>	As for OP1 above, but for operator message Nº2.

TWO PART SEQUENCES

The remaining sequences require a Item and a Type to be entered either as <Item.Type> or as <Item–Type>. If the latter (hyphen) format is used, the 'Type' will be highlighted if in alarm.

ITEMS

Blank	Uses the triggering item (e.g. alarm) itself as the message triggering source
n	Uses measuring channel n as the message triggering source
Dnn	Uses derived channel nn as the triggering source.
Tn	Uses totaliser n as the source if TCT option fitted
Cn	Uses counter n as the source if TCT option fitted
tn	Uses timer n as the source if TCT option fitted
En	Uses event n as the source.

TYPES

PV	Causes the Item's process value to be embedded
TA	Causes the item's tag to be embedded
UN	Causes the Item's units string to be embedded
NO	Causes the Item's ID to be embedded (e.g. t2, 06)

4.9.1 EMBEDDED SEQUENCES (Cont.)

EXAMPLES

An alarm going active on channel 3 has 'Print Message 1 on going active' as one of its jobs.

If Message 1 were set up to be: <TIME><.TA><-PV> then the current time and the tag and process value of channel 3 would be printed on the chart.

If, instead, Message 1 were <TIME><6.TA><6-PV> then the current time and the tag and process value of channel 6 would be printed on the chart when the channel 3 alarm went active.

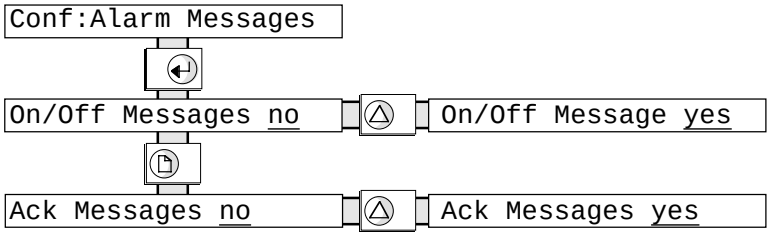
4.10 ALARM MESSAGES

Alarm message printing is available on continuous-trace recorders only if they are fitted with the annotator option.

On/off messages (HH:MM Alarm on CCn, and HH:MM Alarm off CCn) can be printed on the chart when alarms become active (on), or become non-active (off). HH:MM is the time, CC is the channel number and 'n' is the alarm in question.

For latching alarms, the off message is not printed until the alarm is both 'off' AND it has been acknowledged.

Similar messages can also be printed to show when alarms are acknowledged.



4.10.1 On/Off Messages

Scrollable through no and yes, this disables or enables on/off message printing.

4.10.2 Acknowledge messages

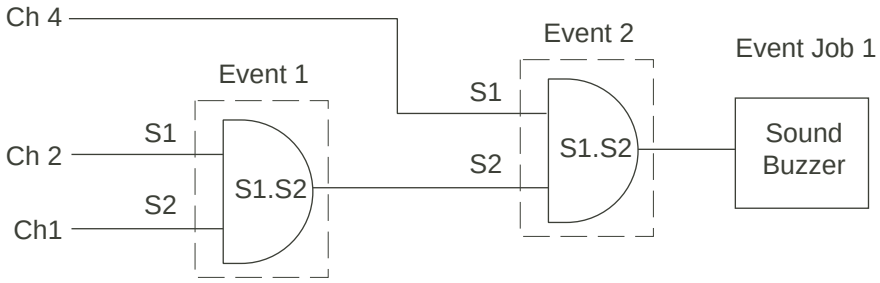
Scrollable through no and yes, this disables or enables acknowledge message printing.

4.11 INTERNAL EVENTS

As standard, there are six internal events, which can be triggered by one or more stimuli, and which can generate up to two jobs each when active. When the event input option is fitted, the number rises to 16. Input sources can be ANDed or ORed, so multiple logical inputs can be used.

For example, to sound a buzzer only when channel 1 and channel 2 and channel 4 are in alarm, we could set up events 1 and 2 as follows:

Event 1:	Event 2:	Job 1
Enabled	Enabled	Sound Buzzer
Source 1(S1) AND Source 2 (S2)	S1 AND S2	While active.
S1:Alm on channel 1.	S1:Alm on channel 4	
S2:Alm on channel 2.	S2:Event 1	



4.11.1 Event sources

Event sources are:
Operator Key (See sections 3.6 and 4.7 - Operator action)
Alarm on Ch N (Alarm on specified channel)
Glb Channel alarm (Alarm on any channel)
Glb UnAck Ch Alm (Unacknowledged alarm on any channel)
System error (Section 3.8)
Clock failure
Event N (Another specified event - see figure above)
Power up (section 2.1)

