4250M

250mm Chart Recorder

Installation and Operation Manual
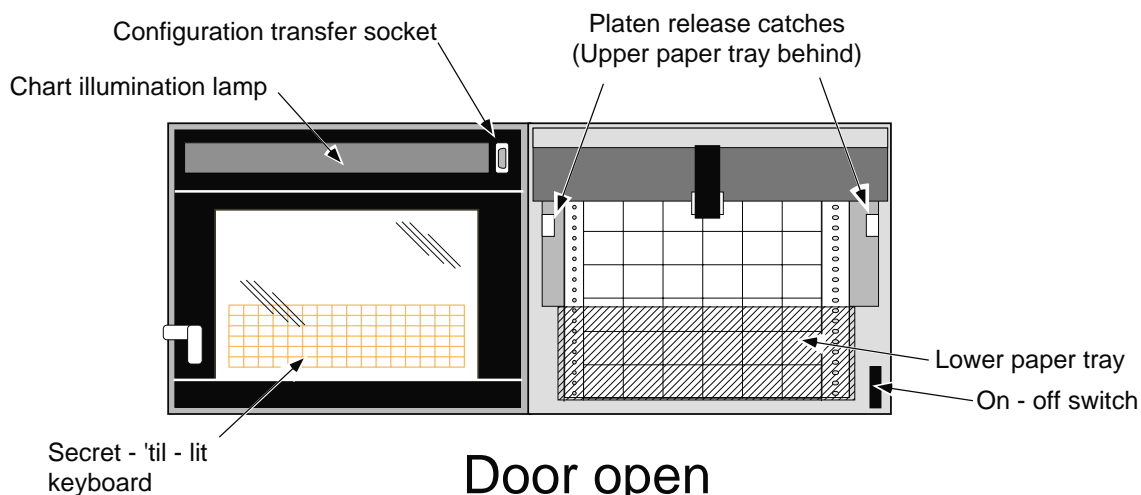
EUROTHERM

An Invensys company

Invensys

An Invensys company

Major functional parts

Hard keys
(Home, Cancel, Enter)

Numeric entry
keypad

Status indicators

80 Character display

Print head / ribbon
cartridge

Softkeys (5 off)

Door catch (lift and
turn clockwise to
unlatch door

Door closed

Configuration transfer socket

Platen release catches
(Upper paper tray behind)

Chart illumination lamp

Lower paper tray

On - off switch
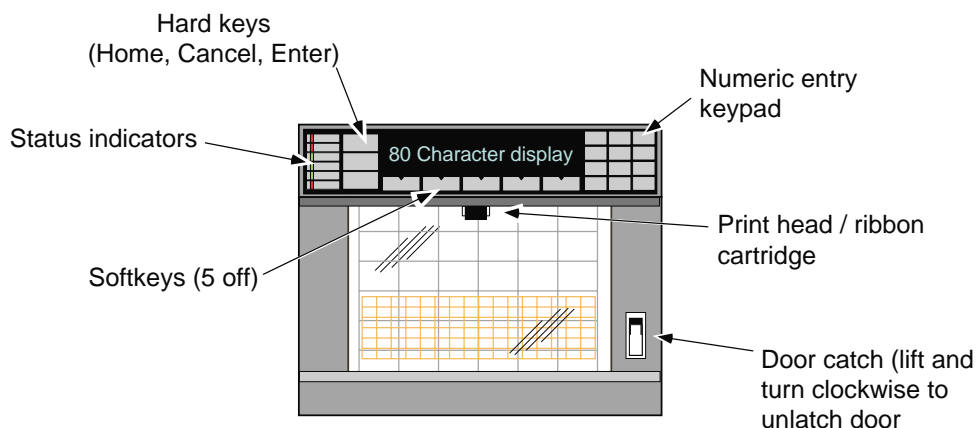
Secret - 'til - lit
keyboard

Door open

Useful part numbers

GD244101Uxxx	22 metre z-fold chart	xxx = N of chart divisions
GD244109Uxxx	32 metre roll chart	= 080, 100, 120, 140, 150
LA243101	6-colour disposable ribbon cartridge	
PA244816	Battery pack	
CH533151	Fuse	
LA246843	PC Configuration Tool	
HA246958	Communications Manual	
HA247361	Memory Card Instruction Manual	
HA247733	Graphics Unit Manual	
HA248559	Technical Manual	
LA246779UK10	100 Shunt	
LA246779UK25	250 Shunt	
LA244180	Input Attenuator	

EUROTHERM CHESSELL

Declaration of Conformity

Manufacturer's name:	**Eurotherm Recorders Limited**
Manufacturer's address	**Dominion Way, Worthing, West Sussex, BN14 8QL, United Kingdom.**
Product type:	**Industrial chart recorder**
Model:	**4250M (Status level R21 or higher)**
Safety specification:	**EN61010-1:1993/A2:1995**
EMC emissions specification:	**EN50081-2 (Group 1; Class A)**
EMC immunity specification:	**EN50082-2**

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

Signed: *PRJ de la Nougerède*   Dated: 22-Oct-96

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

C€

IA249986U080 Issue 2 Oct 96

250 MM MULTIPOINT RECORDER

INSTALLATION AND OPERATION MANUAL

OVERALL CONTENTS LIST

(Continued)

OVERALL LIST OF CONTENTS (Cont.)

Safety Notes

1. Whenever it is likely that protection has been impaired, the unit shall be made inoperative and secured against unintended operation. The nearest manufacturer's service centre should be consulted for advice.
2. 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.
3. The Mains (supply voltage) wiring must be terminated in such a way that, should it slip in the cable clamp, the Earth wire would be the last wire to become disconnected.

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

---

4. Where conductive pollution (e.g. condensation, carbon dust) is likely, adequate air conditioning/filtering/sealing etc. must be installed in the recorder enclosure.
5. This unit contains one or more batteries which must be treated and disposed of with care. In particular, batteries must not be shorted or an explosion can occur. Batteries should be disposed of in accordance with local regulations; they must not be discarded with normal refuse.
6. Signal and supply 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.
7. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.
8. For both portable and panel mounted equipment, the protective earth terminal must remain connected (even when the recorder is isolated from the mains supply) if any of the I/O circuits are connected to hazardous voltages*.

* 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
∿	This recorder for ac supply only
---	This recorder for dc supply only.
⚡	Risk of electric shock

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 (eg masking tape, nylon sheet). The gate-oxide region of all metal oxide semi-conductors (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 anti-static 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 the 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

Anti-static

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.

SECTION 1 INSTALLATION

LIST OF CONTENTS

Note: The instrument can weigh up to 22 kg. It is therefore recommended that a risk assessment be carried out before it is handled.

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SECTION 1 INSTALLATION

1.1 INSTALLATION PROCEDURE

The installation procedure is as follows:

1. Unpack the recorder (section 1.2)
2. If the recorder is to be panel mounted, fit the recorder into the panel (section 1.3)
3. Connect supply and signal wiring (sections 1.4 and 1.5)
4. Fit chart and ribbon cartridge (sections 1.7 and 1.8)
5. Switch on.   Configure the recorder.

1.2 UNPACKING THE RECORDER

The recorder is shipped in a special pack, designed to ensure adequate protection during transit.   Should the outer box show signs of abnormal wear or damage, it should be opened immediately and the recorder examined. If there is evidence of damage, the instrument must not be operated and the local representative contacted for instructions. After the recorder has been removed from its packing, the packing should be examined before it is discarded, to ensure that all accessories and documentation have been removed.

1.3 MECHANICAL INSTALLATION

As shown in figure 1.3 below, the recorder is intended for installation in a cutout 348 mm across by 273.5 mm. high, in a panel which is either vertical or sloping up to 30 degrees. Particular attention should be paid to the recommended minimum distances between adjacent recorders. These distances are advised in order to retain ease of access, to allow full door opening and for panel strength considerations.

The instrument is inserted through the panel cutout, from the front. With the weight of the recorder supported, the panel clamps are clipped into the holes located, one each side of the recorder. The jacking screws are now tightened until the springs of the panel jacks are compressed to approximately half of their free length.

Once the recorder is securely mounted, the door should be opened (by lifting and then turning the latch clockwise) and the internal packing removed.

1.4 SUPPLY VOLTAGE CONNECTION

1.4.1 Supply Voltage Connection

All connections are made at the rear of the recorder. Supply voltage wiring, Supply voltage selection and fuse replacement can all be carried out without the removal of the terminal cover.

As shown in figure 1.4.1 The supply voltage setting switch is located immediately above the fuse drawer associated with the IEC plug. The switch is operated downwards (230V indicated) to select 180 to 264 V, or upwards (115V indicated) to select 90 to 132V.

360 mm (14.2 in)

288 mm
(11.4 in)

Front view

53 mm
(2.1 in)

450 mm (17.72 in)

410 mm (16.15 in)

271.2 mm
(10.17 in)

View on right hand side

Maximum panel thickness
42 mm (1.66 in)

Terminal cover

View on top

346 mm
(13.7 in)

Overall case dimensions

45 mm (1.8 in) min.

348 x 273.5 mm
(- 0 + 1.4 mm)

13.7 x 10.77 in
(- 0 + 0.05 in)

35 mm. (1.4 in) min.

Panel cutout

Vertical

30   30

Maximum installed angles
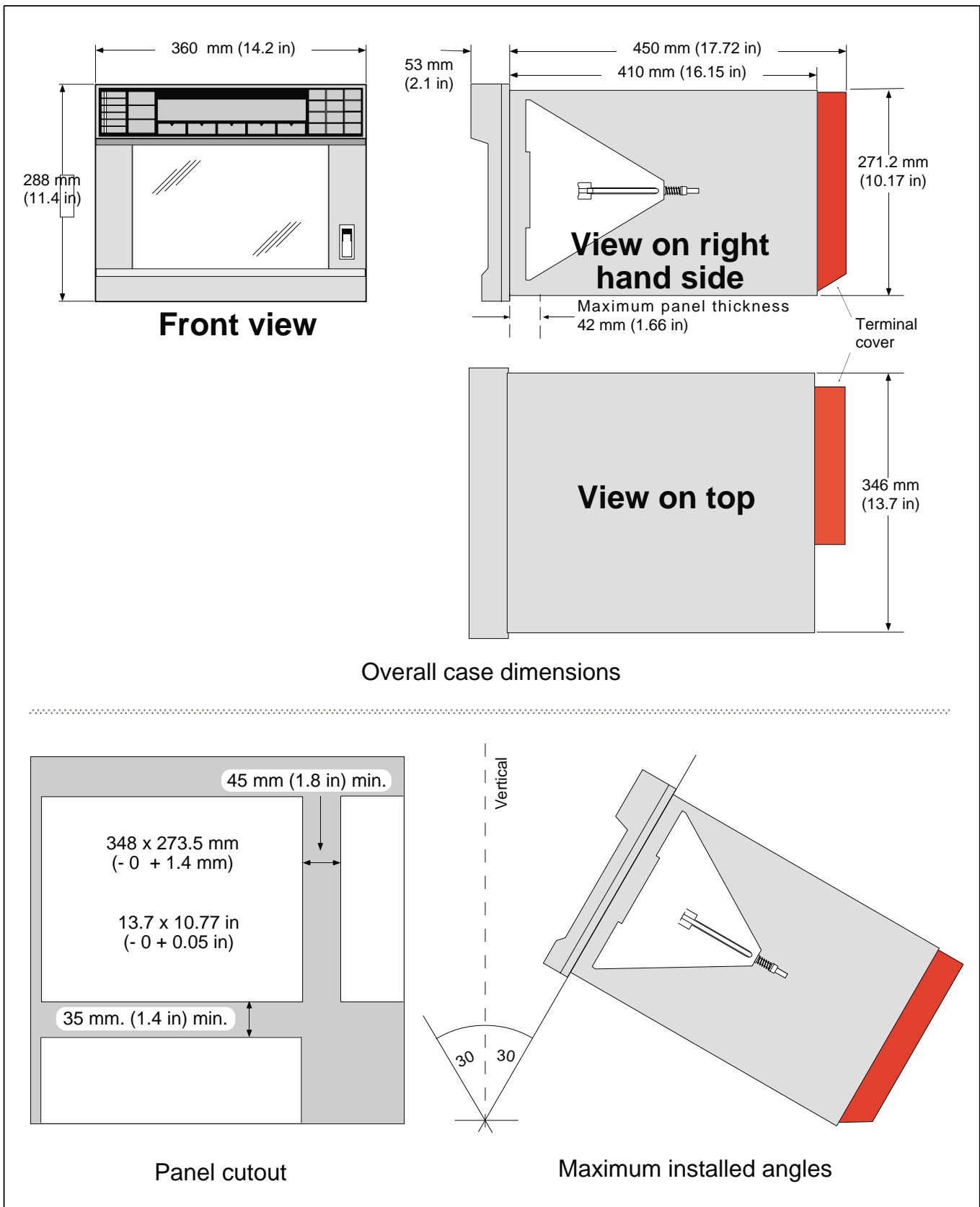
Figure 1.3 Mechanical installation

1.4.2 Supply Voltage Wiring

Before connecting the supply to the recorder, check that the recorder voltage select switch has been set to the correct voltage range, as described above.

Before proceeding further, please read the warnings on page i - 3.

The line supply is terminated using an IEC socket which is connected into the mating plug at the rear of the recorder power supply (figure 1.4.1). Recommended minimum wire size is 16/0.2 (0.5 mm^2)

1.4.3 Supply Voltage Fuse

The supply fuse is located in a pull-out drawer integral with the IEC plug. The fuse specifications (3.15 Amp type F) are the same for both supply voltage ranges, and are as follows:-

Rating:	3.15 Amps
Physical size:	20 mm.
Speed:	Fast blow
Material:	Ceramic

It should be ensured that only fuses with the required rated current and of the specified type are used for replacement. The use of make-shift fuses, and the short-circuiting of fuse holders are prohibited, and will invalidate the manufacturer's warranty.
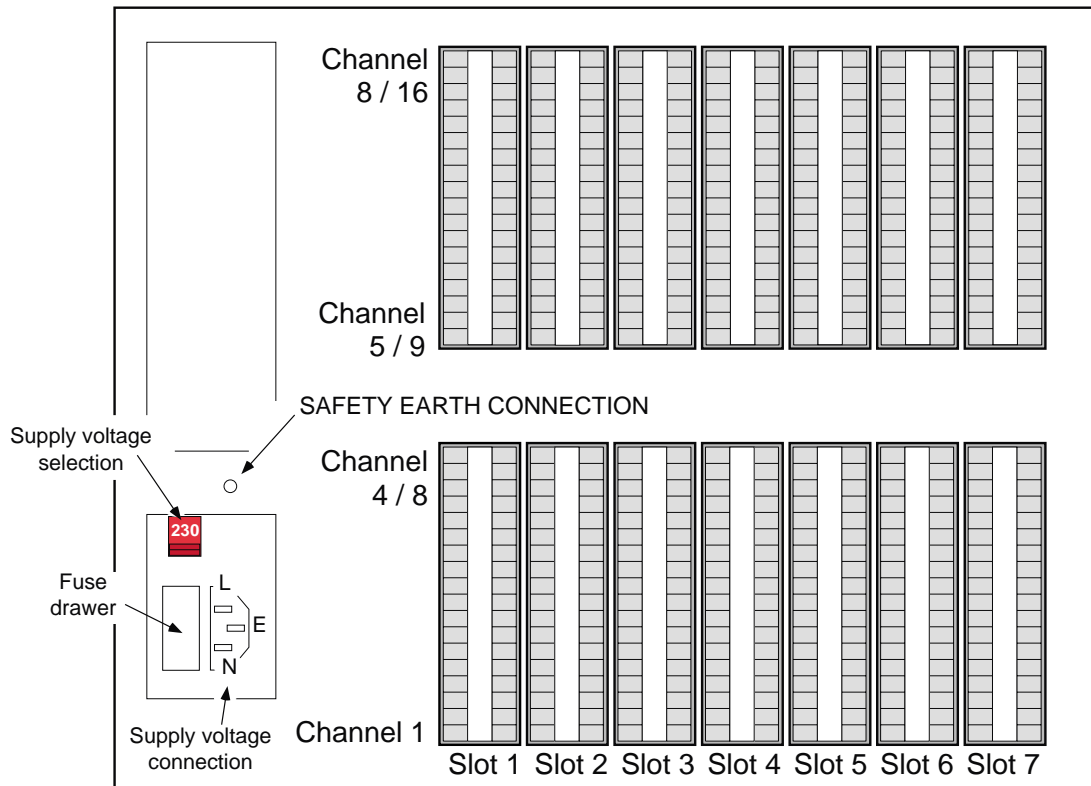
Figure 1.4.1 Recorder rear view with terminal cover removed

1.5 SIGNAL WIRING

It should be noted that the overall channel number (i.e. 1 to 96) is related to the slot number (figure 1.4.1) by the card address, as described in section 4.4.

All signal wiring terminations are located behind the terminal cover (figure 1.3). This acts not only as protection, but also as a thermal 'container' to reduce temperature fluctuations as much as possible for the thermocouple cold junction terminations. To remove the rear cover, release the two screws securing it to the rear of the recorder.

Figure 1.5 shows signal wiring for the types of I/O board available for the recorder

Note: Recommended maximum wire size is 2.5 mm^2

1.5.1 The analogue output board as a transmitter power supply

Each analogue output channel can be wired to provide 24V at up to 25mA. A typical wiring diagram is given in figure 1.5.1 below. Typical configuration pages are as follows:

ANALOGUE OUTPUT CHANNEL

The analogue output channel should be set up as follows:

```
O/P Type mA   4.00 to 24.00                🖺
Source   Constant      24.000    Enabled
```

```
Value Format XXX.XX                        🖺
On error     Drive hi
```

To find the channel number, the 'CARDS' section of the 'INSTRUMENT' configuration should be accessed, to find the address of the analogue output board. Each address is associated with 8 channels, so an address of two, for example, means that the first analogue output channel is 9.

ANALOGUE INPUT CHANNEL

```
I/P Type mA    4.00 to  20.00              🖺
Shunt 100.00 ohms
```

```
Lin Func. Linear                           🖺
Unscaled
```

```
Value format XXX.XX                        🖺
Damping None
```

(Continued)

8 Channel Universal input board

DC Volts, DC mV, Thermocouples

Signal input
(- 5 to +10 Volts)

- C
V
I

Voltage / Thermocouple inputs
should not be connected here!

Contact inputs

nc
com no

Microswitch, Relay
contact etc.

C
V
I

2 - Wire RTD inputs

C
V
I

Resistance
thermometer

Potentiometric inputs

C
V
I

Potentiometer

DC mA

Shunt assembly

Signal input
(DC milliamp)

- C
V
I

+

Voltage / Thermocouple inputs
should not be connected here!

DC Volts (>5 Volts)

Attenuator assembly

Signal input
(- 50 to +100 Volts)

- C
V
I

+

Voltage / Thermocouple inputs
should not be connected here!

3 - Wire RTD inputs

C
V
I

Resistance
thermometer

Channel 8
Channel 7
Channel 6
Channel 5

Polarising
key
position

C 18
V 17
I 16
15
C 14
V 13
I 12
11
10
9
8
C 7
V 6
I 5
4
C 3
V 2
I 1

Channel 4
Channel 3
Channel 2
Channel 1

Polarising
key
position

C 18
V 17
I 16
15
C 14
V 13
I 12
11
10
9
8
C 7
V 6
I 5
4
C 3
V 2
I 1

16 Channel DC input board

DC Volts, DC mV, Thermocouples

Signal input
(-1.5 to +5 Volts)

- V-
V+

+

Contact inputs

Microswitch, Relay contact etc.

nc
com no

V-
V+

Contact inputs not available
on channels 1, 8 or 16

DC mA

Shunt assembly

Signal input
(DC milliamp)

- V-
V+

+

DC Volts (>5 Volts)

Attenuator assembly

Signal input
(-15 to +50 Volts)

- V-
V+

+

Channel 16
Channel 15
Channel 14
Channel 13

Channel 12
Channel 11
Channel 10
Channel 9

Polarising
key
position

V- 18
V+ 17
V- 16
V+ 15
V- 14
V+ 13
V- 12
V+ 11
10
9
V- 8
V+ 7
V- 6
V+ 5
V- 4
V+ 3
V- 2
V+ 1

Channel 8
Channel 7
Channel 6
Channel 5

Channel 4
Channel 3
Channel 2
Channel 1

Polarising
key
position

V- 18
V+ 17
V- 16
V+ 15
V- 14
V+ 13
V- 12
V+ 11
10
9
V- 8
V+ 7
V- 6
V+ 5
V- 4
V+ 3
V- 2
V+ 1

Figure 1.5 Signal Wiring
Sheet 1: Input signals

Relay output board

RELAY BOARD INTERNAL WIRING
(ONLY ONE CHANNEL SHOWN FOR CLARITY)

Channel 8

Channel 7

Channel 6

Channel 5

Channel 4

Channel 3

Channel 2

Channel 1

Polarising
key
position

Polarising
key
position

nc

com   no

Relay coil operated
by JOB as set up in
Channel / Event
etc. configuration

RELAY SHOWN IN ALARM
(DE-ENERGISED) STATE

Analogue output board

Channel 8

Channel 7

Channel 6

Channel 5

Channel 4

Channel 3

Channel 2

Channel 1

Polarising
key
position

Polarising
key
position

Voltage output

Voltage output

−

+

C

Vo

Io

mA output

Current output

−

+

C

Vo

Io

Figure 1.5 Signal Wiring
Sheet 2 Output wiring

Figure 1.5 Signal Wiring
Sheet 2 Output wiring

1.5.1 TRANSMITTER POWER SUPPLY (Cont.)

Figure 1.5.1 Wiring of the analogue output board as a Transmitter Power Supply

1.6 CONFIGURATION TRANSFER WIRING

As explained in section 4.11, the configuration of one recorder can be transferred to or from one or more other recorders using the 9-way D-type socket located on the inside of the recorder door. Figure 1.6a shows the cable specification for a connection between two recorders. No screen is necessary.
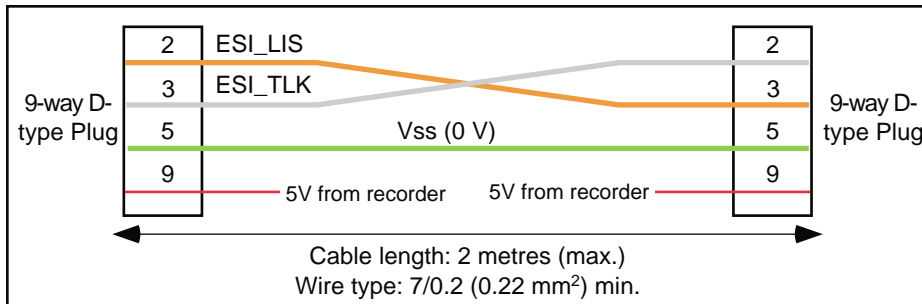
Figure 1.6a Cable specification for configuration transfer

Configuration transfer can also be carried out between the recorder and any host computer or configuration terminal which is capable of accepting 5V logic levels at its RS232 input, and which does not require hardware handshake. An RS232 converter may be required with some computers to change the recorder's signals to 12 Volts.

Figure 1.6b shows how to wire the recorder link to host computer 9-way and 25-way D-types. It is up to the user to determine whether a plug or socket is required at the host computer end of the link.
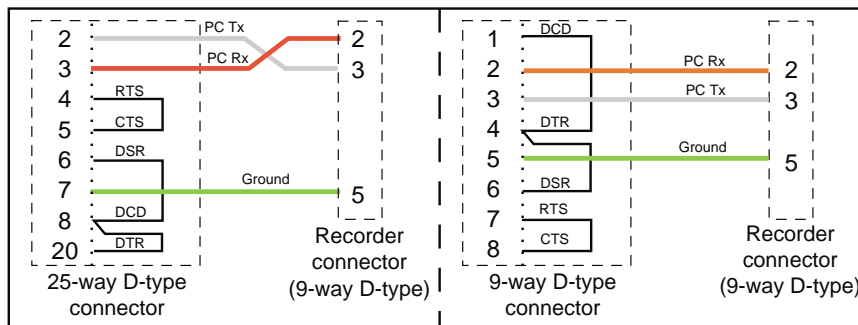
Figure 1.6b Configuration transfer port to host computer wiring

Alternatively, the communications option can be used. This allows not only configuration save and restore, but also full configuration and monitoring functions.   A PC configuration tool is available from the manufacturer.

1.7 CHART INSTALLATION / REPLACEMENT

NOTE. The following instructions assume a used chart is to be replaced. When fitting a chart for the first time, follow only the relevant sections. If required, the recorder can be switched on by opening the door and operating the push-button switch at the bottom right hand corner of the recorder.

When the chart is finished, the printer stops (Printer off LED flashes), the system error LED flashes and a chart out' message appears at the display, with one softkey caption: CLEAR. Operation of the CLEAR key allows normal operation of the recorder to continue, except of course for tracing. After a new chart has been fitted, a 'Press START key' message appears with one softkey caption: START. Operation of the START key returns the channel tracing functions to normal.

Before changing the chart, it is recommended that the cartridge is 'parked', as follows:

a. Operate the 'Home' hard key.

b. Operate the CHART softkey.

c. Operate the ON/OFF softkey and wait until the legend on the top line of the display reads 'Printer is off line'

d. Operate the PARK softkey and ensure that the print cartridge parks at the centre of travel.

Note the position of the ADVANCE softkey.

```
 1  123.4 Deg C  Ch1 Tag
 2 LINE     MODE  HOLD    NEXT   PREVIOUS
```

```
Operator select a category
DISPLAY  CHART   ALARM   CHANNEL    MORE>
```

```
Chart : select a category
 ON/OFF  SPEED  LOG INT  MODE    SCALES
```

```
Printer is on line
   OFF
```

```
Printer is off line
   ON     PARK   ADVANCE
```
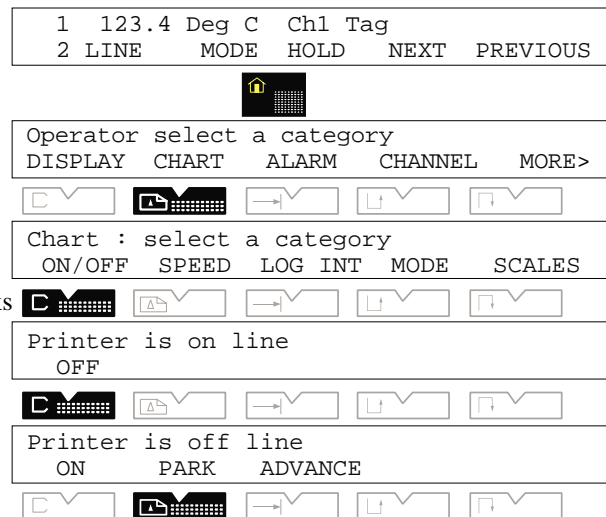
1.7.1 Z-Fold chart replacement

Open the recorder door by lifting, then rotating the latch clockwise.

