

394



EUROTHERM
CHESSELL

Model 394
Chart recorder

Installation and
operation manual



Declaration of Conformity

Manufacturer's name:	Eurotherm Recorders Incorporated
Manufacturer's address	One Pheasant Run, Newtown Industrial Commons, Newtown, PA 18940 USA.
Product type:	Industrial chart recorder
Model:	394 (Status level B2 or higher)
Safety specification:	EN61010-1: 1993 / A2:1995
EMC emissions specification:	EN50081-2 (Group1; Class A)
EMC immunity specification:	EN50082-2

Eurotherm Recorders hereby declares that the above products conform to the safety and EMC specifications listed. Eurotherm Recorders 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: P D De la Nougerède Dated: 25-Mar-98

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



IA249986U130 Issue 1 Mar 98

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Circular Chart Recorder

Installation and Operation Manual

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NOTE

Questions concerning installation, performance or service should be directed to the company from which the instrument was purchased.



STATIC ELECTRICITY

High voltages (tens of kilo-volts) can be generated on the human skin through a number of mechanisms, such as friction between different materials (e.g. nylon and skin), and separation of similar materials (e.g. masking tape, nylon sheet). The gate-oxide region of all metal oxide semiconductors (MOS) is extremely thin, and can be damaged by voltages as low as 60 Volts. Modern MOS devices have built-in clamp diodes which reduce the incidence of obvious static damage considerably. It is possible however, even with such clamping diodes, to produce a small rupture in the oxide layer. This might not destroy the device immediately, but it may result in a gradual reduction in the performance of the device until, eventually, it fails.

For this reason, the following precautions should be taken when handling any recorder circuit board.

1. Personnel handling MOS devices, or circuit boards containing them, should wear antistatic materials such as cotton. Nylon clothing should be avoided.
2. All bench tops should be covered with conductive material (10^4 to 10^5 Ohms per square) maintained at the recorder chassis potential.
3. Circuit boards removed from a recorder should be placed into a static-safe bag, initially at the recorder chassis potential, for storage. Before re-fitting the board, the containing bag should again be returned to the recorder chassis potential.
4. Personnel handling MOS devices, or boards containing them, should wear a wrist strap connected (via a safety resistor) to the bench top, or if appropriate, to a suitable grounding point on the rack.
5. Leads of MOS devices removed from circuit should be shorted together using conductive foam or similar.
6. MOS devices should not be extracted from or inserted into circuit whilst the circuit board has power applied.

TERMINOLOGY

Antistatic

This term means that the material in question does not of itself generate static electricity. Such materials do not afford protection against external electric fields.

Static safe

This means that the material in question:

- a) does not generate static electricity, and
- b) any device enclosed in such material is safe from the effects of external electric fields.

Safety Notes

1. Before any other connection is made, the protective earth ground terminal shall be connected to a protective conductor. The supply voltage (mains) wiring must be terminated in such a way that, should it slip in the cable clamp, the Earth ground wire would be the last wire to become disconnected.
2. In the case of portable equipment, the protective earth ground terminal must remain connected (even if the recorder is isolated from the supply voltage), 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 ground terminal is likely to make the apparatus dangerous under some fault conditions. Intentional interruption is prohibited.

3. The line voltage fuse within the power supply unit is not replaceable. If it is suspected that the fuse is faulty, the manufacturer's local service center 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 center should be consulted for advice.
 5. A switch or circuit breaker shall be included when installing this instrument. It shall be in close proximity to the instrument and within easy reach of an operator. It shall be marked to indicate that it will disconnect this instrument.
 6. 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.
 7. Where conductive pollution (e.g. condensation, carbon dust) is likely, adequate air conditioning/filtering/sealing etc. must be installed in the recorder enclosure.
 8. 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. Where signal wiring is carrying (or could carry, under fault conditions) hazardous voltages *, double insulation should be used.
 9. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.
 10. The battery is not individually replaceable. If the battery does not function, consult the manufacturer for service information.
- * A full definition of 'Hazardous' Voltages appears under 'Hazardous Live' in BS EN61010. Briefly, under normal operating conditions Hazardous voltage levels are defined as >30V RMS (42.4V peak) or >60V dc.

Symbols used on the recorder labelling

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

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

Section 1

INSTALLATION

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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

PANEL MOUNTING

The recorder is inserted through the panel aperture from the front of the panel. With the weight of the recorder supported, the recorder is secured using the two clamp brackets supplied, either at the top and bottom or at the right and left sides of the recorder.

PIPE MOUNTING

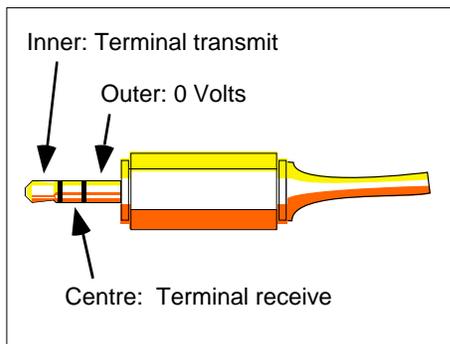
Mounting brackets to suit a 50mm (2 inch) pipe are also available.

1.2.2 Electrical installation

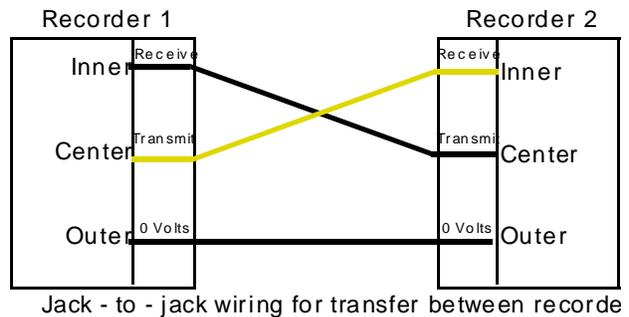
Details for connecting the line supply and for signal wiring are shown in figure 1.2.2. A user supplied and mounted switch for the supply voltage must be included with the installation.

Configuration transfer wiring

Wiring for the configuration port jack plug is as shown below. See section 4.11 for details of the configuration transfer facility.



Jack plug wiring for transfer with host computer/dumb terminal



Jack - to - jack wiring for transfer between recorder

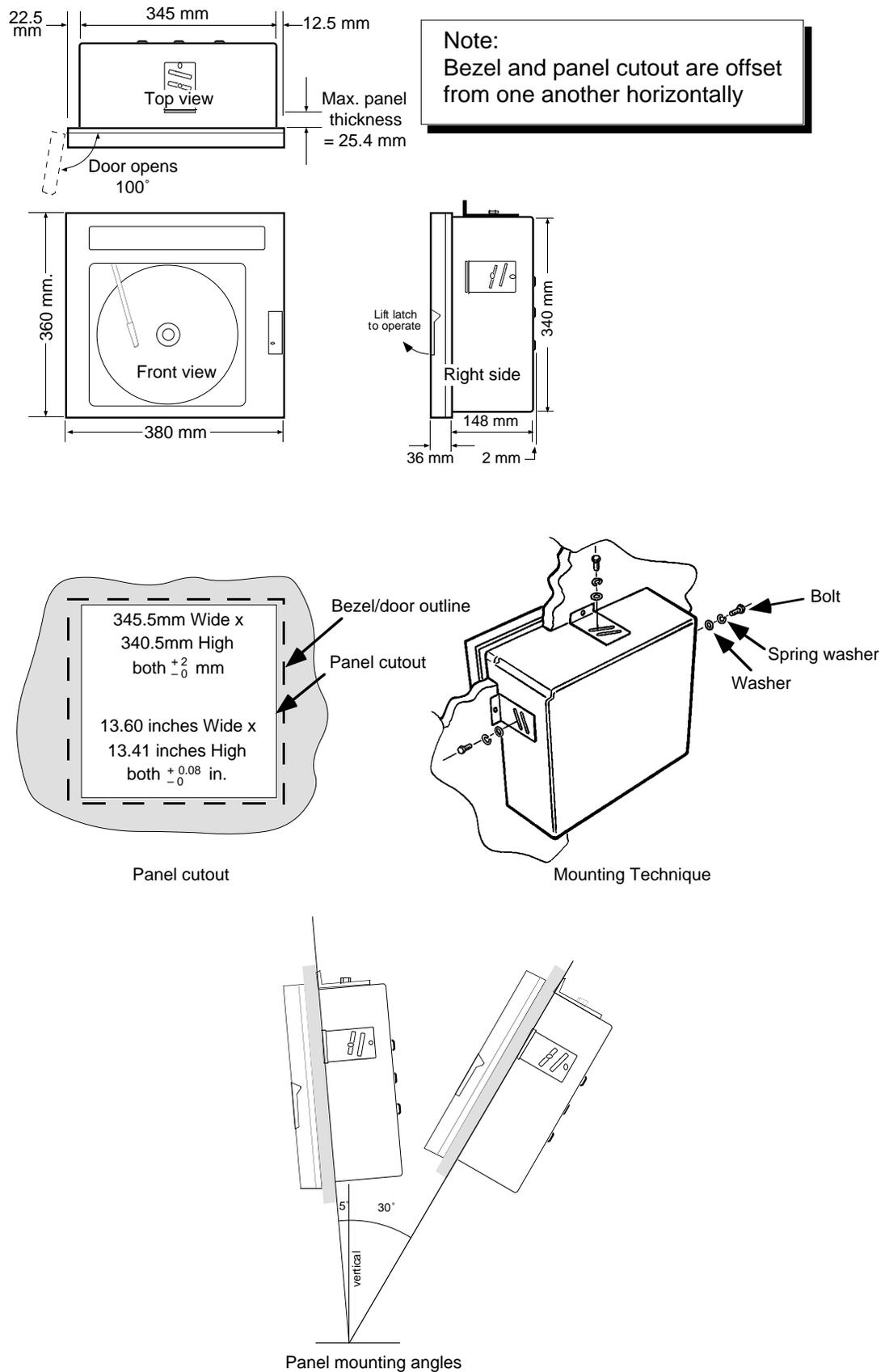


Figure 1.2.1 Mechanical installation

1.2.2 ELECTRICAL INSTALLATION (Cont.)

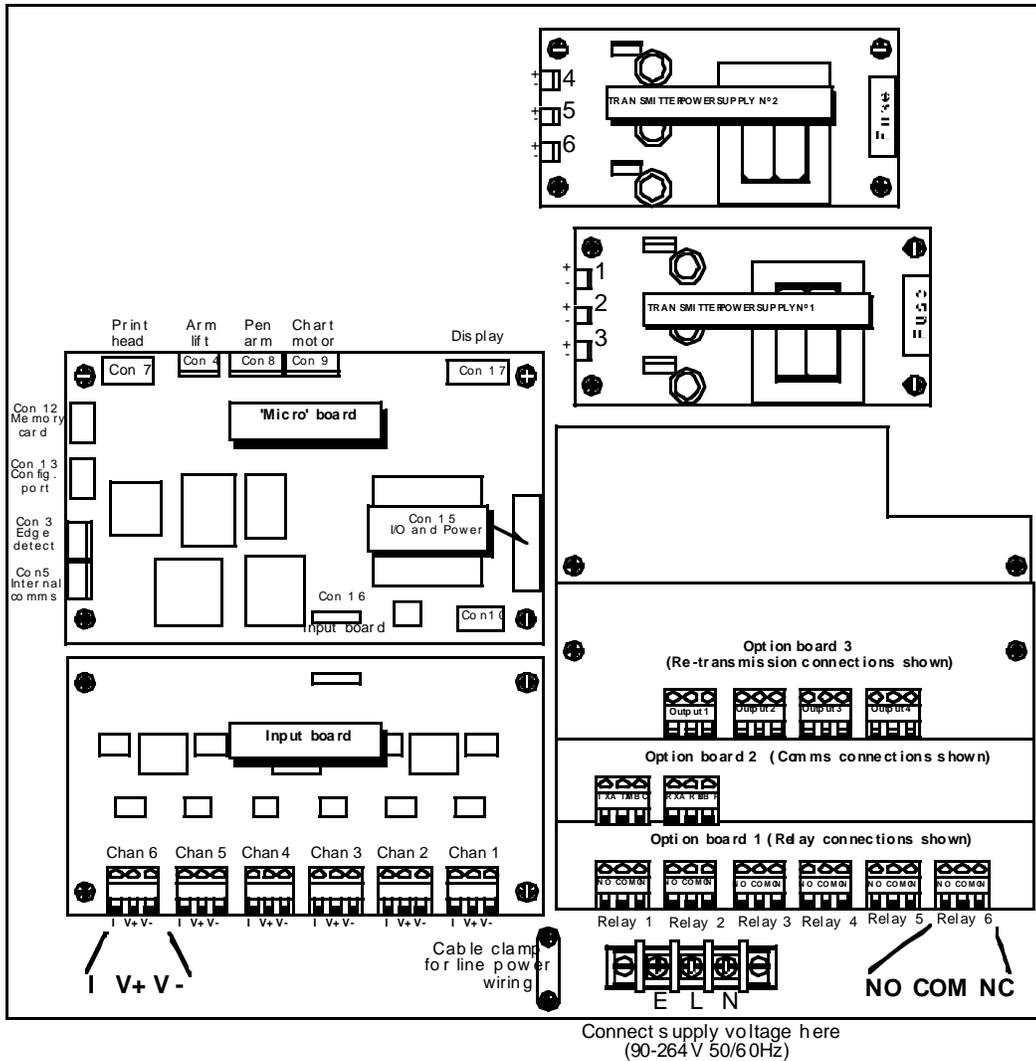
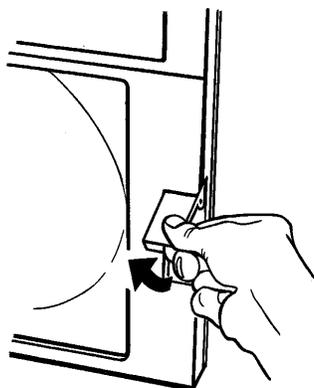


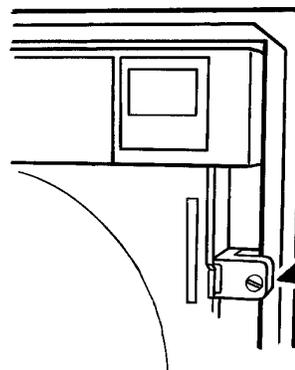
Figure 1.2.2 Electrical installation - overview

Notes:

1. Access to terminals is by opening the door, then undoing the securing screw to release the platen.
2. Option boards are shown as 1 = relays, 2 = serial communications, 3 = retransmission (analogue output). In fact any option board can be fitted in any of the three positions. Up to three relay boards can be fitted, if no other options are fitted.



Lift latch to release door catch



Undo this screw to release platen.

1.2.2 ELECTRICAL INSTALLATION (Cont.)

SUPPLY VOLTAGE (MAINS) WIRING

Leave the earth ground lead longer than the others, so it would be the last to become disconnected should the cable be pulled out of the connector.

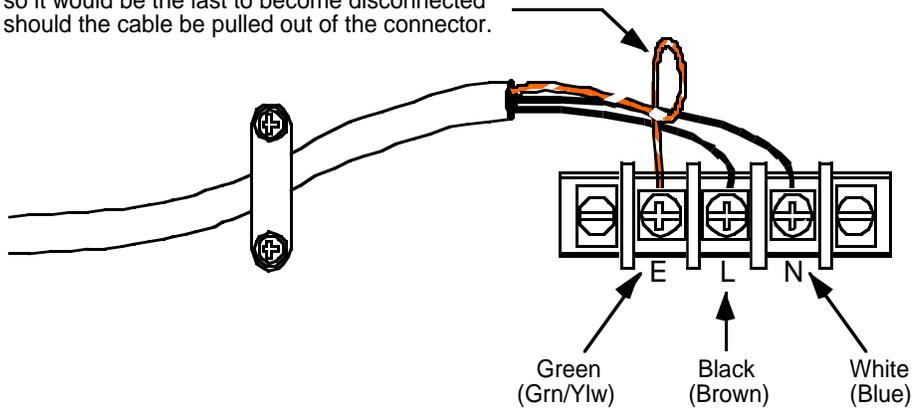


Figure 1.2.2b - Supply voltage wiring

The supply voltage cable is terminated at the terminal block located near the bottom right-hand corner of the case (see figure 1.2.2a). Care should be taken to ensure that only the earth ground wire (green or green with a yellow stripe) is connected to the Earth (left-most) terminal.