4.11 EVENT CONFIGURATION (Cont.)

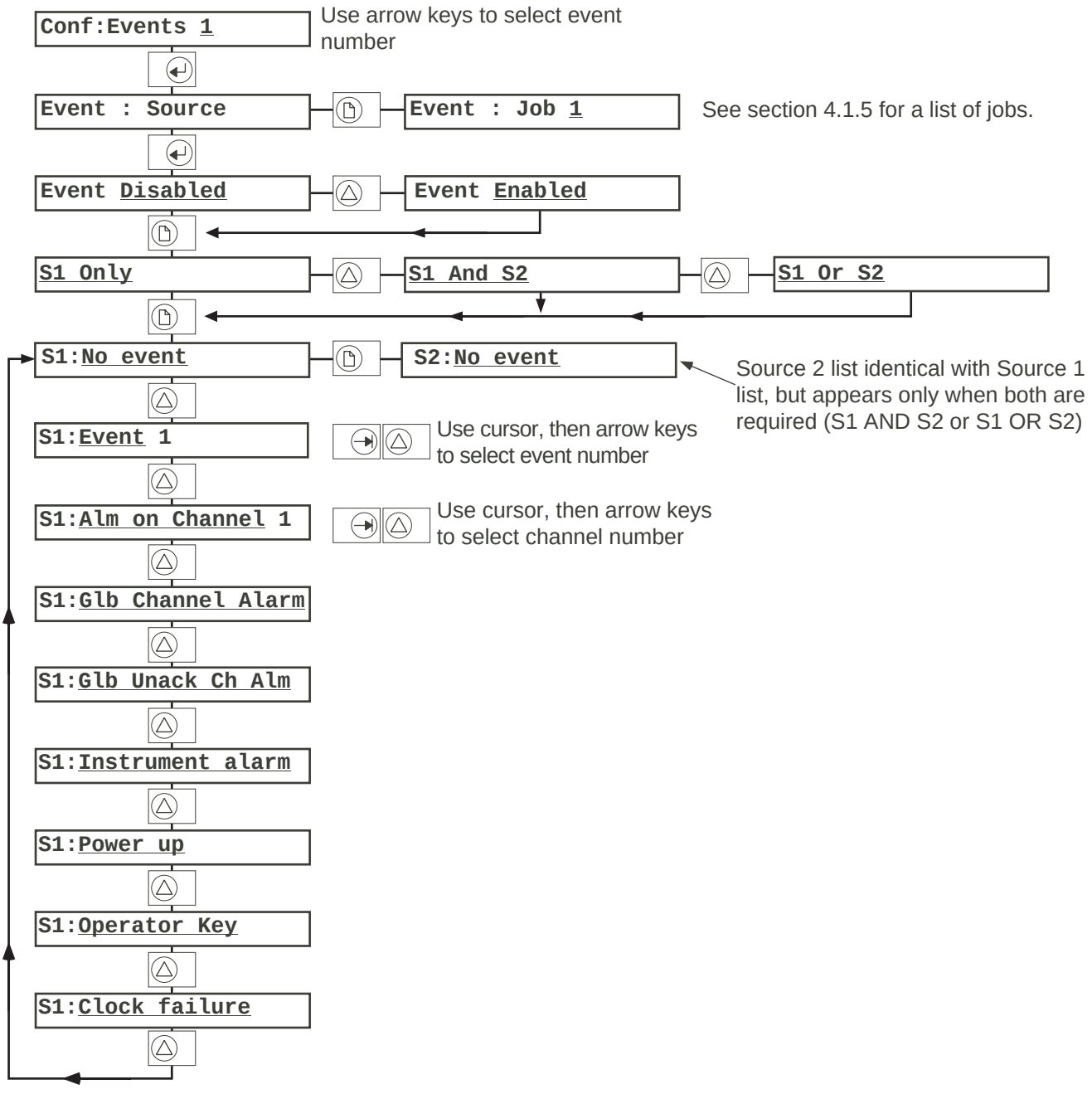


Figure 4.11 Internal event configuration pages

4.12 CONFIGURATION TRANSFER

This facility allows the transfer between recorders, or between the recorder and a host computer using a jack socket located towards the right of the bulkhead behind the cassette (see section 1.2.2 for wiring details). Only the Baud rate is configurable at the recorder, so if you are transferring to and from a host computer, the other settings you need are: Eight data bits, One stop bit and No parity.

The configuration transfer circuit is designed for use with TTL (0 to +5V) signals. A converter may be required with some host computers to change the signals to 12 Volts.

Notes:
1. The Transfer function will overwrite the destination recorder's configuration, ensure that the transfer is carried out in the correct direction (i.e. from save to restore).
2. Any adjustments made to the input channels (section 4.14, below) will be lost during the configuration transfer process

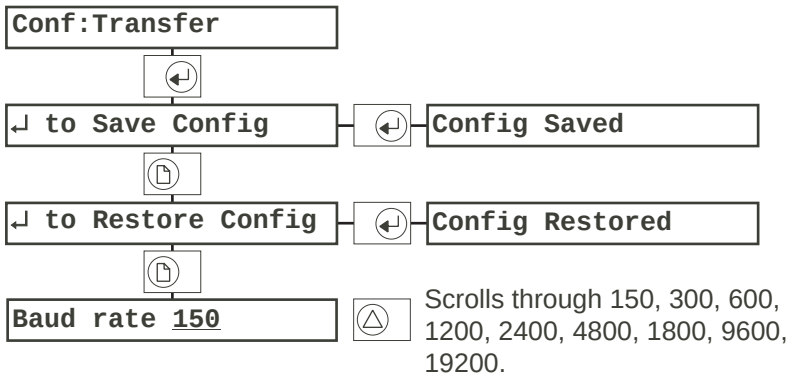


Figure 4.12 Configuration transfer pages.

↵ to Save config

Operation of the enter key causes the configuration to be saved to another recorder or to a host computer.

↵ to Restore Config

Operation of the enter key causes a new configuration to be retrieved from another recorder or from a host computer.

Baud Rate

Specifies the number of characters per second at which the transfer will take place. The setting (150, 300, 600, 1200, 1800, 2400, 4800, 9600, or 19200) must be the same for both sending and receiving devices.

4.13 OPERATOR ACCESS

For the sake of security, it is possible to enable/disable certain of the operator functions. These functions are listed below, together with their 'default permissions' (i.e. how they are despatched from the factory).

Change chart speed from Speed A to Speed B: default = Yes
Switch the chart drive on and off: default = Yes
Edit / print messages: default = No (Continuous-trace recorders need annotator option)
Initiate Log: default = Yes (Continuous-trace recorders need annotator option)
Adjust alarm thresholds: default = No

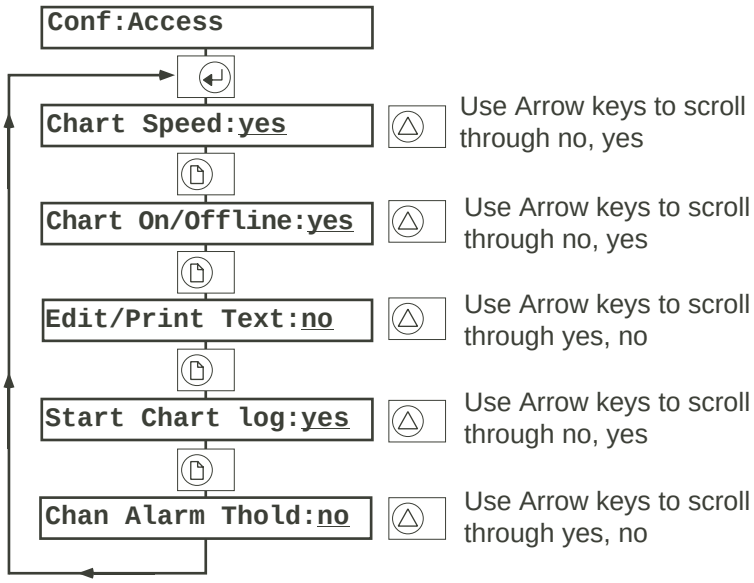


Figure 4.13 Operator permissions pages

4.14 ADJUST

4.14.1 Input adjust

This feature allows input channels to be adjusted to make allowance for non-standard inputs.

The technique used is to apply a known input at the low end of the input range for each channel in question. Once the reading displayed by the recorder has stabilised, the 'correct' value is entered. The process is repeated for a value near the high end of the input range.

Note: Input adjustments are lost during configuration transfer (section 4.12).