Pull the paper guide forwards, as shown, and disengage the remaining chart from the drive sprockets. Pull the end of the chart downwards clear of the platen.

Open the lower paper tray by rotating it forwards as shown in the figure, and remove the old chart.

Remove any residual paper dust from the paper tray.
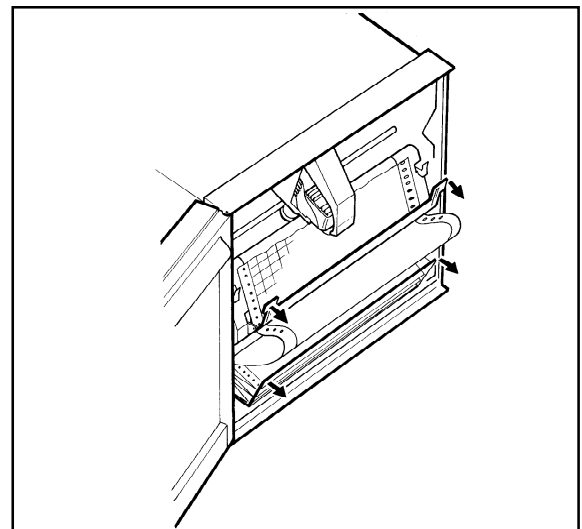
Figure 1.7.1a Z-fold chart removal

1.7.1 Z-FOLD CHART REPLACEMENT (Cont.)

Release the platen by pushing upwards on one or both of the latches, as shown. Swing the platen forwards to reveal the upper paper tray. Remove any residual paper dust.

Check that the printhead / ribbon cartridge guide bar is clean and shiny. Check the drive belts for the printhead/cartridge and for the ribbon are in good condition.

If not, carry out remedial action as described in the Service Manual available from the manufacturer.
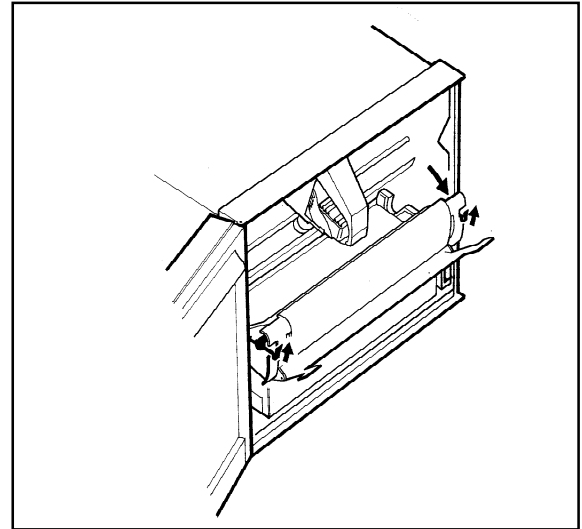
Figure 1.7.1b Paper tray access

Remove the new chart from its packing, and fan (as shown in the figure) several times to separate the leaves, and to remove loose paper dust.   Ensure that the leaves are fully separated, or the paper transport will not operate correctly.

Orient the chart such that the red 'end of chart' line is at the bottom, and the circular chart holes are to the left (i.e. the elongated slots are to the right).
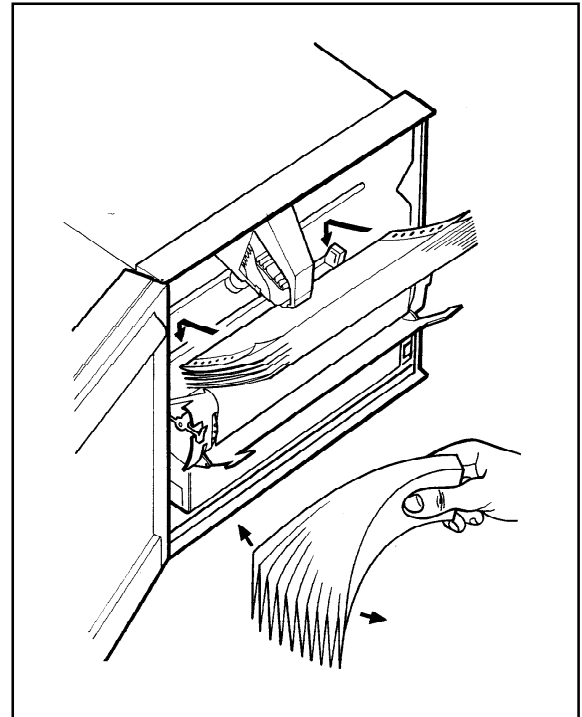
Figure 1.7.1c Z-fold chart loading (1)

1.7.1 Z-FOLD CHART REPLACEMENT (Cont.)

Place the chart into the upper paper tray, and unfold the top two or three leaves. Push the platen closed ENSURING THAT IT LATCHES COR-RECTLY INTO PLACE.

If the chart is loaded correctly, the circular holes will be on the left, and the printed grid will be uppermost, with no red line showing.

Pull the paper guide forwards and feed the end of the chart through the gap between the platen and the paper guide. Close the paper guide, ensuring that both sets of chart holes locate correctly on the drive sprockets, and that the horizontal grid lines are parallel with the chart guide.
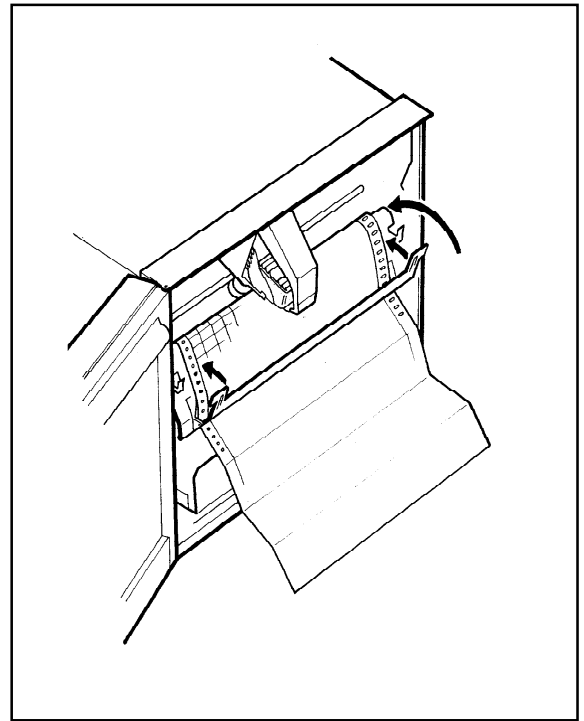
Figure 1.7.1d Z-fold chart loading (2)

Open the lower paper tray and introduce the first few leaves of chart into it. Close the paper tray and, if necessary, apply power to the re-corder and use the ADVANCE softkey to feed extra paper through.

Ensure that the paper lies naturally (i.e. the fold direction is the same as when packed by the chart manufacturer).

FAILURE TO ENSURE THAT THE CHART FOLDS NATURALLY, WILL RESULT IN THE EVENTUAL MALFUNCTIONING OF THE CHART FEED.
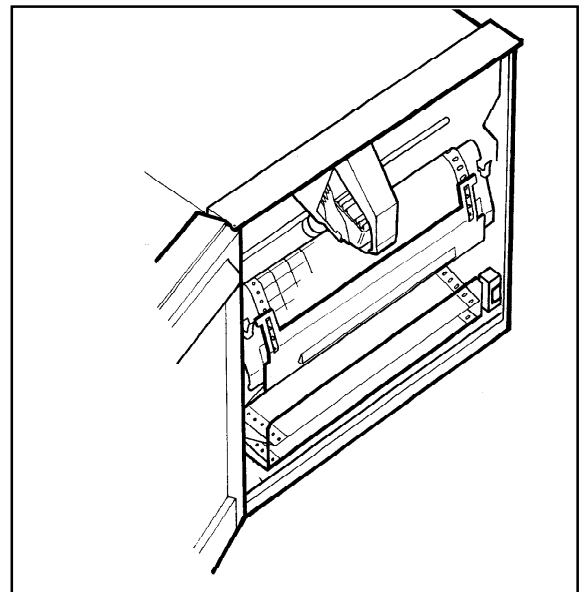
Figure 1.7.1e Z-fold chart loading (3)

1.7.2 Roll chart replacement

NOTE. The roll chart cassette is designed such that once loaded, the paper winds itself onto the take-up spool without operator intervention. The chart must **<u>NOT</u>** be attached to the take-up spool using adhesive tape etc, since this will make subsequent removal of the chart difficult without rewinding the entire chart.

Open the recorder door by lifting the bottom of the catch up and out and then turning it clockwise.

Release the platen by pushing upwards on one or both of the latches, as shown. Swing the platen forwards to reveal the upper paper tray. Remove the empty tube and discard. Remove any residual paper dust.

Check that the printhead / ribbon cartridge guide bar is clean and shiny. Check the drive belts for the print- head / cartridge and for the ribbon are in good condition. If not, carry out remedial action as described in the Technical Manual available from the manufacturer.
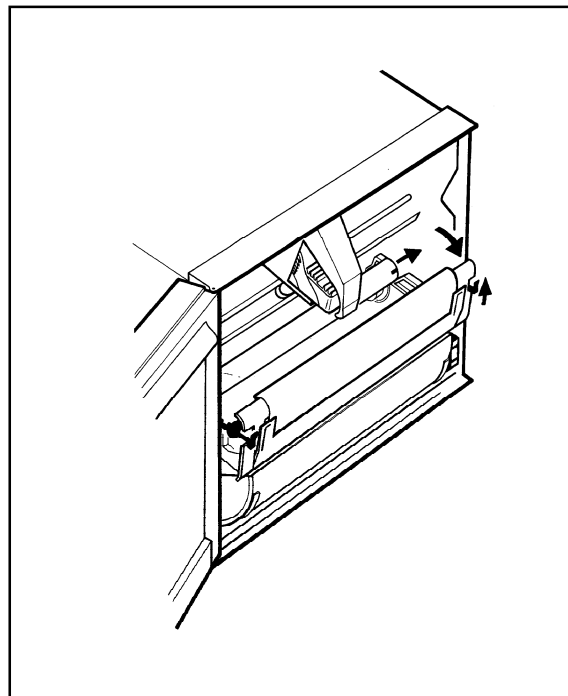
Figure 1.7.2a Paper tray access

Remove the new chart from its packing. Unroll the first 10 to 20 cm, and place the roll in the tray, with the leading edge to the top (i.e. with the chart grid showing).

Push the platen closed **ENSURING THAT IT LATCHES CORRECTLY INTO PLACE.**
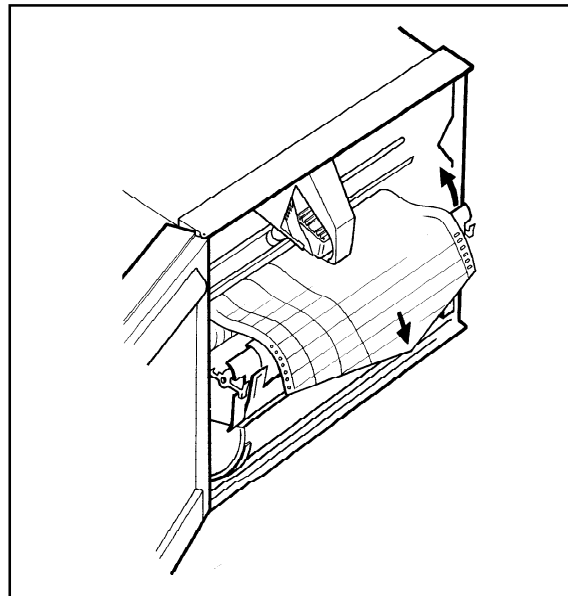
Figure 1.7.2b Roll chart loading (1)

1.7.2 ROLL CHART (Cont.)

Pull the paper guide forwards and feed the end of the chart through the gap between the platen and the paper guide. Close the paper guide, ensuring that both sets of chart holes locate correctly on the drive sprockets, and that the horizontal grid lines are parallel with the chart guide.

If the chart is loaded correctly, the circular holes will be on the left and the printed grid will be uppermost, and aligned with the paper guide.
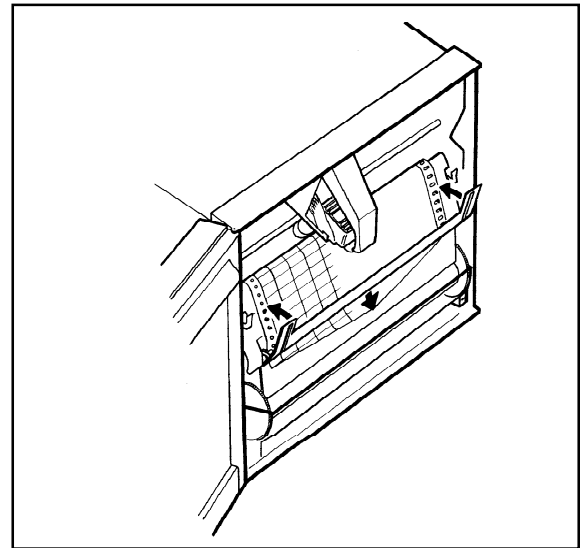
Figure 1.7.2c Roll chart loading (2)

Open the lower paper tray, and remove the take-up spool with the old chart.
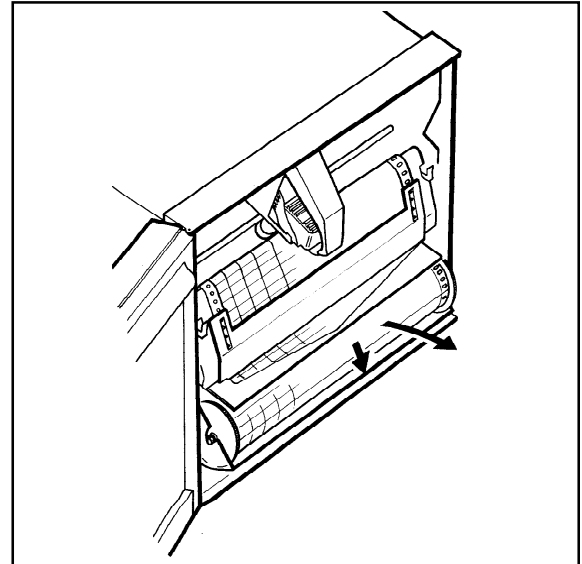
Figure 1.7.2d Roll chart removal

Remove the take-up spool gear wheels from the old chart by pulling them away from the inner tube. Slide the tube out from the used chart and re-fit the gear wheels, ensuring that the keys on the gear hubs are aligned with the key-ways in the tube.

Return the take up spool to the lower paper tray, and check for free rotation.

Close the paper tray and apply power to the recorder.
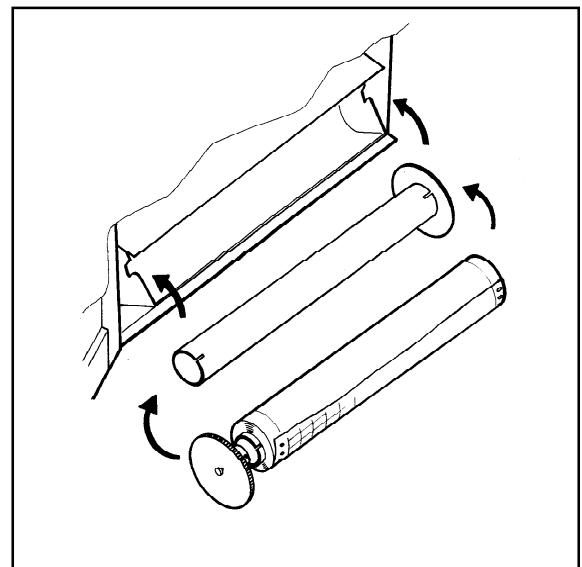
Figure 1.7.2e Take-up spool

1.7.3 Roll chart review

With roll charts it is possible to remove the take-up spool whilst recording is in progress and to unwind the chart manually in order to look at the tracings, messages etc. so far.

In order to return the chart, open the lower paper tray and, whilst holding it down as far as it will go, re-fit the take-up spool, ensuring there are no twists in the 'loose' loop of chart. Close the paper tray.

The auto take-up feature of the recorder will ensure that the chart is re-wound neatly onto the take-up spool.

1.8 RIBBON CARTRIDGE REPLACEMENT

CAUTION

BEFORE ATTEMPTING TO CHANGE THE RIBBON CARTRIDGE, IT IS ESSENTIAL TO ENSURE THAT:

1.   THE RECORDER IS NOT POWERED, OR
2.   THE PRINTHEAD IS PARKED

Switch the printer off-line, park the printhead / cartridge and release the platen as described in section 1.7 above.

Slide the ribbon cartridge to the right to remove it.

Unpack the new ribbon cartridge and introduce it into the carriage. Push the cartridge fully to the left, ensuring intimate contact between the side of the cartridge and the carriage.

If the ribbon cartridge is reluctant to slide fully home, the knob at the right hand side of the cartridge should be turned anti-clockwise a few degrees to allow the ribbon drive to engage.

Close the platen ENSURING THAT IT CLICKS INTO PLACE.
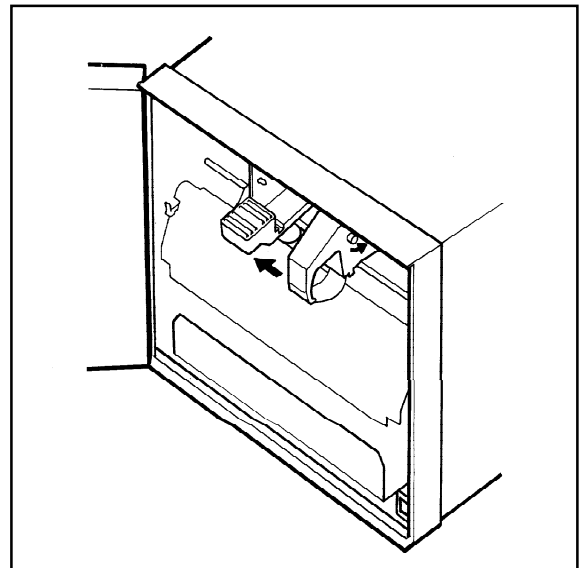
Figure 1.8 Ribbon cartridge replacement

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SECTION 2: BASIC OPERATION

LIST OF CONTENTS

SECTION 2: BASIC OPERATION

This section is designed to help you as a new user to configure a 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 displays see sections 3 and 4/5 respectively.

Figure 2.3 shows the top level menus for a recorder fitted with all available options. If an option isn't fitted then its softkey legend doesn't appear. For this reason, your displays might be slightly different from those depicted.

2.1 FIRST SWITCH ON

When the recorder is first switched on, an initialisation message appears briefly at the display, and a 'Power on' message is printed on the chart. The message includes the current time and date, the print mode (trace priority) and chart speed (120mm / hr).

After initialisation is complete, the display goes into 'background mode' i.e. it displays a single channel's number status and 'tag' on the top line, and will have a series of 'softkey' legends on the lower line.

```
01        OFF 1
2 LINE    MODE    HOLD    NEXT    PREVIOUS
```

The softkeys depicted (2 LINE, MODE etc.) are fully described in section 3.

The first channel to be displayed is the first channel fitted (normally 1). After approximately 3 seconds, the display changes to show channel 2 and so on until all the measuring channels have appeared. After all the measuring channels have been 'scrolled through' in this way, any option values (maths channels, totalisers/counters) are displayed in turn, before channel 1 is returned to .

As delivered, all channels are set to OFF. In order to carry out measurements and start tracing, you need to tell the recorder what input types are wired to each channel, what ranges and scales to use, alarm setpoints, alarm types and so on.

In order to do this you need to access the configuration menus, but before you do, here is some basic information you need to do the job.:

2.2 OPERATOR INTERFACE

The 'Operator interface' is the name given to the display and its associated hardkeys (including numeric keys), softkeys and status indicators and the 'Secret-til-lit' keyboard.
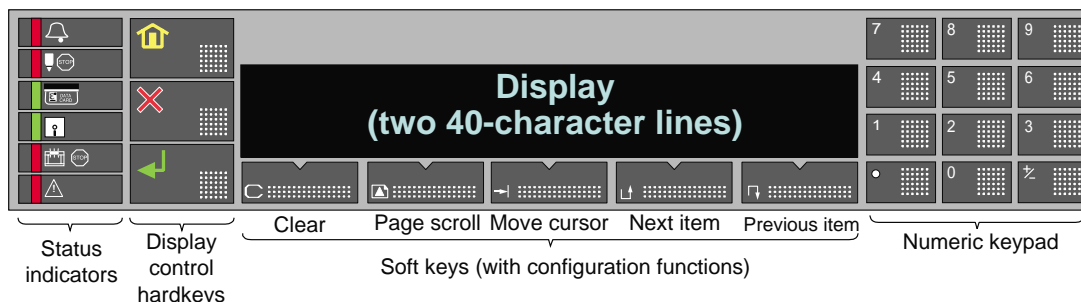
Figure 2.2 Display / Keyboard

2.2.1 Display control hardkeys

These three keys, located to the left of the display (figures 2.2, and 2.2.2) help you to access and edit items with minimum effort . These key functions are repeated on the lower keyboard.

The 'Home' key is used to return to the top level operator menu from any where in theOperator menu structure. During configuration, a single operation of the key causes a return to the top level Configuration menu; a second operation causes a return to the top level Operator Menu.

The 'Cancel' key. The cancel key is used to 'undo' any changes made since the last operation of the 'Enter' key (below).   Where no changes have been made, operation of the cancel key moves the user up one menu level.

The 'Enter' key. This key is used to cause all changes made since the previous operation of the key to become permanent (i.e. the changes are written to the recorder's data base). Where no changes have been made, operation of the key moves the user up one menu level.

2.2.2 Status indicators

Channel Alarm LED

Printer off LED

Memory card status LED

Rolling memory status LED

Display hold LED

System error LED

Home key

Cancel key

Enter key
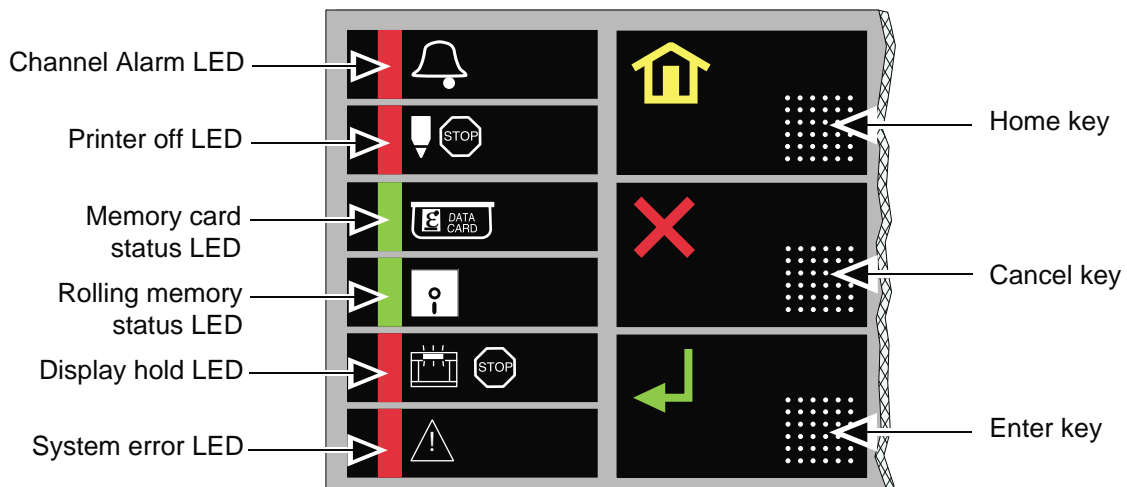
Figure 2.2.2 Status indicators and display control hardkeys

As depicted in the figure above, there are six LED indicators located towards the left hand side of the display / keyboard assembly . These LEDs have the following functions:

1. Channel alarm LED. This LED flashes whenever an unacknowledged active alarm is present. The LED is steadily illuminated if an acknowledged alarm is present but again flashes if a further unacknowledged alarm becomes active. See section 3.2.3 for how to acknowledge alarms.
2. Printer off LED. This LED illuminates steadily if the printer drive has been switched off, or flashes if the chart is finished.
3. Memory card status LED. This LED illuminates steadily when the memory card is inserted correctly, and flashes intermittently during data transfer. The LED is always fitted, whether or not the memory card option is supplied.
4. Rolling memory status LED. This LED is off whilst the memory input is enabled. The LED is illuminated steadily when the rolling memory option is disabled but not empty. The LED flashes whilst memory playback is in progress.
5. Display hold LED. The display hold indicator illuminates whenever channels are selected for continuous display. (Normally all the channels in the selected group are displayed in rotation.)

(Continued)

2.2.2 STATUS INDICATORS (Cont.)

6. System error LED. The System Error indicator flashes if any of the items listed below are true. Any current system errors can be viewed via the operator menu (Section 3) or instrument configuration pages (section 4.2)

    a.   The chart is used up or is missing.

    b.   There is a fault with remote CJ temperature.

    c.   The battery is exhausted or missing.

    d.   There is a failure in the real-time clock.

    e.   There is a fault in the writing system.

    f.   There is a fault in an input or derived channel.

    g.   Battery-backed RAM failure or EEPROM failure.

    h.   The instrument cycle time has been exceeded (section 4.2).

    i.   Memory card battery low or exhausted.

2.2.3 Text editing

USING THE SECRET 'TIL LIT KEYBOARD
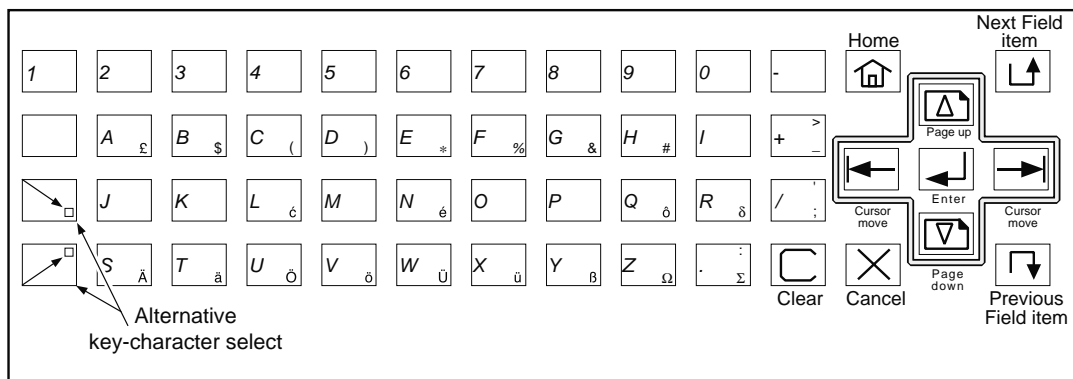
Figure 2.2.3a Secret-'til-lit keyboard

The 'secret-'til-lit' keyboard gives the operator access to a wide range of alpha and numeric characters using the alpha-numeric keys or the field scroll and +/- keys or a combination of both.