The fuse in the main recorder power supply is not user replaceable. If fuse may have been blown, consult manufacturer for service information.

Caution

Although the recorder is designed to work from any 50 or 60Hz voltage between 90 and 264V, the transmitter power supply option is not. When sold with a new order, the transmitter power supply will come with the correct links and fuse for the specified line voltage. When supplied as a retrofit option, or if the supply voltage to the recorder changes, each transmitter power supply board must have its links and fuse correctly selected, or the fuse may rupture when power is applied. Figure 1.2.2c gives details of links and fuse types.

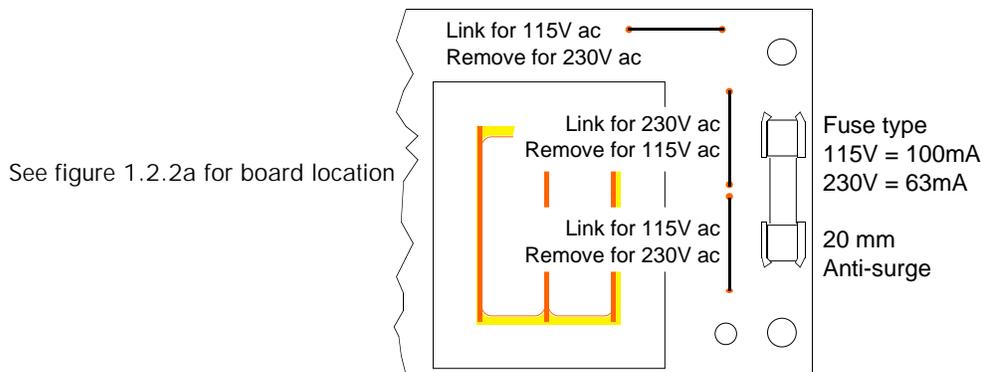


Figure 1.2.2c Transmitter Power Supply link/fuse details

SIGNAL WIRING

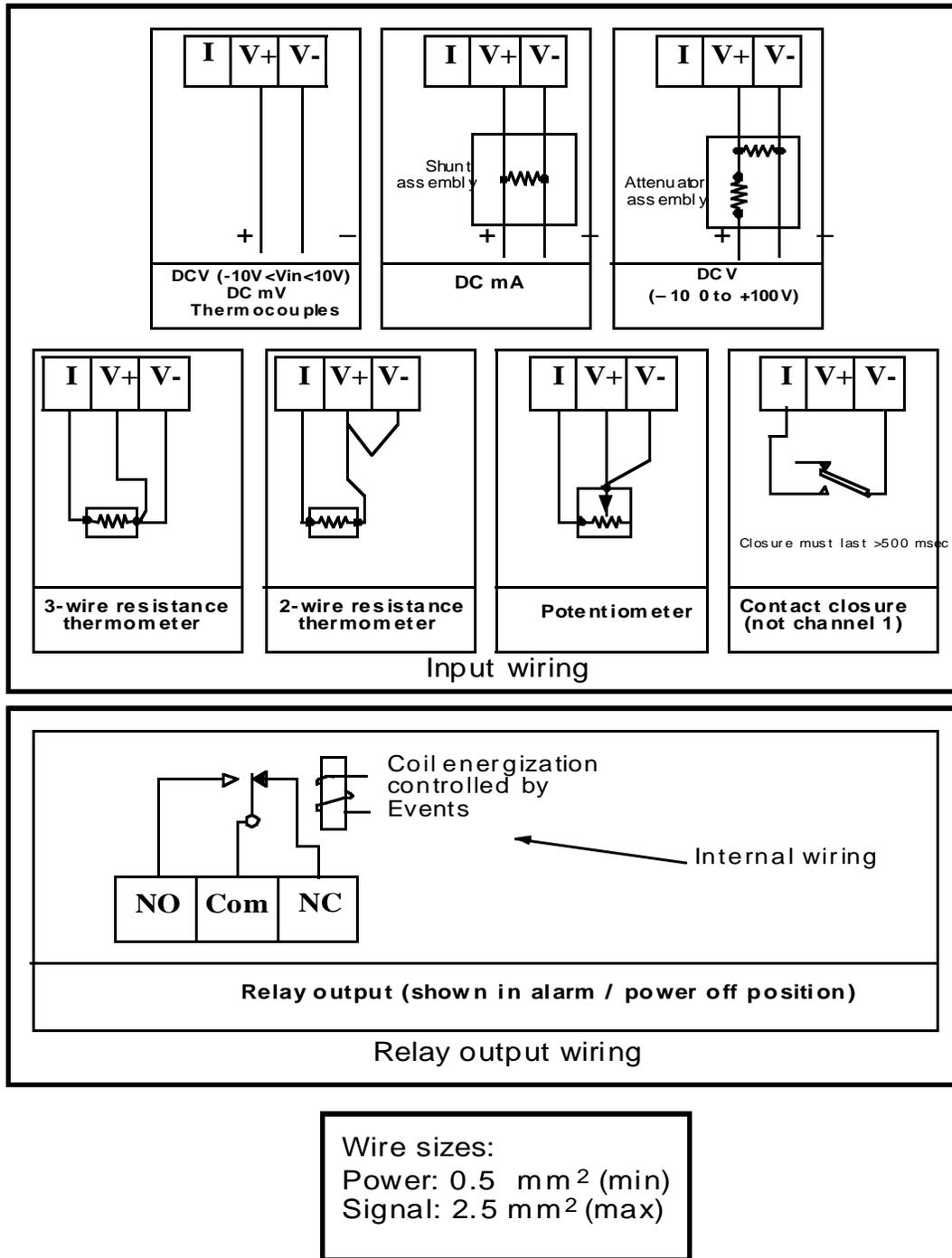


Figure 1.2.2d Input / output wiring

Note: For Serial communications and analogue output (retransmission) wiring, see the options manual. For controller wiring details see the options manual and the controller handbook.

1.3 CHANGING THE CHART

Open the recorder door (fig 1.3a) and operate the cancel (x) key to call the Op: Display page, then use the page key to call the Op: Chart page

Operate the 'Enter' key twice to switch the chart drive off.

If there is currently no chart fitted, ignore the rest of this paragraph. If there is a chart fitted, Lift the paper locking tab at the center of the chart hub ('A' in figure 1.3b), and remove the old chart by lifting it out from under the hold-down tabs ('B') and off the hub.

Place the new chart under the hold-down tabs ('B' in figure 1.3b) and onto the hub ('A') **WITHOUT YET LOWERING THE LOCKING TAB.** Rotate the chart until the current as time printed on the chart is just clockwise (i.e above) the time reference mark ('C' in the figure). Lower the locking tab onto the chart.

Use the page key to call the '↓ to align' page. Press repeatedly, or hold continuously the enter key to rotate the chart counter-clockwise until the current time as printed on the chart is aligned with the time reference point.

Carry out the alignment procedure described in section 3.10 before returning the recorder to service.

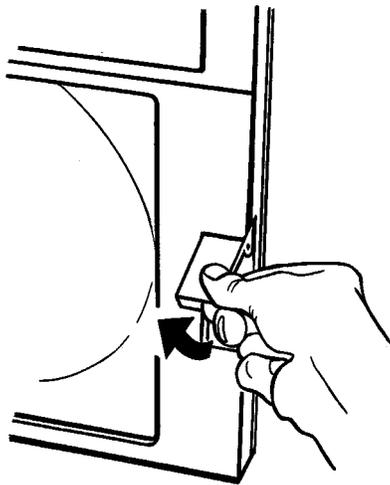
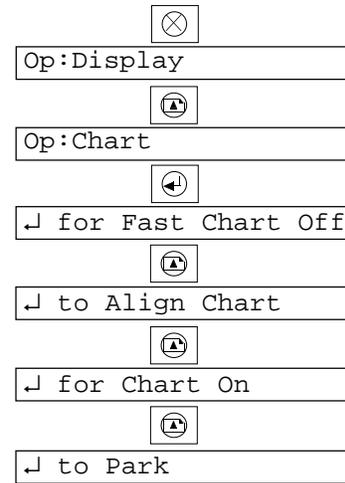


Fig 1.3a Open the recorder door

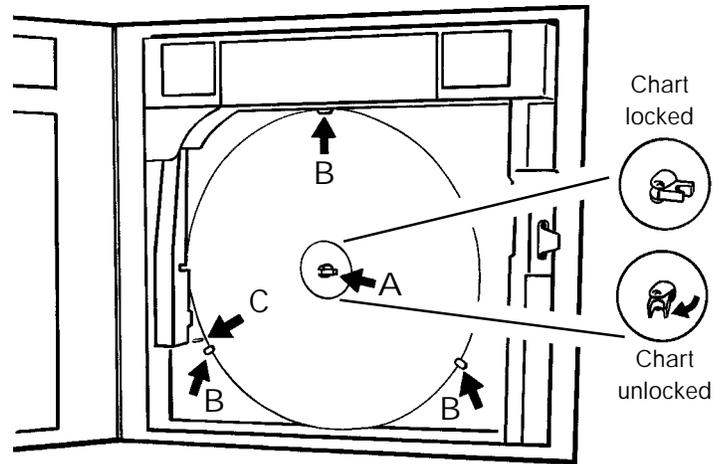


Fig 1.3b Change chart

1.4 CHANGING THE CARTRIDGE

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

Before changing the cartridge, switch the chart drive off as described in section 1.3 above. Then use the page key twice, then the Enter key, to park the printhead.

Lift the printhead arm and pull the print cartridge down and away (figure 1.4). Fit the new cartridge and lower the arm.

Use the page key repeatedly until the ↵ for Chart On page appears. Operation of the enter key restarts tracing.

Note: If the arm is lifted during normal tracing, the pen drive will stop, but the chart will continue to rotate. Subsequent lowering of the pen will set the pen to its normal rest position, before trending restarts. When the printhead is lowered, the chart backs up 2-3 degrees and then comes forward to its original position to ensure chart motor start-up time accuracy.

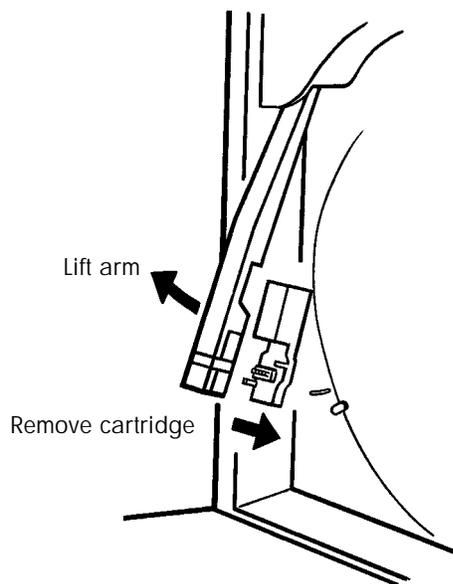


Figure 1.4 Changing the printhead

Section 2

BASIC OPERATION

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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 can be printed on the chart giving any of: time, date, and chart speed. Which (if any) of these is required is set up in Chart Configuration (section 4.4) For example:-

```
09:15 29/02/96 12 Hour Chart
or
29/02/96 7 Day Chart
```

See sections 3.7 and 3.8 if a system error is indicated.

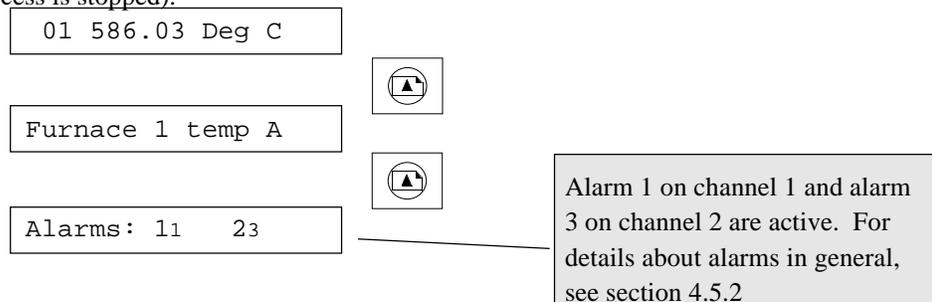
2.2 BACKGROUND DISPLAY

After initialization is complete, the display enters what is called a 'background' display, showing the value of a channel in a format similar to that shown below. If this is the first switch-on, or if the recorder has not been configured, the channel will be OFF.

Initially, the first channel on display is measuring channel 1. This remains on display for 5 seconds, after which channel 2 appears. Channels 'scroll' in this manner until all input channels have been displayed, after which, if the display group has been edited to include them (section 4.6.3) any option channels (derived variables, totalisers and counters) will be scrolled through in the same manner. When all channels have been scrolled-through, input channel 1 is returned to.

01 1.2345 Units	(Measuring channel)
D01 1.2345 Units	(Derived (maths) channel)
T1 123456789 Units	(Totaliser)
C1 12345678 Units	(Counter)

By operating the page up/down keys, the display can be made to show alarm types or the channel identifier (tag) instead of its current value. When either of these alternative displays are selected, the relevant channel is held (i.e. the normal scrolling process is stopped).



2.3 ALARM INDICATION

Each of the six input channels has its own LED indicator on the display. A further alarm icon situated to the left of the display line indicates whenever there is an active alarm. The symbols flash until the alarm is acknowledged or are steadily illuminated if the alarms are still active but have been acknowledged.

Alarms can be acknowledged at any time by using the Alarm acknowledge key (the left-most key of the eight).

Figure 2.4 shows the operator interface with the locations of the channel alarm indicators and the operating keys.

2.4 KEY/DISPLAY FUNCTIONS

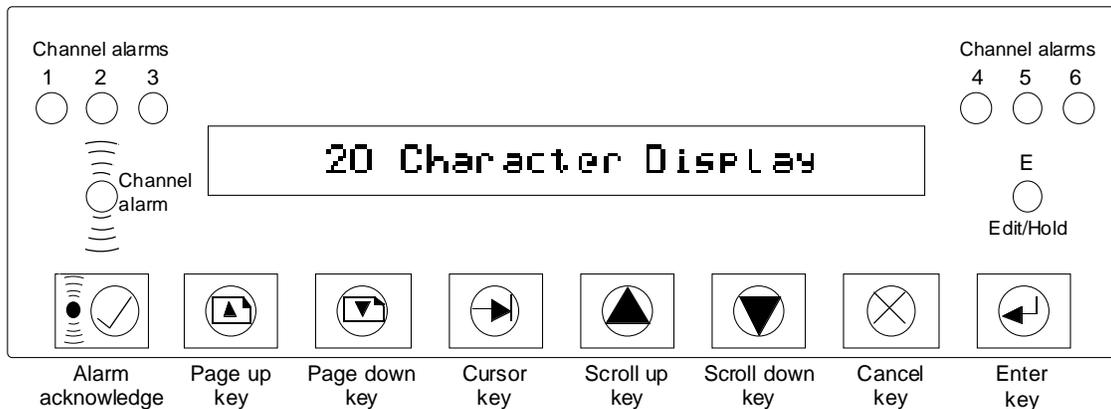


Figure 2.4 Operator interface

2.4.1 Keys

Alarm acknowledge

This key acknowledges all active, unacknowledged alarms.

Page up/down

The Page up and down keys are used

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

Cursor

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. The 'E' LED is illuminated while channel hold is in operation.