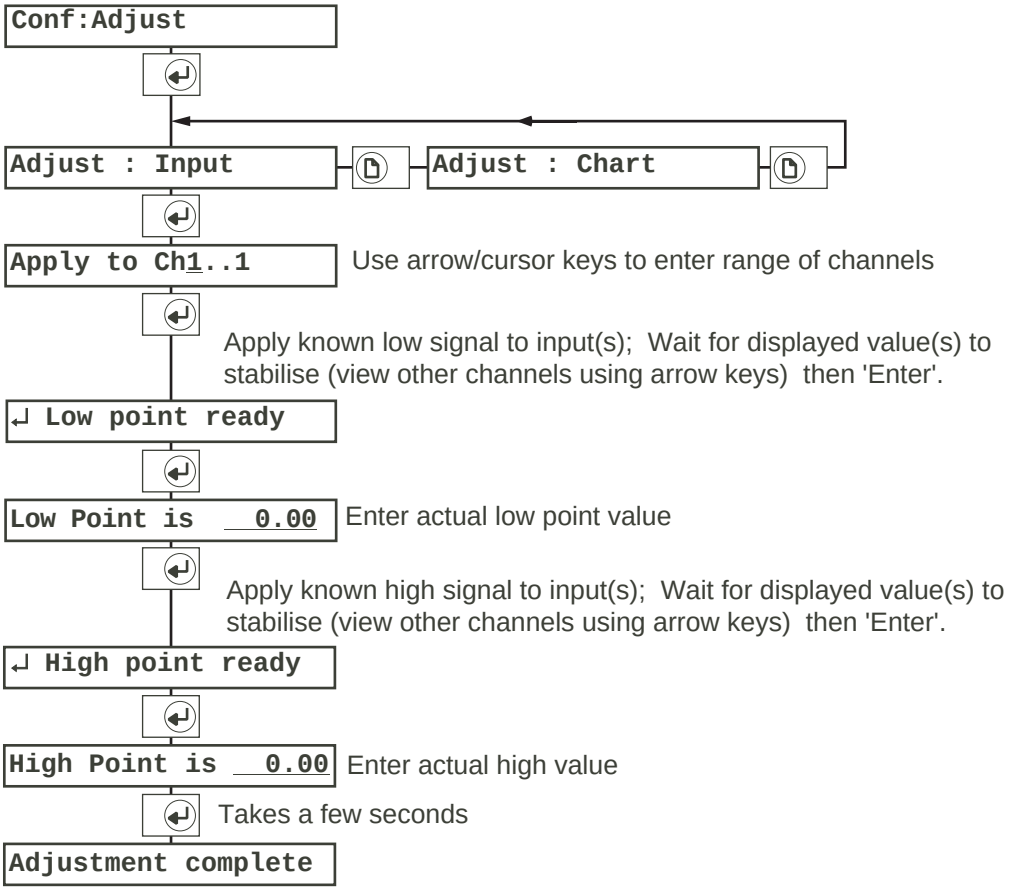


Figure 4.14.1a Input adjust configuration pages

(Continued)

4.14.1 INPUT ADJUST (Cont.)

Adjustments can be removed, and channels can be checked to see if they are 'adjusted' as shown in figure 4.14.1b.

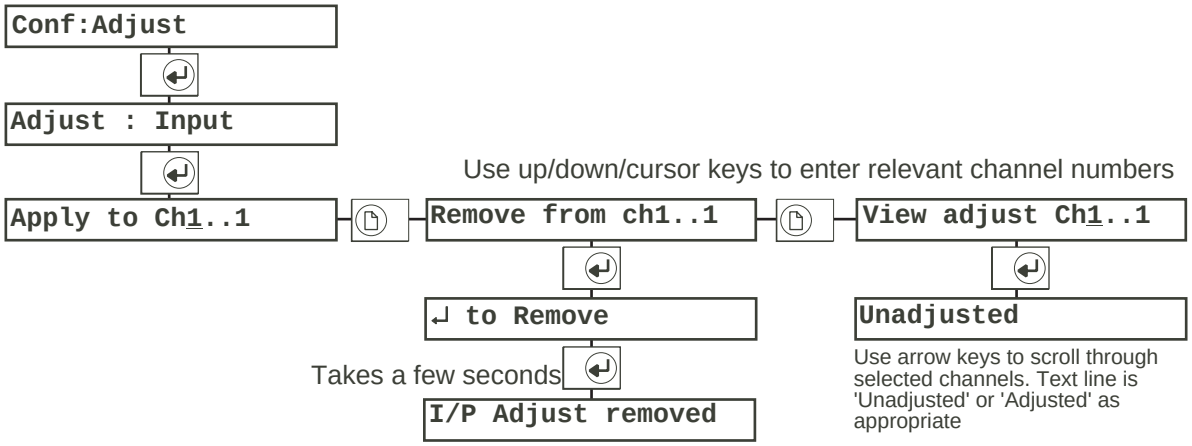


Figure 4.14.1b Remove/View adjust configuration pages

4.14.2 Chart adjust

This feature allows the pens/printhead zero and span positions to be set up as described in section 3.10 above.

For multipont recorders, the configuration menu is different from the operator menu in that a 'backlash' setting page is available to ensure that the dots being placed on a left-right transit are aligned with the dots being placed on the return (right-left) transit. If this is not adjusted correctly the traces appear 'noisy', and text becomes difficult to read.

Once the backlash has been adjusted, the zero and span settings can be re-set. Figure 4.14.2a shows how to access the page, and figure 4.14.2b is an attempt to show the effects of the adjustments.

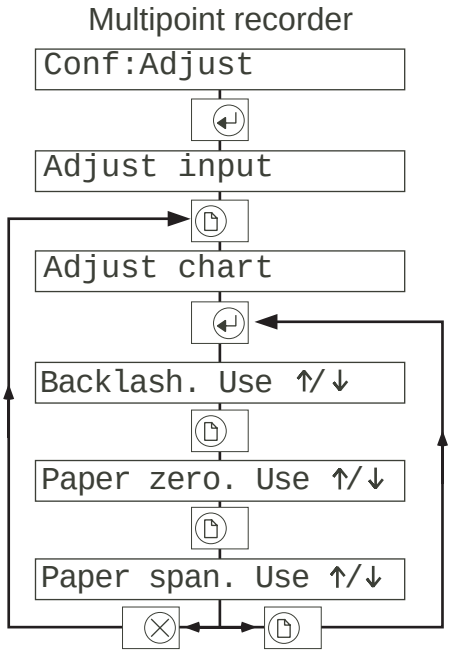


Figure 4.14.2a
Chart adjust configuration menu

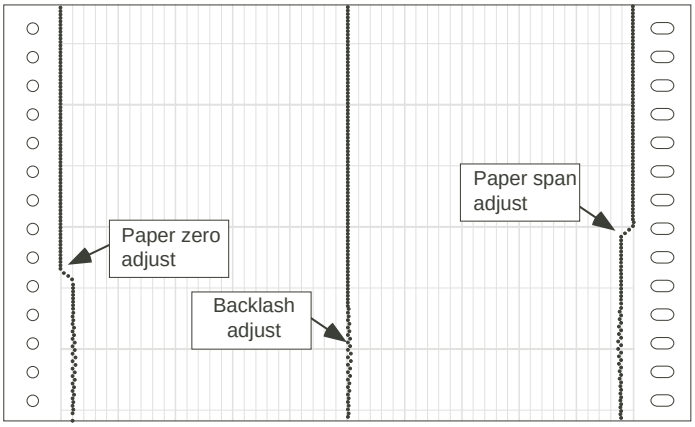


Figure 4.14.2b Backlash, zero and span adjustments
(Simulated multi-point chart sample)

4.15 DEFAULT CONFIGURATION

This function returns the recorder's configuration to its default state, and all user entered adjustments such as pen-to-chart, backlash and channel adjust are lost. If required, such adjustments must be re-entered after the default configuration has been returned-to.

After confirmation has been received, the recorder re-initialises and returns to the background display (section 2.1). As shown in figure 4.15 below, the user can quit before confirmation by using the clear (X) key.