The use of the keys is generally self-evident, with the possible exception of the 'alternative character select' keys located at the bottom left of the keyboard. These two keys are used as follows:

The characters printed in the bottom right hand corners of the keys are selected for as long as the upper of the two keys shown opposite is operated. For example, if this key and the + key are operated together the = character is produced.
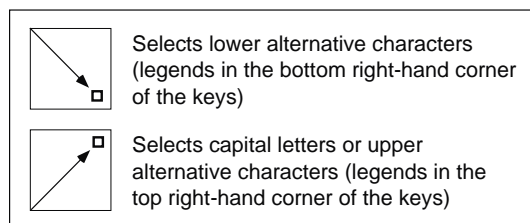
Figure 2.2.3b Alternative keyboard selection

Selects lower alternative characters (legends in the bottom right-hand corner of the keys)

Selects capital letters or upper alternative characters (legends in the top right-hand corner of the keys)

Capital letters and the characters printed in the top right hand corners of the non alpha-numeric keys are selected for as long as the lower of the two keys shown is operated. For example, if this key and the + key are operated together, the > character is produced.

A second character set (depicted below) is also available, accessed using the field scroll keys of the lower keyboard, or by using the softkeys and the +/ key as described below.

2.2.3 TEXT EDITING (Cont.)

USING THE SOFTKEYS

An alternative means of editing text is by means of the cursor and up and down scroll keys:

The cursor (right arrow) key is used to locate the cursor beneath the character to be edited and the scroll keys are then used to scroll through either of the character sets depicted (approximately) below. The advantage of this means of text entry is that more characters are available than appear on the lower keyboard. The disadvantage is the considerable amount of time required to scroll through the character lists. It is therefore recommended that this means of editing is reserved for entering 'special' characters only, the lower keyboard being used for standard text.

NOTES
1.   The two sets can be switched between using the ±   key associated with the numeric keyboard.
2.   The 'C' key can be used to clear the text string from the cursor position to the end inclusive.
3.   Should an error be made, the cancel (X) key can be used to 'undo' all changes so far made to the text string.
4.   Under certain circumstances, it is possible to have the current time, date etc. included in a message to be printed in the chart. See the 'Embedded Sequences' description in section 3.3.3.

NORMAL CHARACTER SET

A to Z, a to z, Ä ä à ç ê è é Ö ö ô Ü ü ù ß ∑ µ Ω ∂ # $ % & ( ) * +, - . / : ; < = > _ £° 0 to 9, (Space)

ALTERNATIVE CHARACTER SET

² ³ ! ¨ '[\ ] ^ ' { | } ~ Ç â å ë ï ì Å É æ Æ ò û ÿ ¢ ¥ á í ó ú ñ Ñ a̲ o̲ ¿ ¡ « » α Γ π σ τ φ θ ∞ ∈ ∩
≡ ± ≥ ≤ ÷ ≈ • . √ h •

For full details of operator and configuration menus, see sections 3 and 4 respectively

'Background display'

```
01  OFF    1
2 LINE   MODE   HOLD   NEXT  PREVIOUS
```

Operate 'Home' key to call 1st
Top level Operator page

Top level operator pages

```
Operator : Select a category
DISPLAY  CHART  ALARM CHANNEL  MORE>
```

```
Operator : Select a category
PROCESS KEYS    TEXT    LOG   MORE>
```

```
Operator : Select a category
CLOCK JOB SRC SYS ERR  CONFIG  MORE>
```

```
Operator : Select a category
MEMORY  M CARD               MORE>
```

This page appears only if Rolling Memory or
Memory Card options fitted

```
Chart : Select a category
ON/OFF  SPEED LOG INT MODE   SCALES
```

```
Enter password  **
   QUIT    ENTER
```

```
Printer is on line
   OFF    FAST OFF
```

The password is set to 10 by the manufacturer.
You can change it as a part of the Instrument configuration
(INSTRM softkey - see section 4.2)

```
Printer is off line
   ON    PARK  ADVANCE
```

Chart must be off for configuration print.

Top level configuration pages

```
Configuration: select a category
INSTRM  CHART  CHANNEL  GROUP   MORE>
```

```
Configuration : Select a category
EVENTS AUTODISP LOGS    COPY  MORE>
```

```
Configuration : Select a category
MATHS  TOTAL'R COUNTER  TIMER  MORE>
```

```
Configuration : Select a category
MEMORY   COMMS   TRANSFR  M CARD   MORE>
```

```
Configuration : Select a category
DIAGS  AUTOCFIG ACCESS   ADJUST  MORE>
```

```
Configuration : Select a category
PRINT                        MORE>
```

Appear only if option(s) fitted

Appear only if option(s) fitted

```
Configuration copy : Select a category
CHANNEL  MATHS  ALARM
```

```
Configuration print: select a category
   ALL   CHANNEL  TRACE   ALARM   MORE>
```

```
Configuration for group : Everything
CONTENT FORMAT  TITLE   NEXT  PREVIOUS
```

COPY CHANNEL/ALARM
CONFIGURATION

```
Configuration print in progress
   STOP
```

This diagram shows all options.
Your display pages may be different, since softkeys
do not appear for options which are not fitted.

PRINT CHANNEL CONFIGURATION

```
Channel  1 : Select a category
   RANGE   ALARM   ZONE   TRACE   IDENT
```

```
Chart : Select a category
   SPEED  LOG INT  MODE   FORMAT  TRACES
```

BASIC
CONFIGURATION

Figure 2,3
Basic menu structure

2.3 CONFIGURATION EXAMPLE

This section gives you a step-by-step guide to the configuration of a single channel (Nº 5) to an imaginary set of input and output conditions.

It is recommended that if you are a new user, you first follow this example, and then modify it to suit your particular requirement . You can then use the COPY facility (section 2.4) to copy your configuration to one or more further channels before modifying them if necessary.

2.3.1 Required channel inputs/outputs

Before you start to configure any channel you will need to know exactly what you want the recorder to do with the input you are providing. It is recommended that, for each channel, you have a list of parameters which are to be set up similar to the following:

Channel Number	5
Temperature range	0 to 900 ˚C
Display scale	0.00 to 900.0 ˚C
Input type	Type K thermocouple, using the recorder's internal cold junction for compensation.
Chart span	400 to 800 ˚C
Chart scale	10 divisions
Input Break response	Upscale Drive.
Trace	Enabled; orange; interpolation on.
Descriptor	Furnace No1 temp A
Tag	Furn01A
Alarm	Tripped immediately if temperature exceeds 780 ˚C. Remains tripped until acknowledged. Sounds internal buzzer whilst active.

The channel is to be displayed as a member of a group called 'Furnace 1 temps' which includes channels 5 to 8, and it is to be traced with the recorder chart speed set to 60 mm/hr.

2.3.2 Accessing configuration

If the recorder is off, open the recorder door, and operate the power on-off switch located towards the bottom right of the lower paper tray

The recorder will initialise itself. This means that it gets data from the various areas of memory, and sets up the trace/ display etc. functions previously configured. If no previous configuration has taken place (as assumed below) then the 'default' values (i .e. values entered at manufacture) are used.

Once initialisation is complete, the first display page appears. The page shown opposite is the default type of display mode. Operation of the home key calls the first of the top level Operator Menu pages to the display.

```
01  OFF   1
2-LINE   MODE   HOLD   NEXT   PREVIOUS
```

Operation of the 'Softkey' immediately below the MORE> legend calls the second of the top level Operator Menu pages to the display.

```
Operator : Select a category
DISPLAY   CHART   ALARM   CHANNEL   MORE>
```

Operation of the softkey immediately below the MORE> legend calls the third of the top level Operator Menu pages to the display.

```
Operator : Select a category
 PROCESS   KEYS   TEXT      LOG     MORE>
```

As you can see, CONFIG is the fourth softkey.

```
Operator : Select a category
CLOCK   JOB SRC SYS ERR   CONFIG    MORE>
```

2.3.2 ACCESSING CONFIGURATION (Cont.)

THE RECORDER IS DESPATCHED FROM THE MANUFACTURER WITH A PASSWORD OF '10'

Operation of the softkey immediately below the CONFIG legend causes the Password entry page to appear.

```
Operator : Select a category
CLOCK   JOB SRC SYS ERR   CONFIG     MORE>
```

Enter the password, by operating the '1', then the '0' numeric keys followed by operation of the 'Enter' key:

<1> <0> ⏎ (Enter)

```
Enter Password ********
```
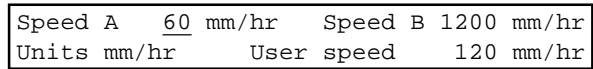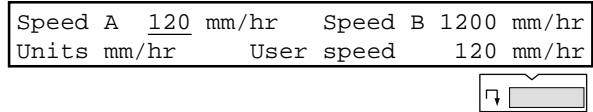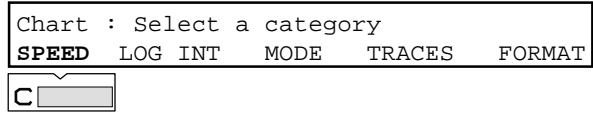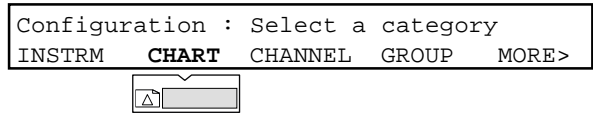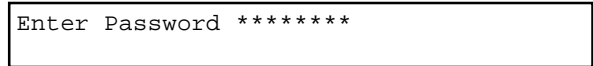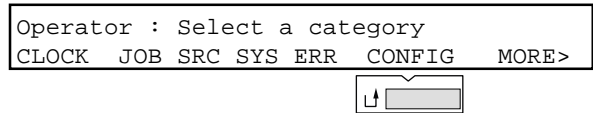
2.3.3 Chart speed

Operation of the CHART softkey calls the CHART configuration page. We are interested only in setting the chart speed, so the SPEED softkey needs to be operated

```
Configuration : Select a category
INSTRM   CHART   CHANNEL   GROUP    MORE>
```

```
Chart : Select a category
SPEED   LOG INT    MODE    TRACES     FORMAT
```

Operate the scroll down key to change speed A to 60 mm/hr, then press the enter key to save the new speed in the recorder's memory. Operate the 'HOME' key to return to the top level configuration menu. ⏎ 🏠

```
Speed A   120  mm/hr    Speed B 1200 mm/hr
Units mm/hr      User speed      120 mm/hr
```

```
Speed A    60  mm/hr    Speed B 1200 mm/hr
Units mm/hr      User speed      120 mm/hr
```

2.3.4 Channel range

Use the CHANNEL softkey to call the top level Channel Configuration Menu to the display.

```
Configuration : Select a category
INSTRM    CHART   CHANNEL   GROUP    MORE>
```

```
Channel  1 : Select a category
 RANGE    ALARM    ZONE    TRACE    IDENT
```

Select the required channel number (5 in this case) using the numeric keyboard. After channel five has been selected, press the RANGE softkey.

<5>

```
Channel  5 : Select a category
 RANGE    ALARM    ZONE    TRACE    IDENT
```

You can use the field scroll keys to scroll through the various input types available. (A single operation of the up key calls T/C (thermocouple) as input type.)

```
I/P Type Off
```

Note that ˚C and CJC type internal are default values. Alternative values are scrollable using the field scroll keys.

```
I/P Type T/C 0            to 10.00 ˚C
CJC type Internal
```

Use the arrow key twice to move the cursor to the second of the temperature input fields.

```
I/P Type T/C 0            to 10.00 ˚C
CJC type Internal
```

```
I/P Type T/C 0            to 10.00 ˚C
CJC type Internal
```

Enter the high input range (900) using the numeric keys.

<9><0><0>

Do not operate the enter key yet !

```
I/P Type T/C 0            to 900   ˚C
CJC type Internal
```

Use the page scroll key to call the next page.
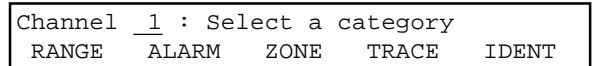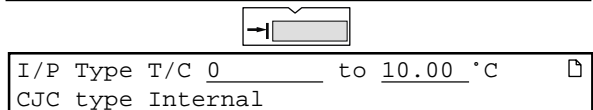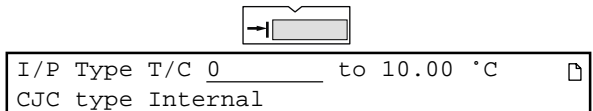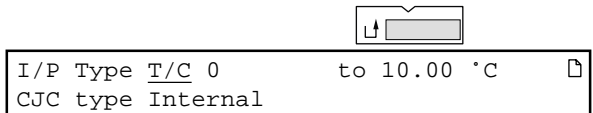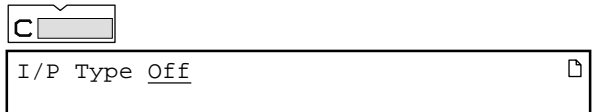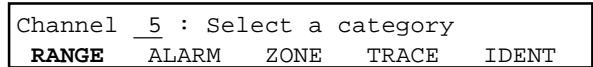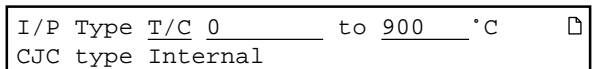
2.3.4 CHANNEL RANGE (Cont.)

LINEARISATION TYPE AND SCALING

The page scroll key calls the second channel range page to the display, where 'Linear' appears as the default.

Use the field scroll up key repeatedly to scroll through the linearisation types until 'Type K' appears.

Use the page scroll key to call the next display page:

```
Lin Func Linear
Unscaled
```

```
Lin Func Type K
Unscaled
```
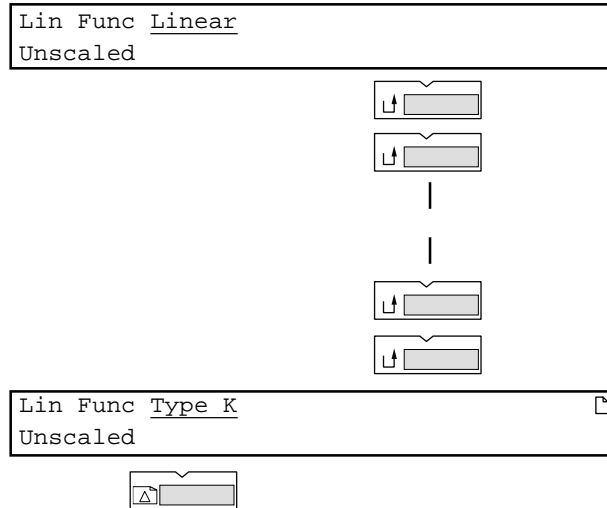
DISPLAY FORMAT AND INPUT BREAK RESPONSE

The default decimal point position is two decimal places as required.   Use the arrow key to move to the 'Damping' field.

The default 'Damping' value of 'None' is as required.

Use the arrow key to move the cursor to the 'I/P break response field. Use the field scroll up key, to change from None to 'Drive hi'.

Operate the Enter key once to confirm all the changes so far, then again to return to the top level Channel Configuration menu.

```
Value format XXX.XX
Damping None I/P break response None
```

```
Value format XXX.XX
Damping None I/P break response None
```

```
Value format XXX.XX
Damping None I/P break response None
```

```
Value format XXX.XX
Damping None I/P break response Drive hi
```
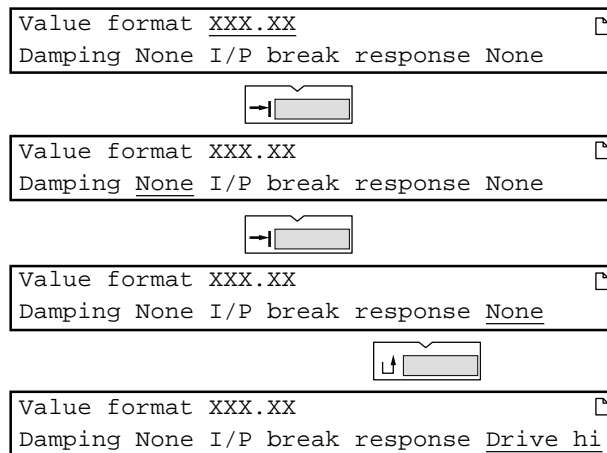
2.3.5 Channel alarms

ALARM TYPE AND SETPOINT

Use the alarm softkey to call the alarm setpoint / jobs page to the display. The default alarm number is 1, which will be used here for convenience. (The numeric keys would be used to select alarms 2 to 4 for this channel). Use the SET PT softkey to access the set-point configuration page.

Use the field scroll down key twice to scroll the alarm enable field from 'Off' through 'Trigger' to 'Latched'.

The alarm type is as required, so use the right arrow key twice to move the cursor to the Setpoint field.

Use the numeric keys to enter the value of 780.

Use the page key to call the next alarm page. Hysteresis and dwell defaults are as required. (If it had been necessary, numeric entry keys would have be used to enter a hysteresis value and to change the dwell period.)

Use the enter key once to confirm the changes, then again to return to the top level alarm page.

ALARM ACTIONS

Operation of the JOBS softkey calls the Alarm Jobs page. The default job number is 1, which we will use for convenience. You would have to use Page scroll keys to select jobs 2 to 4, were they required.

Use the field scroll up key to scroll through the job categories: Chart, Trace, Alarm.

Use the right arrow key to move the cursor to the action field, followed by a single operation of the field scroll down key to 'Sound Buzzer'. 'While active' is the required job action, and this completes the alarm configuration.

Operate the enter key once to confirm the changes, again, to return to the top level alarm page, and a third time to return to the top level channel configuration page.

```
Channel  5 : Select a category
 RANGE   ALARM   ZONE   TRACE   IDENT
```

```
Alarm 1 : Select a category
SET PT   JOBS
```

```
Enable Off       Type Absolute high
Set Point 10.00 ˚C
```

```
Enable Latched   Type Absolute high
Set Point 10.00 ˚C
```

```
Enable Latched   Type Absolute high
Set Point 10.00 ˚C
```

```
Enable Latched   Type Absolute high
Set Point 10.00 ˚C
```

<7><8><0>

```
Enable Latched   Type Absolute high
Set Point   780 ˚C
```

```
Hysteresis 00000 ˚C
Dwell 0s
```

```
Alarm 1 : Select a category
SET PT   JOBS
```

```
J1 No action
```

```
J1 Alarm     Acknowledge alarms of
Everything              On going active
```

```
J1 Alarm     Acknowledge alarms of
Everything              On going active
```

```
J1 Alarm     Sound Buzzer
                     While active
```

2.3.6 Channel zone

SETTING THE CHART AREA FOR TRACING

Use the ZONE softkey to call the first Channel Zone page. This, together with the following page allows you to enter values for Chart Span A, Chart Zone A and Chart Divisions A. Two further pages allow similar entries to be made for zone B. (Zone A or B is selected for use either by job or by Operator action.) For this example, only zone A will be configured.

Use the field scroll key to access the span page.

Use the right arrow key and numeric keys to enter the chart range (span) of 400 to 800 C

The default chart zone (full width of chart) is acceptable, so operate the page up key to call the chart scale (number of divisions) page.

CHART SCALE

Operate the field scroll up key to select 'Automatic.'

Use the right arrow key once, then the numeric keys <1> <0>, to change the number of divisions from the default (5) to 10 (as required).

This completes the channel zone configuration. Operate the enter key twice to return to the top level Channel Configuration page.

```
Channel  5 : Select a category
 RANGE    ALARM    ZONE    TRACE    IDENT
```

```
Unspanned
Chart zone A 000.0 to 100.0%
```

```
Chart span A 0       to  900    °C
Chart zone A 000.0 to 100.0%
```

<4><0><0>

```
Chart span A 400     to  900    °C
Chart zone A 000.0 to 100.0%
```

```
Chart span A 400     to  900    °C
Chart zone A 000.0 to 100.0%
```

<8><0><0>

```
Chart span A 400     to  800    °C
Chart zone A 000.0 to 100.0%
```

```
Chart scale A Off
```

```
Chart scale A Automatic divs 5
```

```
Chart scale A Automatic divs 5
```

<1><0>

```
Chart scale A Automatic divs 10
```

2.3.7 Channel trace

TRACE ON/OFF; TRACE COLOUR

Use the TRACE softkey to call the trace definition page.

Default conditions are as required except for Colour A which is required to be orange.

Use the right arrow key to move the cursor to the 'Colour A' field.

Use the field scroll down key to change colour 'A' from Red to Orange.

Use the enter key twice to return to the top level Channel Configuration page.

2.3.8 Channel Identification

SETTING TRACE IDENTIFIERS

Use the IDENT softkey to call the first channel descriptor / tag page.

Use the Clear key to clear the default descriptor.

Use the lower (secret-'til-lit) keyboard to enter the required channel name (descriptor).

Use the page key to call the Channel Tag page, and enter the new string (Furn01A) in a similar way to that described above for the descriptor.

Operate the Enter key to confirm the changes, then the Home key to return to the top level configuration page.

```
Channel   5 : Select a category
 RANGE    ALARM   ZONE   TRACE   IDENT
```

```
Trace On          Line thickening OFF
Colour A Red      Colour B Red
```

```
Trace On          Line thickening OFF
Colour A Red      Colour B Red
```

```
Trace On          Line thickening OFF
Colour A Red      Colour B Red
```

```
Trace On          Line thickening OFF
Colour A Orange Colour B Red
```

```
Channel   5 : Select a category
 RANGE    ALARM   ZONE   TRACE   IDENT
```

```
Descriptor Channel Number 5
```

```
Descriptor
```

```
Descriptor Furnace No1 temp A
```

```
Tag 5
```

```
Tag Furn01A
```

```
Configuration : Select a category
INSTRM   CHART  CHANNEL  GROUP   MORE>
```

This concludes the channel configuration as defined at section 2.3.1. It now remains to set up the group to which it is to belong (Furnace 1 temps) and finally to select that group for display. We will then print the configuration on the chart.

2.3.9 Group configuration

SELECTING THE GROUP

Use the GROUP softkey to call the top level Group Configuration page to the display.

Use the field scroll up key to scroll to the first empty group.

Use the TITLE softkey then enter the new name (Furnace 1 temps) as described for channel ident above.

A double operation of the Enter key confirms the changes, and re-calls the top level Group Configuration Page.

DEFINING GROUP CONTENT

Operation of the CONTENT softkey calls the content page.

Use the ADD and TO softkeys and numeric entry keys to enter channels 5 to 8.

Operate the Enter key twice to confirm the changes and to return to the top level Group Configuration page.

GROUP FORMAT

Operation of the format softkey allows the format of the channels in the specified group to be defined as 'Number/tag', 'Number only' or 'Number/Descriptor' using the field scroll keys.

The engineering units may be defined as being included or not according to the yes/no field on the bottom line of the display (field scroll key).

In this case, the defaults are acceptable, and the group configuration is completed by an operation of the Enter key.

This is followed by two operations of the Home key to cause a return to the Operator Top Level Menu.

```
Configuration : Select a category
INSTRM    CHART    CHANNEL   GROUP MORE>
```

```
Config for Group: Everything
CONTENT   FORMAT   TITLE   NEXT   PREVIOUS
```

```
Config for Group: Empty 1
CONTENT   FORMAT   TITLE   NEXT   PREVIOUS
```

```
Group Title is Furnace 1 temps
```

```
Config for Group: Furnace 1 temps
CONTENT   FORMAT   TITLE   NEXT   PREVIOUS
```

```
->
 CLEAR   TYPE ↑    -->    ADD      TO
```

```
->_01,
 CLEAR   TYPE ↑    -->    ADD      TO
```

<5>

```
->_05,
 CLEAR   TYPE ↑    -->    ADD      TO
```

```
-> 05- 01,
 CLEAR   TYPE ↑    -->    ADD      TO
```

<8>

```
-> 05- 08,
 CLEAR   TYPE ↑    -->    ADD      TO
```

```
Config for Group: Furnace 1 temps
CONTENT   FORMAT   TITLE   NEXT   PREVIOUS
```

```
Include item units yes
Item identification by Number/Tag
```

```
Configuration : Select a category
INSTRM    CHART    CHANNEL    GROUP    MORE>
```

```
Operator : Select a category
DISPLAY   CHART   ALARM   CHANNEL    MORE>
```

2.3.10 Selecting the group for display

Operation of the DISPLAY softkey, followed by the MODE softkey, calls the 'Group Select' page to the display

Use the NEXT and PREVIOUS keys to scroll through the various group names, until 'Furnace 1 temps' appears.

Operation of the Enter key now completes the configuration defined in Section 2.3.1

The displayed value (probably <Range) will be meaningless since the example set-up just completed will not match the actual input conditions of your own recorder. Remain in Operator Mode for the time being.

```
Operator : Select a category
DISPLAY  CHART  ALARM  CHANNEL   MORE>
```
```
C▭
```
```
01 23.57 Deg C   Pond Temperature
2-LINE    MODE   HOLD   NEXT    PREVIOUS
```
```
△▭
```
```
Grp : Everything_____  Mode Numeric
                   -->  NEXT   PREVIOUS
```
```
↵▭
```
```
Grp: Furnace 1 temps____  Mode Numeric
                   -->  NEXT   PREVIOUS
```
```
 5 <Range ˚C  Furn01A
  2-LINE   MODE   HOLD  NEXT   PREVIOUS
```

2.3.11 Printing the configuration on the chart

Before the recorder will print the configuration on the chart, you will have to turn the printer off line. To do this, operate the HOME key to bring the top level Operator menu to the display.

```
 5 <Range ˚C  Furn01A
  2-LINE   MODE   HOLD    NEXT   PREVIOUS
```
```
⌂
```
```
Operator : Select a category
DISPLAY  CHART  ALARM  CHANNEL    MORE>
```

Operate the CHART softkey
```
△▭
```
```
Chart : Select a category
 ON/OFF  SPEED  LOG INT   MODE   SCALES
```

Operate the ON/OFF softkey
```
C▭
```
```
Printer is on line
  OFF
```

Operate the OFF softkey
```
C▭
```
```
Printer is Off line
  ON      PARK  ADVANCE
```

Operate the Home key again and enter configuration mode as described in section 2.3.2.

2.3.11 PRINTING THE CONFIGURATION(Cont.)

From the first top level configuration page, use the MORE> key repeatedly until the PRINT softkey appears. (How many MORE> keys t here are, depends on how many options you have fitted in your recorder.)

```
Configuration : Select a category
INSTRM   CHART   CHANNEL   GROUP    MORE>
```

```
Configuration : Select a category
EVENTS  AUTODISP  LOGS    COPY    MORE>
```

'Maths', 'Total'r', 'Counter' and 'Timer' do not appear unless the options are fitted.

```
Configuration : Select a category
 MATHS   TOTAL'R COUNTER   TIMER   MORE>
```

'M Card` and 'Comms' appear only if the options are fitted.

```
Configuration : Select a category
 MEMORY   COMMS   TRANSFER   M CARD  MORE>
```

```
Configuration : Select a category
 DIAGS    AUTOCFIG ACCESS   ADJUST   MORE>
```

Operate the PRINT softkey.