In operator and configuration pages, the cursor key is used to move from field to field where there is more than one item whose value can be changed. The cursor position is shown by the selected field's flashing on and off. For example, the Log interval page (part of chart configuration) has both hours and minutes fields (shown underlined below) which are moved between using the cursor.

Log Int 0hrs 0mins

Log Int 0hrs 0mins



2.4.1 KEYS (Cont.)

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).

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).

2.4.2 Indicators

CHANNEL ALARMS

Each input channel has a dedicated LED indicator to show alarm status. The LED comes on (flashing) when any one of the four alarms are triggered and stays on for a period determined by the type of alarm (section 4.5.2).

For latching alarms, the LED will stay illuminated until the cause (trigger) of the alarm has returned to a non-alarm state AND the alarm has been acknowledged. If the alarm trigger is still active when the alarm is acknowledged, the LED will stop flashing and remain steadily illuminated until the trigger goes inactive. If the alarm trigger has already returned to a non-active state by the time the alarm is acknowledged, then the LED will extinguish immediately on acknowledgement.

For non-latching alarms, the LED will be illuminated (flashing if unacknowledged) only until the trigger returns to a non active state.

GLOBAL ALARM

This alarm symbol to the left of the display line becomes active if there is any alarm which is active (on input and derived channels, totalizers etc.). Again the icon flashes if the alarm is unacknowledged.

EDIT/HOLD

During operation it is possible to hold one channel permanently on display (i.e. you can disable the normal scrolling-through of all the items in the display group) by operating the cursor (right arrow) key while the required channel is on display.

During configuration, the 'E' indicator illuminates if a change has been made to the configuration, which has not been written to the recorder memory by operation of the 'Enter' key.

2.5 CONFIGURATION EXAMPLE

This section gives you a step-by-step guide to the basic configuration of a single channel (N°2) 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. Section 4.5 gives details for each entry.

Notes

1. Because of the difficulties involved in representing items which flash on and off, the cursor position is shown in this manual by an underline character.
2. The 'Page up' key is used in this description to scroll through page menus. The page down key can also be used, but the scroll order is reversed and will therefore not match the description.

2.5.1 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. Log channels 1 to 6 on the chart on alarm.

2.5.2 Entering configuration

From the background display, operate the Cancel key



01 OFF

The data display area changes to the first of the operator pages.

Op: Display

Repeated operation of the Page up key scrolls through the top level operator pages. (The page down key scrolls in the opposite direction, but is omitted here for the sake of clarity.)

Op:Chart

Op:Alarm Summary

Op:Channel 1 Alarm 1

Op: Action

Op:Clock

Op:System Error

Op:Configuration

Password 00000



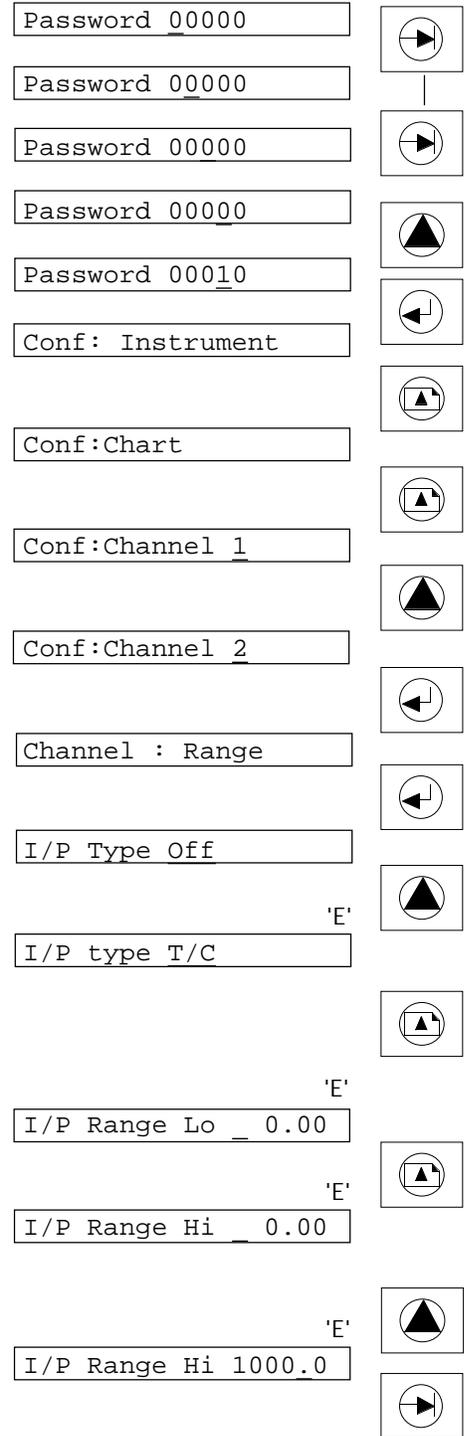
When the configuration page is reached, operate the 'Enter' key



2.5.2 Entering Configuration (Cont.)

The password is set to '10' at the factory. The password can be edited in Instrument Configuration.

To enter '10', press the cursor key three times, then the up arrow and 'enter' keys.



2.5.3 Channel configuration

Operate the Page up 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). Note the other input type choices.

The 'E' LED illuminates to remind you that you have made a change which has not yet been entered into the data base.

Operate the Page up 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 stop when '0' appears in the display.
3. Repeat step 2.
4. Repeat step 2.
5. Repeat step 2 but stop when the decimal point appears.

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

2.5.3 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 up key to call the linearisation type page.

Linearization type

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

Operate the Page up key to call the CJC page.

CJC Type

Use the up arrow key to scroll from 'Off' to 'Internal'. This is the usual CJC type choice.

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 up key.

Scaling is used where an input signal (e.g. 4-20 mA) is used to represent another type of input (e.g. 0-500 gal/min), or where, a potentiometer wiper voltage may be required to appear as, say, 0 to 100% instead of 0-1 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).

'E'
I/P Units °C



'E'
Lin Type Type B



'E'
Lin Type Type C



'E'
Lin Type Type E



'E'
Lin Type Type J



'E'
CJC Type Off



'E'
CJC Type Internal



'E'
Unscaled



'E'
Val Format XXXXX.



'E'
Val Format XXXX.X



'E'
Val Format XXX.XX



2.5.3 CHANNEL CONFIGURATION (Cont.)

Input Break Response

Use the Page up 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 outer edge of the chart and trace at Full Scale, thus making it obvious that there is a problem.

'E'

Damping None 

'E'

Brk Rsp None 

'E'

Brk Rsp Drive Hi 

Offset

Used to add a fixed value (in engineering units) to measurements. This is normally set to 0.0.

'E'

Offset _ 0.00 

'E'



Tag

This page allows entry of a 14-character text string to describe the channel. The tag can appear 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 flashing. The cursor key is used to move you along the string to the position to be edited. See section 4.1.2 for characters.

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.

'E'

Tag: Channel 1 

'E'

Tag: Furnacel tempA 

'E'

Tag: Furnacel tempA 

'E'

Tag: Furnacel tempA 

'E'

Tag: Furnacel tempA 

Channel : Range 

Channel : Alarm 1 

Alarm type

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

By default, alarm 1 of the four alarms 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 up key to call the alarm type page. By default, 'Absolute Low' appears at the display.

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

Alarm : Setpoint 

Enable Off 

'E'

Enable Unlatched 

'E'

Enable Latched 

'E'

Type Absolute Low 

'E'

Type Absolute High 

2.5.3 CHANNEL CONFIGURATION (Cont.)

Alarm Threshold (Setpoint)

Operate the Page up 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 2.5.3 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.

Alarm JobS

Use the Page up 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 'Send log 1 to chart' appears, then operate the page key.

Initially, log 1 contains input channels 1 to 6. The contents can be changed in log configuration as described in section 4.6.1.

Page to the actions choice. The 'On going Active' action is as required, and our alarm configuration is now complete,

Operate the Enter key to enter the changes made so far, then operate the Cancel key twice to return to the *Channel : Alarm 1* page.

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

Type Absolute High



Threshold _ 0.00



Threshold 780.00 'E'

Threshold 780.00



Threshold 780.00



Alarm : Setpoint



Alarm : Job 1



No Action



Chart Online 'E'

Chart Online



Chart span B Ch 1 'E'

Chart span B Ch 1



Chart Span B for All 'E'

Chart Span B for All



Disable all alarms 'E'

Disable all alarms



Ack all alarms 'E'

Ack all alarms



Send log 1 to chart 'E'

Send log 1 to chart



On going active 'E'

On going active



On going active



Alarm : Job 1



Channel : Alarm 1



Channel : Trace



2.5.3 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 manual, as appropriate.

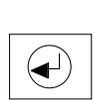
Channel : Trace



Trace Off



Trace On



Trace On



Channel : Trace



Conf:Channel 2



Op: Configuration



OP:Display



02 > Range deg C

02 < Range deg C

Section 3

OPERATOR MENUS

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SECTION 3 OPERATOR MENUS

3.1 INTRODUCTION

This section describes the operator menu structure of the basic recorder. For details of Options such as relays, analog retransmission, derived variables (math), memory card or serial communications; see the Multipoint Circular Chart Options Manual.

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' keys. The other Top level operator pages (excluding options) are:

Op:Chart

Op:Alarm Summary

Op:Alarm setup

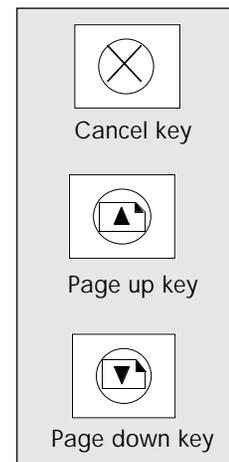
OP:Action

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 for the replacement of chart or print head
3. Align the chart time.
4. Display current chart speed
5. To initiate logging to chart.
6. To print scales on the chart immediately instead of waiting for their normal cycle time to come round.

3.3 CHART SUBMENU (Cont.)

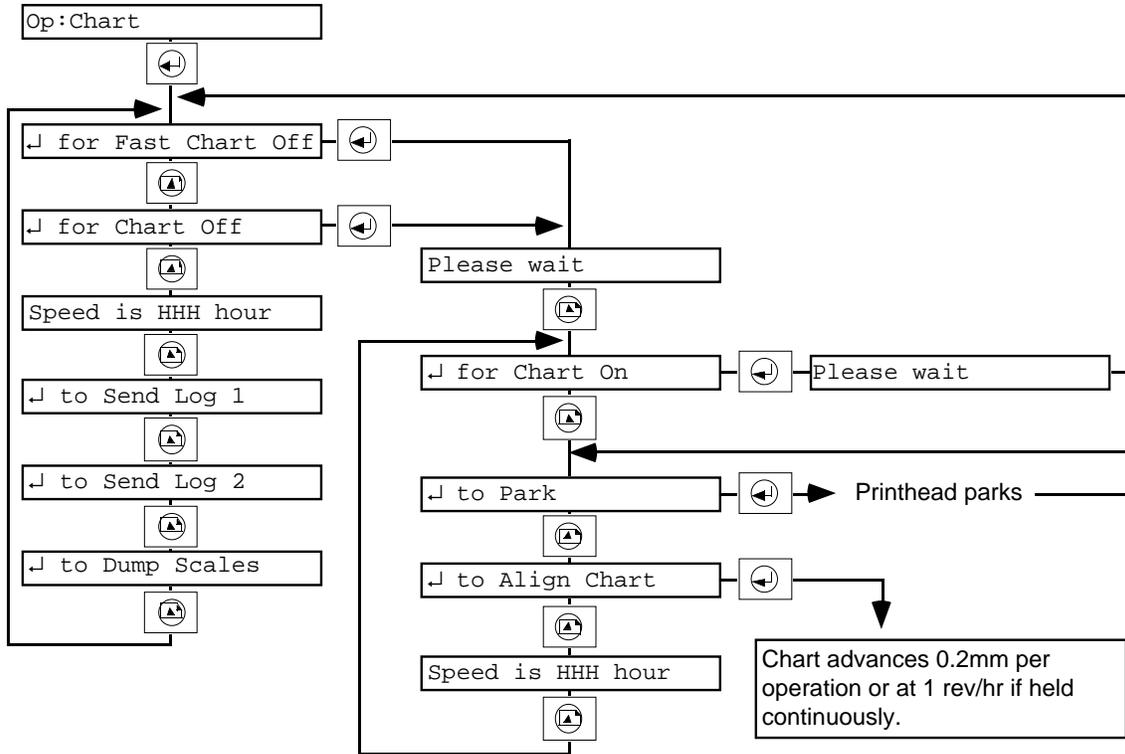


Figure 3.3 Chart Operator Menus

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 the chart is off, the printhead can be 'Parked' for replacement. 'Chart fast off' allows the recorder to complete the current line of printing (if any) before switching chart drive off. 'Chart off' causes the recorder to print any queued messages before switching off.

CHART ALIGN

This function is used to align the pre-printed time marks on the chart with the time reference point of the recorder (see section 1.3). Single operations of the enter key cause the chart to move approx 0.2 mm at its edge. Continuous operation of the key causes the chart to move continuously at 1 rev/hr until the key is released. Chart drive must be off.

3.3.2 Logs

When delivered from the factory, Log groups 1 and 2 contain all the recorder's input channels. During 'Group configuration' (section 4.6) these items can be deleted individually, and if the relevant options are present, derived variables, totalisers and counters can be added. The log format can be set up to include tags or not as required.

OPERATOR INITIATION

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



JOB INITIATION

The contents of Log 1 group and/or Log 2 group can be sent to chart and/or memory card (if present) using 'jobs' as described in section 4.1.5.

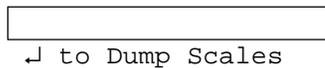
AUTOMATIC LOGGING

Two log intervals (A and B) can be configured in 'Chart configuration' and if this is done, log group 1 will be printed on the chart automatically at log interval A or B, interval B being selected by job action. Setting interval A (B) to 0hr, 0 min, disables the automatic printing of the log at interval A (B).

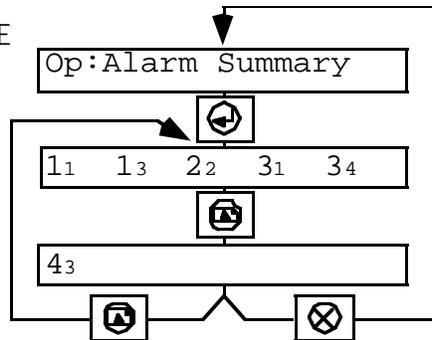
Two archive intervals (A and B) can be configured in 'Memory card configuration' if the relevant option is present. If this is done, log group 2 will be sent to memory card automatically at archive interval A or B, interval B being selected by job action. Setting interval A (B) to 0hr, 0 min, disables the automatic archiving of the log at interval A (B). Logs are printed in black with values in alarm shown in red.

3.3.3 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.



3.4 ALARM SUMMARY PAGE



For more details of alarm types and actions see section 4.5.2

For a description of the alarm display; see next page.

Figure 3.4 Alarm summary page

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).

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.

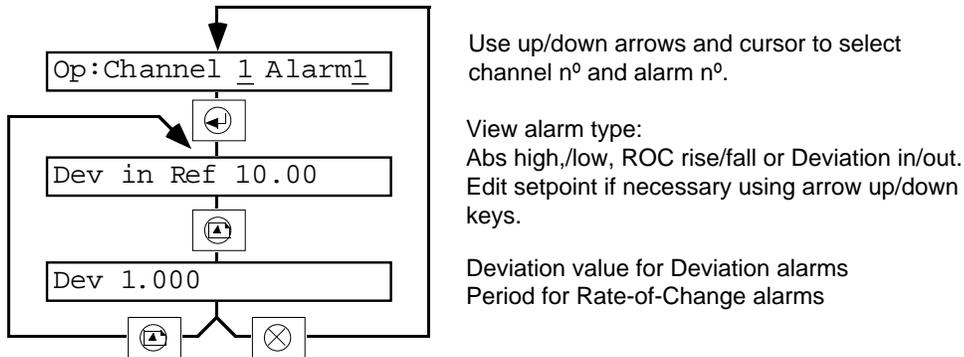


Figure 3.5 Alarm setup page

3.6 ACTION

This page allows the 'Enter' key to be used as an event trigger (Section 4.10). 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.