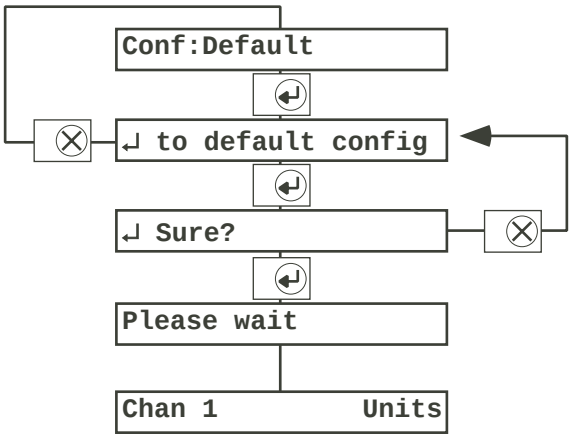
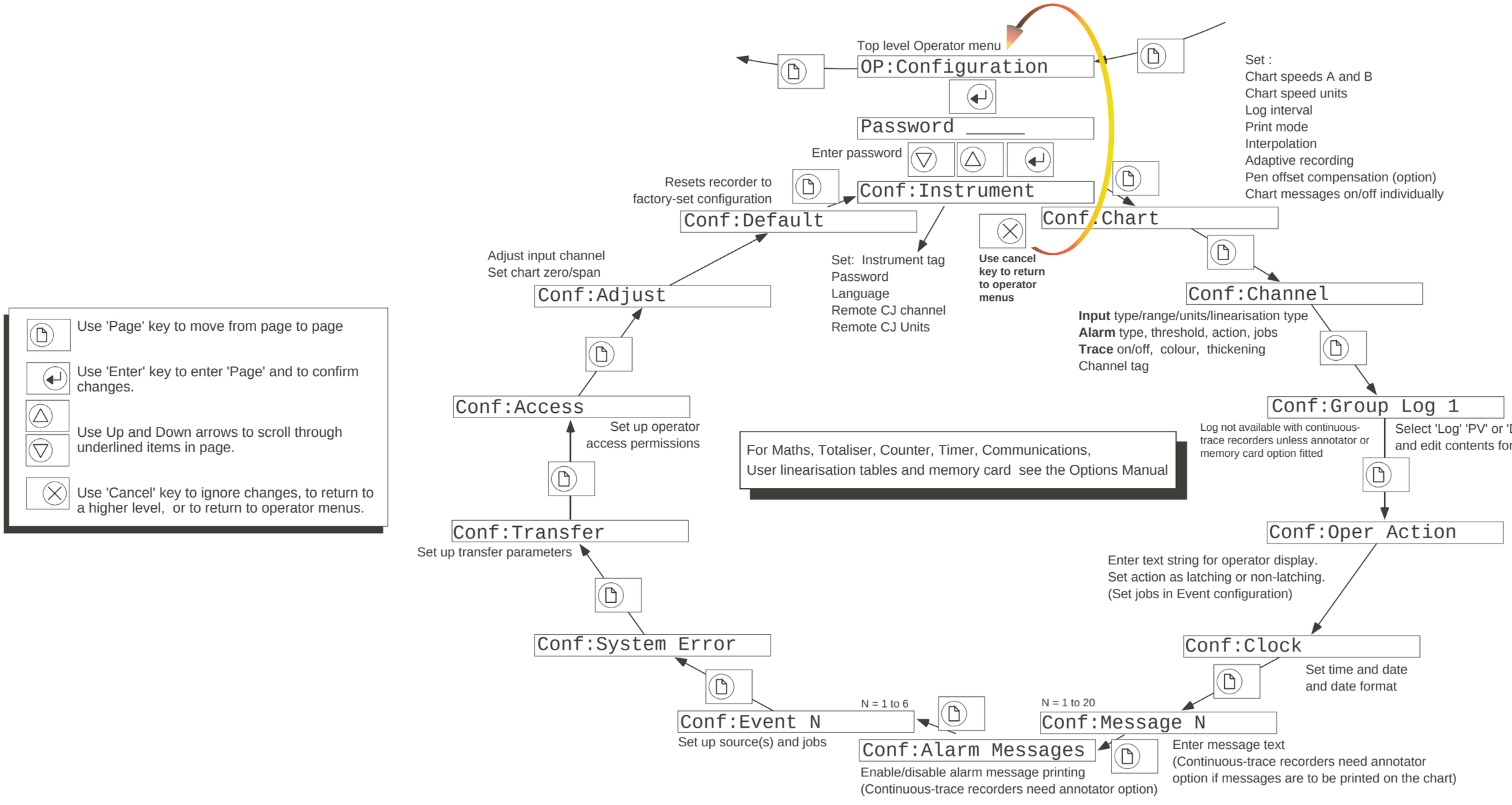


Figure 4.15 Default configuration

4.16 CONFIGURATION MENUS SUMMARY



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SECTION 5 REFERENCE

5.1 COSHH

5.1.1 Printheads

Note: The COSHH data included here is derived directly from data sheets produced by the manufacturer to cover all its products. This is reflected in the fact that the lists of part numbers may include more than those items relevant to this product.

Product: WATER BASED INKS NOT CONTAINING FORMAMIDE

Part numbers: LA248163
LA249556
LA250280

HAZARDOUS INGREDIENTS

Name	% Range	TLV	Toxicological data
Acid dye	1 to 4	Not available	Not established

PHYSICAL DATA

Boiling point	>212 ˚ C	Specific gravity	1.05 to 1.1
Vapour pressure	<20 mm Hg	Solubility in water	Complete
Odour	None	Colours	Various

FIRE AND EXPLOSION DATA

Flash point (deg C) (Method used)	Not flammable	FLAMMABLE LIMIT	
Extinguishing media	Use medium appropriate to primary cause of fire.	LEL Not available	UEL Not available
Special fire-fighting procedures	None		
Unusual fire and explosion hazards	None		

HEALTH HAZARD DATA

Threshold limit value	Not established		
LD 50 Oral	> 5g/kg	LD 50 Dermal	Not established
Skin and eye irritation	None in normal use		
Over-exposure effects	Slight irritation of mucus membrane		

FIRST AID PROCEDURES

Eyes and skin	Flush affected areas with water. If irritation develops, consult a physician.
Ingestion	If swallowed, dilute with water. Induce vomiting. Obtain immediate medical attention
Inhalation	If inhaled, move to fresh air. If necessary, aid breathing and obtain medical attention

REACTIVITY DATA

STABILITY				Conditions to avoid
Stable	Yes	Unstable		Strong oxidising agents and temperatures above 90˚C
Hazardous decomposition products	None			
Hazardous polymerisation	Will not occur			

SPILL OR LEAK PROCEDURES

Wipe up spills with towels and cloths. Remove stains with soap solution.

Dispose of waste in accordance with local environment control regulations

SPECIAL PROTECTION INFORMATION

Respiratory	If vapours are generated, use organic vapour respirator
Ventilation	Normal ventilation is adequate
Protective clothing	Use gloves when handling printheads to avoid stains on skin/clothing
Other	When printheads are being used for recording purposes, there are no known deletarious effects arising from the inks or pen tips.