Operate the CHANNEL softkey to initiate printing of the channel configuration on the chart.

```
Configuration : Select a category
PRINT                              MORE>
```

```
Configuration for group  Furnace 1 temps
   ALL    CHANNEL   TRACE   ALARM    MORE>
```

This will cause the recorder to print the configuration of all the channels fitted.

```
Configuration print in progress
   STOP
```

Once this is finished, the display reverts to the previous page (Configuration for group Furnace 1 temps), allowing you to print the alarm configuration, or any other part of the configuration you wish (See section 4.16 for a full list.)

```
Configuration : Select a category
   ALL    CHANNEL   TRACE   ALARM    MORE>
```
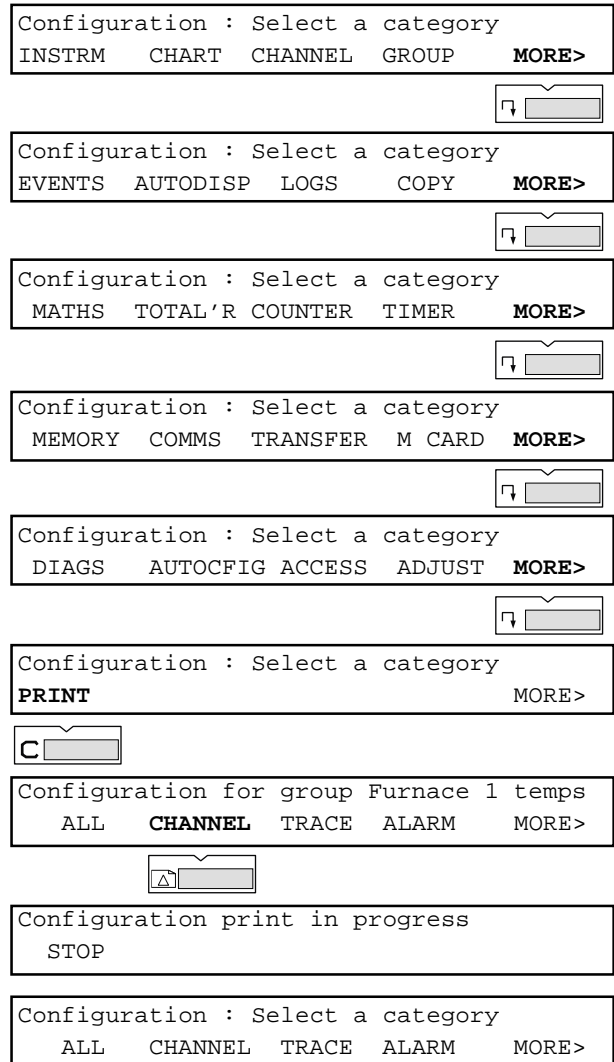
Figure 2.3.11 is an attempt to show how the channel configuration just completed should look when printed on the chart. The configuration printed includes all channels which are not configured to OFF. (In this case it is assumed that all channels except channel 5 are OFF, as delivered.)

```
**************************************************************************************
                4250M INSTRUMENT CONFIGURATION 1.11                 11:46:30  29/08/93

                    INPUT CHANNEL CONFIGURATION 1
--------------------------------------------------------------------------------------
 |TAG     |   DESCRIPTOR   |TYPE |   INPUT / RANGE     |FUNCTION|FORMAT  |    SCALE     |UNITS
 |--------|----------------|-----|---------------------|--------|--------|--------------|------
5|Furn01A|Furnace No 1 tempA|T/C  |0.0000>900.00 C   CJ INT|TYPE K |XXX.XX |400.00>800.00| C
--------------------------------------------------------------------------------------

                    INPUT CHANNEL CONFIGURATION 2
--------------------------------------------------------------------------------------
 |ADJUST    |CJ     |MV     |OHMS   |BREAK   |DAMPING
--|----------|-------|-------|-------|--------|--------
5|NONE      |       |FACTORY|FACTORY|DRIVE HI|NONE
--------------------------------------------------------------------------------------

**************************************************************************************
11:44:55 29/08/93 PRINTER OFF
```

Figure 2.3.11 Channel configuration print out.

2.4 COPY CONFIGURATION

Once a channel has been configured, you can copy its range, zone and alarm data to one or more other channels with similar configurations. The new channels retain their original trace and ident configurations.

EXAMPLE

To copy the configuration of channel 5 to channels 6 to 8, then make the following changes:
Channel 6: Trace colour = Red, Descriptor = 'Furnace No 1 temp B', Tag = Furn01B
Channel 7: Trace colour = Blue, Descriptor = 'Furnace No 2 temp A', Tag = Furn02A
Channel 8: Trace colour = Green, Descriptor = 'Furnace No 2 temp B', Tag = Furn02B

Apart from these changes, the configuration of the channels (including alarm type and setpoint etc.) is the same as for channel 5.

```
Configuration : Select a category
 INSTRM   CHART   CHANNEL   GROUP      MORE>
```

2.4.1 Copy range and zone

Enter configuration as described in section 2.3.2 above.

```
Configuration : Select a category
 EVENTS AUTODISP   LOGS      COPY      MORE>
```

Use the MORE> key, then the COPY key to access the copy menu page.

```
Configuration copy : Select a category
CHANNEL    MATHS    ALARM
```

Use the CHANNEL softkey to access the channel copy page.

```
Copy channel 01's range / zone config to
channel(s) 01 to 01
```

Note that the MATHS softkey appears only if the maths pack option is fitted.

<5>
```
Copy channel  5's range / zone config to
channel(s) 01 to 01
```

Use the numeric keys and the cursor key to enter the source channel (5) and the destination channels (6 to 8).

```
Copy channel  5's range / zone config to
channel(s) 01 to 01
```

<6>
```
Copy channel  5's range / zone config to
channel(s)  6 to 01
```

```
Copy channel  5's range / zone config to
channel(s)  6 to 01
```

<8>
```
Copy channel  5's range / zone config to
channel(s)  6 to  8
```

Initiate the copy using the Enter key.

```
Please wait
```

A further operation of the enter (or cancel) key causes a return to the previous (Select a category) page, from which you can select ALARM.

```
Copy channel  5's range / zone config to
channel(s)  6 to 8
```

```
Configuration copy : Select a category
 CHANNEL   MATHS   ALARM
```

Enter source and destination channels, and initiate the copy as for copying channels above.

```
Copy Channel  1's alarm / job config to
channel(s)   1 to   1
```

2.4 COPY CONFIGURATION (Cont.)

2.4.2 Trace colour

```
Configuration : Select a category
INSTRM    CHART    CHANNEL   GROUP     MORE>
```

Operate the Home key and enter CHANNEL configuration.

```
Channel  _5 : Select a category
 RANGE    ALARM    ZONE    TRACE     IDENT
```

<6>

Select channel 6, and operate the TRACE softkey to call the trace definition page.

```
Channel  _6 : Select a category
 RANGE    ALARM    ZONE    TRACE     IDENT
```

Default conditions are as required (trace is red).

```
Trace On          Line thickening Off
Colour A Red      Colour B Red
```

Use the enter key twice to return to the top level Channel Configuration page.

2.4.3 Trace identifiers

```
Channel  _6 : Select a category
 RANGE    ALARM    ZONE    TRACE     IDENT
```

Use the IDENT softkey to call the first channel descriptor / tag page.

```
Descriptor Channel Number 6
```

Use the Clear key to clear the default descriptor.

```
Descriptor _____
```

Enter the new descriptor using the lower keyboard as described in 2.3.8 above.

Repeat for the channel 6 tag.

```
Descriptor Furnace No1 temp B
```

```
Tag 6
```

```
Tag Furn01B
```

Use the enter key twice to return to the top level Channel Configuration page, and repeat the above for channels 7 and 8.

```
Channel  _6 : Select a category
 RANGE    ALARM    ZONE    TRACE     IDENT
```

When complete, operate the Enter key to confirm the changes, then the Home key to return to the top level configuration page.

As a final check, you can print the channel and alarm configurations on the chart.

2.4 COPY CONFIGURATION (Cont.)

```
*********************************************************************
            4250M INSTRUMENT CONFIGURATION 1.11    12:03:40  29/03/97

              CHANNEL ALARM CONFIGURATION

       |            ALARM TYPE        |UNITS AVERAGE HYSTERESIS    DWELL
 ENABLE|                             |
05_1|LATCHED  |ABSOLUTE HIGH  780.00 |  C          0.0000          0s
06_1|LATCHED  |ABSOLUTE HIGH  780.00 |  C          0.0000          0s
07_1|LATCHED  |ABSOLUTE HIGH  780.00 |  C          0.0000          0s
08_1|LATCHED  |ABSOLUTE HIGH  780.00 |  C          0.0000          0s

              CHANNEL ALARM JOBS

05_1-1| ALARM   SOUND BUZZER WHILE ACTIVE
06_1-1| ALARM   SOUND BUZZER WHILE ACTIVE
07_1-1| ALARM   SOUND BUZZER WHILE ACTIVE
08_1-1| ALARM   SOUND BUZZER WHILE ACTIVE
*********************************************************************

*********************************************************************
            4250M INSTRUMENT CONFIGURATION 1.11    11:56:30  29/08/93

              INPUT CHANNEL CONFIGURATION 1

TAG|   DESCRIPTOR         |TYPE|  INPUT / RANGE      |FUNCTION|FORMAT  |    SCALE        |UNITS
 5 |Furn01A Furnace No 1 TempA|T/C |0.0000>900.00 C  CJ INT|TYPE K |XXXX.XX |400.00>800.00  C
 6 |Furn01B Furnace No 1 TempB|T/C |0.0000>900.00 C  CJ INT|TYPE K |XXXX.XX |400.00>800.00  C
 5 |Furn02A Furnace No 2 TempA|T/C |0.0000>900.00 C  CJ INT|TYPE K |XXXX.XX |400.00>800.00  C
 5 |Furn02B Furnace No 2 TempB|T/C |0.0000>900.00 C  CJ INT|TYPE K |XXXX.XX |400.00>800.00  C

              INPUT CHANNEL CONFIGURATION 2

ADJUST |CJ     |MV     |OHMS   |BREAK    |DAMPING
 5 NONE|FACTORY|FACTORY|FACTORY|DRIVE HI |NONE
 6 NONE|FACTORY|FACTORY|FACTORY|DRIVE HI |NONE
 7 NONE|FACTORY|FACTORY|FACTORY|DRIVE HI |NONE
 8 NONE|FACTORY|FACTORY|FACTORY|DRIVE HI |NONE
*********************************************************************

11:54:55  29/08/93 PRINTER OFF
```

Figure 2.4 Configuration print for channels 5 to 8

SECTION 3: OPERATOR MENUS

LIST OF CONTENTS

SECTION 3 OPERATOR MENUS

3.1 INTRODUCTION

The operator menus (if enabled - see section 4.14) allow the operator to control certain basic recorder functions without having to use a password (i.e. without having to enter the recorder's configuration). The functions are as follows:

1   View process variable (e.g.channel, totaliser etc.) values and status.
2   Chart control.
3   Alarm status and acknowledgement.
4   Channel value display and alarm setpoint adjustment.
5   Derived channel, totaliser, counter and timer option view and control (if option(s) fitted).
6   Direct initiation of 'jobs' via softkey operation.
7   Text entry of two 'Operator Messages'.
8   Log initiation.
9   Viewing of system time and date.
10 Job source search.
11 View system errors.
12 Entry to configuration using the password.
13 Control of Rolling Memory option.
14 Control of memory card option functions.

The operator menus are arranged as a top level menu, with a number of lower levels accessed using softkeys, as depicted in figure 3.1. Page one of the top level menu appears when the 'HOME' hardkey is operated one or more times. Further pages are revealed by operating the MORE softkey on each page.

TOP LEVEL OPERATOR MENU PAGE 1 (Section 3.2)

```
Operator : Select a category
DISPLAY   CHART  ALARM  CHANNEL   MORE>
```

TOP LEVEL OPERATOR MENU PAGE 2 (Section 3.3)

```
Operator : Select a category
PROCESS   KEYS   TEXT      LOG     MORE>
```

TOP LEVEL OPERATOR MENU PAGE 3 (Section 3.4)

```
Operator : Select a category
CLOCK    JOB SRC  SYS ERR CONFIG   MORE>
```

TOP LEVEL OPERATOR MENU PAGE 4 (Section 3.5)

```
Operator : Select a category
MEMORY   M CARD              MORE>
```

Operation of MORE in page 4, causes a return to page 1. The above displays show all options current at time of print. The actual layout of the displays will depend on which options are actually fitted.

⌂ Home

Operator: Select a category
DISPLAY   CHART   ALARM   CHANNEL   MORE>

Operator: Select a category
PROCESS   KEYS   TEXT   LOG   MORE>

Operator: Select a category
CLOCK   JOB SRC SYS ERR   CONFIG   MORE>

Operator: Select a category
MEMORY   M CARD   MORE>

Use numeric keypad to enter channel number

Select channel
VALUE   ALARM   IDENT   SET PT   ZONE

Displays current channel's value
Displays current channel's alarms
Displays current channel's tag and descriptor
Displays current channel's alarm setpoints
Allows selection of alternative span, zone and scale

I/P channels in alarm
OLDEST NEWEST   ACK   CHANNEL   MORE>

Shows oldest active alarm
Shows newest active alarm
Acknow-ledges all active alarms on this page
Shows further input channel alarms, or if none, shows derived channel (if fitted) alarms.

Derived channels in alarm
OLDEST NEWEST   ACK   MATHS   MORE>

Shows further derived channel alarms, or if none, shows input channel alarms.

Chart : Select a category
ON/OFF   SPEED LOG INT   MODE   SCALES

Select chart speed A or B
Select interval A or B for log 1
Select print mode A or B
Initiate quick scale print to chart

Printer is on line
OFF   FAST OFF

Printer is off line
ON   PARK   ADVANCE

02   542.95 C   Furn01A
2 LINE   MODE   HOLD   NEXT   PREVIOUS

Select scroll or hold display
Display next or last process variable.

Grp Everything   Mode Numeric
          -->   NEXT   PREVIOUS

Use --> to move between Grp and Mode
For Grp: Scroll through the available groups.
For Mode: Scroll through Numeric, Indicator, or PV.

02   542.73 C   Furn01A
03   543.09 C   Furn01B

Operate any softkey to return to single line working

Log Everything   to chart
SEND   NEXT   PREVIOUS

Initiate log of displayed group name
Destination always 'to chart' unless memory card archiving option is fitted
Select group for printing

Text : Select a category
EDIT 1 EDIT 2 PRINT 1 PRINT 2

Print Operator Message 1 or 2 on the chart

Enter / edit Operator Message N (N = 1 or 2)

Operator message N
CLEAR   <--   -->   NEXT   PREVIOUS

Clears from cursor position to end of line.
Move cursor left or right.
Scroll through character set from current character. Use +/- key to swap character sets

Manual job keys
ACK ALL   KEY 2   KEY 3   KEY 4   KEY 5

Default action is to acknow-ledge all alarms
Actual key legends are set up in Instrument configuration. Keys are set up as latching or non-latching in Instrument configuration. Actions to be taken when the keys are operated are defined in Event configuration.

Operator : Select a category
MATHS   TOTL'R COUNTER   TIMER

Display / preset totaliser values
Display / preset counter
Start / reset/ monitor timers

Softkeys appear only if option fitted.

Use numeric keyboard to select channel number

Select derived channel
VALUE   ALARM   IDENT   SET PT

Displays current channel's value
Displays current channel's alarms
Displays current channel's tag and descriptor
Displays current channel's alarm setpoints

Enter password _____
ENTER   QUIT

Password 10 when despatched from the manufacturer. Can be edited in Instrument Configuration.

System error display
                    NEXT   PREVIOUS

Job source search : Select a category
CHART   TRACE   ALARM MESSAGE MORE>

Select job type for search

Job source search : Select a category
MEMORY LOGGING DERIVED TIMER   MORE>

Select job type for search

Job source search : Select a category
TOTAL'R COUNTER RELAY   CLOCK   MORE>

Select job type for search

Job source search : Select a category
M CARD   MORE>

Select job type for search

HH:MM:SS   Day   DD MMM YYYY

Enable/Disable input to memory;
Replay specified period (if input disabled)

Format card;
Save/restore configuration;
View status;
View directory;
Delete files;
Set up report;
Start/Stop replay;
Select archive interval A or B for log 2;
Control chart copy;
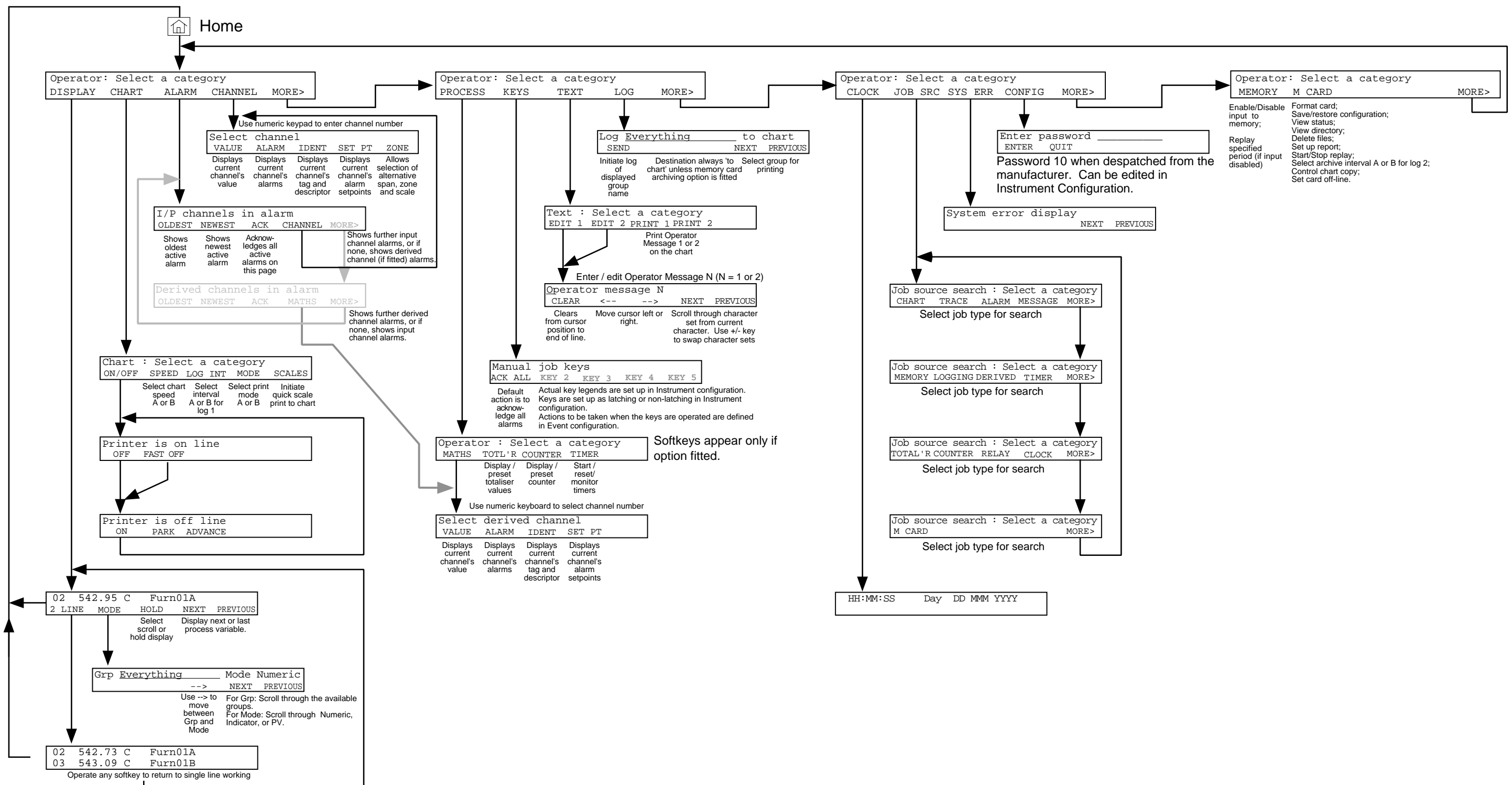Set card off-line.

Figure 3.1 Operator menu structure

This page is deliberately left blank

3.2 TOP LEVEL OPERATOR MENU PAGE 1

3.2.1 DISPLAY softkey

Operation of the DISPLAY softkey calls the DISPLAY menu page. This page contains a process variable (PV) display and the softkeys described below. After approximately 3 seconds, the PV number changes to the next highest in the group, unless HOLD has previously been selected (in which case the softkey legend is SCROLL, not HOLD). The numeric +/- key can be used to scroll through the PVs in both SCROLL and HOLD mode.

```
Operator : Select a category
DISPLAY    CHART   ALARM   CHANNEL    MORE>
```

```
01   1.234  V      Channel Descriptor—
 2 LINE    MODE    HOLD    NEXT   PREVIOUS
```

2 LINE Operation of this softkey causes the lower line of the display to show a second set of process variables, instead of the soft key captions. Enter or Cancel hardkeys, or any of the softkeys can be used to return to Single line display (i.e with softkeys on the bottom line).

MODE Operation of this key calls the 'Display mode / Group Select' page to the display. See figures 3.2.1a/b for an illustration of the different display modes available.

```
Grp Group descriptor——Mode: Indicator
—>   NEXT    PREVIOUS
```

For group functions, the top line contains the name of the currently selected group and the present display mode (Indicator in the example above). The bottom line contains three new softkeys NEXT and PREVIOUS used to scroll through the groups/display modes, and —> used to move the cursor from 'Grp' to 'Mode'.

Grp Use NEXT and / or PREVIOUS softkeys to scroll through the 12 groups.

Mode Use NEXT and / or PREVIOUS softkeys to scroll through the display modes:

 Numeric Up to three PVs can be displayed as digital values on each display line, depending on the format selected for the group. This group format (section 4.5) defines whether units and / or tags and / or descriptors appear alongside the value, and thus how many values can appear on each line (figure 3.2.1a).

 Indicator The display contains a digital value for channels and a green dynamic analogue (bar) display for the channel value.   Alarm setpoints (absolute and deviation) are shown using red underline characters (figure 3.2.1b). Totalisers, counters and timers appear only as a digital value, without the bar display. With centre zero scales, the bar origin is at the zero point, and moves left for negative values and right for positive values.

 Auto Produces a display showing the highest and lowest channels etc. in the group, together with up to two other selected channels as configured. See section 4.7.

 PV Select Allows up to 4 process variables to be selected for continuous display, independently of Group organisation.   The display can be two PVs on a single line as shown in figure 3.2.1b, or if the 2 LINE softkey is operated, the bottom line can be used to display two further PVs. To select a PV, the cursor is moved to the appropriate field, the type (Derived, Totaliser etc.) is selected, and the number entered. The cursor is moved using the softkey or the numeric decimal point key. The type is selected using the TYPE softkey or the numeric ± key, and the required PV number is entered using the numeric entry keys.

3.2.1 DISPLAY SOFTKEY (Cont.)

Group format defines what information appears at the display, and therefore how many process variables appear on each line.   The examples below show two-line working.

Process variable | Process variable value

```
05   542.95   06   543.09  07   421.98
08   432.09   D01 -120.97 D02 -111.00
```
Number only, Units: No
= 3 PVs per line

Process variable | Process variable value | Process variable units

```
05   542.95  C        06   543.09   C
07   421.98  C        08   432.09   C
```
Number only, Units: Yes
= 2 PVs per line

Process variable | Process variable value | Process variable tag

```
05   542.95 Furn01A
06   432.09 Furn01B
```
Number /tag, Units: No,
= 1 PV per line

Process variable | Process variable value | Process variable units | Process variable tag

```
07   421.98  C    Furn02A
08   432.09  C    Furn02B
```
DEFAULT DISPLAY TYPE
Number /tag, Units: Yes
= 1 PVs per line

Process variable | Process variable value | Process variable descriptor

```
05   542.95 Furnace No 1 tempA
06   543.09 Furnace No 1 tempB
```
Number /descriptor, Units: No
= 1 PV per line

Process variable | Process variable value | Process variable units | Process variable descriptor

```
07   421.98  C    Furnace No 2 tempA
08   432.09  C    Furnace No 2 tempB
```
Number /descriptor, Units: Yes
= 1 PV per line

Figure 3.2.1a Numeric indication modes

3.2.1 DISPLAY SOFTKEY (Cont.)

Alarm setpoint
(red underline)

Analogue channel value
(green underline)

Channel
Number

Digital channel
value

Scale
lower
limit

```
-20        13    -13.4 deg C     20
0          14    301.7 deg C     500
```

Scale
upper
limit

INDICATOR DISPLAY MODE (2-LINE)

Low channel

High channel

Note...
Each element of the auto
display page is configurable.
Several highest / lowest
channels can be displayed.

```
LO1    -13.4 deg C HI14     878.4 deg C
15      307.1 deg C D4       24.8 l/hr
```

Permanent channel (input)   Permanent channel (derived)

AUTO DISPLAY MODE (2-LINE)

Input channel units

Totaliser number

Input channel current value

Totaliser current value

Input channel number

Totaliser units

Note...
PV numbers fixed. To
display new PV use --> (.),
TYPE (+/-) and numeric
keys.

```
05    542.95   C    T12 34452878 litre
2 LINE    MODE    -->    TYPE ↑
```

Allows a further two PVs to be
displayed (on the bottom line). Any
softkey returns to single-line working.

Selects D (Derived channel), T (totaliser), C (counter)
or blank (Input channel). This key's function is also

Calls a further display page which
allows a new mode to be selected
(Numeric, indicator, Auto or PV).

Moves cursor. This key's function is
also carried out by the decimal point
numeric key.