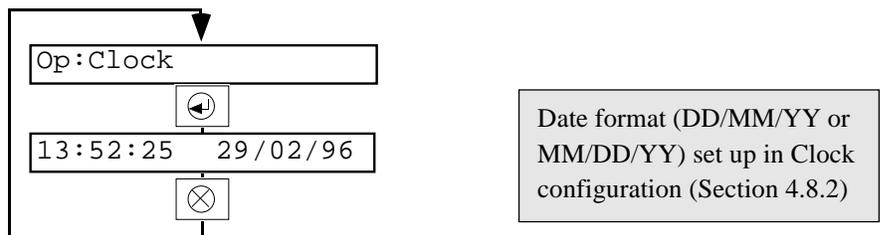


Figure 3.7 Operator clock display page

3.7.1 Back-up battery

The system date and time are maintained under power-off conditions, by a re-chargeable Nickel-metal hydride battery. When fully charged, the battery will maintain the time and date for approximately one month.

As despatched from the factory, the battery is discharged. A fully charged battery will provide backup protection for a minimum of one month at a maximum temperature of 40°C. A discharged battery, charged for one hour, will provide a minimum of 48 hours of backup protection at a maximum of 40°C.

NOTE

The battery on the main circuit board is not a user replaceable item. If the battery does not function, consult factory for service information.

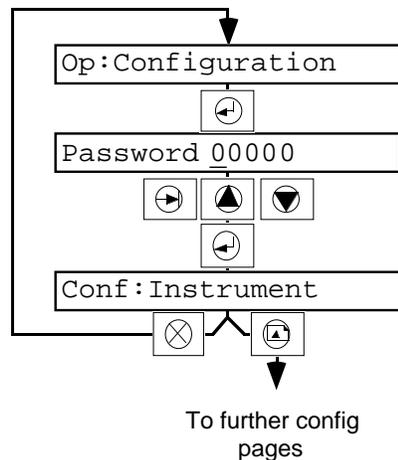
3.8 SYSTEM ERROR

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 with no disk present or no more disk space available).
- 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 printhead zero and span positions to be set to chart zero and span. On initiation, the printhead traces lines on the chart where it thinks zero and span are. If incorrect, the positions can be adjusted using the up arrow key to move the trace slightly to the right, or the down arrow key to move it to the left.

Note: Zero (center of chart) setting should always be carried out before the span (outer edge of chart) setting. The chart must be turned OFF to access this function.

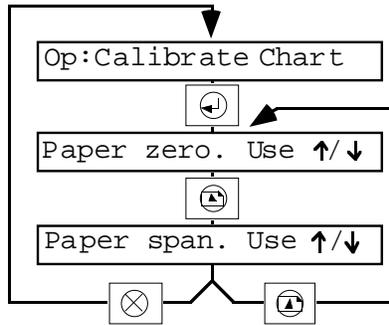


Figure 3.10a Chart calibration pages

Use up/down keys to adjust trace position
(Effects shown much exaggerated for clarity)

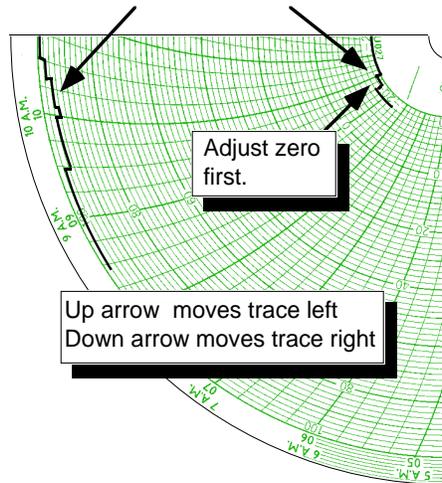


Figure 3.10b Zero and Span adjustments (simulated chart sample)

3.11 OPERATOR MENUS SUMMARY

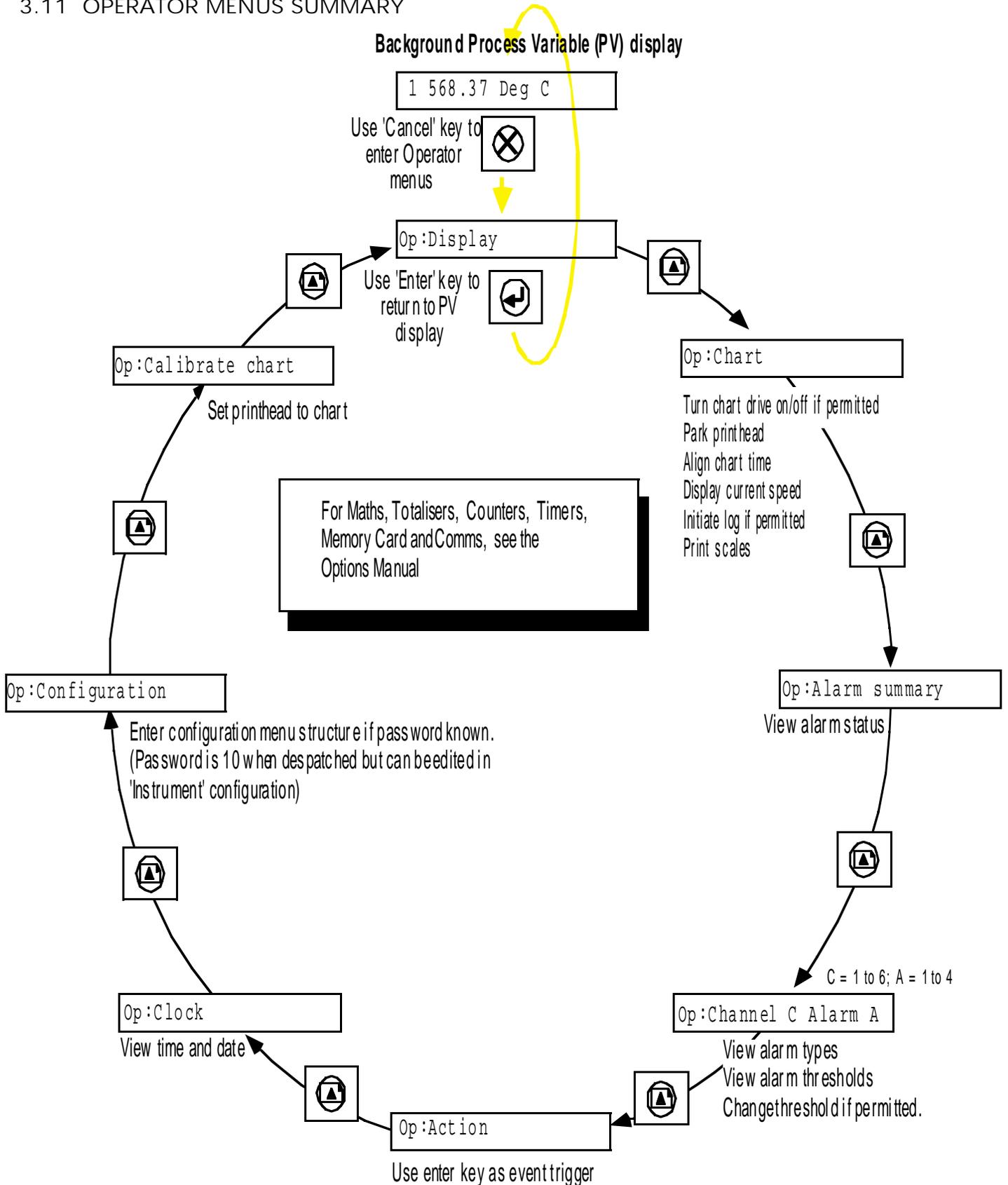


Fig 3-11a

OPERATOR MENUS cont.

	Use 'Page' keys 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 (Y) or not (N) in the menus as shipped from the factory. See section 4.13.

Chart - on / off line.....	Y
Channel - alarm setpoints (thresholds).....	N
Log - send log to chart.....	Y
-----selections present only with options-----	
DV - alarm setpoints (thresholds).....	N
DV - calculation reset.....	N
Counters - reset.....	N
Timer - control timer.....	N
Memory card - save configuration.....	N
Memory card - restore configuration.....	N
Memory card - format card.....	N
Memory card - status/directory.....	Y
Memory card - delete file.....	N
Memory card - send archive file to card.....	Y
Memory card - place offline.....	N

Section 4

CONFIGURATION

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Section 4 Configuration

Note: In order to help new users, a brief configuration guide appears as section 2 of this manual. This guide gives step-by-step instructions to show the example configuration of a single input channel to.

Note: 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.

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 ß Σ μ Ω δ ² ³ ! “ ” • [\] ^ ‘ { | } ~ Ç â å ë ì î ï Å É æ Æ ò û ý ç
 ¥ á í ó ú ñ Ñ ù ò ì ; « » α Γ π σ τ φ θ ∞ ∈ ∩ ≡ # \$ % & () * + , - . / : ; < = > _ £ ° 0 to 9
 (Space)

4.1 INTRODUCTION (Cont.)

Table 4.1 Configuration parameter locator

Parameter etc. to be edited	Configuration page name	Where to look
Adaptive recording	Chart	Section 4.4.5
Adjust input	Adjust	Section 4.14
Alarm Jobs	Channel: Alarm: Jobs	Section 4.5.2
Alarm Parameters	Channel : Alarm : Setpoint	Section 4.5.2
Break response	Channel : Range	Section 4.5.1
CJC (remote) channel	Instrument	Sections 4.3.3, 4.3.4
CJC type selection	Channel : Range	Section 4.5.1
Channel color	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 speed	Chart	Sections 4.4.1
Clock setting	Clock	Section 4.8
Configuration read/write	Transfer	Section 4.11
Damping	Channel : Range	Section 4.5.1
Date setting/format	Clock	Section 4.8
Date embedding in messages	Message	Section 4.9.1
Decimal point position	Channel : Range	Section 4.5.1
Diagnostics	Diagnostics	Section 4.12
Displayed channels	Group	Section 4.6
Dwell period	Channel : Alarm: Setpoint	Section 4.5.2
Event sources / jobs	Events	Section 4.10
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 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
Linearization type	Channel : Range	Section 4.5.1
Log contents	Group	Section 4.6
Log interval	Chart	Section 4.4.3
Messages	Messages	Sections 4.4.4, 4.9
Operator action key	Operator action	Sections 3.6, 4.7, 4.10
Operator permissions	Access	Sections 4.13
Password	Instrument	Sections 3.9, 4.1.1, 4.3.1
Pen zero/span setting	Calibrate chart	Section 3.10
Printing on the chart	Chart	Section 4.4.4
Process value in messages	Message	Section 4.9.1
Reference (deviation alarms)	Channel : Alarm : Setpoint	Section 4.5.2
Remote CJ	Instrument	Sections 4.3.3, 4.3.4
Restore configuration	Transfer	Sections 1.2.2, 4.11
Save configuration	Transfer	Sections 1.2.2, 4.11
Shunt Value	Channel : Range	Section 4.5.1
Tag	Channel : Range	Section 4.5.1
Text entry/embedding	Various	Sections 4.1.2, 4.9.1
Time embedding in messages	Message	Section 4.9.1
Time set	Clock	Section 4.8
Value format	Channel : Range	Section 4.5.1

4.1.3 Options

In order to simplify this manual, option descriptions for relays, analog retransmission, derived variables (math), memory card and serial communications are included in the Options Manual supplied, if appropriate, with your recorder.

4.1.4 Logs 1 and 2

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) memory card option is fitted, they can be sent to memory card. As despatched from the factory, the two log groups contain input channels 1 to 6. 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 group format to be defined, i.e. whether Process variable (PV) tags and instrument tag are to be included.

Logs can be initiated in the following ways:

- a. Automatically at fixed time periods (section 3.3.3)
- b. From the Operator menu (section 3.3.3)
- c. By job action - (section 4.1.5)

Note: When logging automatically:

Log 1 prints contents on the chart at one of two logging intervals (A or B) set up in Chart configuration (section 4.4.3). Normally, interval A is used; interval B is selected by job action (section 4.1.5).

If a memory card archive option is fitted, Log 2 saves its group contents to the memory card at one of two archive intervals (A or B) set up in the Memory Card configuration (described in the options manual). Normally, archive interval A is used; interval B is 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 job actions and 'modifiers' is given in figure 4.1.5 following.

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

4.1.5 JOBS (Cont.)

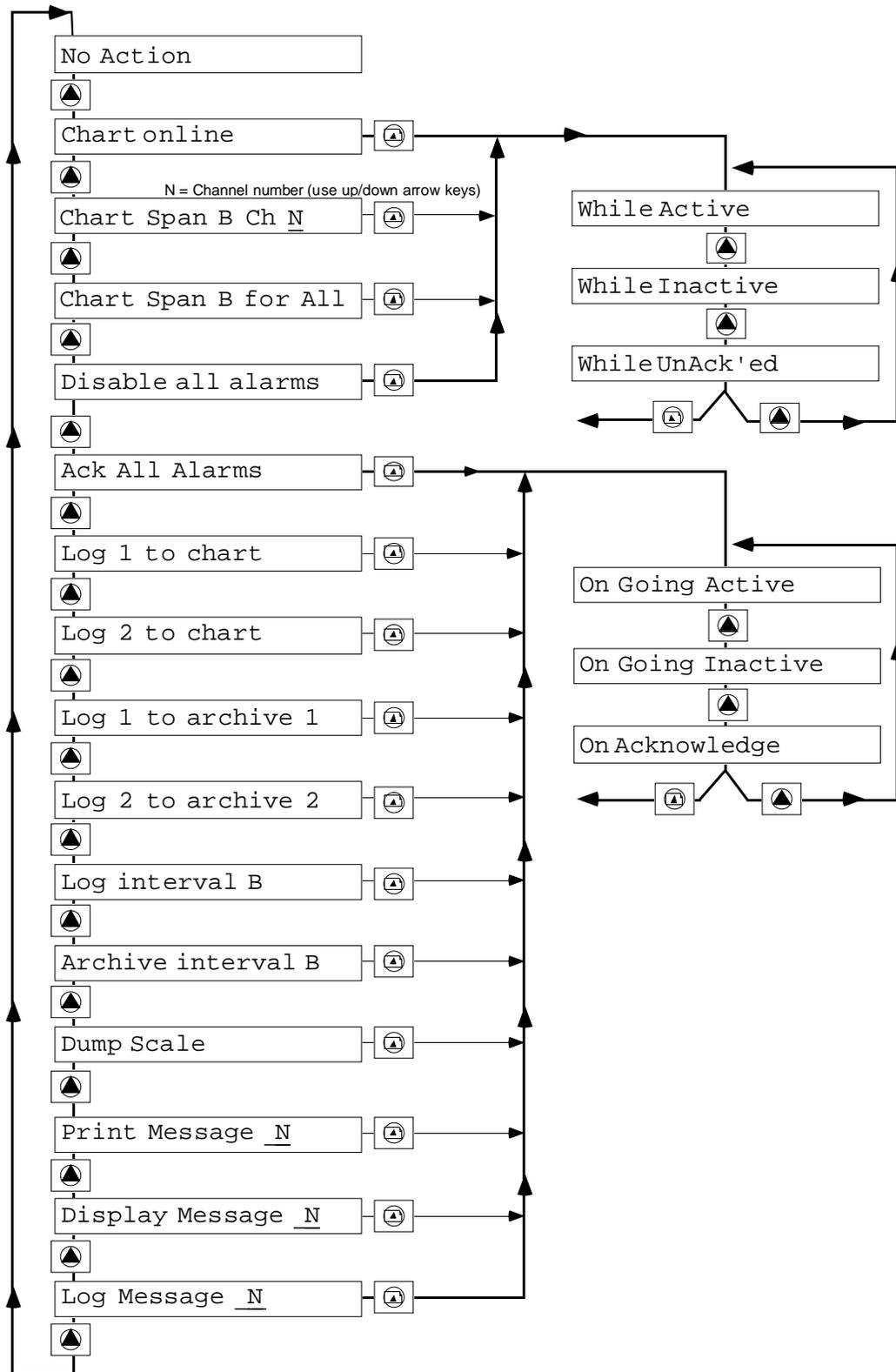


Figure 4.1.5 Jobs and modifiers

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.