5.1.2 Pen inks

Product:	RECORDING PENS						
Part numbers:							
LZ127886	LA125451	LA128964	LA230393				
LZ127887	LA125452	LA128965	LA233023	LA234423	LA243770	LA246521	**LA249550**
LZ127888	LA125453	LA128966	LA233461	LA234424	LA243771	LA246522	**LA249551**
LZ127889	LA128961	LA128969	LA233462	LA234425	LA243772	LA246523	**LA249552**
LZ127890	LA128962	LA203211	LA233463	LA235347	LA243773	LA247158	**LA249553**
	LA128963	LA203212	LA233701	LA235348			**LA249554**
		LA203213	LA233702	LA235349			
		LA203214	LA233703	LA235350			

HAZARDOUS INGREDIENTS

Name	% Range	TLV	Toxicological data
Formamide	25 to 30	Not available	Not established
Acid dyes	1.5 to 3	Not available	Not established

PHYSICAL DATA

Boiling point	100 ˚ C	Specific gravity	1.06 to 1.1
Vapour pressure	Due to H_2O only. 0.62% approx	Solubility in water	Complete
Odour	Nearly odourless	Colours	Various

FIRE AND EXPLOSION DATA

Flash point (deg C) (Method used)	Not flammable	FLAMMABLE LIMIT	
Extinguishing media	Use medium appropriate to primary cause of fire.	LEL Not applicable	UEL Not applicable
Special fire-fighting procedures	None		
Unusual fire and explosion hazards	None		

HEALTH HAZARD DATA

Threshold limit value	Not established		
LD 50 Oral	Not established	LD 50 Dermal	Not established
Skin and eye irritation	None in normal use		
Over-exposure effects	Unknown		
Chemical nature	Solution of dyestuffs in water and organic solvents		

FIRST AID PROCEDURES

Eyes and skin	Flush affected areas with water. If irritation develops, consult a physician
Ingestion	If swallowed, dilute with water. Induce vomiting. Obtain immediate medical attention
Inhalation	If inhaled, move to fresh air. If necessary, aid breathing and obtain medical attention

REACTIVITY DATA

STABILITY				Conditions to avoid
Stable	Yes	Unstable		Temperatures above 70˚C
Hazardous decomposition products	None			
Hazardous polymerisation	Will not occur			

SPILL OR LEAK PROCEDURES

Wipe up spills with towels and cloths. Remove stains with soap solution.

Dispose of waste in accordance with local environment control regulations

SPECIAL PROTECTION INFORMATION

Respiratory	If vapours are generated, use organic vapour respirator
Ventilation	Normal ventilation is adequate
Protective clothing	Use gloves when handling pens to avoid stains on skin/clothing
Other	All colours contain dyes which are suspected carcinogens

5.2 ERROR MESSAGES

5.2.1 Invalid configuration

This message can appear under a number of circumstances, but is normally the result of the operation of the 'Enter' key before configuration is complete. For example if you have set input type to T/C, but operate the Enter key before you set a suitable Linearisation type, the message will appear, and the attempted 'Enter' will be ignored.

5.2.2 Failure to adjust channel (Adj fail on ch NN)

Appears during the input adjust procedure (section 4.14) if the channel is in error or if there is a hardware or internal communications fault.

5.2.3 Input adjust not available (I/P Adj n/a on ch NN)

Appears if an attempt is made to adjust an input channel which is not an analogue input.

5.2.4 Printer must be off line

Certain functions require that the chart be off line before they can take place. Op:Chart must be accessed, and the chart drive switched off.

5.2.5 Writing system failure (W/S failure)

As a result of the amount of data that has to be stored, chart speeds below 13 mm/hr. cannot be used when Pen Offset Compensation (section 4.4.8) is applied to continuous-trace recording. This minimum usable chart speed rises if the recorder configuration is complex, for example - if a large number of averaging maths functions are configured.

Should the selected chart speed be below the current minimum, pen offset compensation is automatically switched off, and the Writing System Failure message appears. The problem is solved by increasing the selected chart speed, by reducing the complexity of the configuration or by switching off the Offset Compensation facility.

5.3 GLOSSARY OF TERMS

The following glossary is general to all the manufacturer's products and may thus contain terms which are not applicable to your particular unit. In particular, many of the terms are relevant only to configurable recorders.

Alarm	A function which is triggered when an *input signal* or a signal derived from it reaches a certain value (absolute or deviation alarms) or changes faster than a specified rate (rate-of-change alarms) or changes state (digital alarms). Once triggered, the alarm can initiate a *job list*, such as causing a *relay output* to change state, sounding a buzzer, changing chart speed etc.
Analogue input	An input which changes in a smooth (non-stepped) way (e.g. thermocouples, resistance thermometers).
Analogue output	An output from the recorder which is a scaled and linearised copy of an *analogue input* or *derived channel*. Also called retransmission output.
Attenuator	A resistive device which reduces the signal voltage by a known ratio (usually 100:1)
Break response	The recorder can detect an open circuit at its input terminals. As a part of the channel configuration, the instrument's response to an open circuit can be defined as 'None', 'Drive high' or 'Drive low'. If 'none' is selected the trace is allowed to drift according to what the input wiring is picking up (acting as an aerial). Drive high (low) causes the trace to be drawn at the extreme right (left) side of the chart.
Chart cassette	A mechanical paper transport system for containing and feeding the chart past the *pens* or *printhead* at a known speed. The cassette includes reservoirs for unused (pay-out tray) and used (take-up tray) sections of chart.
Cold Junction Compensation	Also known by the abbreviation CJC. The voltage generated by a *thermocouple* (TC) junction depends on the temperature difference between the actual bonded junction (the hot junction), and the other (non-bonded) end of the conductors (the cold junction (CJ)). Thus, for any reading from a TC to be accurate, the temperature of the CJ must be taken into account. This can be done in three ways: Internal, External or Remote. Internal. The recorder has integral temperature detectors measuring the temperature near the terminal blocks (the cold junction for directly connected TCs). External. For remote TCs, the cold junction can be held at a known temperature. This temperature is entered (in degrees) as a part of the CJC configuration. Remote. For remote TCs, an auxiliary temperature detector can be used to measure the cold junction temperature. This detector is then connected to a separate input channel. This input channel number is entered as a part of the CJC configuration.
Communications	Most recorders now offer a 'Serial Communications' option to allow a computer (PC) to communicate directly with one or more recorders in order to *configure* them, or to read information from them regarding the *process variables* being measured.
Configuration	This is used as a verb to mean 'the process of telling your recorder what you want it to do', and as a noun to mean 'the way in which the recorder has been set up (or configured)'. Recorders fitted with *memory card* or *communications* options can save their configuration to the memory card or to the host computer. This ensures against loss, and also allows configurations to be copied from one recorder to another.
Continuous trace	This is used to describe recorders which have a single *pen* associated with each *process variable*, and this pen *traces* the value continuously. See also multipoint recorder.
Counters	Counters can be incremented or decremented by digital/discrete inputs or by *job list* action. Counters can be preset. Each counter can have a set point which triggers a *job list* when the counter value passes through the set point either incrementing (High) or decrementing (Low).

5.3 GLOSSARY OF TERMS (Cont.)

Data acquisition — A general term describing the successful reading of an input signal. The term Data Acquisition Unit describes those units which are able to read input signals and act upon them (*alarms retransmission* maths functions etc) without necessarily having the facility of displaying or recording them.

Derived channel — A 'pseudo' channel which contains the results of maths pack operations so they can be traced on the chart, logged etc.