PROCESS VARIABLE (PV) DISPLAY MODE (SINGLE LINE WORKING)

Figure 3.2.1b Other display modes

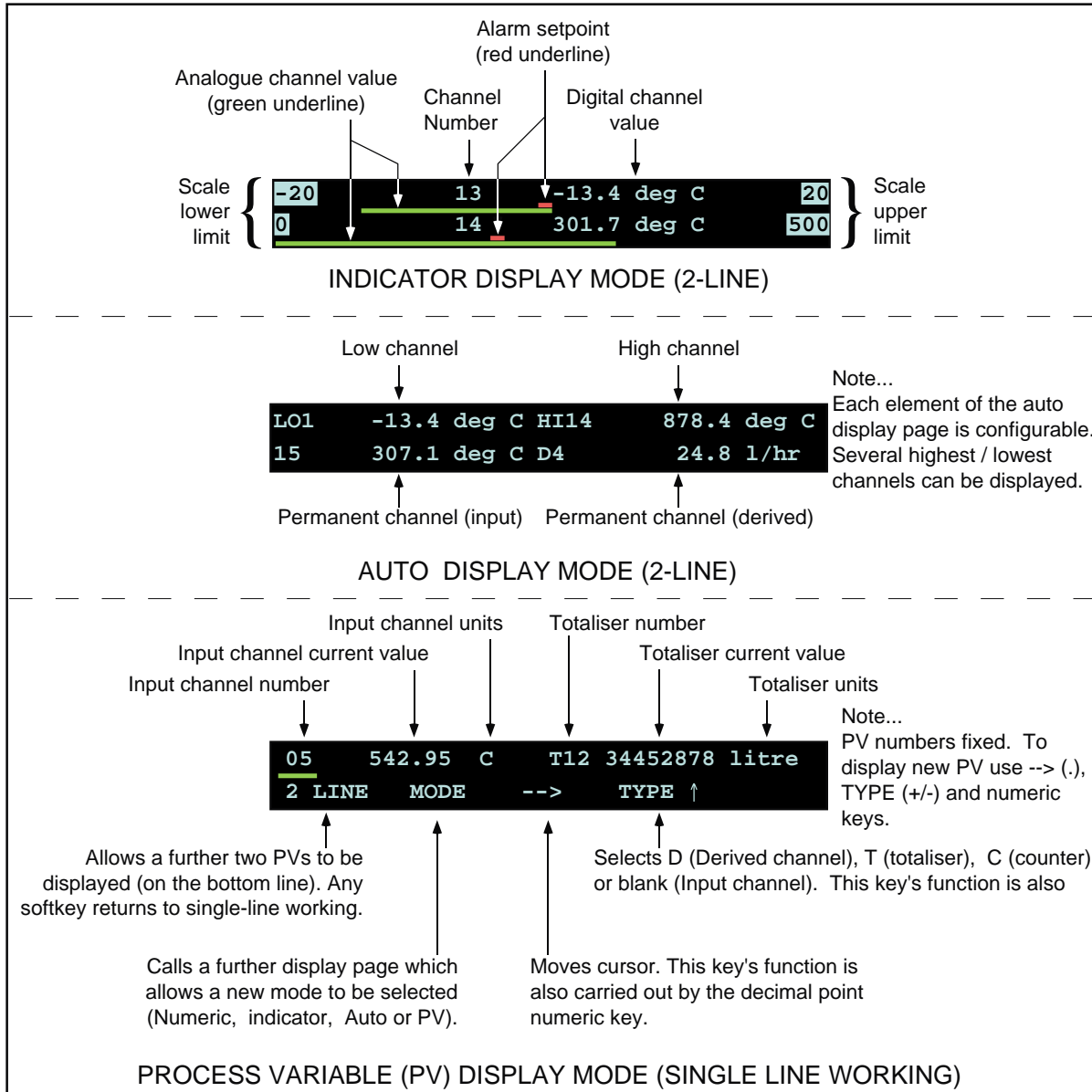|		
HOLD	Hold	Operation of this softkey causes the process variable currently being displayed to remain at the top line, instead of being replaced by the next PV in the group. Operation also causes the legend to change to 'Scroll' and the 'Hold' status indicator LED to be illuminated.
	Scroll	Operation of this softkey causes the normal PV scrolling process to take place, where each PV in the group is displayed in turn for about 3 seconds. Operation of the softkey also causes the legend to change to 'Hold' and extinguishes the 'Hold' indicator LED.
NEXT		Causes the next 'page-full' of process variables (PVs) in the currently selected group, to be displayed. The number of PVs on a display page depends on the format (see above) selected in Group Configuration (described in section 4.5) and on whether one-line or two-line operation is selected (see '2-LINE' above).
PREVIOUS		As 'NEXT' above, but the direction of scrolling is reversed.

3.2.2 Chart control page

```
Operator : Select a category
DISPLAY   CHART   ALARM   CHANNEL    MORE>
```

Operation of the CHART softkey calls the menu page depicted below.

```
Chart: Select a category
 ON/OFF   SPEED    LOG INT   MODE    SCALES
```

ON/OFF SOFTKEY

Operation of this soft key calls the chart on-off line page.   With the chart on-line, the page is as depicted below.

```
Printer is   On line
   OFF
```

OFF   If the OFF softkey is operated, the chart and printhead drives are switched off, the 'Printer Off' LED illuminates, and the display changes to the off line display:-

```
Printer is Off line
   ON       PARK   ADVANCE
```

ON   Switches the chart and print mechanism on. The display changes to the 'On-line' page shown above and the 'Printer Off' LED is extinguished..

PARK   Causes the printhead / ribbon cartridge assembly to move to the centre of the chart. Charts and ribbon cartridges should be changed only with the carriage parked in this way.

ADVANCE Operation of this key causes the chart to advance 16 cm.

SPEED SOFTKEY

Operation of the SPEED softkey allows the operator to switch between two chart speeds, known as chart speeds A and B, set up during chart configuration as described in section 4.3.

```
Chart speed is   120 mm/hr      : Speed   A
120    1200
```

```
Chart speed is 1200 mm/hr      : Speed   B
120    1200
```

The current chart speed is shown in the top line of the display. Chart speed is changed from speed A (120 mm/hr in the example above) to speed B (1200 mm/hr) by operation of the relevant softkey.

Chart speed A is selected by operation of the left-most soft key; speed B by operation of the next softkey to the right.

3.2.2 CHART CONTROL PAGE (Cont.)

```
Operator : Select a category
DISPLAY    CHART   ALARM   CHANNEL     MORE>
```
```
Chart: Select a category
 ON/OFF   SPEED    LOG INT   MODE    SCALES
```

LOG INT SOFTKEY

Log 1 can be triggered automatically, at one of two intervals, known as interval A and interval B, set up as a part of Chart configuration (Section 4.3). The group allocated to Log 1 is defined as a part of Log Configuration described in section 4.8. (If the memory card archiving option is fitted, log 2 can also be triggered automatically at one of two Archive Intervals set up as a part of the memory card configuration.) The destination of the log (chart or memory card) is set up as a part of Log configuration described in section 4.8.

Operation of the LOG INT softkey allows the operator to switch between these interval A and interval B. The current log interval is shown in the top line of the display, and the softkey captions show the alternative intervals. A log interval of, say, 00:30 means that log N°1 is printed on the chart every 30 minutes. A log interval of 00:00 stops the log being printed.

For example purposes only, in the displays depicted below, log interval A is 0 and log interval B is 1 hour.

```
Logging  interval  is  00:00   :  Interval   A
   00:00   01:0
```
```
Logging  interval  is  01:00   :  Interval   B
   00:00   01:00
```

MODE SOFTKEY

The recorder offers three 'Print Modes' which define the way in which information is presented on the chart. These modes are called : Trace priority, Text priority and Text only, and are fully described in section 4.3 (Chart configuration).

Operation of the Mode softkey allows the operator to choose between two of these modes (Mode A and Mode B) set up as a part of Chart configuration. The current print mode is shown in the top line of the display, and the softkey captions show the alternative print mode available.

For example purposes only, in the displays depicted below, Print mode A is Trace priority and Print mode B is Text priority

```
Print mode is Trace priority    : Mode   A
 TRC PRI TXT PRI
```
```
Print mode is Text priority     : Mode   B
 TRC PRI TXT PRI
```

SCALES SOFTKEY
Operation of this softkey causes the 'Quick Scale Dump' page to appear. Operation of the START soft key causes the recorder to print on the chart, the scales of all channels currently set up to trace (section 4.4.5).

```
Quick Scale Dump - Trace will be broken
   START
```

3.2.3 View and acknowledge alarms page

Operation of the ALARM softkey calls the first alarm overview page to the display. The top line of the display shows channels currently in alarm*. In the first example below, channels 3, 6 and 13 are in alarm. Alarms are presented in channel number order, with derived channels (second example below) following measuring channels.

* Or channels with latching type alarms that were not acknowledged before going out of alarm.

Channels with one or more unacknowledged alarms have a flashing underline; channels with all active alarms acknowledged have a steady underline.

```
Operator : Select a category
DISPLAY    CHART   ALARM   CHANNEL    MORE>
```

```
I/P chans 03, 06, 13,
OLDEST   NEWEST    ACK     CHAN      (MORE>)
```

```
DV chans D01, D02, D03
OLDEST   NEWEST    ACK     CHAN      (MORE>)
```

OLDEST   Shows details of the oldest currently active alarm. Allows the operator to scroll through the list of active alarms in chronological order and to acknowledge individual alarms as required.

NEWEST   Shows details of the latest currently active alarm. Allows the operator to scroll through the list of active alarms in chronological order and to acknowledge individual alarms as required.

ACK   Acknowledges all currently active, unacknowledged alarms on the display page.

> NOTE: In general, to acknowledge all active alarms the operator need make only two or three keystrokes viz: HOME hardkey (if necessary) to enter the top level operator menu; ALARM softkey and finally ACK softkey.

CHAN   Calls current channel display page (see section 3.2.4 below for details). Allows the operator to interrogate alarms channel by channel.

MORE   If there are more active alarms than can be shown on one page, or if both input and derived channel alarms are active, then the softkey caption 'MORE' appears, allowing further alarm pages to be viewed.

3.2.4 Channel parameters and alarm setpoint adjustment page

Facilities   View channel value and (in linear indication mode) scale.

View channel alarms;

View and/or modify alarm setpoints (thresholds)

View channel tag and descriptor. The tag (seven characters) is printed on the chart alongside the channel trace. The descriptor (20 characters) can be configured to appear at the display, and in printed logs.

Select 'zone' A or B (Alternative zero and full scale values, print zones and chart scales).

Access   Home key (if necessary) followed by operation of the CHANNEL softkey then numeric entry of the channel required OR

Direct to the channel value display from the alarm page described in 3.2.3 above.

Operation of the CHANNEL softkey in the top level operator menu, calls the channel menu page, as depicted below. Once the page is displayed, a channel number (6 in the page depicted below) can be entered using the numeric keypad to the right of the display.

```
Operator : Select a category
DISPLAY    CHART   ALARM   CHANNEL     MORE>
```
```
                      [↵ ▭ ]
              <6>
```
```
Channel  6: Select a category
VALUE    ALARM    IDENT   SET PT    ZONE
```

VALUE   This causes the selected channel's details to be displayed, showing current value (digital and bar-type display) descriptor, alarm setpoint(s) and scale end values.

```
 6 600.37 deg C  Furnace No 1 tempB
400                                 800
━━━━━━━━━━━━━━            ▬
```

ALARM   This causes details of the first of the channel's active alarms (if any) to be displayed. The top line shows the channel number and descriptor, the alarm number and type, and alarm time.

```
06₁   Furnace No 1 temp B  In   14:42:22
                  ACK    NEXT   PREVIOUS
```

ACK   Operation of the ACK softkey causes the alarm to be acknowledged, if unacknowledged.

NEXT   Operation of the NEXT softkey allows the channel's active alarms (if any) to be scrolled through.

PREVIOUS Operation of the PREVIOUS softkey allows the channel's active alarms (if any) to be scrolled through.

Operation of the Enter or Cancel hardkeys causes a return to the Select Channel display.

IDENT   Operation of this softkey causes the channel's tag and descriptor to appear at the top line of the display. Other channels can be accessed using the NEXT and PREVIOUS softkeys.   The Enter or Cancel hardkey is used to return to the Select Channel display.

(Continued)

3.2.4 CHANNEL PARAMETERS AND ALARM SETPOINT ADJUSTMENT PAGE (Cont.)

```
Operator : Select a category
DISPLAY   CHART  ALARM  CHANNEL   MORE>
```
```
         ⌐□
```
<6>
```
Channel  6: Select a category
VALUE   ALARM   IDENT  SET PT   ZONE
```

SET PT   Allows the operator to change alarm setpoints, reference values etc. if permitted (see access configuration in section 4.14). The example below shows a deviation alarm page. numeric entry keys are used to change the setpoint, the new value appearing in the underlined field. Operation of the enter key causes the new value to be read into the recorder data base.

```
06₁   Dev in   Ref  10.00 Dev 5.000
CLEAR (PERIOD+)   —>   NEXT  PREVIOUS
```

CLEAR   Resets the entered values to zero.

PERIOD+   Appears only with Rate-of-Change alarms, and allows scrolling of the 'period' field.

→   This softkey allows the active (i.e. flashing) cursor to be moved between the configurable fields Ref and Dev. Once the flashing cursor is below the relevant field, the numeric keys are used to enter the new value. The cursor changes from green to red to indicate that the enter key needs to be operated to save the new value(s).

NEXT   Calls the next alarm for the channel.

PREVIOUS   Calls the previous alarm for the channel

ZONE   Operation of this softkey allows the user to select one of two settings (A or B) of zero, span and print zone, to apply to the selected channel.   The settings for A and B are defined in the channel Zone configuration described in section 4.4.4

```
6 Zone is 0   to 100% :    Zone A
ZONE A   ZONE B
```
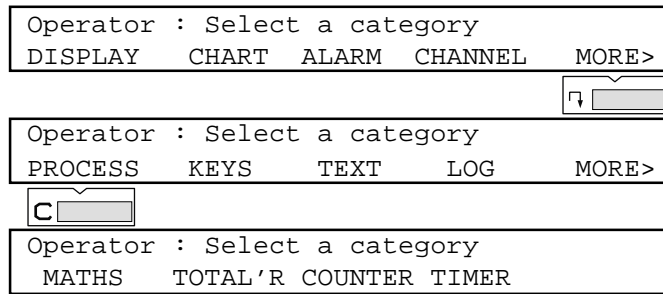
ZONE A   Allows user to select zone A

ZONE B   Allows user to select zone B
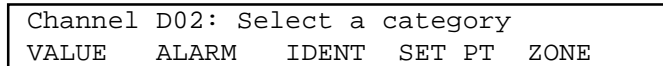
3.3 TOP LEVEL OPERATOR MENU PAGE 2

Facilities	Maths pack	As for measuring channels, but channel number prefixed with 'D' (Use =/- key to toggle between measuring and derived channels).
	Totalisers	View totaliser value; Edit pre-set value; Set totaliser to pre-set value
	Counters	View counter value; Edit pre-set value; Set counter to pre-set value
	Timers	Start and / or reset timer(s). View timer status.

Access   HOME key (if necessary) followed by operations of the MORE and PROCESS softkeys.

3.3.1 Process page

Operation of the PROCESS softkey calls the process menu page to the display if any options are fitted. If no options are fitted, then a message 'No process options fitted' will appear for three seconds.

```
Operator : Select a category
DISPLAY    CHART   ALARM   CHANNEL     MORE>
```

```
Operator : Select a category
PROCESS    KEYS     TEXT     LOG      MORE>
```

```
Operator : Select a category
 MATHS    TOTAL'R COUNTER TIMER
```

MATHS   Operation of this softkey calls the DERIVED CHANNEL menu page as depicted below.

```
Channel D02: Select a category
VALUE    ALARM    IDENT   SET PT   ZONE
```

Once the page is displayed, a channel number can be entered using the numeric keys. The remaining displays are as described for measuring channels (section 3.2.4 above), except that where a maths function is resettable, a RESET softkey appears in the relevant VALUE page.

TOTAL'R Operation of this softkey allows totaliser values to be viewed, and pre-set, if required. The relevant totaliser (1 to 1 2) is selected by use of the numeric entry keys.

```
Totaliser T 1 :Select a category
  VALUE   EDIT
```
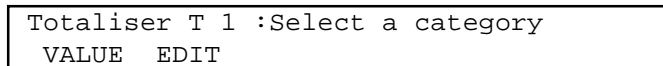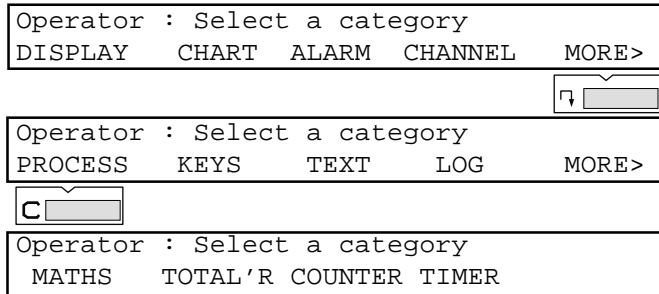
VALUE Operation of this softkey displays the value of the selected totaliser. The totaliser value can be set to the pre-set value, using the PRESET softkey. NEXT and PREVIOUS softkeys call other totalisers' values to the display.

EDIT   Allows the Pre-set value to be changed.

```
T 1 12345678 Units Totaliser descriptor
PRESET                        NEXT PREVIOUS
```
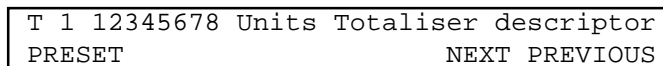
COUNTER Similar to the totaliser described immediately above allowing the counter to be set to a pre-set value, from which it will count.
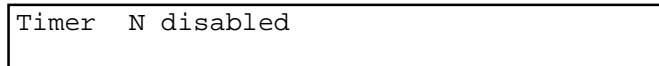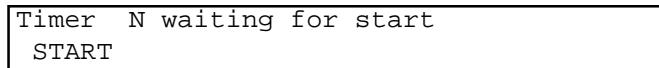
3.3.1 PROCESS PAGE (Cont.)

```
Operator : Select a category
DISPLAY   CHART  ALARM  CHANNEL    MORE>
```

```
Operator : Select a category
PROCESS   KEYS     TEXT    LOG     MORE>
```

```
Operator : Select a category
 MATHS    TOTAL'R COUNTER TIMER
```

TIMER   Operation of this softkey calls the timer display page. The required timer is selected using the numeric
              entry keys.
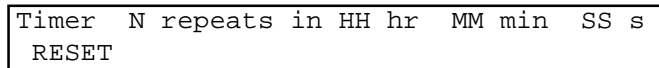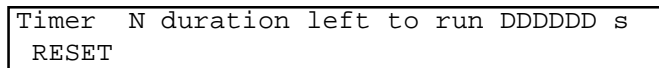
```
Timer 1:Select a category
CONTROL IDENT
```
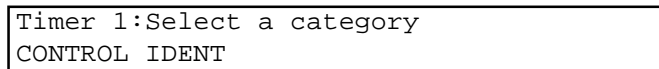
CONTROL   Calls one of the following control pages, depending on current status..

```
Timer  N disabled
```

The timer is disabled in timer configuration (section 5.4)

```
Timer  N waiting for start
 START
```

START   Causes the timer to start.

```
Timer  N duration left to run DDDDDD s
 RESET
```

```
Timer  N repeats in HH hr  MM min   SS s
 RESET
```

RESET   Resets the timer. Duration / Repeat period are set up in timer configuration (section 5.4).

IDENT   Calls the timer ident page.   A 20-character descriptor can be entered as a part of each timer's
              configuration (section 5.4).

```
Timer  N DDDDDDDDDDDDDDDDDDDD
NEXT   PREVIOUS
```
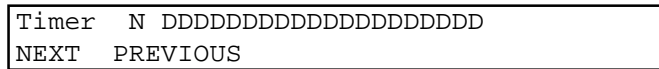
NEXT   Calls the next timer's ident page to the display
PREVIOUS Calls the previous timer's ident page to the display.

3.3.2 KEYS softkey

Operation of this softkey calls the user-configured softkey captions (section 4.2.1 - Instrument configuration Page 2) to
the display. The softkeys are used to allow the operator to trigger jobs. Use the Cancel or Enter key to return to the top
level menu.

3.3.3 TEXT softkey

Applications   Generating notes to print on the chart.
               Adding batch numbers to the chart.
               Entering the Operator's name to be embedded in other messages.
Access   HOME key (if necessary), followed by operation of the MORE and TEXT softkeys

The TEXT softkey allows the operator to edit up to two messages, one or both of which can then be printed on the chart, using the PRINT 1 and / or PRINT 2 softkeys. Either of these messages can be embedded in other messages (Section 4.2).

```
Operator : Select a category
DISPLAY    CHART   ALARM   CHANNEL    MORE>
```

```
Operator : Select a category
PROCESS    KEYS    TEXT       LOG     MORE>
```

```
Text: select a category
EDIT 1   EDIT 2   PRINT 1   PRINT 2
```

Operation of the EDIT 1 or EDIT 2 softkey calls the edit page to the display.

Text of operator message number 1 or 2

```
CLEAR      <--       -->    NEXT   PREVIOUS
```

CLEAR   Clears the message from the cursor position (inclusive) to the end of the line.
<—   Moves cursor left
—>   Moves cursor right
NEXT*   Selects next character in the currently selected character set
PREVIOUS*   Selects previous character in the currently selected character set

* The lower keyboard would normally be used for text entry. The NEXT and PREVIOUS keys allow the entry of characters which do not appear on the lower keyboard. See section 2.2.3 for details of character sets.

EMBEDDED SEQUENCES

The messages can include one or more embedded sequence, each of which causes the current value of a particular variable (eg. time, date, value of channel N etc.) to be included, automatically, in the message when printed. The sequences are embedded using the < and > characters (delimiters) to separate them from normal text. The available sequences, which must be entered as shown, are as follows:-

 <TIME> Embeds the current time in hh:mm:ss format
 <DATE> Embeds the current date in the format defined in Instrument Configuration (DD/MM/YY or MM/DD/YY).
 <OP1>   Not valid for Operator Messages. For Custom or Alarm Messages (section 4.2.1) <OP1> embeds operator message N° 1. If Operator message N° 1 itself contains embedded sequence commands, these will not be expanded.
 <OP2>   As <OP1>, but for operator message N° 2.

The remaining sequences require both a source and a type to be defined as <ITEM-TYPE> or <ITEM.TYPE>. If the ITEM is a channel, and the hyphen (-) format is used, then the TYPE is underlined (in red) if it has an active or unacknowledged alarm associated with it. If the dot (.) format is used, or if the ITEM is not a channel, this underlining is not carried out.

(Continued)

3.3.3 TEXT PAGE (Cont.)

EMBEDDED SEQUENCES (Cont.)

ITEMS

Blank Use the triggering item itself (e.g alarm, totaliser) as the source.
nn   Use measuring channel nn as the source.
Dnn   Use derived channel nn as the source.
Tnn   Use totaliser Nº nn as the source.
Cnn   Use counter Nº nn as the source.
Enn   Use event Nº nn as the source.
tnn   Use timer Nº nn as the source.

TYPES

PV Causes the ITEM's process value to be embedded.
TA Causes the ITEM's tag to be embedded.
DE Causes the ITEM's descriptor to be embedded.
UN Causes the ITEM's units string to be embedded
NO Causes the ITEM's identification number (eg. 11, T2, D43) to be embedded.

EXAMPLES

The message <TIME><DATE><.TA><-PV><.UN> would cause the current time and date, followed by the tag, process value (underlined if in alarm) and units, to be printed for the message's triggering source.

For a specified ITEM (measuring channel 12 in this example) <TIME><DATE><12.TA><12-PV><12.UN> would result in the same message being printed, but for channel 12 instead of the triggering source.

3.3.4 Manual log generation

This softkey appears only if operator access to log generation has not been disabled (section 4.14).   Operation allows the operator to initiate the any of the logs.

```
Operator : Select a category
DISPLAY    CHART   ALARM   CHANNEL   MORE>
```

```
Operator : Select a category
PROCESS    KEYS    TEXT      LOG      MORE>
```

```
Log Everything            to destination
  SEND                      NEXT   PREVIOUS
```

Log   Presents the title of the group assigned to the first log (section 4.8). Logs can be scrolled through using NEXT and PREVIOUS softkeys.
destination   'to chart' or, if a memory card logging option is fitted, 'to filename' according to how the log is configured.
SEND   Causes selected log to be initiated.
NEXT   Allows further logs to be scrolled through 'forwards'.
PREVIOUS   Allows further logs to be scrolled through 'backwards'.

3.4 TOP LEVEL OPERATOR MENU PAGE 3

```
Operator : Select a category
DISPLAY    CHART ALARM  CHANNEL    MORE>
```

```
Operator : Select a category
PROCESS    KEYS    TEXT     LOG     MORE>
```

```
Operator : Select a category
 CLOCK   JOB SRC   SYS ERR CONFIG    MORE>
```

3.4.1 CLOCK softkey

Operation of the CLOCK softkey calls the following page to the display, allowing the operator to check the system time and date.

Setting time and date, and selecting date format (DD/MM/YY or MM/DD/ YY) are part of Instrument Configuration described in section 4.2.1.

```
HH:MM:SS     Day DD MMM YYYY
```

3.4.2 Job source search

Function   To allow the operator to find all the triggers which have been set up to initiate a particular job.

Operation of the JOB SRC softkey calls the first of the following pages to the display. Subsequent pages are called by operation of the MORE> softkey.

```
Job source search : Select a category
 CHART    TRACE    ALARM   MESSAGE    MORE>
```

```
Job source search : Select a category
 MEMORY LOGGING DERIVED   TIMER     MORE>
```

```
Job source search : Select a category
TOTAL'R COUNTER    RELAY   CLOCK     MORE>
```

```
Job source search : Select a category
 M CARD                             MORE>
```

Operation of any of the category softkeys presents the menu of jobs associated with the selected category (section 4.1.4). Use of the next and / or previous softkeys allows the menu items to be scrolled through. The first item in the CHART category is depicted as an example, below.

```
Chart printer on line
                        NEXT   PREVIOUS
```

Once the required job has been located, operation of the enter key causes the recorder to search for all trigger sources for that job.

<div align="center">(Continued)</div>

3.4.2 JOB SOURCE SEARCH (Cont.)

After a 'Please wait' message, the job sources will be presented at the bottom line of the display. Up to 8 sources can be displayed on one page, but if there are more than eight, the first six are displayed along with a 'MORE>' softkey to allow access to remaining sources.

```
Chart printer on line
01₁, D03₂, E06, T04, C01, t05, MORE>
```

Where

a. Normal measuring channels are presented without prefix.
b. Derived channels have the prefix 'D'.
c. Event numbers have the prefix 'E'.
d. Totaliser numbers have the prefix <u>CAPITAL</u> 'T'.
e. Timer numbers have the prefix 't'.
f. Counters have the prefix 'C'.
g. Alarm numbers are presented as subscript numbers after the associated channel number.

Thus, in the above example, the chart is put on-line by Channel 1, Alarm 1 or Derived channel 3, Alarm 2 or Event 6 or Totaliser 4 or Counter 1 or Timer 5 or by further sources on subsequent pages (MORE>).

3.4.3 System error display

System errors can be viewed by operating the SYS ERR key in the operator menu. System errors are presented one at a time on the top line of the display. If more than one system error is operative, the 'page' symbol appears as the right-most character of the top line, and the NEXT and PREVIOUS keys can be used to scroll through the list (section 2.2.2).