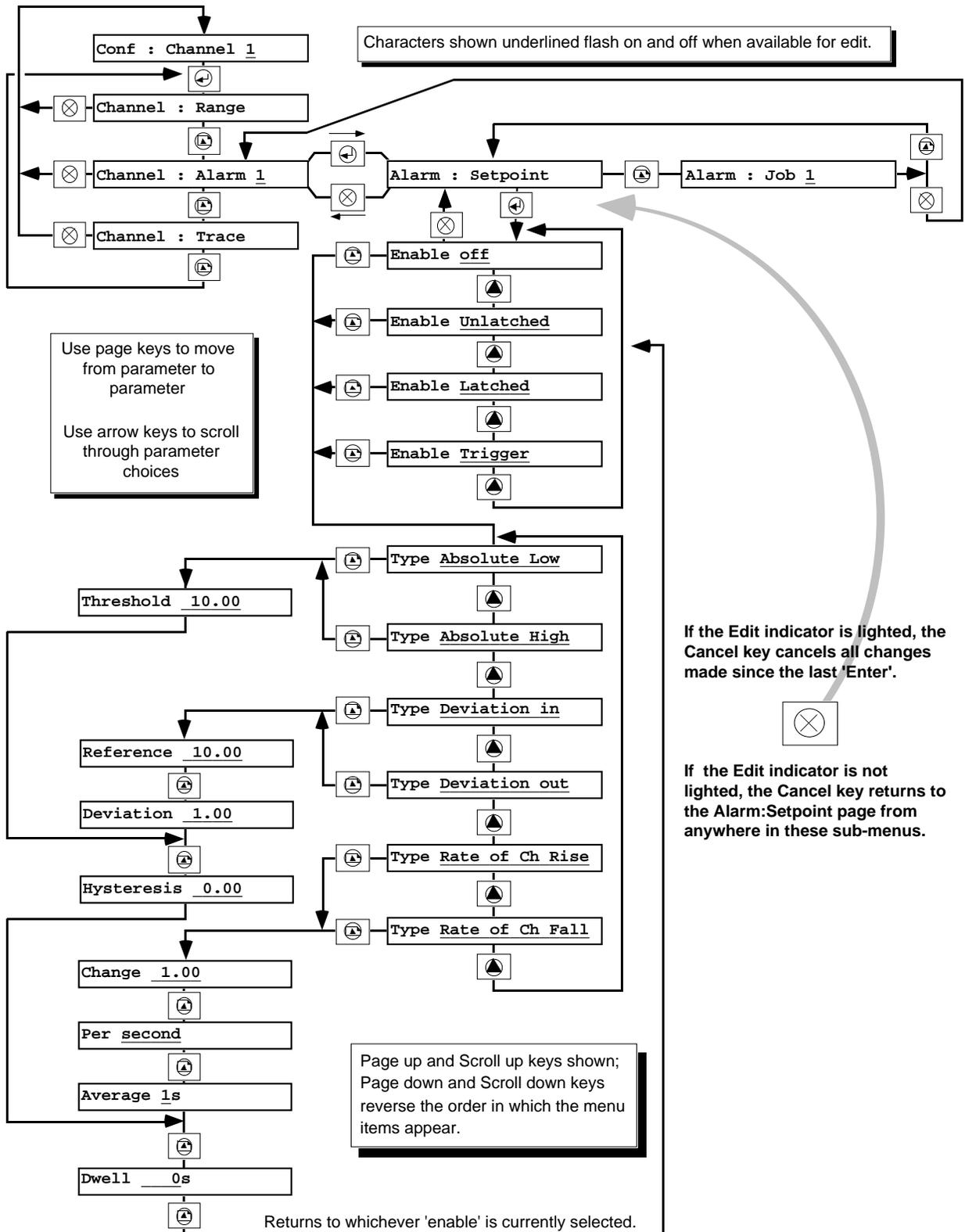


Figure 4.2 Configuration techniques

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

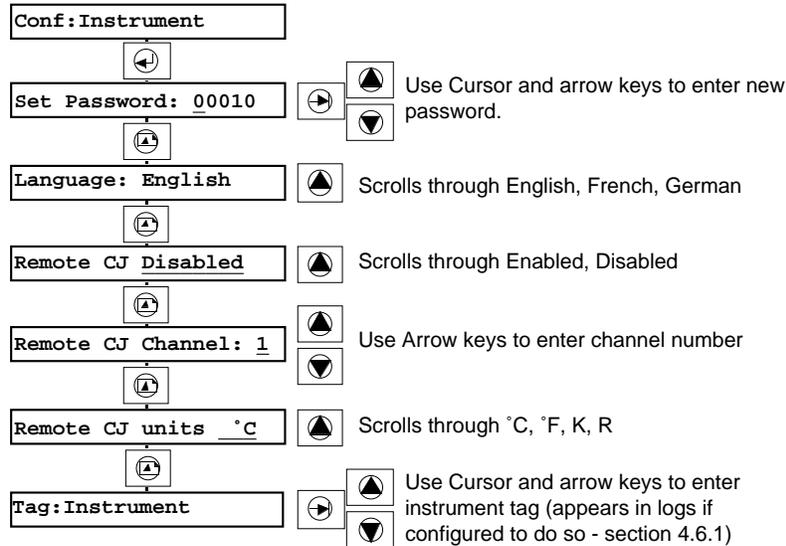


Figure 4.3 Instrument Configuration pages

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 16-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. Chart speed.
2. Log interval for logging Log 1 Process Variables automatically on the chart.
3. Time/date/scale/chart speed etc. data.
4. Adaptive recording on/off.

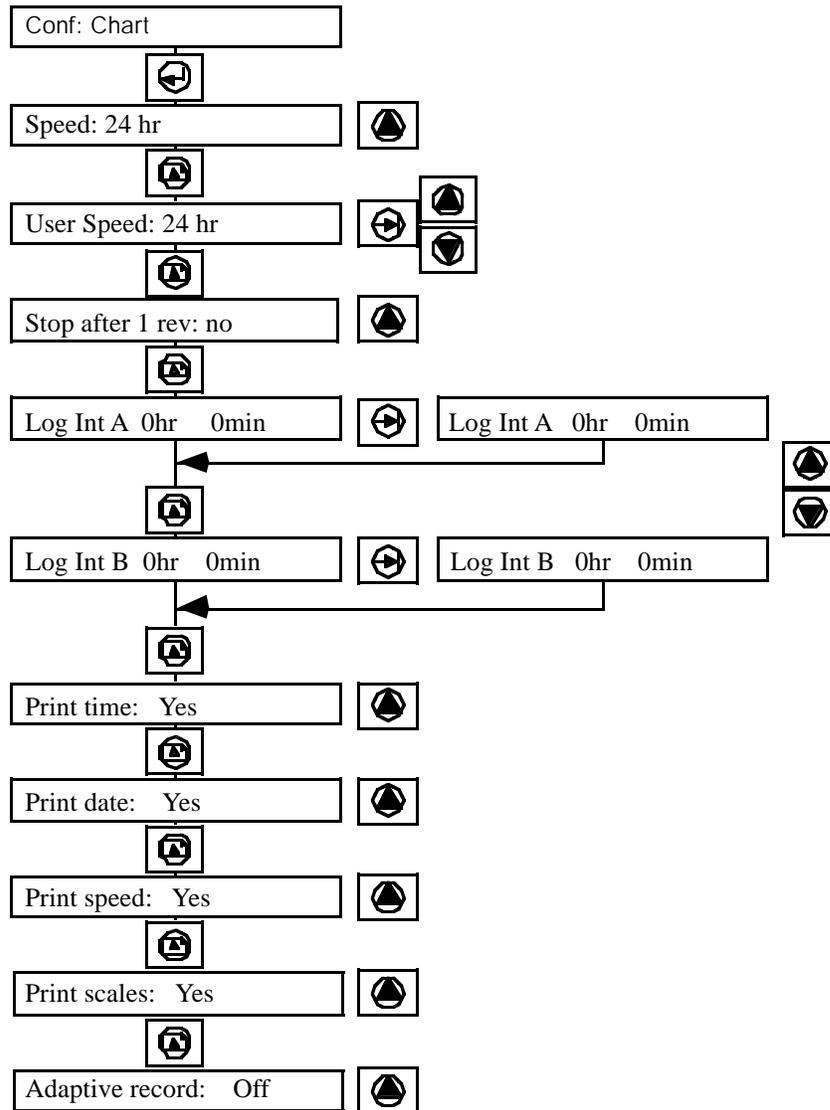


Figure 4.4 Chart configuration pages

4.4.1 Chart speed

Standard chart speeds of 1 revolution per: 12 hours, 24 hours, 48 hours, 72 hours, 7-days or user can be selected. If 'User' is selected, the recorder will use the speed entered on the following page.

4.4.2 User chart speed

A number of hours per revolution, from 1 to 960, can be entered here. This speed is used if 'User' is selected in the Chart speed page described above. All annotation stops (tracing continues) at chart speeds faster than 6 hr/rev.

4.4.3 Stop After One Revolution

When selected, this feature causes the chart to complete one turn from the point at which it was last placed online and then stop. The tracing will stop, the "Chart online" event source will become inactive and any demand annotation will print at maximum speed.

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 'hr' to 'min' fields, and the up/down arrow keys to enter the required value. An entry of 0 hours, 0 minutes stops automatic logging to chart at that interval (i.e. A or B). For log content and format, see Group configuration - section 4.6

Log interval A is used under normal conditions. Interval B can be selected only through job action (section 4.1.5)

4.4.5 Printing

TIME/DATE/CHART SPEED

If individually selected 'yes', time, date, and chart speed can be on the chart at chart on-line.

SCALE

If selected 'Yes' low and high end scale values will be printed at regular intervals on the chart.

MESSAGES

Twenty user messages of 20 characters each can also be printed as a result of job action.

4.4.6 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.

4.5 CHANNEL CONFIGURATION

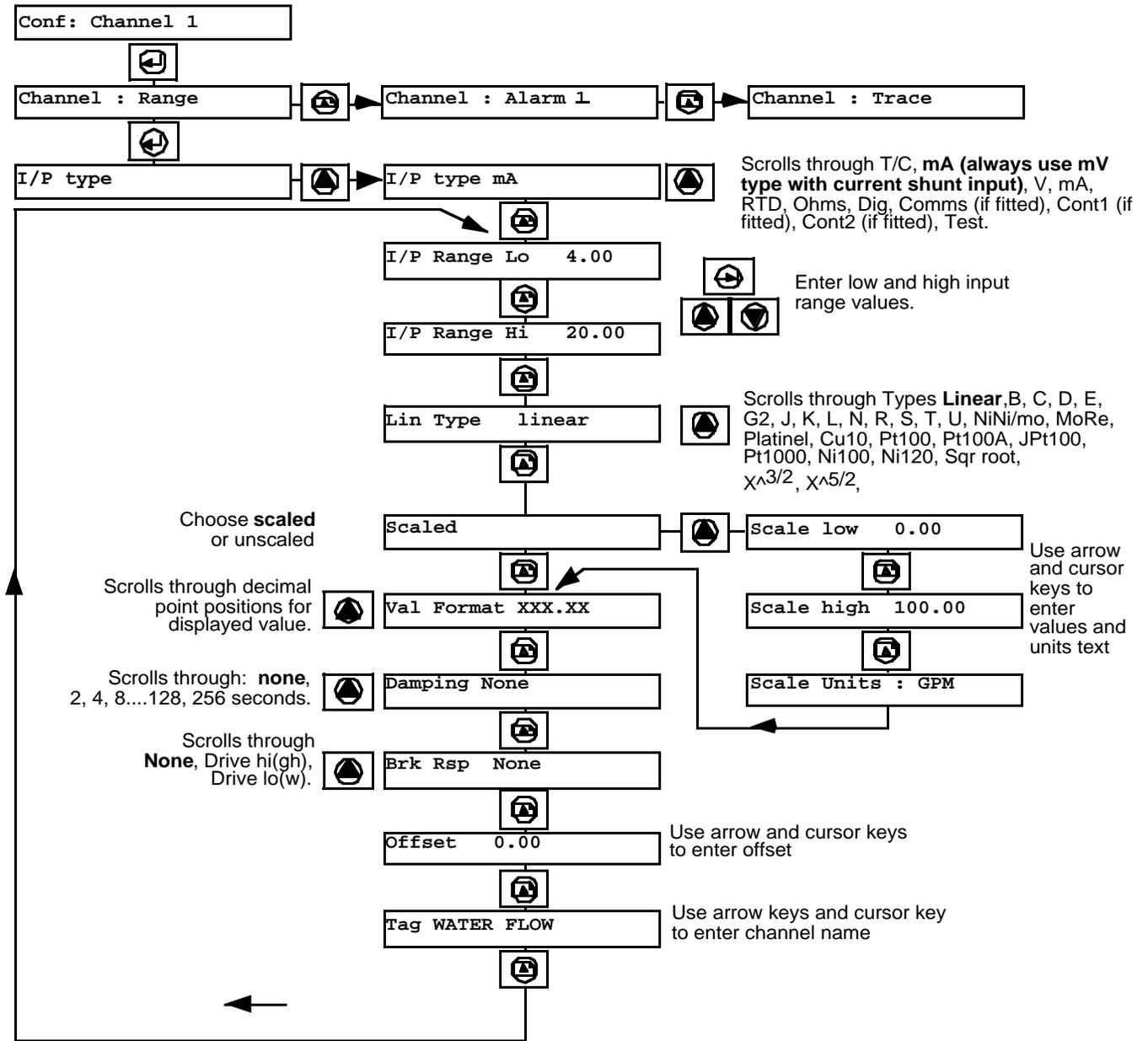


Figure 4.5.1 Channel configuration pages for thermocouple pages

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

4.5.1 Range configuration

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

Figure 4.5.1 shows the configuration menu for Input Type = volts (from a 4-20 mA input using a 250Ω shunt. Other input types are similar, and any parameters unique to a particular input type are indicated in the accompanying descriptions. Figure 4.5.1 Channel configuration pages for voltage inputs

Input type

Allows an input type of Thermocouple (T/C), mV, V, mA, Resistance Temperature Detector (RTD), Ohms, Digital input, Comms (if communications fitted), Cont 1/2 (if controller(s) fitted) or 'Test' to be selected. The appearance of some subsequent display pages is dependent on this selection.

NOTE - To ensure best accuracy

ALWAYS use mA input type with current input through a shunt resistor.

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. Best accuracy can be achieved by using a current loop shunt of 50Ω or less (1.0 Volts at 20 mA). See page A-3 for accuracy information.

Input units

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

Linearization 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 Pt₁₀₀, Pt₁₀₀₀, Ni₁₀₀, JPt₁₀₀, Pt₁₀₀A, Cu₁₀

4.5.1 RANGE CONFIGURATION (Cont.)

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).

Scaled

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.

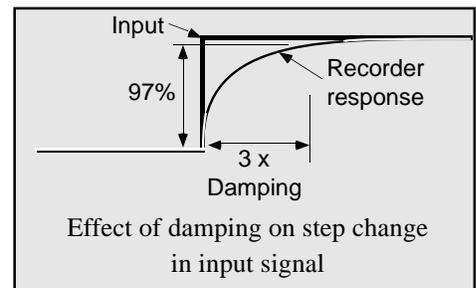
Value Format

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 X.XXXXX (when set to X.XXXXX, the decimal point will "float" to the right as the number increases).