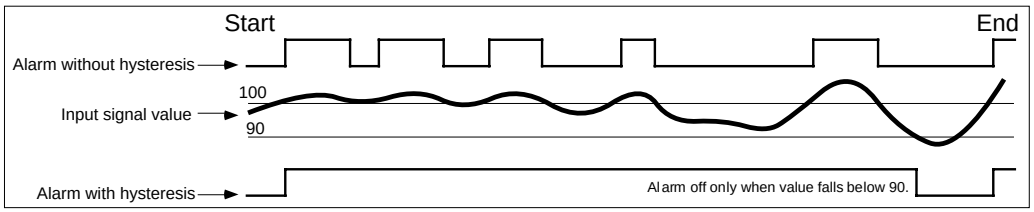
Derived Variable (DV) — The result of one or more *input channel* or *derived channel* being acted upon by a *mathematical function* (e.g. Channel average).

Digital (discrete) input — An input which has only two states (on or off). Examples are switch inputs or voltage pulse inputs.

Event input — A discrete (switch) or digital (voltage level) input. When active, an event input can initiate a *job list.*

Graphics recorder/unit — A recorder or display unit which uses a touch-sensitive liquid crystal display both as its operator interface, and to display traces as though on a chart. Recorders can come with or without charts; chartless recorders using electronic storage rather than paper to save information.

Hysteresis — When an *input signal* is 'hovering' near a *setpoint*, then an annoying and potentially damaging series of *alarms* can be generated, instead of just one alarm which can be acknowledged and the cause dealt with if necessary. To avoid this, a 'hysteresis' value can be entered in the alarm configuration, which effectively puts a dead band round the set point. For example an absolute high alarm with a set point of 100 and a hysteresis value of 10, would be triggered when the input signal value rose above 100, but would not re-trigger again until after the alarm had been 'cleared' by the process value falling below 90. An attempt to depict this example is given in the figure below.



Input channel — An input circuit which accepts voltage, current or digital *input signals* from the user.

Input signal — A voltage, current or digital input applied to the recorder input circuits. See also Analogue input and Digital (discrete) input.

Job list — A set of actions to be carried out by the recorder, when the job list becomes active. Typical 'jobs' are to activate a *relay*, display a message, change chart speed etc.

Linearisation table — Most *transducers* produce an output which is not directly proportional to the input. For example, the voltage output from a *thermocouple* does not vary linearly with the temperature it is exposed to. The recorder uses a 'look-up' table to find a temperature value for any mV input from a specified thermocouple type. Similar tables exist for other transducers such as *resistance thermometers*. In most modern instruments, the user can enter one or more tables of his/her own.

Log — Logging allows *process variable* values to be printed numerically in tabular form on the chart. Alternatively, logs can be sent to the *memory card* (if fitted).

Mathematical function — With the maths pack option(s) fitted, a number of mathematical functions become available to the user. For example, you may want to look at the difference between two *input signals*, in which case a simple Subtract function would be used. The resulting *Derived Variable* can be traced, using a *derived channel*, or could be used to trigger a *job list* if the difference between the two input signal became too great or too small, and so on. A complete list of functions is given below, but not all are available on all instruments.

5.3 GLOSSARY OF TERMS (Cont.)

Maths functions (Cont.)

Constant	Square root	Log base 10	Latching maximum	Switch
Copy	Channel average	Rate of change	Continuous maximum	High select
Add	Group average	Sample and hold	Polynomial	Low select
Subtract	Rolling average	Channel minimum	Relative humidity	Trace generator
Multiply	Exponent	Latching minimum	Linear mass flow	Stopwatch
Divide	Natural log	Continuous minimum	Square root mass flow	Time stamp
Modulus	10^x	Channel maximum	Zirconia probe	F value

Measured value	An umbrella term which means: the value of an *input channel, derived channel, totaliser, counter, timer* etc. measured in mathematical units as a proportion of the *span*. See also Process variable.
Memory card	Used to describe SRAM (Static Random Access Memory) solid state memory cards, or portable hard or floppy disks, used to record *configurations*, data etc. which can then be taken to a remote PC for further analysis, if required.
Multipoint recorder	This is used to describe recorders which have multiple pen *printheads* rather than individual pens to produce the *trace* on the chart. Each trace is made up of dots, produced by the printhead as it traverses across the chart at regular intervals. Advantages are that many more traces can be laid down on the chart, the traces can be annotated for identification and messages can be printed on the chart. Disadvantages are that fast transients may be missed at low chart speeds.
Operator interface	A term used to describe the controls (e.g. pushbuttons, keypads) and visual feedback (display) that are used to operate and configure the unit.
Paper transport system	This includes the *chart cassette* and the mechanical system, motors etc. needed to move the chart through the cassette. The paper transport system is often considered to be an integral part of the *writing system*.
Pen	A fibre-tipped disposable stylus with an integral ink reservoir. Used to draw (trace) the value of a single process variable on the chart in *continuous trace* recorders.
Pen offset compensation	With most *continuous trace* recorders, the mechanical positions of the pen tips are offset, in the time axis, in order that they do not collide with one another as they traverse the chart. A result of this is that simultaneous events in more than one channel can appear to be very far from simultaneous, particularly at slow chart speeds. To overcome this apparent time difference, most recorders now offer pen offset compensation, which delays the signals of all but the final channel. This has the disadvantage that changes may not appear on the chart until a considerable time after they have happened.
Pen tray	With modular recorder designs, each *pen* has its own mechanical system (including motor and feedback device) associated with it to drive it backwards and forwards across the chart. Pen tray is the general term for such mechanical systems. With some recorders, the pen drive electronics are integral with the pen tray.
Printhead	This is a device which, together with a disposable multi-colour cartridge, allows multi-point recorders to mark the chart.
Process variable	An umbrella term which means: the value of an *input channel, derived channel, totaliser, counter, timer* etc. measured in engineering units (e.g. Degrees Celsius). See also Measured value.
Relay output	A set of contacts which changes state as a result of a *job list* being run. Relays are energised continuously except when 'in alarm', so that if power to the recorder fails they go into their 'alarm' state.
Resistance thermometer	Also known as a resistance temperature detector (RTD), a resistance thermometer is constructed of a material whose resistance varies in a known way on the temperature it is exposed to. The resistance variation is non-linear, but for any given type, this non-linearity is well known and invariable and is compensated for by *linearisation tables* in the recorder memory.