3.5 TOP LEVEL OPERATOR MENU PAGE 4

```
Operator : Select a category
DISPLAY    CHART   ALARM   CHANNEL    MORE>
```

```
Operator : Select a category
PROCESS    KEYS    TEXT      LOG      MORE>
```

```
Operator : Select a category
 CLOCK   JOB SRC   SYS ERR CONFIG    MORE>
```

```
Operator : Select a category
MEMORY   M CARD                      MORE>
```

3.5.1 MEMORY softkey

Function   To allow the operator to enable / disable input to the rolling memory, and to replay from a specified date
                and time

```
Memory input Disabled Output Stopped
ENABLE                         REPLAY
```

Rolling memory stores data from a single group, sampled either on event, or at a specified interval as set up in configuration (Section 5.6).

If operator access is allowed (section 4.14), the operator can enable and disable input to the memory.   Whenever input is enabled, the previous contents of the memory are destroyed. The operator can also replay the contents of the memory. The replay takes place at 1200 mm/hr. chart speed; the equivalent 'real' chart speed for the memory period is printed on the chart at the start of replay. All other chart 'activities' are stopped during replay.

If input is enabled when REPLAY is operated, the memory will be replayed from the start.

If input is disabled then the operator may enter a start time and date, and the replay will include only the period between the specified start time and the latest sample. If no start time is entered, the entire memory content is replayed. Once replaying, the memory input cannot be enabled.

For further details, see the description in section 5.6 of this manual.

3.5.2 M CARD softkey

A full description of this option is to be found in a separate Memory Card Instruction Manualsupplied with every recorder fitted with the option.

```
Memory card : Select a category
  DIR     STATUS CHT CPY OFFLINE    MORE>
```

```
Memory card : Select a category
 REPORT INTERVL    SAVE   RESTORE    MORE>
```

```
Memory card : Select a category
  FORMAT                            MORE>
```
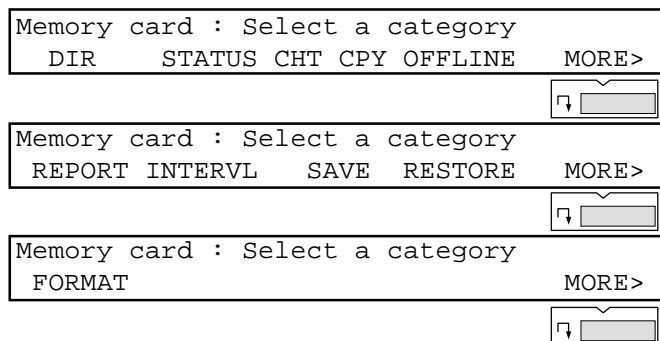
DIR	Allows the operator to scroll through the files on the card and to delete any which are unwanted.
STATUS	Allows the operator to view the number of unused kB available on the card.
CHT CPY	Allows an exact copy of chart traces to be saved on the memory card
OFFLINE	Allows data transfer to the card to be stopped. This allows a full card to be changed without loss or corruption of data.
REPORT	Allows one or more specified files to replayed (e.g. all today's files)
INTERVL	Allows the user to select archiving interval A or B. SAVE Allows a configuration to be saved on a formatted memory card
RESTORE	Allows a configuration, previously saved on the memory card, to be retrieved to any similar recorder having the memory card option.
FORMAT	Allows a memory card to be formatted prior to a SAVE operation.

Operator access to some or all of the above functions can be disabled as described in section 4.14.

SECTION 4: CONFIGURATION

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(Continued)

SECTION 4

LIST OF CONTENTS (Continued)

SECTION 4: CONFIGURATION

From Operator menu (Figure 3.1)

```
Configuration : Select a category
  INSTRM    CHART    CHANNEL    GROUP    MORE>
```
Section 4.2 | Section 4.3 | Section 4.4 | Section 4.5

Clock | Speed | Input type | Content
Messages | Log interval | Linearisation | Format
Alarm | Mode | Units | Title
messages | Format | Range
Scales | Traces | Scale
   More> | | Alarm
| | Zone
Cards | | Trace
Password | | Ident
Softkeys
Language
   More>

Remote CJ
Lin. tables
Trace table*
Cycle time
   More>

System error
Ident
Network*

```
Configuration : Select a category
  EVENTS    AUTODISP    LOGS    COPY    MORE>
```
Section 4.6 | Section 4.7 | Section 4.8 | Section 4.9

Source | Set up | Content | Channel
Jobs | autodisplay | Destination* | Alarms
Ident | windows | Units | Maths*

```
Configuration : Select a category
  MATHS*    TOTAL'R*    COUNTER*    TIMER*    MORE>
```
Section 5.3 | Section 5.2 | Section 5.2 | Section 5.2

Function | Function | Preset | Function
Units | Alarm | Alarm | Jobs
Scale | Ident | Ident | Ident
Alarm
Zone
Trace
Ident

> * Option softkeys appear only if the relevant option is fitted. (For this reason, the positions of the softkeys on your instrument may vary from those shown in this diagram.)

```
Configuration : Select a category
  MEMORY*    COMMS*    TRANSFER    M CARD*    MORE>
```
Section 5.4 | See separate manual | Section 4.11 | See separate manual

Sample | Protocol | Save/ | Format card
interval | Baud Rate | restore | Save/
| Parity | settings | restore
| Data bits | | configuration
| Stop bits | | View status
| Handshake | | View
| Group | | directory
| address | | Delete files
| | | Set up report
| | | Start/stop
| | | replay
| | | Archive
| | | interval
| | | Chart copy
| | | Card off line

```
Configuration : Select a category
  DIAGS    AUTOCFIG    ACCESS    ADJUST    MORE>
```
Section 4.12 | Section 4.13 | Section 4.14 | Section 4.15

SBC type | Initiate | Chart | Input
Boards | | Channel | Output
Printer | | Text | Chart
Relays | | Group | Calibrate
Output | | Maths
CJ Temp | | Counter
Comms | | Totaliser
Default | | Timer
configuration | | Memory
Mem card
Display

```
Configuration : Select a category
  PRINT                            MORE>
```
Section 4.16

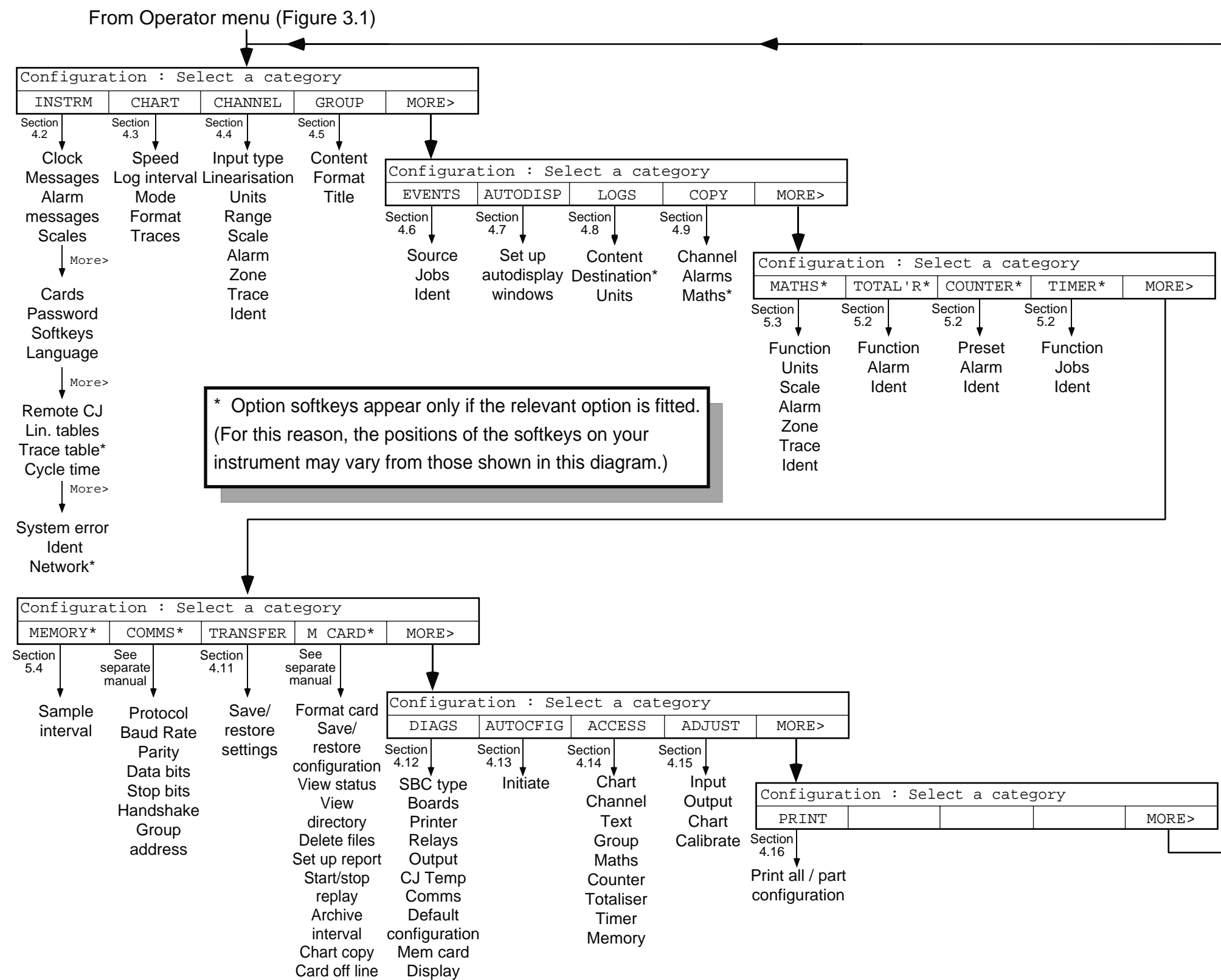Print all / part
configuration

Figure 4.1 Access to configuration

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4.1 INTRODUCTION

> NOTE: In order to help new users, a configuration guide appears as Section 2 to this manual. This gives step-by-step instructions to allow the configuration of a single input channel to be carried out and then copied to other channels.

The configuration of the recorder is carried out in a number of separate operations (categories) as listed below in the order in which they appear at the recorder display. See figure 4.1.

1.   Instrument
2.   Chart
3.   Channels / alarms
4.   Groups
5.   Events and jobs
6.   Auto display
7.   Logs
8.   Configuration copy
9.   Maths functions (option)
10. Totalisers (option)
11. Counters (option)
12. Timers (option)
13. Rolling memory (option)
14. Memory Card (option)
15. Communications (option)
16. Transfer
17. Diagnostics
18. Autoconfiguration
19. Operator access
20. Adjust
21. Configuration print

As will become clear, the techniques used in the configuration of the recorder are largely the same as those for the Operator Menu described in section 3 above. For this reason, large parts of this configuration section are laid out more as a reference section than as descriptive matter.

TIMEOUT

Unless one of the activities listed below is taking place, a return to the normal background display will be made after 4 minutes of keyboard inactivity. Should this happen, the configuration menus can be re-entered only after a further entry of the password (see section 4.1.1 below).

Timeout will not occur under the following conditions:
Changes to CARDS configuration are being confirmed
Autoconfiguration in progress
Configuration save or restore (to memory card) in progress
Memory card being formatted
Memory card is offline
Configuration printing is in progress
Channels are being copied
Channel adjustment, Input calibration or Cold Junction calibration is in progress
Recorder is in diagnostics.

4.1.1 Password

In order to prevent unauthorised access to the recorder configuration, a password protection system operates. When dispatched from the factory the password is 10.

This password can be changed as a part of the Instrument Configuration described below. If a password of a single 0 (zero) is set up, the configuration menus can subsequently be accessed directly from the operator menu (CONFIG softkey) without password.

4.1.2 Character set

When entering text strings, the following characters are available directly from the lower keyboard.

0 to 9, A to Z, a to z, - _ < + > = / , ; . : Σ ∫ $ ( ) * % & # μ à ° ç ê é ù è ô δ Ä ä Ö ö Ü ü ß Ω

Capital letters, <, >, comma and : are entered by operating the lower of the Alternative key-character select keys at the bottom left of the keyboard at the same time as the relevant character key. Lower case letters, numerals, -, +, / and full stop are entered by using only the appropriate key. The alternative characters printed at the bottom right-hand corner of most keys are entered using the second (upper) alternative key-character key (see section 2.2.3 for more details).

Thus, to enter a units string of mΩ/V, for example, the key strokes would be:

Together   Together
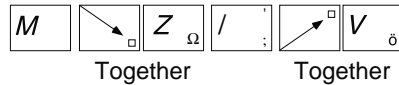
Other characters are available using the field scroll and +/- keys as described in section 2.2.3.

4.1.3 Other keys

   The 'Home' key, is used to return to the top level menus. During 'Operation' the Home key will cause a return to the top level operator menu from anywhere in the lower operator menus. During 'Configuration', the Home key will cause a return to the top level Configuration menu from any of the lower level configuration menus. A further operation causes a return to the top level operator menu.

   The 'Enter' key, is used to confirm parameter changes, text entries etc. and cause them to be written to the recorder's data base. As soon as a configurable item is changed, its underline changes to red to remind the operator that the enter key will need to be operated before this change is saved in the recorder's memory.

The 'Cancel' key, is used to cancel all changes made and indicated by a red underline. Operation of the cancel key restores the previous values, and the cursor changes back to green.

   The 'Clear' key, is used to delete text strings from the cursor position to the end of the line, or to set numeric values to zero in order to make entry of new data easier. This key should not be confused with the blank key (located below the '1') used for entering spaces in the text.

   The left and right arrow keys are used to move the cursor from field to field. Field scroll keys are used to scroll through the various items associated with certain fields. For example the various linearisation types can be viewed by continuous use of one of these keys.

   Page scroll keys are used to access second or third pages of certain displays. For example, the communications configuration is in two pages; the first page allows the desired protocol, Baud rate, Parity value and the number of data bits to be set up. Operation of a page key calls the second page, which allows the number of stop bits to be defined, and allows the hardware handshake to be enabled or disabled.

NOTES
1. A page symbol (▯) appears at the top right of the display if there are further pages to access.
2. The left cursor and page down keys are not available at the upper keyboard.

4.1.4 Jobs

A 'job' is defined as an action that can be initiated by an alarm, a timer, a counter etc. Jobs can be configured to be active continuously whilst the initiating source is active (or inactive) (e.g. Select chart speed B), or to carry out a particular task (e.g. Increment totaliser Nº 3) as the result of a single trigger going active or inactive. Up to four jobs can be initiated by each alarm, timer etc. as shown in figure 4.1.4 below.

Job triggers

JOB TYPES	JOB ACTIONS (Up to four per trigger)
Chart Jobs	Switch chart drive on; Switch to chart speed B; Switch to print mode B; Chart advance.
Trace Jobs	Trace specified channel/group; Select Zone B for specified channel/group; Select colour B for specified channel group; Rapid scale print.
Alarm Jobs	Acknowledge alarms of specified group Disable alarms in specified group; sound buzzer.
Message Jobs	Output specified message to the chart, display, rolling memory, or memory card.
Logging Jobs	Output specified log; Switch to log interval B; Switch to archive interval B
Derived Channel Jobs	Reset, trigger, disable, switch or trace specified channel or group of channels
Timer Jobs	Start or reset specified timer; Reset all timers (global reset).
Counter Jobs	Increment, decrement, preset or disable specified counter; Preset or disable group of counters.
Totaliser Jobs	Preset specified totaliser / group of totalisers; Disable specified totaliser or group of totalisers.
Memory Jobs	Start or stop replay; Enable or disable input; Trigger sample; Select sample interval B.
Relay Jobs	Operate specified relay on specified relay board.
Clock Jobs	Add or subtract one hour; Load preset time.
Memory card Jobs	Switch chart copy on/off; Replay specified report; Stop replay of current report.

Channel alarm

Contact closure i/p

Counter setpoint

Totaliser setpoint

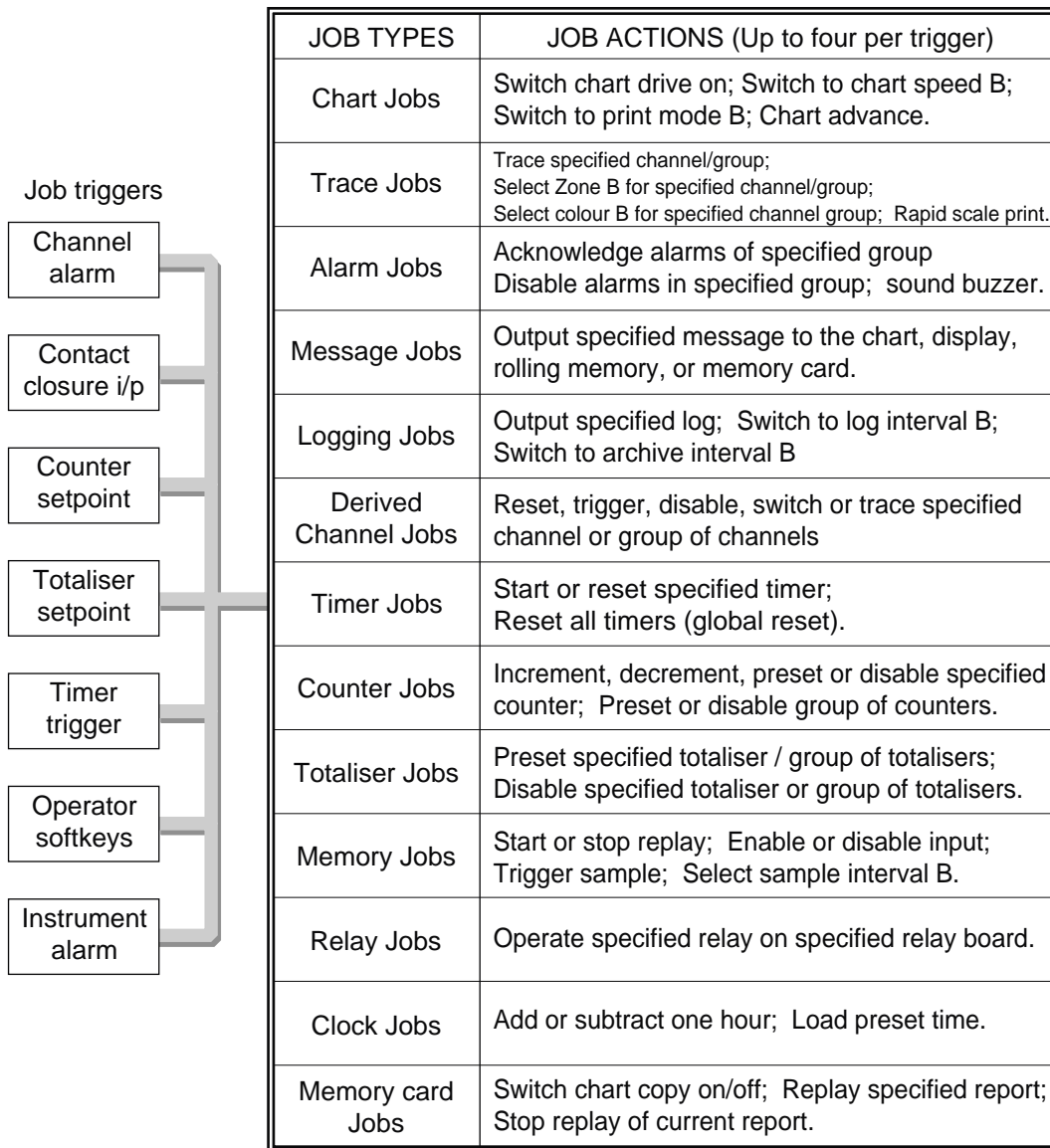Timer trigger

Operator softkeys

Instrument alarm

Figure 4.1.4 Job triggers, types and actions

4.1.5 Logs

Logs are alpha-numeric reports showing the current values of a specified group of variables. Which group is allocated to which log is set up as a part of the log configuration (section 4.8), and the content of each group is set up as a part of Group Configuration (Section 4.5).

Logs can either be printed on the chart, or if the relevant option is fitted, they can be directed to a memory card. Log destination (chart or card) is set up as a part of Log configuration (section 5.7)

LOGGING TO CHART

Logs are printed in black (with a coloured underline for status indication), either on demand, or as a result of a job becoming active.

Log 1 can be printed automatically, at one of two configurable log intervals (Chart configuration - section 4.3) selectable from the operator menu. If the relevant option is fitted, log 2 can also be printed automatically, at one of two configurable archive intervals (Memory card configuration) selectable from the operator menu.

Two chart logging formats are available as follows:

Tabular logs. When tabular log mode is in operation, the relevant values are printed across the full width of the chart. The number of values per line depends on how much information (e.g. descriptors, tags) is to be included (group configuration - section 4. 5).

Column logs. When column log mode is in operation, each logged value is printed on a separate line, at the left edge of the chart. It is thus possible, (using the zoning feature to ensure the traces are to the right - hand side of the chart), to print a log without overprinting the traces.

Up to 12 logs are available, each of which can be allocated a 'group' as described in section 4.8. The printing of a log can be initiated in the following ways:
a) by the operator (section 3.3.4)
b) as a result of job action (section 4.1.4)
c) for log 1, automatically, at one of two fixed time periods (log intervals).
d) if memory card archiving software is fitted, log 2 can also be printed automatically at one of two fixed time periods (archive intervals) set up as a part of the memory card configuration

The content of the log depends on how the group has been configured (e.g. do channels have descriptors / tags, units printed etc.) as described in section 4.5.

OPERATOR INITIATION

As described in section 3.3.4, log printing can be initiated, at any time, by the operator, from the LOG softkey in the level 1 Operator Menu.

JOB ACTION

As shown in figure 4.1.4, one of the jobs types available is 'Logging'. Within this category, a particular log number can be selected for printing when the job becomes active, and / or the logging interval can be selected to 'B'.

4.1.5 LOGS (Cont.)

LOG INTERVAL

As detailed in section 4.3 below, two log intervals (A and B) can be entered as a part of the chart configuration. The intervals are in hours and minutes; an entry of 0:0 disabling automatic log printing. As supplied by the factory, log interval A is set to 00:00 (off); interval B to 01:00 (1 hour). Under normal conditions, log interval A is used by the recorder.   Log interval B is selected either by the operator from the CHART menu, or by job action (see section 4.1.4).

ARCHIVE INTERVAL

If memory card archiving software is fitted, two archive intervals (A and B) can be entered, as a part of the memory card configuration, for the automatic printing of log 2. Interval A or B is selected for use from the top level Operator menu or by job action (section 4.1.3). The intervals are in hours, minutes and seconds; and entry of 00:00:00 disabling automatic printing. As supplied by the factory, both archive intervals are set to 00:00:00 (off). Refer to the Memory Card manual for full details.

LOGGING TO MEMORY CARD

Logging to memory card is initiated in exactly the same way as logging to chart, described above, except that the destination (set up in Log configuration) is a file name instead of 'chart'. Refer to the Memory Card manual for full details.

4.2 INSTRUMENT CONFIGURATION

```
┌─────────────────────────────────────────┐
│ Configuration : Select a category       │
│  INSTRM    CHART   CHANNEL   GROUP    MORE> │
└─────────────────────────────────────────┘

┌─────────────────────────────────────────┐
│ Iinstrument : Select a category         │
│  CLOCK    MSG'S   ALM MSGS SCALES    MORE> │
└─────────────────────────────────────────┘

┌─────────────────────────────────────────┐
│ Instrument : Select a category          │
│  CARDS    PASSWD    KEYS   LANG'GE   MORE> │
└─────────────────────────────────────────┘

┌─────────────────────────────────────────┐
│ Instrument : Select a category          │
│  REM CJ   LIN TAB TRC TAB   CYCLE    MORE> │
└─────────────────────────────────────────┘

┌─────────────────────────────────────────┐
│ Instrument : Select a category          │
│  SYS ERR   IDENT                     MORE> │
└─────────────────────────────────────────┘
```
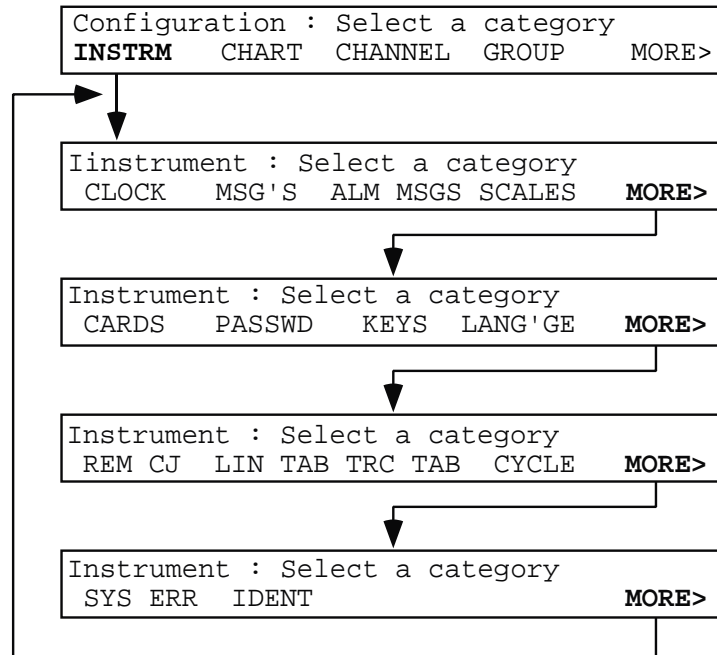
Figure 4.2 Instrument configuration

The instrument configuration allows the following items to be set up:

1. Current Date and Time (CLOCK softkey). It should be noted that adding or subtracting an hour can be done using 'Clock' jobs, simplifying time changes at Spring and Autumn.
2. A Preset Time (CLOCK soft key). Used to synchronize clocks of multiple instruments.
3. The date format (Day/Month/Year or Month/Day/Year) to be chosen
4. Printed messages (up to 50 printed or displayed by job action) (MSG'S softkey). These are different from the two Operator Messages described in section 3.3.3, but may include these, and other embedded sequences.
5. Alarm on/off and alarm acknowledgement messages, including the time at which the action occurred, can be printed automatically if the messages are enabled (ALM MSG'S softkey). The messages apply only to latching and non-latching alarms on measuring or derived channels. This saves the user having to set up jobs to trigger user messages.
6. Customised scales (SCALES softkey). This allows the user to define exactly what information is to appear where on the printed scale. Up to four scales can be set up, and any channel can be configured to use one of these scales, instead of the normal automatic scaling. See section 4.4.4 - Channel zone.
7. Which card type is located in which slot is usually determined automatically using AUTOCONFIG. This can be overruled from within the CARDS pages to allow slots to be used for COMMS or TEST inputs, neither of which requires an I/O board to be fitted. Further , it is possible to 'shutdown' cards I/O boards to allow them to be removed without spurious alarms being generated.
8. A new password can be entered (PASSWD softkey). The recorder is dispatched from the factory with the password '10'.
9. The five softkeys can be used as event sources. The KEYS softkey allows the labels which are to appear above the keys to be entered, and the key action to be defined as latching or non- latching. Softkey jobs are set up in Event Configuration (section 4.6).
10. The display language can be selected as French, German or English (LANG'GE softkey).
11. One or more channel numbers can be defined as remote CJ inputs (REM CJ softkey). This allows either a single channel to be used for all channels set up for remote CJ, or a channel can be set up as remote CJ input for each input card. The remote CJ temperature units can also be set up.