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.



Break Response

For lower ranges only (i.e. thermocouples and voltages less than 150mV) the recorder can be made to respond in a known way if a break in the input circuit is detected.

NOTE - The break response for ALL CHANNELS on any single recorder must be selected as either: (upscale or none) OR (downscale or none) upscale and downscale CANNOT BE MIXED on a recorder

Break response can be set to

- None (trace drifts with input wiring acting as an aerial)
- Drive hi (trace is placed at the outside edge of the chart)
- Drive lo (trace is placed at the inside edge of chart)

4.5.1 RANGE CONFIGURATION (Cont.)

Open / Closed

For Input Type digital (not available on Channel 1), 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 four test waveforms can be selected and scaled both for tracing on the chart and for the displayed value:

Triangle - 5 hrs or 40 mins

Sine - 5 hrs or 40 mi

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 (or waiting) 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.

Use arrow keys to select channel

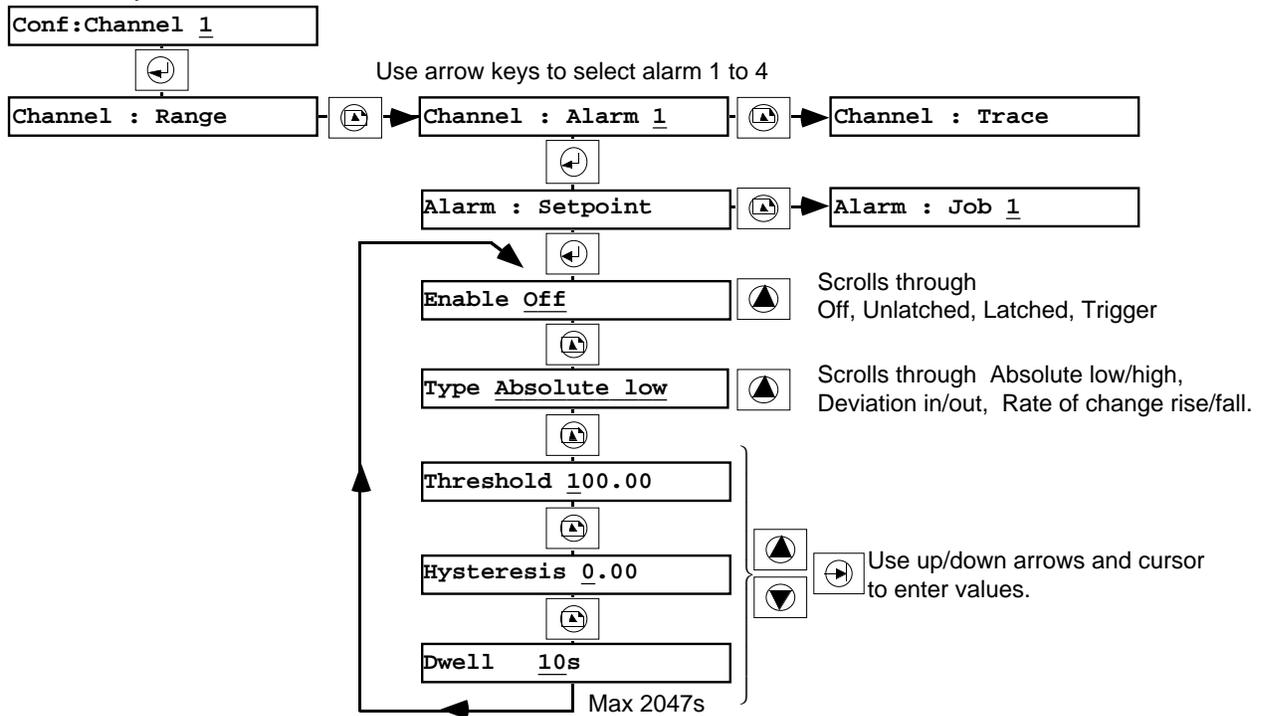


Figure 4.5.2a Alarm configuration pages: Absolute alarms.

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 can be printed on the chart if alarm jobs trigger Customer Messages.
- 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. Continuous jobs remain active only until the source has returned to a non-alarm state (whether or not the alarm has been acknowledged). NOTE - relay action does not latch when alarm is no longer active.
- 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.

4.5.2 ALARM CONFIGURATION (Cont.)

For clarity, the following alarm diagrams are shown with straight rather than curved value lines. PV values increase from the right (inner) to left (outer) portion of the chart.

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*).

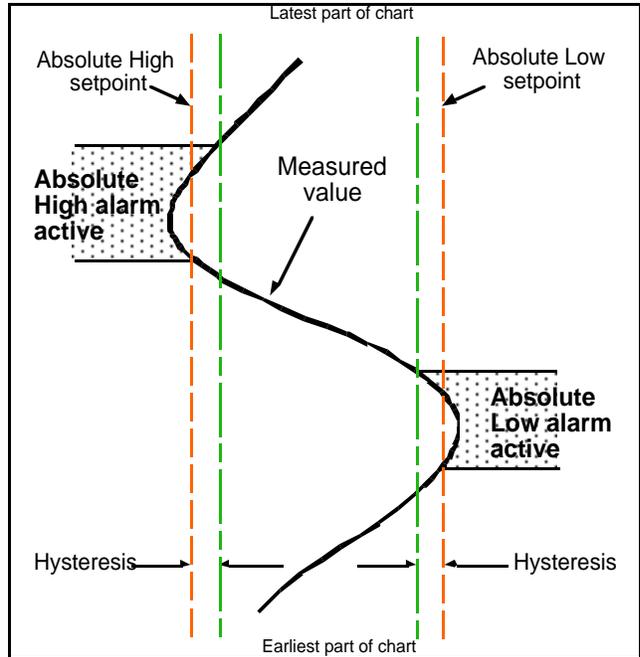


Figure 4.5.2b Absolute alarm definition

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.

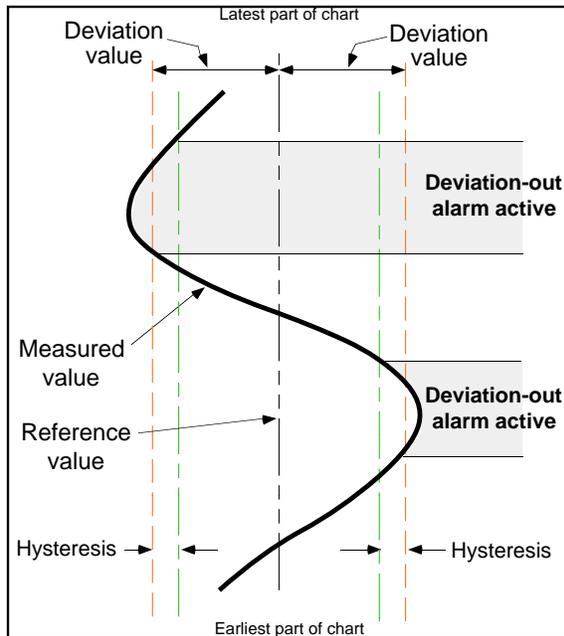


Figure 4.5.2c 'Deviation out' alarm definition

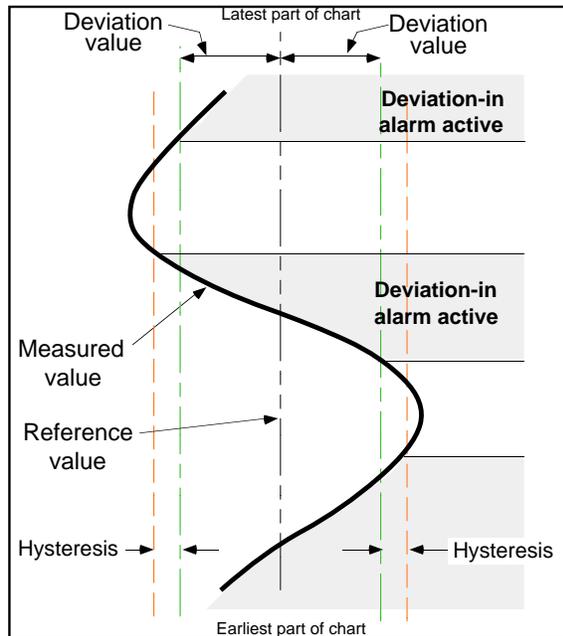


Figure 4.5.2d 'Deviation in' alarm definition

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.

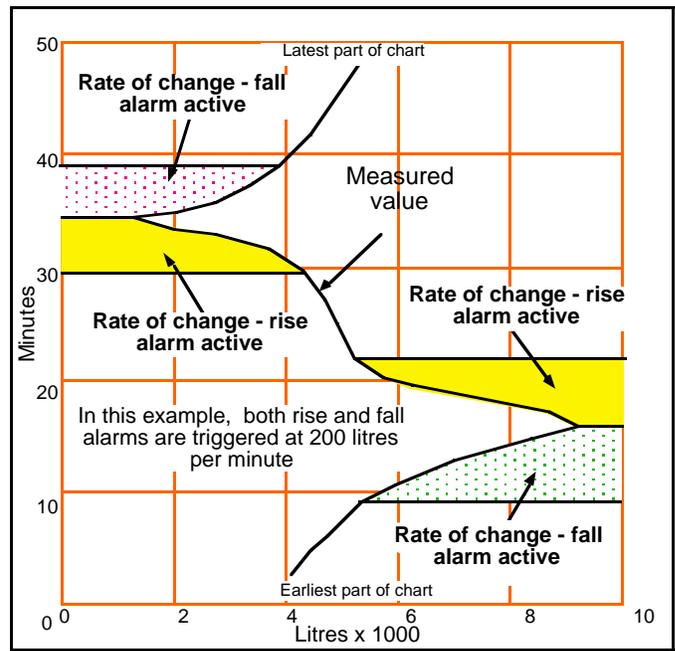


Figure 4.5.2e Rate-of-change alarm definitions

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 on page 4-15, 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 chart spans A and B for the channel

Figure 4.5.3 on the next page shows typical Channel Trace pages.

Trace

Scrollable through Off and On.

Color

The following colors can be selected: blue, red, green, black, blue/red and green/black . For single color traces, the channels' scales are printed on the chart in the same color as the trace. For bi-color traces, the traces swap color every 6 mm (approx.) and the scales are printed in blue for blue/red traces and green for green/black traces.

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 chart 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 as a trigger (to avoid alarm light coming on) at say, 600°C with an associated job: 'Span B for 1' 'while active'.

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

4.5.3 TRACE CONFIGURATION (Cont.)

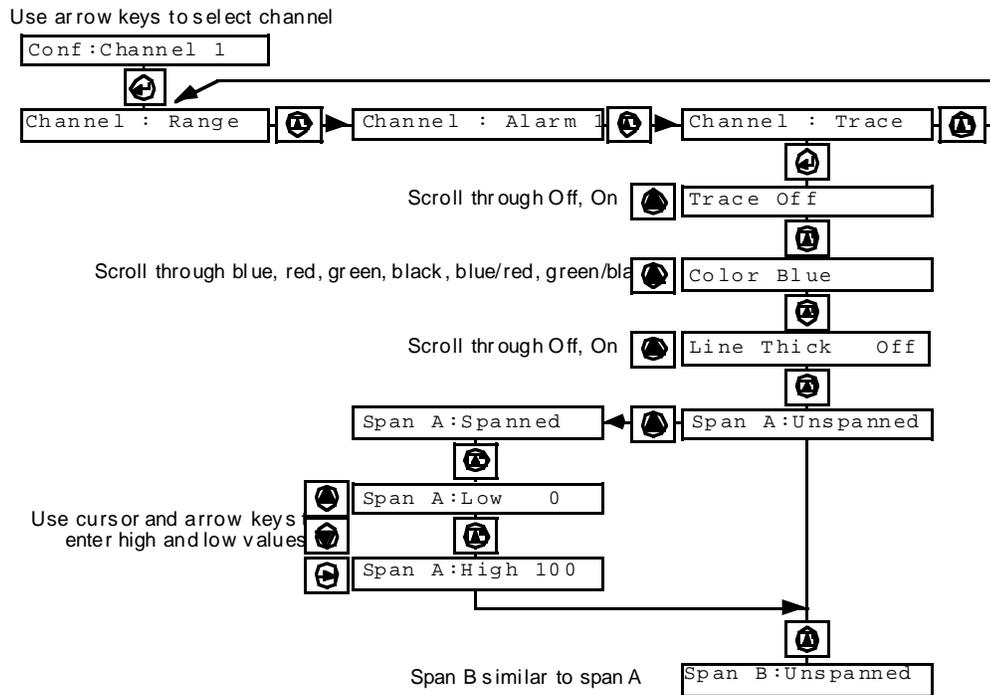


Figure 4.5.3 Channel Trace pages.

4.6 GROUP CONFIGURATION

This allows contents and format of four* groups to be set up: Log1, Log2, DV*, and display.

* Note: DV appears only if the maths option is fitted.

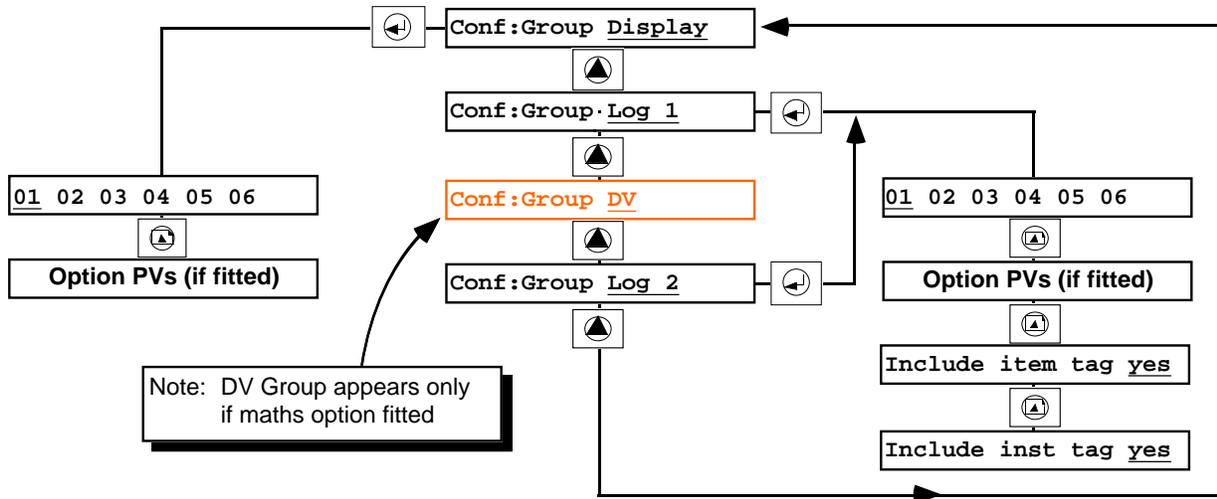


Figure 4.6 Group Configuration pages

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 4.4.3) 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

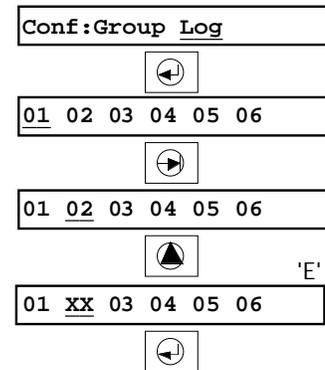
Initially, the log group contains all input channels. In order to edit the list, the cursor key is used to move the underline to the item to be added, and the arrow keys used to change its status from included (PV number shown) to excluded (XX shown). The example shows how to delete channel 2 from log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

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

When present, optional derived variables, totalizers and counters can be added to any log.

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. This group can contain all values available to the display and the two logs, but cannot be printed to the chart.