5.3 GLOSSARY OF TERMS (Cont.)

Retransmission output	See Analogue output.
Setpoint	Also known as 'threshold', this is the point at which an *alarm* becomes active or inactive. See also *hysteresis*.
Shunt	The input circuit of each recorder channel measures voltage signals. If current signals are connected to the recorder, a low value resistor must be placed across the inputs, to convert the current signal to Volts, according to Ohms law (Volts = Amps x Ohms). Thus, a 0 to 20 mA (0.02 Amps) signal applied across a 250 Ω resistor produces a voltage range of 0 to (0.02 x 250) Volts = 5 Volts. Such resistors are called 'Shunt resistors' or 'Shunts' for short, and are usually of very close tolerance.
Span	Span has two common meanings: the right-most grid of the chart, or the value given by (maximum value - minimum value). The two meanings are identical where the minimum value is zero.
Trace	The line produced on the chart or display screen showing the value of the *process variable* being measured.
Thermocouple	A junction of two dissimilar metals which produces a small voltage, the value of which depends on the temperature of the junction. The voltage varies in a non-linear way with temperature, but for any given type, this non-linearity is well known and invariable and is compensated for by *linearisation tables* in the recorder memory.
Threshold	See setpoint.
Timer	Timers carry out general timing functions, and can initiate *job lists*.
Totaliser	A mathematical function which allows flow rates (e.g. cubic feet per second) to be converted to actual quantities (e.g. cubic feet).
Transducer	A device which produces an electrical output proportional to temperature, flow rate, pressure, speed, position etc. Common transducers are potentiometers, *thermocouples, resistance thermometers (RTDs)* and flow meters.
Transmitter	Thermocouple wire (compensation wire) is expensive, and if the thermocouple is a long way from the measuring device, it is often cheaper to instal a 'transmitter' local to the thermocouple. This device converts the mV signal from the thermocouple to a mA signal which can then be wired to the recorder using normal copper wire. Transmitters can be self powered, or they may need power generated for them. Most recorders can be fitted with Transmitter Power Supplies as an option.
Writing system	A general term used to describe the mechanical means of moving *pens/printheads* across the chart width. The term often includes the paper transport system used to drive the chart through the cassette.
Zero	Zero is generally taken to mean the value associated with the left-most grid line on the chart. Its actual value need not be zero, as long as it is less than the Span value.

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ANNEX A TECHNICAL SPECIFICATION

INSTALLATION CATEGORY AND POLLUTION DEGREE

This product has been designed to conform to BS EN61010 installation category II and pollution degree 2. These are defined as follows:

INSTALLATION CATEGORY II
The rated impulse voltage for equipment on nominal 230V ac mains is 2500V.

POLLUTION DEGREE 2
Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation shall be expected.

A1 TECHNICAL SPECIFICATION (Recorder)

Board types (I/O)

Universal input board (standard)
3-Changeover relay output board (optional)
4 Normally open relay output board (optional)
4 Normally closed relay output board (optional)
2 channel analogue output (retransmision) board (optional)

Options (See options manual)

Host Communications
Memory Card
Chart illumination
Event inputs
Transmitter Power Supply

Environmental Performance

Temperature limits	Operation: 0 to 50˚C. Storage: –20 to + 70˚C
Humidity limits	Operation: 5% to 80% RH (non-condensing). Storage: 5% to 90% RH (non condensing)
Protection	Door and Bezel: IP54. Sleeve: IP20. Transmitter Power Supply option rear cover: IP10
Shock	BS EN61010
Vibration	10 Hz to 150Hz at 2g peak
Altitude (max)	< 2000 metres

Physical

Panel mounting	DIN43700
Bezel size	144 x 144 mm.
Panel cutout dimensions	138 x 138 (both – 0 + 1 mm)
Depth behind bezel rear face	220 mm (No terminal cover); 236 mm (with terminal cover)
Weight	<3.5 kg
Panel mounting	Vertical ± 30˚

Printing system (continuous trace)

Pen type: Disposable fibre-tipped pens

Pen resolution: 0.15 mm

Default pen colours (can be changed during configuration)

Channel	Colour	Channel	Colour
1 (top)	blue	4 (bottom)	violet
2	red	annotator	black
3	green		

Pen life: 1.2km (channel pens); 7.5 x 10^5 dots (annotator)

Update rate: 8 Hz

Response time: 1 sec max.

Annotated characters per line: 42

Printing system (multipoint)

Pen type: Six-nib cartridge

Print resolution: 0.2 mm

Default trace colours (can be changed during configuration)

Channel	Colour	Channel	Colour
1	violet	4	green
2	red	5	blue
3	black	6	brown

Printhead life: 1.5 x 10^6 dots per colour

Update rate: 2 Hz

Trace rate (maximum): 1 pass every 1.5 seconds

Characters per line: 42

A1 TECHNICAL SPECIFICATION (Recorder) (Cont.)

Electromagnetic compatibility (EMC)

	Emissions:	BS EN50081-2
	Immunity:	BS EN50082-2
Electrical safety		BS EN61010. Installation category II; Pollution degree 2

Paper transport

Type		Stepper motor driving sprocket tube
Chart speeds	Continuous:	0 to 36,000 mm/hr (0 to 1417 in/hr)
		(Annotation inhibited at speeds >900 mm/hr; Pen offset compensation disabled at speeds <13mm/hr. (typ))
	Multipoint:	0 to 1200 mm/hr (0 to 47 in/hr)
Chart type		16- metre z-fold (standard) or 32-metre roll (option)
Transport accuracy		0.5 cm in 16 m (approx. 0.03%)

Power requirements

Line voltage	Standard:	90 to 264V; 45 to 65 Hz.
	Enhanced interrupt protection:	90 to 132V; 45 to 65 Hz
	Low voltage option:	20 to 53V dc or ac (45 to 400 Hz RMS).
Power (Max)		100VA
Fuse type		None
Interrupt protection	Standard:	40ms at 75% max. instrument load
	Enhanced:	120msec at 75% max. instrument load

A2 TECHNICAL SPECIFICATION (Input board)

General

Termination	Edge connector / terminal block
Maximum number of inputs	Continuous trace recorder = 4. Multipoint recorder = 6.
Input ranges	- 8 to + 38 mV, - 30 to + 150 mV; - 0.2 to + 1 Volt, - 2 to + 10 Volts
Input types	DC Volts, dc millivolts, dc milliamps (with external shunt), thermocouple, 2 / 3-wire resistance temperature detector (RTD), Ohms, Contact closure (not channel 1) (Minimum contact closure = 60 msec (continuous trace) and 250msec (multipoint))
Input type mix	Freely configurable
Noise rejection (48 to 62 Hz)	Common mode: >140dB (channel - channel and channel - to - ground). Series mode: >60dB.
Maximum common mode voltage	250 Volts continuous
Maximum series mode voltage	45 mV at lowest range; 12 Volts peak at highest range.
Isolation (dc to 65 Hz; BS EN61010)	Installation category II; Pollution degree 2 300 V RMS or dc channel - to - channel (double insulation); Channel to common electronics (double insulation) and channel - to - ground (basic insulation)
Dielectric strength (BS EN61010)	Channel to ground =1350 Vac; Channel to channel = 2300 Vac (both 1 minute type tests).
Insulation resistance	>10 MΩ at 500 V dc
Input impedance	38mV, 150 mV and 1 V ranges: >10 MΩ; 10 V range: 68.8 kΩ
Overvoltage protection	50 Volts peak (150V with attenuator).
Open circuit detection	± 57 nA max.
Recognition time	Continuous-trace = 125 msec; Multipoint = 500 msec.
Minimum break resistance	10 MΩ

DC Input ranges

Shunt/Attenuator	Externally mounted resistor modules
Additional error due to shunt	0.1% of input
Additional error due to attenuator	0.2% of input

Performance

Low Range	High Range	Resolution	Maximum error (Instrument at 20˚C)	Worst case temperature performance
-8 mV	38mV	1.4µV	0.085% input + 0.073% range	80ppm of input per deg C
-30 mV	150mV	5.5µV	0.084% input + 0.053% range	80ppm of input per deg C
-0.2 Volt	1 Volt	37µV	0.084% input + 0.037% range	80ppm of input per deg C
-2 Volts	10 Volts	370µV	0.275% input + 0.040% range	272ppm of input per deg C

A2 TECHNICAL SPECIFICATION (Input board) (Cont.)