(Continued)

4.2 INSTRUMENT CONFIGURATION (Cont.)

12. User linearisation tables of up to 32 points can be entered as input / output pairs.
13. A fixed trace profile can be entered to act as a 'template' for a process variable (e.g. to see how closely the measured value compares with the theoretical value).
14. A recorder iteration period can be set, which overrides the normal 1 second period. If an error message is required when the recorder cannot meet the specified iteration rate, then this can also be set up.
15. System errors can be displayed, and where relevant, cleared.
16. A recorder identifier can be entered for use in logging to memory card (if fitted) and with networked instruments

As can be seen from figure 4.2 above, entry is by operation of the INSTRM softkey in the top level configuration menu. In order to return to higher levels of menu, the Cancel, Enter or Home key is operated.

PAGE 1 PARAMETERS

CLOCK (Page 1)	Time	Allows entry of Hours and Minutes. Entry method: numeric keys. The clock starts when the 'Enter' key is operated.
	Date	Allows entry of Day number, Month and Year. Entry method: field scroll keys (month); numeric entry (Day, month and year). Day name is automatically linked to the rest of the date.
	Preset time	Allows entry of preset hours and minutes for job action (e.g. clock synchronization among multiple recorders). Entry method: numeric keys.
CLOCK (Page 2)	Date format	Allows Day/Month/Year (DD/MM/YY) or Month/Day/Year (MM/DD/YY) to be chosen for date display/printing.
MSG'S	Select Customised Message. EDIT	Entry method: Numeric or field scroll keys. (1 to 50) Presents selected message text for editing using lower keyboard. See also section 3.3.3 for details of embedded sequences.
ALM MSG'S	Alarm on/off messages	Scrollable Yes or No to enable / disable, respectively, the automatic printing of alarm on and alarm off messages. (Format of messages is: HH:MM Alarm(s) on (off) CCn, DCCn etc, where HH:MM is the time at which the alarms changed state, CC is the channel number and n is the alarm number (1 to 4). DCC is used to denote a derived channel number.)
	Alarm acknowledgement messages	Scrollable Yes or No to enable/disable, respectively, the automatic printing of alarm acknowledgement messages.
SCALES	Select customised scale EDIT	Entry method: Numeric or field-scroll keys. (1 to 4). Presents selected scale for editing. The lower line of the display initially represents the first 40 of the 104 positions at which characters can be printed on the chart. The right and left arrow keys are used to move the cursor around the scale. When the fortieth character is reached (i.e. the right-hand end of the display line) further operations of the right arrow key result in the scale's apparently moving left, until cursor position 104 is reached. Any of the keyboard characters can be entered at any of the 104 positions. Operation of the 'Enter' key confirms the new scale. 'Cancel' or a further 'Enter' returns to the 'Select customised scale' page.

4.2.1 INSTRUMENT PARAMETERS (Cont.)

PAGE 2 PARAMETERS

CARDS	Addr1 to AddrB	Allows the card type for each address to be set up (see section 4.4.1), and to be defined as either enabled or shutdown. 'Shutdown' allows a card to be removed from its slot without any resulting alarms etc. being generated and also allows the recorder I/O to be configured even if the cards are not fitted. The page scroll keys are used to scroll through Empty, Universal i/p, Relay, Comms, Test, 8-channel o/p 16 channel i/p or 4-channel o/p. (Comms is used when data sent over a serial link to be traced on the chart without an I/O board.) If any modification is made, operation of the ENTER key will call up a 'QUIT / CONTINUE' page, asking if the instrument is to be re-initialised to the new card configuration.
PASSWD	Enter new password	A new password can be entered. Passwords can be up to 10 characters long and can include any of the keyboard characters. A password of 0 (zero) allows direct entry from the operator menu. Once the password has been confirmed by operation of the 'Enter' key, the operator is requested to enter it again (to ensure that it was correct the first time). If the second entry differs from the first, the message 'New Password Rejected' appears, and the recorder returns to the 'Instrument: Select a category' page.
KEYS	Operator key N	Allows the five softkeys to be defined for use from the Operator menu as event sources. The page scroll keys are used to scroll through the five displays. On each page, the softkey legend can be entered using the keyboard, and each softkey can be defined as being latching or non-latching by using the field scroll keys. The actions associated with each softkey are defined as part of the Event configuration (Section 4.6).
LANG'GE	ENGLISH / FRENCH / GERMAN	Sets all further displays into English / French / German.

4.2.1 INSTRUMENT PARAMETERS (Cont.)

PAGE 3 PARAMETERS

REM CJ	Channel NN (DNN)	Allows one or more input channels to be defined (using the numeric keys) as remote CJ inputs. The input types, linearisations etc. must be entered as a part of channel configuration, using the same temperature units as those specified in the 'Units of' field described immediately below. To use a derived channel, the channel number must be entered with a 'D' prefix, or the ± key must be used.
	Units of	Allows ˚C, ˚F , Kelvins or ˚ Rankine to be selected for the remote CJ, using the field scroll keys.
	Enable/Disable	Allows the operator to disable the remote CJ channels.
LIN TAB	CONTENT	Allows entry of up to three linearisation tables, each of which can have up to 32 input / output pairs, either equally or non-equally spaced. The user can select which sets of points to apply to a particular input signal. A linear interpolation is carried out between pairs.
	TITLE	Allows a table title to be entered.
TRC TAB	CONTENT	If the Quality Monitor Option is fitted, this allows the entry of a profile to be traced on the chart. Used, for example, to compare an input signal with a theoretical ideal. Up to six 'tables may be entered, each of which may have up to 32 segments. See section 5.5 for details.
	TITLE	Allows the operator to enter an eight-character descriptor for the selected table.
CYCLE	Cycle time	Allows the operator to force the recorder iteration rate to a value other than its normal one second.
	System error cycle time limit	When set to zero, no error is reported if the recorder cycle time exceeds the default (1 sec.) or user specified cycle time. If the error time limit is set to the default or user specified time, then a system error message is generated each time the cycle time exceeds the error limit time.

PAGE 4 PARAMETERS

SYS ERR	Operation of this softkey causes any system errors (e.g. Paper Out) to be displayed. Where appropriate, a CLEAR softkey is included on the bottom line. If more than one error message is active, the page scroll keys are used to access further pages.
IDENT	Allows the operator to enter a unique instrment identifier for inclusion in memory card logs (if the relevant option is fitted) and with networked instruments.

4.3 CHART CONFIGURATION

The chart configuration allows the following items to be set up:

1. Chart speed units (SPEED softkey). This allows the choice of mm/hr or inches/hr. This selection should be made before any new chart speed settings are made.
2. Chart speeds A and B (SPEED softkey). This allows two alternative speeds to be entered for selection from the Operator menu (section 3.2.2) or by job action (section 4.1.4). The available fixed speeds (table 4.3) are scrolled through using the field scroll keys.
3. A user-defined chart speed can be entered using the numeric keys. The available range is from 0 to 1500 mm/hr or 0 to 60 in/hr. according to the speed units chosen.
4. Logging intervals A and B (LOG INT softkey). This allows two alternative logging intervals to be entered for selection from the Operator menu or by job action. The logging interval defines how often log 1 is automatically triggered. (0 = automatic triggering of log 1 disabled.)
5. Print modes A and B (MODE softkey). This allows two print modes to be defined for selection from the Operator Menu or by job action. The available print modes: Trace priority, Text priority and Text only are described below in section 4.3.2.
6. Log format (FORMAT softkey). Two formats are available, Tabular (across the chart) and columnar (down the left-hand side of the chart).
7. Interpolation (TRACES softkey). Allows interpolation to be switched on or off. Interpolation 'on' causes the printer to draw a horizontal line between normal dotting points, to smooth the trace at high chart speeds.
8. Dot density (TRACES softkey). Scrollable between high and low. High increases the trace density of all channels, at the expense of reduced ribbon life.
9. Adaptive recording (TRACES softkey). Allows adaptive recording to be switched on or off. Adaptive recording traces all signal variations even at low chart speeds.

```
Configuration : Select a category
INSTRM   CHART   CHANNEL   GROUP     MORE>
```

```
Chart : Select a category
 SPEED   LOG INT   MODE      FORMAT   TRACES
```
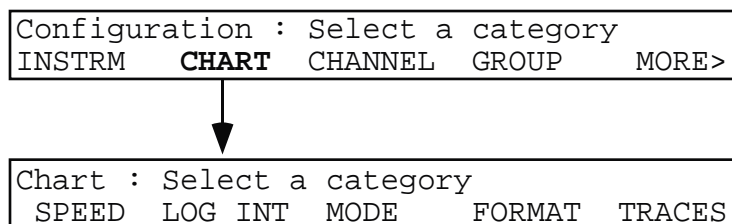
Figure 4.3 Chart configuration

As can be seen from the figure, entry is by operation of the CHART softkey in the top level configuration menu. In order to return to higher levels of menu, the Cancel, Enter or Home key is operated.

4.3.1 Chart parameters

NOTE: If the chart speed units are to be changed, this should be done before setting chart speeds. In particular, the 'user speed' is not converted, so if, for example, a mm/hr value is entered and the units are subsequently changed to in/hr. the entered 'user speed' value is lost.

SPEED	Speed A (B)	Allows chart speed A (B) to be entered for selection by the operator or as a result of job action. Chart speeds are scrolled-through using the field scroll keys. The available chart speeds are listed in the table below.
	Units	Allows mm/hr or in/hr to be selected using the field scroll keys. See the note above.
	User speed	Allows entry of any speed up to 1500 mm/hr (60 in/hr) using the numeric keys. As stated in the note above, if this entry is made before the chart speed units are changed, the value is lost (i.e. set to zero).

mm/hr	Off	5	10	20	30	60	120	300	600	1200	1500	User
mm/hr	Off	0.25	0.5	1	2	4	5	6	10	25	50	User

Table 4.3 Available chart speeds

LOG INT	Logging interval A (B)	Allows log 1 interval A (B) to be entered for selection by the operator or as a result of job action. Logging intervals (in hours and minutes up to 99 hrs, 99 minutes.) are entered using the numeric entry keys. An entry of 00:00 causes automatic initiation of log 1 to be inhibited. (Archive interval is set up as a part of the Memory Card configuration.)
MODE	Print mode A (B)	Allows print mode A (B) to be entered for selection by the operator or as a result of job action. The field scroll keys are used to scroll through the three available modes: Trace priority, Text priority, Text only (see section 4.3.2 for further details).
FORMAT	Scale format	Allows channel scales to be printed with: descriptor only, tag only or descriptor and tag.
	Log format	Allows Columnar or Tabular to be selected for logging format by means of the field scroll keys.
TRACES	Interpolation	Use the field scroll keys to enable / disable interpolation.
	Dot density	Use the field scroll keys to select high/low density.
	Adaptive recording	Use the field scroll keys to enable / disable adaptive recording.

4.3.2 Print modes

The recorder can operate in one of three modes to print data on the chart:

Trace priority. All message types can be printed, but the traces are not interrupted. All demand messages are queued until printed. If the queue overflows, 'Message lost' is printed on the chart.

Text priority. Demand messages are printed in overprint (i.e. traces are not interrupted) if the print queue is less than 70% full. Otherwise, message printing takes priority and the traces are broken. When logging, tabular logs always break the trace, columnar logs never break the trace. If the queue overflows, 'Message lost' is printed on the chart.

Text only. All cyclic messages are inhibited. Only logs and demand messages are output. This mode is intended for report generation and alarm logging. If the print queue overflows, 'Message lost' is printed on the chart

4.4 CHANNEL CONFIGURATION

Channel / alarm configuration is described in the following sub-sections: Range, Alarm, Zone, Trace, Ident. Each of these categories is accessible by softkey action from the Channel level 1 display.

In order to help new users, Section 2 gives step-by-step instructions to allow the complete configuration of a single input channel to be carried out, then copied to further channels.

4.4.1 Channel address allocation

Each I/O board has an address (irrespective of its physical slot location) allocated to it by a user-accessible rotary switch. Each address is associated with eight channels as shown in table 4.4.1.

If, for example, 8-channel boards with addresses 1 and 3 are fitted, but address 2 is not used, then channels 1 to 8 and 17 to 24 are available for measurement purposes but channels 9 to 16 are not. These channels can still be configured (if shutdown as described in section 4.2.1 (CARDS)), if the missing board is later to be fitted.

Address	Channel Numbers	Address	Channel Numbers
0	Invalid	8	57 to 64
1	1 to 8	9	65 to 72
2	9 to 16	A	73 to 80
3	17 to 24	B	81 to 88
4	25 to 32	C	89 to 96
5	33 to 40	D	Relay only
6	41 to 48	E	Relay only
7	49 to 56	F	Relay only

Table 4.4.1 Channel addressing

ADDRESSING RULES

1.   Address 0 is not recognised by the I/O boards, and any data requested or sent is ignored.
2.   16-channel boards use two addresses, so the first address after a 16-channel board, must not be used. (This does not mean that the slot cannot be used, just that one address must be skipped). 16-channel cards cannot be allocated Address C
3.   8-channel input boards can be allocated any valid address provided that the preceding address is not assigned to a 16-channel board.
4.   Relay output boards can be allocated any valid address provided that the preceding address is not assigned to a 16-channel board.
5.   As despatched from the factory, address 1 is at the left-most slot when viewed from the rear of the recorder.

ACCESS TO ADDRESS-SETTING SWITCHES

CAUTION
Always switch the recorder off, or isolate from line power before opening the writing system, and ensure that the printhead is parked.

Release the captive screws located as indicated in figure 4.4.1. Pull the writing system forward to its stops, then lift it out, disconnecting the connector at the Power Supply Unit as it becomes accessible.

The address switches are located on the front edges of the I/O boards. The address is adjusted by inserting a small, preferably plastic, tool into the switch slot, and rotating the switch wiper to the required position.
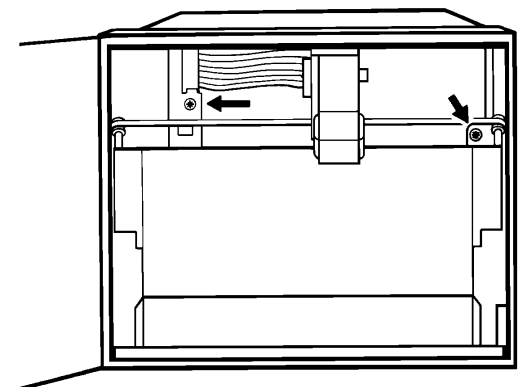

Figure 4.4.1 Opening the writing system

4.4.2 Channel configuration: Range

INPUT CHANNELS

Operation of the CHANNEL softkey causes the level 1 channel configuration page to appear. Operation of the RANGE softkey from this page calls the first of the three Range pages to appear. Four of the alternative input types, together with their subsequent pages are depicted in figure 4.4.2a. The parameters on these pages set the selected channel to measure as required and are described in the tables below.

On page one, select input type and range of measurement. Go to page two before operating the 'Enter' key.   For thermocouples, select cold junction compensation type.   For 'current' inputs, specify a shunt value. For 'digital' inputs, open and closed state labels (descriptors) can be entered.

On page two, select a linearisation type to match the input type selected at page one. For a voltage or current input representing a temperature, enter a linearisation range. For signals requiring scaling before trace and display, enter scale limits to match the input range.

On page three, select decimal point position for the display, select a damping period and input break response.
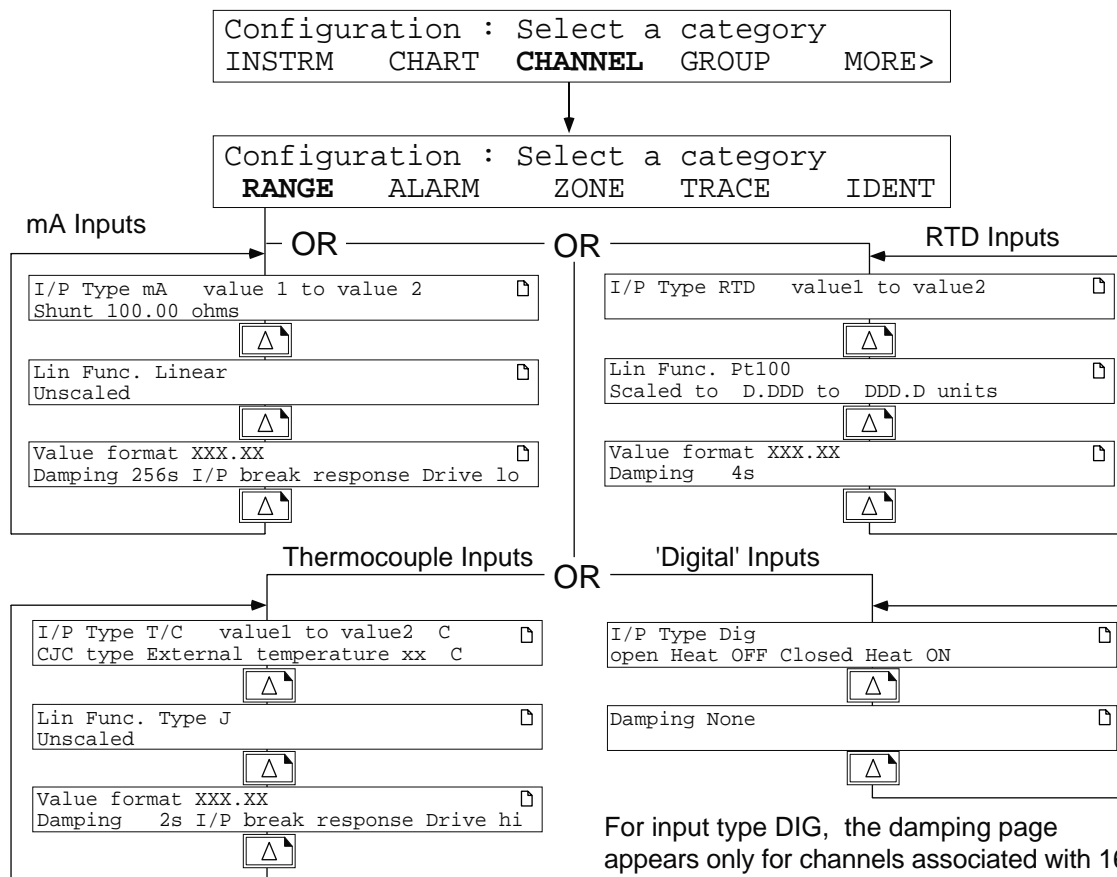

Figure 4.4.2a Input channel configuration: Typical range pages

4.4.2 INPUT CHANNEL CONFIGURATION: RANGE (Cont.)

PAGE 1 PARAMETERS

I/P type		Allows the required input type to be selected. The available types (scrolled by the field scroll keys) are as follows:
	NOTE: A suitable linearisation function must be selected from page two before the 'Enter' key is operated. If this is not done, the message 'Invalid configuration' will appear.	
	Off	The channel is switched off; no processing of channel input or alarms takes place.
	T/C	Selects 'thermocouple' as the type of input.
	mV	Selects mV as the type of input.
	V	Selects Volts as the type of input
	mA	Selects mA as the type of input
	RTD	Selects resistance thermometer as the type of input. (Not 16-channel board)
	Ohms	Selects Ohms as the type of input. (Not 16-channel board).
	Dig	Selects digital (discrete) input (switch contact). Open input is accepted if the resistance across the input terminals is > 3000 Ohms. Closed input is accepted if the resistance across the input terminals is less than 500 Ohms. Contact closure inputs are not available on channels 1, 8 or 16 of the 16- channel dc input board (dig does not appear as a menu item for these channels.)
	Comms	Must be selected if the host computer is to write values to the channel (applicable only to recorders fitted with the communications option).
	Test	Allows a test sine or triangular waveform to be selected.
Value 1 (2)		Allows entry of the expected range of the input signal. Value 1 is the low end of the range; Value 2 the high end.
°C		For thermocouple and RTD inputs, the temperature units can be set to °C, °F, K (Kelvin) or Rankine (R) using the field scroll keys.
CJC type		Allows Internal, external or remote cold junction compensation to be applied by scrolling through the three types, using the field scroll keys. Applies only if input type is 'thermocouple'.
	Internal	The recorder uses the recorder's integral cold junction for compensation.
	External	Allows the temperature, at which the external cold junction is to be maintained, to be entered using the numeric keys. The temperature units for the cold junction are those set up as input units.
	Remote	Selects 'Remote' to be used for cold junction compensation. The channel which measures the temperature to be used is defined as a part of the instrument configuration, as described in section 4.2.
Shunt		Allows a shunt value to be entered (using numeric keys) when mA is selected as input type. A 100 Ohm shunt gives 2 V at 20 mA ; a 250 Ohm shunt gives 5 V at 20 mA. The value entered must match the shunt connected across the inputs.
Open (closed)		Allows two legends to be entered for 'digital' inputs, one for the open input case; the other for when the inputs are closed. These legends appear at the display as channel status.

The page down key is operated to call the second range page to the display:

NOTE: DEFAULT ALARMS.
If the input type is changed to DIG, the alarm type defaults to OFF, Digital, Dwell 0 sec.
If the input type is changed from DIG, the alarm type defaults to OFF, Absolute high, Setpoint 10.00.

4.4.2 INPUT CHANNEL CONFIGURATION: RANGE (Cont.)

PAGE 2 PARAMETERS

Lin Func	Allows an appropriate linearisation function to be defined for the input type selected at page one. The following linearisations can be scrolled through using the field scroll keys:
	Thermocouples:
	    Types B, E, J, K, L, N, R, S, T, U, NiMoNiCo (note 3), Platinel II
	Resistance thermometers:
	    Pt100, Pt1000, Cu10, Ni100, Ni120
	Other functions:
	    Linear, sqrt, $x^{3/2}$, $x^{5/2}$, User 1, User 2, User 3

	NOTES 1. An appropriate linearisation function must be selected here, before the i/p type is 'Entered' at page one. If this is not done, the message 'Invalid Configuration' will appear. 2. The 16 channel dc input card supports a maximum of eight different linearisation functions, including 'linear'. 3. Previous versions of the recorder came with NiNiMo linearisation instead of NiMoNiCo.
Unscaled / Scaled to	The field scroll keys are used to scroll between 'Unscaled' and 'Scaled to'. <u>Unscaled</u>: The scale is identical with the range. <u>Scaled to</u>: Used to allow entry of chart / displayed values, when the input value (page 1) and the chart/displayed values are to be different, as in the following example. <u>Example</u>: An input from a transducer has a range of 0 to 5 V. It is required however that the displayed value is in %, where 0 V represents 0% and 5 V represents 100%. In such a case, a range would be set (in page 1) of 0 to 5, and a scale would be set here, in page 2, of 0 to 100.
Units	Allows a Units string to be entered using the keyboard / field scroll keys. The cursor (left and right arrow) keys are used to move from character to character. The Clear (C) key can be used to delete the existing or newly entered string, from cursor to the end of the line. (Use of the Cancel (X) key will cause all the changes so far made in pages one and two to be lost).

The page down key is operated to call the third range page to the display.

PAGE 3 PARAMETERS

Value format	Allows the required decimal point position to be chosen for display. The available positions (scrolled-through by the field scroll keys) are: X.XXXX, XX.XXX. XXX.XX, XXXX.X, XXXXX.
Damping	For the 16-channel dc input board, one of the following time constants (scrolled-through using the field scroll keys) can be applied to any input signal: None, 2, 4, 8, 16, 32, 64, 128 or 256 seconds. For the 8-channel universal input board, damping can be applied to all types of input, except 'dig' (Contact closure).
I/P Break response	Allows Drive hi(gh), Drive lo(w) (not 16-channel board) or None to be selected, using the field scroll keys. Drive hi causes the trace to move to full scale (span) if the input goes open circuit. Drive lo causes the trace to move to chart zero. If 'none' is selected, the trace will drift, responding to any voltages picked-up by the external wiring acting as an aerial.

Operation of the Enter key causes all the changes made in pages one, two and three to be sent to the recorder data base. Operation of the page down key recalls page one to the display. A further operation of the 'Enter' key, or operation of the cancel key returns the level 1 Channel configuration page to the display.

4.4.2 CHANNEL CONFIGURATION : RANGE (Cont.)

OUTPUT CHANNELS

Operation of the CHANNEL softkey causes the level 1 channel configuration page to appear. Operation of the RANGE softkey from this page calls the first of the Range pages to appear. Alternative output types, together with their subsequent pages are depicted in figure 4.4.2b. The parameters on these pages are described in the tables below.

On page one, select output type, range of measurement and source of input.   For input or derived channel sources, page two allows offset and span values to be entered. for constant source, this page does not appear.

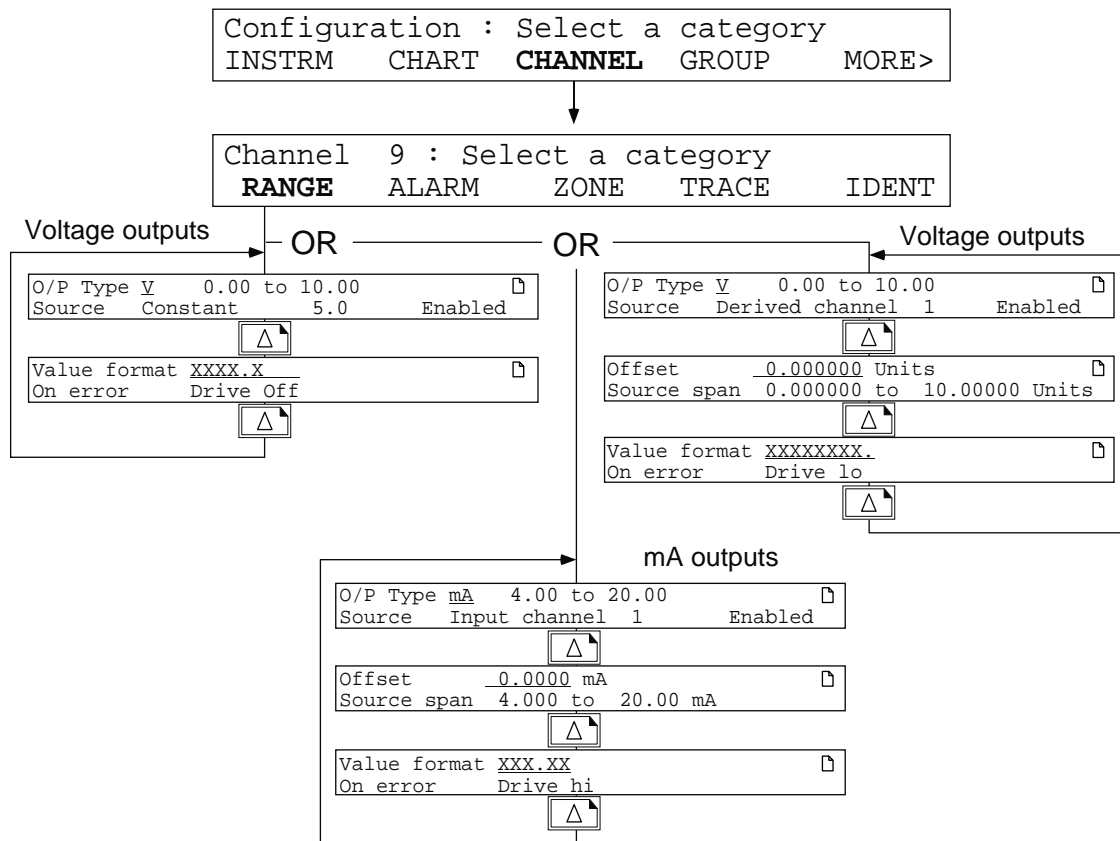On page three, select decimal point position for the display and error response.