4.6.3 Display Group

The Display group is similar to the Log group 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 up to two jobs. See section 4.10 (Internal events) for more details

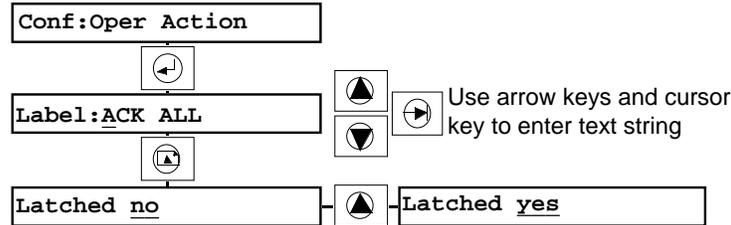


Figure 4.7 Operator action configuration

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 nickel-cadmium battery as described in section 3.7.1

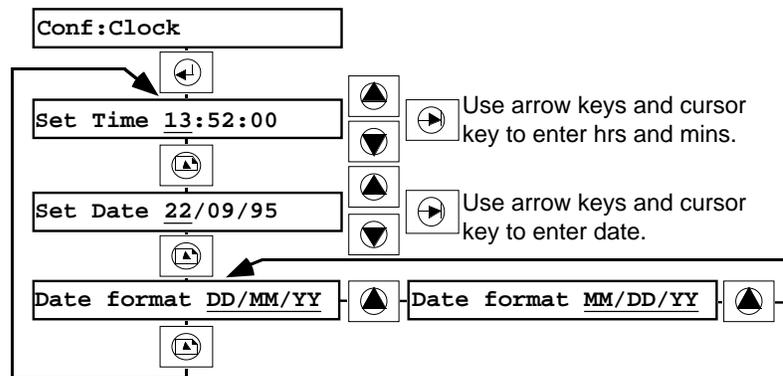


Figure 4.8 Clock configuration pages

4.8.1 Set Time

Use the up/down keys to set the hours. 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.

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 (packed data only) if present. 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)
- <TMDT> Embeds time and date

TWO PART SEQUENCES

The remaining sequences require an 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

- NO Causes the Item's ID to be embedded (e.g. t2, 06)
- 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
- VU Causes the items process value and units to be embedded.

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.

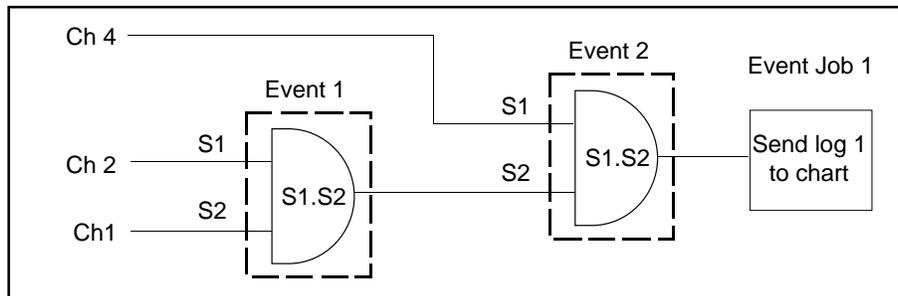
If, instead, Message 1 were <TIME><6.TA><6-PV> then the current time and the tag and process value of channel 6 would be printed on the chart when the channel 3 alarm went active.

4.10 INTERNAL EVENTS

As standard, there are six internal events, which can be triggered by one or more sources, and which can generate up to two jobs each when active. Input sources can be ANDed or ORed, so multiple logical inputs can be used.

For example, to send a log to the chart when any alarm on channel 1 and channel 2 and channel 4 are active, we could set up events 1 and 2 as follows:

<p>Event 1: Enabled Source 1(S1) AND Source 2 (S2) S1:Alm on channel 1. S2:Alm on channel 2.</p>	<p>Event 2: Enabled S1 AND S2 S1:Alm on channel 4 S2:Event 1</p>	<p>Job 1: Log 1 to chart On going active.</p>
--	--	---



4.10.1 Event sources

- Event sources are:
- Alarm on Ch N (any Alarm on specified channel)
 - Chart is online (See section 4.4.3 - Stop after One Revolution).
 - Clock failure
 - Event N (Another specified event - see figure above)
 - Glb Channel alarm (Alarm on any channel)
 - Glb UnAck Ch Alm (Unacknowledged alarm on any channel)
 - Operator Key (See sections 3.6 and 4.7 - Operator action)
 - Power up
 - System error (Section 3.8)

4.10 EVENT CONFIGURATION (Cont.)

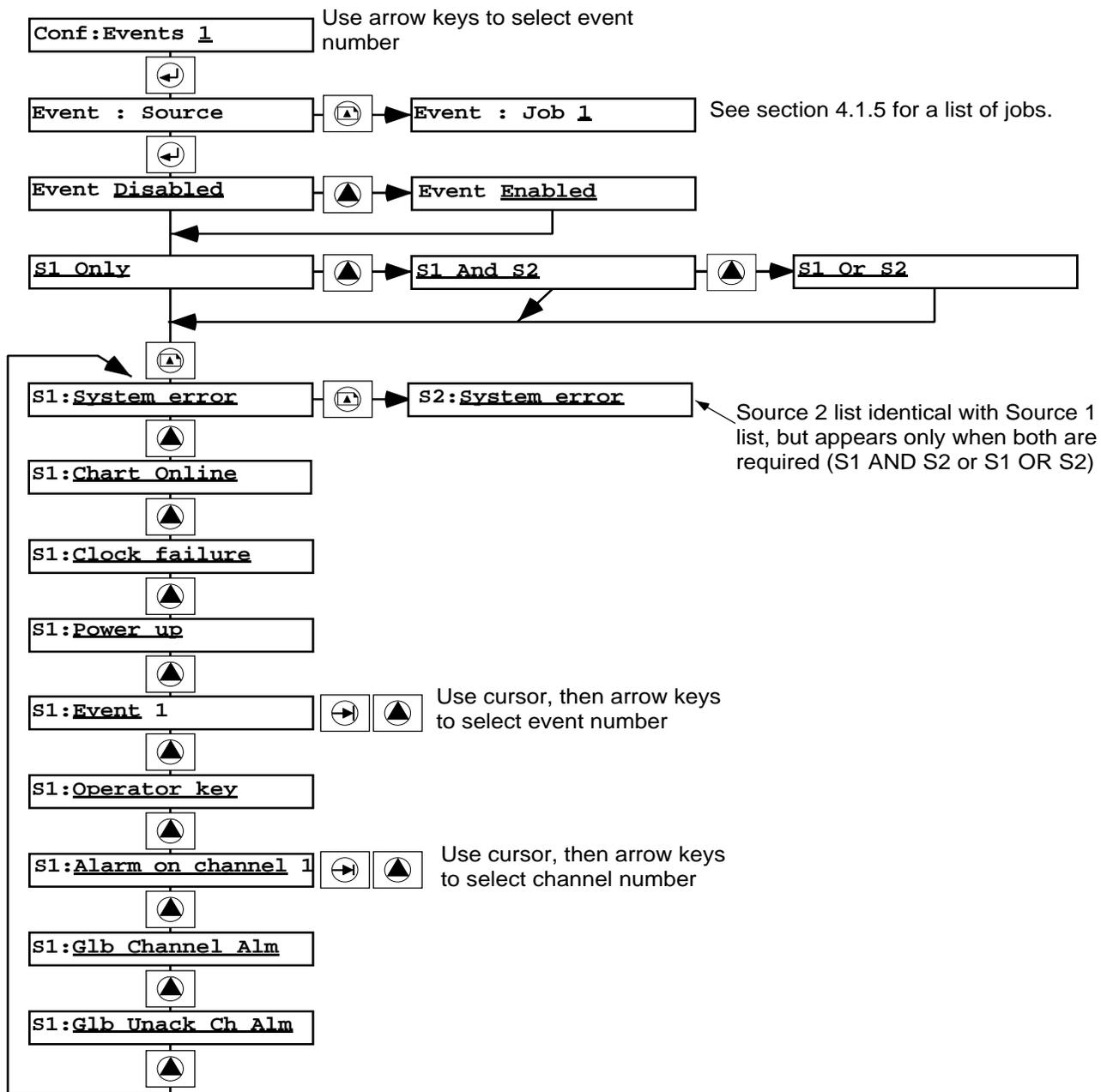


Figure 4.10 Internal event config

4.11 CONFIGURATION TRANSFER

This facility allows the transfer between recorders, or between the recorder and a host computer (running PC configuration software) using a jack socket located towards the right of the bulkhead behind the cassette. 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 the normal RS232 port with 12 Volt signals.

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)

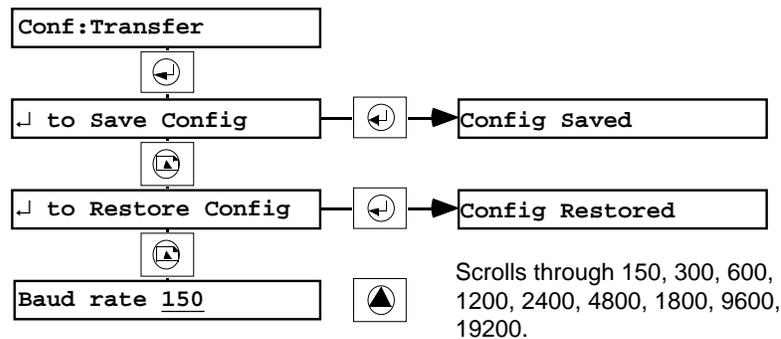


Figure 4.11 Configuration transfer pages.

↵ 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 data bits 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.

For jack plug wiring, see section 1.2.2

Wiring to computers requires a cable (available from the manufacturer) that has a 9 or 25 pin serial port connector as well as the jack plug for the recorder. Details of this wiring are provided with the available PC configuration software.

4.12 NOT USED

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).

Switch the chart drive on and off: default = Yes

Initiate Log: default = Yes

Adjust alarm thresholds: default = No

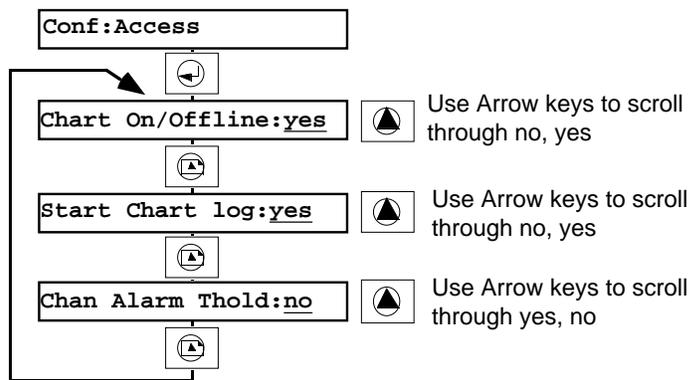


Figure 4.13 Operator permissions pages

4.14 ADJUST

4.14.1 Input adjust

NOTE, input boards are permanently calibrated and require no periodic calibration.

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 stabilized, the 'correct' value is entered. The process is repeated for a value near the high end of the input range.

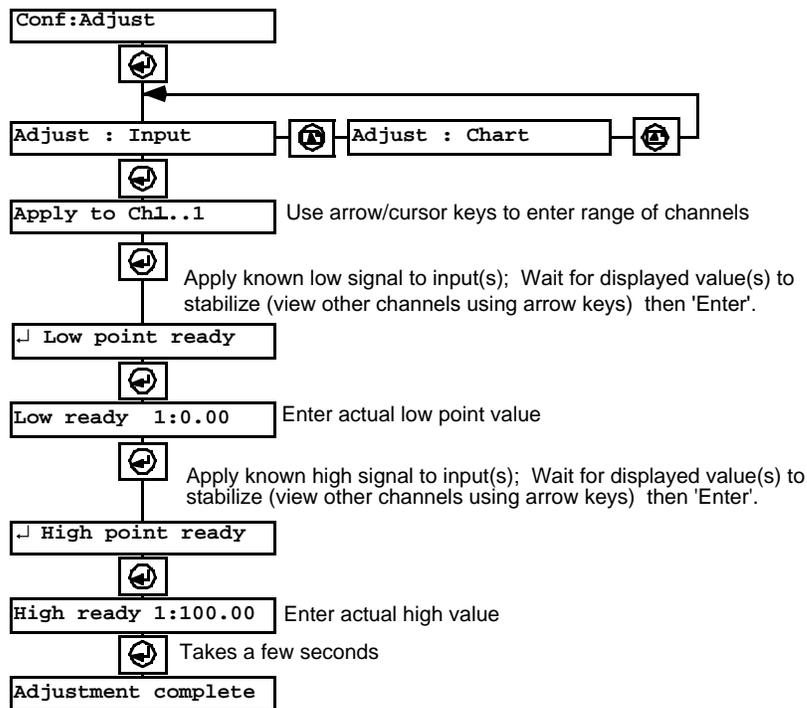


Figure 4.14.1a Input adjust configuration pages

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

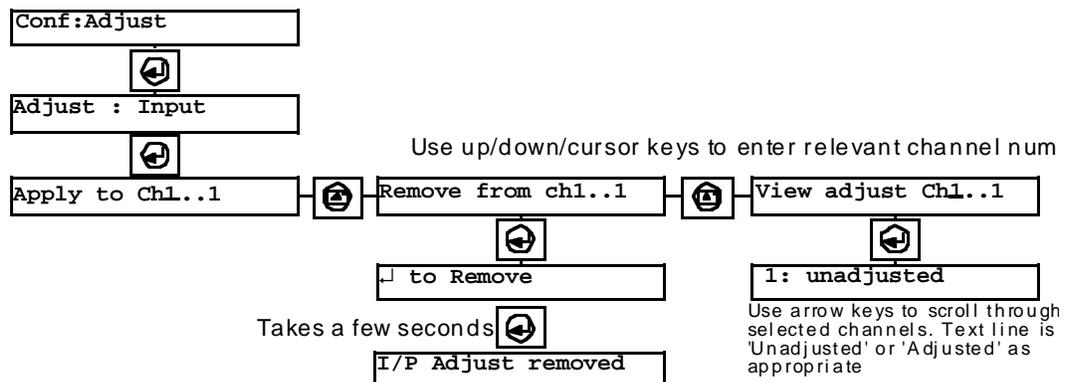


Figure 4.14.1b Remove/View adjust configuration pages

4.14.2 Chart adjust

This feature is the same as the Operator Calibrate Chart feature described in section 3.10

4.15 DEFAULT CONFIGURATION

This section allows the user to return to the factory set configuration. 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.