Thermocouple data

Temperature scale	ITS90
Bias current	0.05 nA
Cold junction types	Off, internal, external, remote
CJ error	1˚C max; instrument at 25 ˚C
CJ rejection ratio	50:1 minimum
Remote CJ	Via any user-defined input channel
Upscale / downscale drive	High, low or none selectable for each thermocouple channel
Types and ranges	See table

T/C Type	Overall range (˚C)	Standard	Max linearisation error
B	0 to + 1820	IEC 584.1	0 to 400˚C: 1.7˚C 400 to 1820˚C: 0.03˚C
C	0 to + 2300	Hoskins	0.12˚C
D	0 to + 2495	Hoskins	0.08˚C
E	- 270 to + 1000	IEC 584.1	0.03˚C
G2	0 to + 2315	Hoskins	0.07˚C
J	- 210 to + 1200	IEC 584.1	0.02˚C
K	- 270 to + 1372	IEC 584.1	0.04˚C
L	- 200 to + 900	DIN43700:1985 (To IPTS68)	0.20˚C
N	- 270 to + 1300	IEC 584.1	0.04˚C
R	- 50 to + 1768	IEC 584.1	0.04˚C
S	- 50 to + 1768	IEC 584.1	0.04˚C
T	- 270 to + 400	IEC 584.1	0.02˚C
U	- 200 to + 600	DIN 43710:1985	0.08˚C
Ni/NiMo	0 to + 1406	Ipsen	0.14˚C
Platinel	0 to + 1370	Engelhard	0.02˚C

Resistance inputs

Ranges (including lead resistance)	0 to 150 Ω, 0 to 600 Ω, 0 to 6kΩ
Influence of lead resistance	Error = negligible; Mismatch = 1 Ω/Ω
Temperature scale	ITS90

Resolution and accuracy

Low Range	High Range	Resolution	Maximum error (Instrument at 20˚C)	Worst case temperature performance
0Ω	150Ω	5mΩ	0.045% input + 0.110% range	35ppm of input per deg C
0Ω	600Ω	22mΩ	0.045% input + 0.065% range	35ppm of input per deg C
0Ω	6kΩ	148mΩ	0.049% input + 0.035% range	35ppm of input per deg C

RTD types, ranges and accuracies

RTD Type	Overall range (˚C)	Standard	Max linearisation error
Cu10	-20 to + 400	General Electric Co.	0.02 ˚C
JPT100	-220 to + 630	JIS C1604:1989	0.01 ˚C
Ni100	- 60 to + 250	DIN43760:1987	0.01 ˚C
Ni120	-50 to + 170	DIN43760:1987	0.01 ˚C
Pt100	-200 to + 850	IEC 751	0.01 ˚C
Pt100A	-200 to + 600	Eurotherm Recorders SA	0.09 ˚C
Pt1000	-200 to + 850	IEC 751	0.01 ˚C

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Inter-Company sales and service locations

AUSTRALIA Sydney
Eurotherm Pty. Ltd.
Telephone (+61 2) 9838 0099
Fax (+61 2) 9838 9288
E-mail info@eurotherm.com.au

AUSTRIA Vienna
Eurotherm GmbH
Telephone (+43 1) 7987601
Fax (+43 1) 7987605
E-mail eurotherm@eurotherm.at

BELGIUM & LUXEMBURG Huy
Eurotherm S.A/N.V.
Telephone (+32) 85 274080
Fax (+32) 85 274081
E-mail sales@eurotherm-belgium.be

BRAZIL Campinas-SP
Eurotherm Ltda.
Telephone (+5519) 3707 5333
Fax (+5519) 3707 5345
E-mail eurothermltda@eurothermltda.com.br

DENMARK Copenhagen
Eurotherm Danmark A/S
Telephone (+45 70) 234670
Fax (+45 70) 234660
E-mail info@eurotherm.se

FINLAND Abo
Eurotherm Finland
Telephone (+358) 22506030
Fax (+358) 22503201

FRANCE Lyon
Eurotherm Automation SA
Telephone (+33 478) 664500
Fax (+33 478) 352490
E-mail ea@automation.eurotherm.co.uk

GERMANY Limburg
Eurotherm Deutschland GmbH
Telephone (+49 6431) 2980
Fax (+49 6431) 298119
E-mail info@regler.eurotherm.co.uk

HONG KONG & CHINA
Eurotherm Limited Aberdeen
Telephone (+85 2) 28733826
Fax (+85 2) 28700148
E-mail eurotherm@eurotherm.com.hk

Guangzhou Office
Telephone (+86 20) 8755 5936
Fax (+86 20) 8755 5831

Beijing Office
Telephone (+86 10) 6762 0936
Fax (+86 10) 6762 0931

Shanghai Office
Telephone (+86 21) 6352 6406
Fax (+86 21) 6352 7351

INDIA Chennai
Eurotherm India Limited
Telephone (+9144) 24961196
Fax (+9144) 2256682070
E-mail sales@eurothermdel.com

IRELAND Dublin
Eurotherm Ireland Limited
Telephone (+353 1) 469180
Fax (+353 01) 4691300
E-mail info@eurotherm.ie

ITALY Como
Eurotherm S.r.l
Telephone (+39 31) 975111
Fax (+39 31) 977512
Telex 380893 EUROTH I
E-mail info@eurotherm.it

KOREA Seoul
Eurotherm Korea Limited
Telephone (+82 31) 2738507
Fax (+82 31) 2738508
E-mail help@eurotherm.co.kr

NETHERLANDS Alphen a/d Ryn
Eurotherm B.V.
Telephone (+31 172) 411752
Fax (+31 172) 417260
E-mail sales@eurotherm.nl

NORWAY Oslo
Eurotherm A/S
Telephone Oslo (+47 67) 592170
Fax (+47 67) 118301
E-mail info@eurotherm.se

SPAIN Madrid
Eurotherm España SA
Telephone (+34 91) 6616001
Fax (+34 91) 6619093
E-mail ventas@iberica.eurotherm.co.uk

SWEDEN Malmo
Eurotherm AB
Telephone (+46 40) 384500
Fax (+46 40) 384545
E-mail info@eurotherm.se

SWITZERLAND Freienbach
Eurotherm Produkte (Schweiz) AG
Telephone (+41 55) 4154400
Fax (+41 55) 4154415
E-mail epsag@eurotherm.ch

UNITED KINGDOM Worthing
Eurotherm Limited
Telephone (+44 1903) 268500
Fax (+44 1903) 265982
E-mail info@eurotherm.co.uk
Web www.eurotherm.co.uk

U.S.A Leesburg VA
Eurotherm Inc.
Telephone (+1 703) 443 0000
Fax (+1 703) 669 1300
E-mail info@eurotherm.com
Web www.eurotherm.com

invensys
EUROTHERM
EUROTHERM LIMITED
Faraday Close, Durrington, Worthing, West Sussex, BN13 3PL
Telephone: 01903 695888 Facsimile: 01903 695666
e-mail: info@eurotherm.co.uk
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