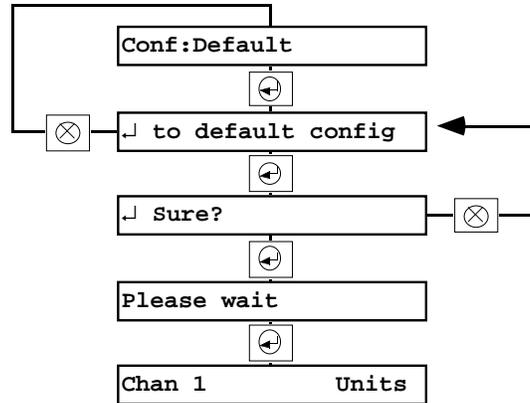
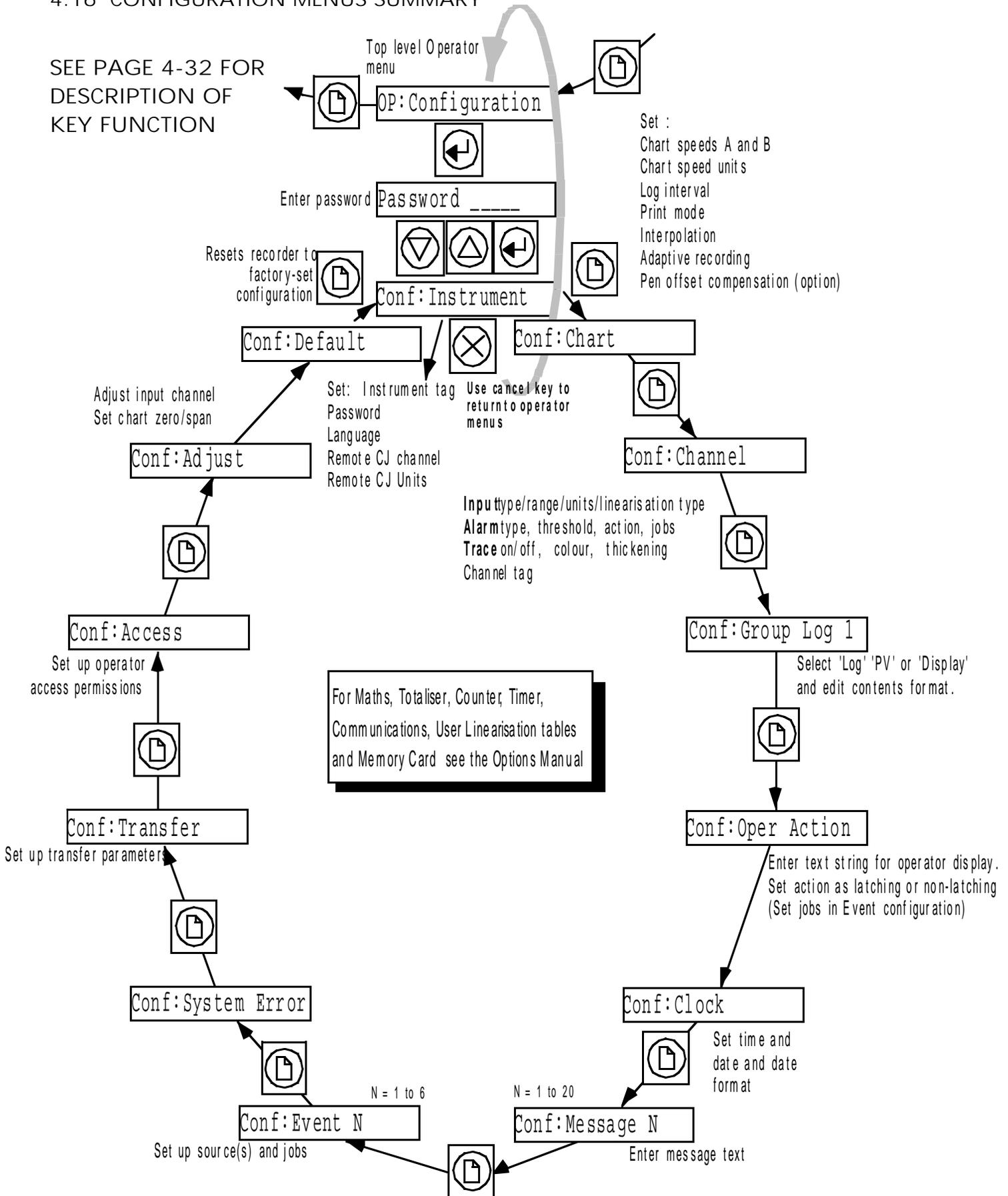


Figure 4.15 Default configuration

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4.16 CONFIGURATION MENUS SUMMARY

SEE PAGE 4-32 FOR DESCRIPTION OF KEY FUNCTION



	
	Use 'Page' keys 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.

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Section 5

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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.

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5.1 COSHH

5.1.1 Printheads

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 Strong oxidising agents and temperatures above 90° C
Stable	Yes	Unstable	
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 deleterious effects arising from the inks or pen tips.		

5.1.2 Batteries

Product: Rechargeable batteries			
Part numbers: PA250331			
HAZARDOUS INGREDIENTS			
Name	% Range	TLV	Toxicological data
Mischmetal alloy	10	Not available	
Nickel Hydroxide	10	Not available	Highly toxic if ingested
Potassium hydroxide	8	Not available	Highly toxic, Highly corrosive.
PHYSICAL DATA			
Boiling point	Not applicable	Specific gravity	Not applicable
Vapour pressure	Not applicable	Solubility in water	Not applicable
Odour	Not applicable	Colours	Not applicable
FIRE AND EXPLOSION DATA			
Flash point (deg C) (Method used)	Not applicable		FLAMMABLE LIMIT
Extinguishing media	Use medium appropriate to primary cause of fire		LEL Not applicable UEL Not applicable
Special fire-fighting procedures	Not applicable		
Unusual fire and explosion hazards	Batteries might explode due to excessive pressure build-up which might not be self-venting. Toxic fumes might be generated.		
HEALTH HAZARD DATA			
Threshold limit value	Not applicable		
LD 50 Oral	Not applicable	LD 50 Dermal	Not applicable
Skin and eye irritation	Should cells leak, the leak material will be a caustic solution. Avoid contact.		
Over-exposure effects	Not applicable		
Chemical nature	See above. There are no risks in normal use.		
FIRST AID PROCEDURES			
Eyes and skin	If leakage occurs, wash the affected area with plenty of water and cover with dry gauze. If eyes are affected, wash with plenty of water. Seek medical assistance.		
Ingestion	If ingestion of leak material occurs, DO NOT induce vomiting. Give plenty of milk to drink. Obtain immediate medical assistance, stating 'NiMH battery'. If battery ingested, seek medical assistance.		
Inhalation	Not applicable		
REACTIVITY DATA			
STABILITY			CONDITIONS TO AVOID
Stable	Yes	Unstable	Mechanical damage, Overcharging Short circuiting terminals Charging temperatures outside the range 0 to 65°C
Hazardous decomposition products	None		
Hazardous polymerisation	Will not occur		
SPILL OR LEAK PROCEDURES			
In normal use there is no risk of leakage. If batteries are abused, this may lead to the leaking of a caustic alkaline solution which will corrode aluminium and copper. The leak material should be neutralised using a weak acidic solution such as vinegar, or washed away with copious amounts of water.			
Contact should be avoided			
DISPOSAL			
Batteries must be disposed of in accordance with current local regulations. Batteries should not be discarded with normal refuse.			
SPECIAL PROTECTION INFORMATION			
Respiratory	Not applicable		
Ventilation	Not applicable		
Protective clothing	Not applicable		
Other			

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 Linearization 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 4.13) 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.

5.3 LIST OF EFFECTIVE PAGES

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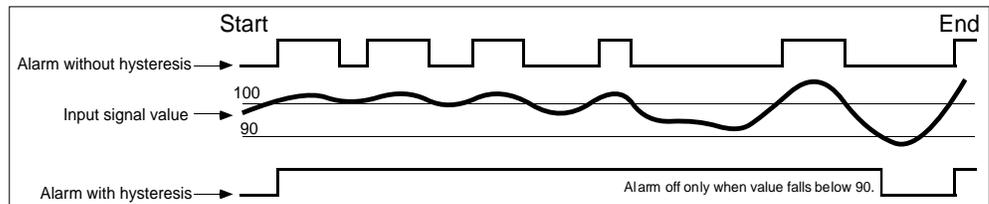
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5.4 GLOSSARY OF TERMS

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 <i>input signal</i> 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 <i>job list</i> , such as causing a <i>relay output</i> 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 linearized copy of an <i>analogue input</i> or <i>derived channel</i> . 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 drive	A mechanical paper rotation. Includes chart hold-down tabs and a means for gripping the center of the chart to turn in at a specified rate..
Cold Junction Compensation	Also known by the abbreviation CJC. The current generated by a <i>thermocouple</i> (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. <u>Internal</u> . The recorder has integral temperature detectors measuring the temperature near the terminal blocks (the cold junction for directly connected TCs). <u>External</u> . 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. <u>Remote</u> . 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 <i>configure</i> them, or to read information from them regarding the <i>process variables</i> 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 <i>memory card</i> or <i>communications</i> 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.
Counters	Counters can be incremented or decremented by digital/discrete inputs or by <i>job list</i> action. Counters can be preset. Each counter can have a set point which triggers a <i>job list</i> when the counter value passes through the set point either incrementing (High) or decrementing (Low).
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 (<i>alarms retransmission</i> 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, used in other calculations etc.
Derived Variable (DV)	The result of one or more <i>input channel</i> or <i>derived channel</i> being acted upon by a <i>mathematical function</i> (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 <i>job list</i> .
Hysteresis	When an <i>input signal</i> is 'hovering' near a <i>setpoint</i> , then an annoying and potentially damaging series of <i>alarms</i> 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 <i>input signals</i> 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 <i>relay</i> , display a message, change chart speed etc.
Linearization table	Most <i>transducers</i> produce an output which is not directly proportional to the input. For example, the voltage output from a <i>thermocouple</i> 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 <i>resistance thermometers</i> . In most modern instruments, the user can enter one or more tables of his/her own.
Log	Logging allows <i>process variable</i> values to be printed numerically in tabular form on the chart. Alternatively, logs can be sent to the <i>memory card</i> (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 <i>input signals</i> , in which case a simple Subtract function would be used. The resulting <i>Derived Variable</i> can be traced, using a <i>derived channel</i> , or could be used to trigger a <i>job list</i> 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.

Span	Span has two common meanings: the highest (or outer) 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 <i>process variable</i> 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 <i>linearisation tables</i> in the recorder memory.
Threshold	See setpoint.
Timer	Timers carry out general timing functions, and can initiate <i>job lists</i> .
Totalizer	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, <i>thermocouples</i> , <i>resistance thermometers (RTDs)</i> 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 <i>pens/printheads</i> across the chart width. The term often includes the paper transport system used to drive the chart.
Zero	Zero is generally taken to mean the value associated with the lowest (or center) grid line on the chart. Its actual value need not be zero, as long as it is less than the Span value.

Annex A

TECHNICAL SPECIFICATION

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A2 TECHNICAL SPECIFICATION (INPUT BOARD)	A - 3
A3 TECHNICAL SPECIFICATION (RELAY BOARD)	A - 4

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 or lower ac line voltage is 2500V. I.E. The equipment is supplied from the fixed installation (IEC664)

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, 6-Changeover relay output board, 4-Channel analog output (retransmission) board

Options (See options manual)

Host Communications
 Memory Card
 Transmitter Power Supply
 Controllers (see also separate controller manual)
 Also Case Heater (not described)

Environmental Performance

Temperature limits 0 to 50°C operating (-20 to 50°C with case heater)
 With control, 0 to ≈40°C (depends on exact hardware configuration)
 Humidity limits 10 to 90% non-condensing
 Protection door and bezel - IP54 (optional IP65)
 Shock BS EN61010, corner drop test & BS EN60873 edge drop test
 Vibration BS EN60873 (10 to 60 Hz @ .07 mm displacement; 60 to 150 Hz @ 1g)
 Altitude (max) < 2000 metres

Physical

Bezel size 360 High by 380mm wide (Bezel centreline offset 5 mm right with respect to cutout centreline - see fig 1.2.1)
 Panel cutout dimensions 340.5 High by 345.5 wide (both - 0 + 2 mm)
 Depth behind bezel rear face 150 mm
 Weight average 7 Kg (15 lbs)
 Panel mounting Vertical + 5/- 30 degrees (where + means top or recorder towards operator - see figure 1.2.1)

Printing system

Pen type Four-nib cartridge
 Print resolution 0.2 mm
 Default trace colours
 (can be changed during configuration)

Channel	Color	Channel	Color
1	blue	4	black
2	red	5	blue/red
3	green	6	green/black

Printhead life 1.0 x 10⁶ dots per color - black has extra 50%
 Update rate 2 Hz (1 Hz when supplied with derived channels, timers, archiving or retransmission)
 Trace rate (maximum) 1 pass every 5 seconds
 Characters per line 39

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
 Chart speeds 1 to 960 hours per rev.
 Chart type 12 hour; 24 hour; 7-day, not timed
 Transport accuracy 0.25% single turn time accuracy

Power requirements

Line voltage Standard: 90 to 264V; 45 to 65 Hz
 Low voltage option: 20 to 53V ac (45 to 400 Hz) or dc (dc inrush-15A for 10ms @ 20V dc)
 Power (Max) 100VA, ac; 60W, dc
 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	Terminal block
Maximum number of inputs	Six.
Input ranges	±38mV, ±150mV, ±1V, ±10V
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 = 500msec)
Input type mix	Freely configurable
Noise rejection (48 to 62 Hz)	Common mode: >130dB (channel - channel and channel - to - ground). Series mode: >60dB.
Maximum common mode voltage	250 Volts continuous
Maximum series mode voltage	45 mV peak 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) 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 resistance	>10MΩ (38mV, 150mV, 1V); 68KΩ on 10V (always use <u>mA input type</u> for current inputs with shunts as it corrects for the 68K)
Overvoltage protection	42 V rms (terminal I to terminal V), 50 V rms (terminal V+ to terminals V- or I)
Sensor break detection	± 57 nA max.
Recognition time	500 msec.
Minimum break resistance	10 MΩ

DC Input ranges

Shunt/Attenuator	Resistor or voltage divider for terminal board mounting
Additional error due to shunt	0.1% of input
Additional error due to attenuator	0.2% of input

Performance @ 20 °C, ±2 °C

Range	Resolution	Maximum Error - at 20°C	Maximum Temperature Drift
±38mV	1.4µV	0.085% reading + 0.051% range	80 ppm of reading/°C +18.6 ppm of range/°C
±150mV	5.5µV	0.084% reading + 0.038% range	80 ppm of reading/°C + 7.8 ppm of range/°C
±1 Volt	37µV	0.084% reading + 0.029% range	80 ppm of reading/°C + 1.6 ppm of range/°C
±10 Volts	370µV	0.275% reading + 0.030% range	272 ppm of reading/°C + 3.5 ppm of range/°C

Resistance inputs

Ranges (including lead resistance)	0 to 150 Ω, 0 to 600 Ω, 0 to 6kΩ
Influence of lead resistance	Error = negligible (3-wire); Mismatch = 1 Ω/Ω (3-wire)

Temperature scale ITS90

Resolution and accuracy

@ 20 °C, ±2 °C

Range	Resolution	Maximum Error - at 20°C	Maximum Temperature Drift
0 - 150Ω	5mΩ	0.045% reading + 0.141% range	35 ppm of reading/°C + 36.6 ppm of range/°C
0 - 600Ω	22mΩ	0.045% reading + 0.069% range	35 ppm of reading/°C + 14.6 ppm of range/°C
0 - 6KΩ	148mΩ	0.049% reading + 0.032% range	35 ppm of reading/°C + 1.9 ppm of range/°C

RTD types, ranges and accuracies

RTD Type	Overall range (°C)	Standard	Linearization error, max
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

A2 TECHNICAL SPECIFICATION (Input board) (Cont.)

Thermocouple data

Temperature scale	ITS90
Bias current	1.7nA on ± 38 mV range, 8nA on all other ranges
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	Set on a PER RECORDER basis. All channels must be set (high or off) OR (low or off)
Types and ranges	See table

T/C Type	Overall range (°C)	Standard	Max Linearization 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)	0.02°C
N	- 2 400	IEC 584.1	0.04°C
R	- 200 to + 600	IEC 584.1	0.04°C
S	0 to + 1406	IEC 584.1	0.04°C
T	0 to + 1370	IEC 584.1	0.02°C
U		DIN 43710:1985	0.08°C
Ni/NiMo		Ipsen	0.14°C
Platinel		Engelhard	0.02°C

A3 TECHNICAL SPECIFICATION (Relay board)

The relay specification for resistive loads is as follows (derate contacts with inductive loads):

Number of relays per board	two, four or six
Estimated life	30,000,000 operations
Maximum contact voltage	250V ac
Maximum contact current	2 Amps
Maximum switching power	500VA or 60W
Safety isolation (dc to 65Hz; BS EN61010)	Installation category II, Pollution degree 2 (see page 2 for definitions).
Relay to relay:	300v RMS or dc (double insulation)
Relay to ground:	300V RMS or dc (basic insulation)

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