Figure 4.4.2b Output channel configuration: Typical range pages

4.4.2 CHANNEL CONFIGURATION : RANGE (Cont.)

PAGE 1 PARAMETERS

O/P type		Allows the required output type to be selected as Off, V or mA
	Off	Channel output goes to 0mA at Io and C terminals, and approximately -1 Volt across Vo and C terminals.
	V	Sets the channel to apply a voltage signal across Vo and C terminals. Allows a span of up to 10V to be entered. Io is set to its Off state.
	mA	Sets the channel to source current at the Io and C terminals. Allows a span of up to 25mA to be entered. Vo is set to its Off state.
Source	Input channel N	Use numeric keys to enter channel number
	Derived channel N	If maths pack option fitted, use numeric keys to enter derived channel number.
	Constant	Allows a constant to be entered using the numeric keys. The output range available is -15 to +115% of the span set in the top line of the page, provided that this does not exceed the absolute maximum figures given in the technical specification at Annex A.
Enabled		Scrollable through 'Disabled' and 'Enabled'. When disabled to outputs are set to their off states.

PAGE 2 PARAMETERS

Note: this page does not appear when input source 'constant' is selected in page 1.

Offest		Allows an adjustment to be made to match the recorder output with external equipment.
Source span		Initially shows the source channel's span, but can be edited using the numeric keypad.

PAGE THREE PARAMETERS

Value format		Allows the required decimal point position to be chosen. For source = constant, the available positions (scrolled-through by the field scroll keys) are: X.XXXX, XX.XXX. XXX.XX, XXXX.X, XXXXX. For source = input or derived, additional formats are available as follows: XXXXXXXX, XXXXXXX.X, XXXXXX.XX, XXXXX.XXX, XXXX.XXXX, XXX.XXXXX, XX.XXXXXX, scientific, time, date, elapsed. See section 5.3.1 for details.
On error		Determines what the output signal does if the source channel fails or if the recorder internal communications stop.
	lo	Signal goes to 'zero' - 15% span.
	hi	Signal goes to span + 15% span
	Off	Switches output off as defined in 'O/P type' in 'Page 1 parameters' above.

4.4.3 Channel configuration: Alarms

> NOTE: In the following diagrams, the measured value increases from left to right.

The available alarm types are: Absolute high, Absolute low, Deviation in, Deviation out, Rate-of-change rise, Rate-of-change fall, Discrete input High, Discrete input Low.   Up to four alarms can be configured for each channel.

For absolute and deviation types, a hysteresis value can be configured to prevent continuous triggering of the alarm, should the process variable value 'hover' at or near the setpoint (or threshold). For all types of alarm, a 'Dwell' period can be configured, to delay the alarm becoming active after it has been triggered. If the value goes out of alarm during the dwell time, then the alarm is ignored.

Alarms can be used to trigger a wide range of jobs (Section 4.1.4) including the operating of output relays.

ALARM ACTION

The four types of alarm action are as follows:

Off	The alarm is disabled.
Trigger	Once active, the alarm stays active until the alarm source returns to a non-alarm state. Any continuous jobs (e.g. change print mode) remain active for the duration of the alarm state. Trigger alarms are not annunciated in any way (e.g. no messages on the chart, no flashing LED) and do not appear in alarm history lists.
Latching	Once active, the alarm stays active until it is both acknowledged AND the alarm source has returned to a non-alarm state. Continuous jobs (e.g. change chart speed) remain active only until the source returns to a non-alarm state (whether or not the alarm has been acknowledged).
Non-latching	Once active, the alarm stays active until the alarm source returns to a non-alarm state. Any continuous jobs (e.g. change print mode) will remain active for the duration of the alarm state.

ALARM TYPES

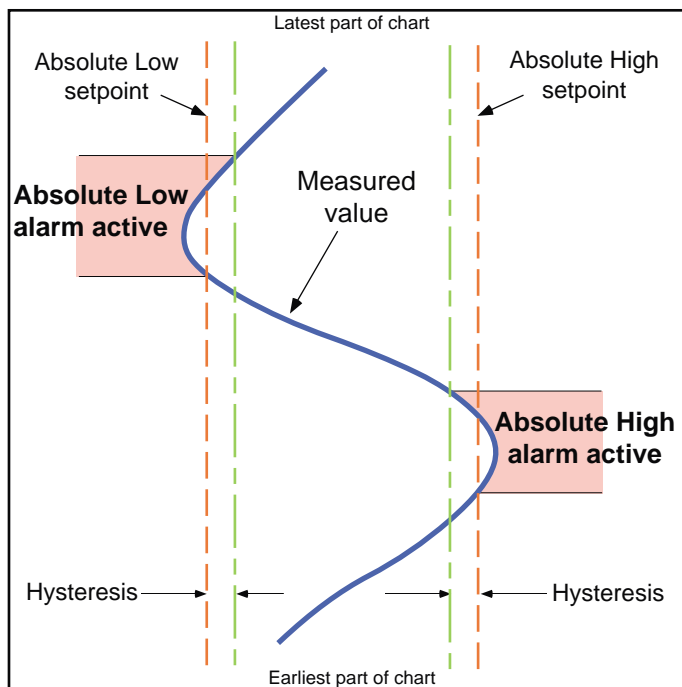Figure 4.4.3a Absolute alarm definitions

An **absolute high** alarm becomes active when its setpoint value is exceeded, and it remains active until the measured value falls below the value (*setpoint - hysteresis*).

An **absolute low** alarm becomes active when its setpoint value is exceeded (in the negative sense), and it remains active until the measured value rises above the value (*setpoint + hysteresis*).

4.4.3 ALARM TYPES (Cont.)
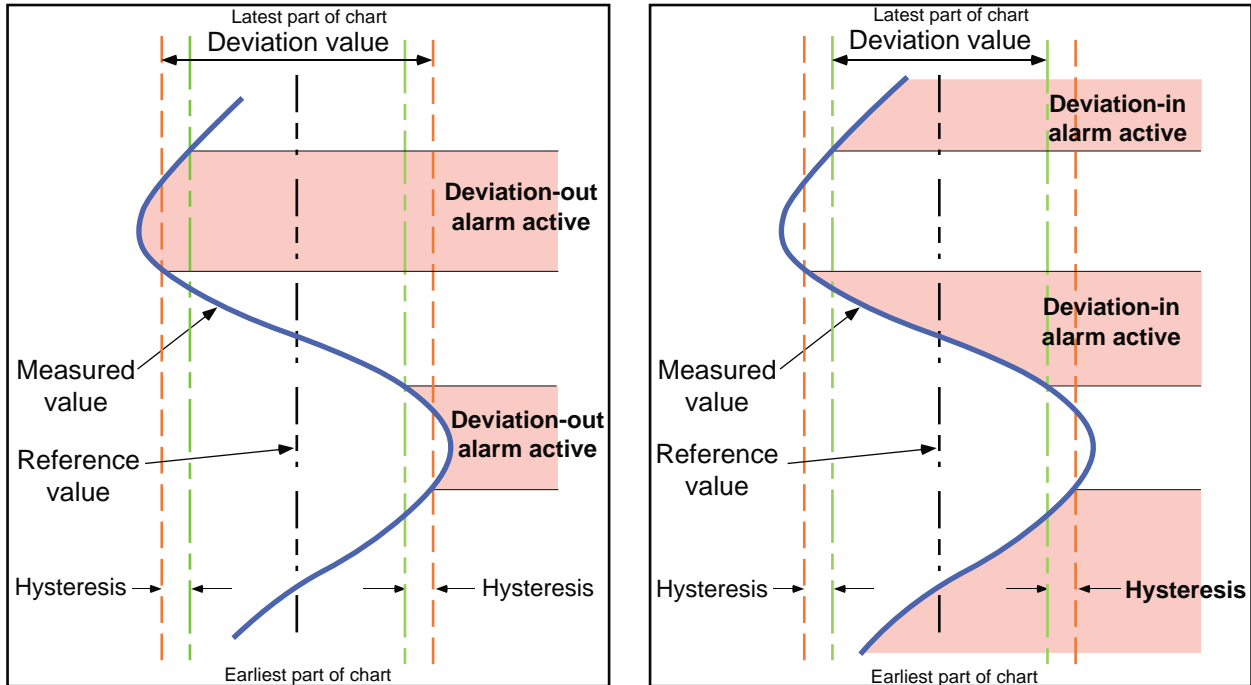
Figure 4.4.3b Deviation alarm definitions
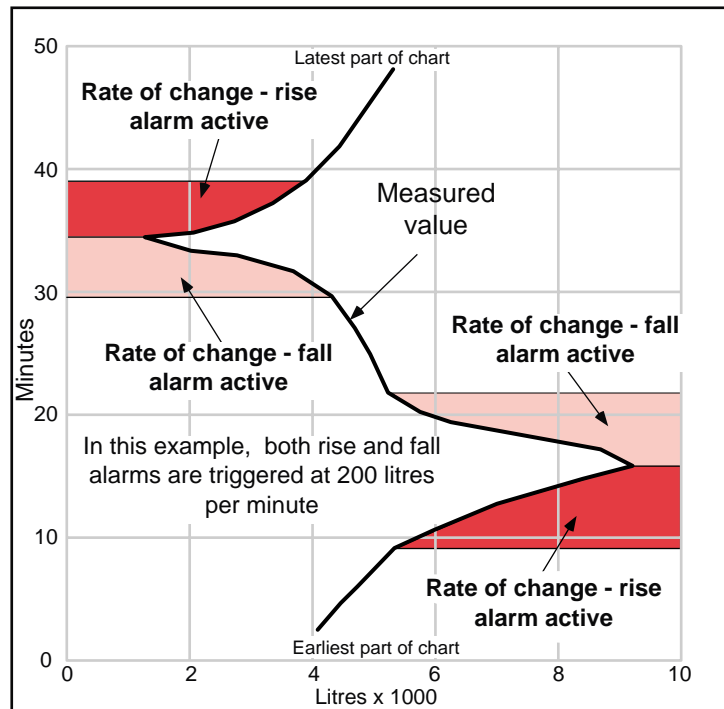
Figure 4.4.3c Rate-of-change alarm definitions

With Rate-of-change alarms, a value (200 litres in the above sketch), a time period (one minute above), and an averaging period have to be configured. The alarm is triggered if the measured value changes by more than the configured value in less than the configured period (more than 200 litres per minute in the above example). The averaging period is used to change the sensitivity of the alarm, such that noise spikes on, or normal oscillations in the input signal do not trigger false alarms.

4.4.3 ALARM TYPES (Cont.)

DISCRETE (DIGITAL) ALARMS

These alarms are triggered by contact closures or openings as defined during configuration.

> NOTE: Contacts closed is defined as a resistance of less than 500Ω across the input;
>   Contacts open is defined as a resistance of more than 3000Ω across the input.

ALARM CONFIGURATION

Figure 4.4.3d shows typical display pages for the four types of alarm. Select alarm 1 to 4 for the channel, using the field scroll keys

```
Configuration : Select a category
INSTRM    CHART   CHANNEL  GROUP    MORE>
```

Select channel using numeric keypad ↓

```
Channel 05 : Select a category
 RANGE    ALARM    ZONE    TRACE    IDENT
```

↓ Select alarm1 to 4 using numeric keypad

```
ALARM 1 : Select a category
 SET PT   JOBS
```

OR ──────────── OR ─────

Absolute alarms

```
Enable Unlatched Type Absolute high
Set Point 780.0 Units
```
△

```
Hysteresis XXXXX units
Dwell 0 s
```
△

Deviation alarms

```
Enable Trigger    Type Deviation out
Reference 245.0   Deviation 10 units
```
△

```
Hysteresis XXXXX units
Dwell 0 s
```
△

── OR ──

Rate of change alarms

```
Enable Latched   Type Rate of chg rise
10 units per 1 s  Average
```
△

```
Dwell 100s
```
△

Digital alarms

```
Enable Off       Type Digital
Active Heat ON   Dwell 2s
```
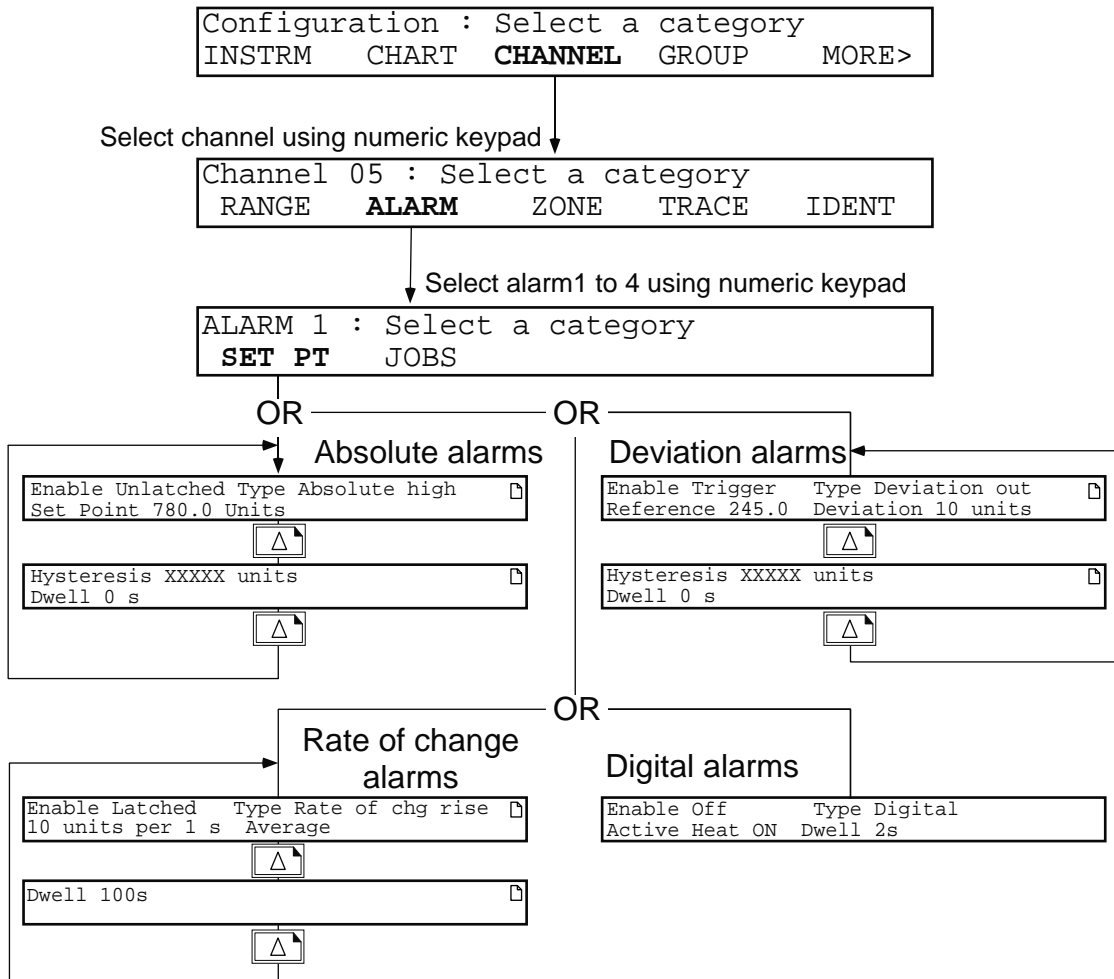
Figure 4.4.3d Channel configuration: Typical alarm pages

4.4.3 CHANNEL CONFIGURATION: ALARMS (Cont.)

SET PT SOFTKEY: PAGE 1 PARAMETERS

Enable		Allows the following Enable functions to be scrolled-through using the field scroll keys.
	Off	All alarm action inhibited
	Trigger	Initiates jobs but does not annunciate. Suitable for remote control purposes such as updating the clock, resetting totalisers etc.
	Unlatched	Alarm display and job actions are active as long as the alarm is active.
	Latched	Alarm display is active until the alarm returns to a non-active state, and the alarm has been acknowledged. Job actions continue until the alarm returns to its non-active state, whether the alarm is acknowledged or not..
Type		Allows the different types of alarm to be scrolled through using the field scroll keys: Absolute high / low; Rate-of-change rise / fall; Deviation in / out; Digital.
Absolute	Set Point	For absolute alarms only. This is the trigger level entered using the numeric keys, at which the alarm becomes active.
Deviation	Reference	For deviation alarms only. This sets a central value about which the Deviation value (see immediately below) is to operate. Entered using the numeric keys.
	Deviation	For deviation alarms only. This sets a range, either side of the reference value, inside which a 'deviation in' alarm is active or outside which a 'deviation out' alarm is active. Entered using the numeric keys.
Rate	Value	For rate-of-change alarms only, allows a value (D) to be entered using the numeric keys. If the change in the channel value (ΔPV) over the time period specified (T) (see immediately below) is greater than D, the alarm becomes active. I.E. if $\Delta PV/T > D$ the alarm is active.
	Time	Allows a time period (T) to be entered (using the field scroll keys) for use with the above Value. Scrollable values are: 1, 10, 30 and 60 seconds, and 10, 30 and 60 minutes.
	Average	Allows averaging periods of 1 to 9 seconds to be entered using the numeric keys. This allows the sensitivity of the rate-of- change alarms to be varied.
Digital	Active	Scrollable between the Open state and Closed state text strings as entered in page one of the range configuration (see section 4.4.2 above). If set to the open state, then the alarm is active with a high resistance input. If set to the closed state the alarm is active with a low resistance input.
	Dwell	Allows initiation of alarm action to be delayed by up to 2048 seconds after the alarm is detected. If the channel goes out of alarm within this period, the alarm is ignored.

SET PT SOFTKEY: PAGE TWO PARAMETERS

Hysteresis		Allows 'deadband' areas to be entered (using numeric keys), for absolute and deviation alarms, to stop 'twitching' if the channel value is hovering around the setpoint.
Dwell		Allows initiation of alarm actions to be delayed for up to 2048 seconds after the alarm is detected. If the channel goes out of alarm within the dwell period, the alarm is ignored.

4.4.3 CHANNEL CONFIGURATION: ALARMS (Cont.)

JOBS SOFTKEY

As previously stated, each channel may have up to four jobs allocated to it (see section 4.1.4).   Figure 4.4.3e shows some typical job pages.   The job number is selected using page scroll keys.
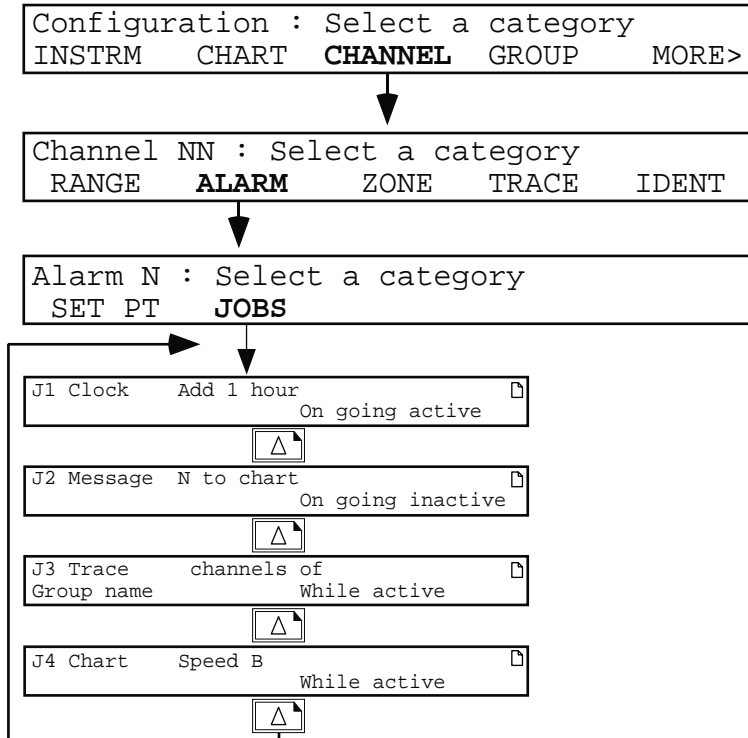
```
┌─────────────────────────────────────────────┐
│ Configuration : Select a category           │
│  INSTRM    CHART   CHANNEL   GROUP    MORE>  │
└─────────────────────────────────────────────┘

┌─────────────────────────────────────────────┐
│ Channel NN : Select a category              │
│   RANGE    ALARM     ZONE    TRACE    IDENT  │
└─────────────────────────────────────────────┘

┌─────────────────────────────────────────────┐
│ Alarm N : Select a category                 │
│   SET PT    JOBS                            │
└─────────────────────────────────────────────┘

┌─────────────────────────────────────────────┐
│ J1 Clock    Add 1 hour               ▯      │
│                    On going active          │
└─────────────────────────────────────────────┘
              ┌─────┐
              │  △  │
              └─────┘
┌─────────────────────────────────────────────┐
│ J2 Message   N to chart              ▯      │
│                    On going inactive        │
└─────────────────────────────────────────────┘
              ┌─────┐
              │  △  │
              └─────┘
┌─────────────────────────────────────────────┐
│ J3 Trace       channels of           ▯      │
│ Group name              While active        │
└─────────────────────────────────────────────┘
              ┌─────┐
              │  △  │
              └─────┘
┌─────────────────────────────────────────────┐
│ J4 Chart     Speed B                 ▯      │
│                    While active             │
└─────────────────────────────────────────────┘
              ┌─────┐
              │  △  │
              └─────┘
```

Figure 4.4.3e Typical job pages

JOB PARAMETERS

Type	Allows a job category to be selected using the field scroll keys.
	Categories are: No action, Chart, Trace, Alarm, Message, Logging, Derived, Timer, Counter, Totaliser, Clock, Memory, Relay , assuming the relevant options are fitted.
Action	The actions that can be scrolled through (using the field scroll keys), depend on the category selected - see section 4.1.4.
Trigger	This field allows the trigger types to be scrolled-through using the field scroll keys. The types are: On going active; On going inactive; On acknowledgement; While active; While inactive, While unacknowledged.

4.4.4 Channel configuration: Zone

Zone configuration sets up spans, zones and scales A and B. These allow the location of the trace on the chart to be defined. Zone A or B is chosen by Operator selection or job action. Figure 4.4.4 shows the relevant display pages.
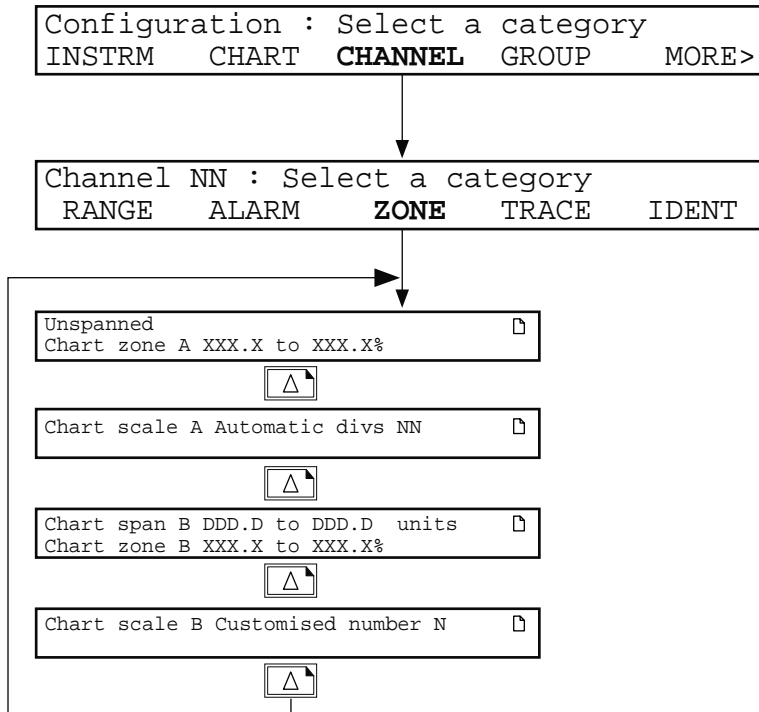

Figure 4.4.4 Channel configuration: Zone

ZONE PARAMETERS

Unspanned	Unspanned	Used when chart span is the same as the range / scale. Field scroll keys are used to scroll to Span A or B (according to which page is being configured).
	Span A (B)	Allows a chart zero and full scale to be entered that is different from the input zero and full scale. For example, a range of 100 to 250 ˚C may be traced on the chart out of an input range of say, 0 to 800 ˚C, thus allowing an area of particular interest to be enlarged on the chart.
Zone A (B)		Allows the printing area of the chart to be defined in percentage terms. In this way, a particular trace can be restricted to the right half of the chart to avoid being overprinted by columnar logs, or restricted to a part of the chart which is clear of other traces.
Scale A (B)		Allows the user to define the format of the scale.
	Automatic divs.	Selection of automatic divisions 1 to 10 (numeric entry), allows the user to choose how many divisions of the scale are printed on the chart. For example selecting '1', causes 'zero' and full scale values only to be printed: Selecting '4', causes 0, 25%, 50%, 75 and 100% of the span to be printed.
	Customised number N	Causes one of the four (selected by numeric entry keys) customised scales set up in the instrument configuration (section 4.2.1 (SCALES)) to be used by this channel. The portion which is used, of the customised scale, depends on the Zone setup.
	Off	Inhibits scale printing for this channel

4.4.5 Channel configuration: Trace

Trace configuration allows the channel trace on the chart to be switched on or off, line thickening to be enabled/disabled and the trace colour for the channel to be defined.   Figure 4.4.5 shows the relevant page. For interpolation, dot density, and adaptive recording on/off see Chart configuration - section 4.3.
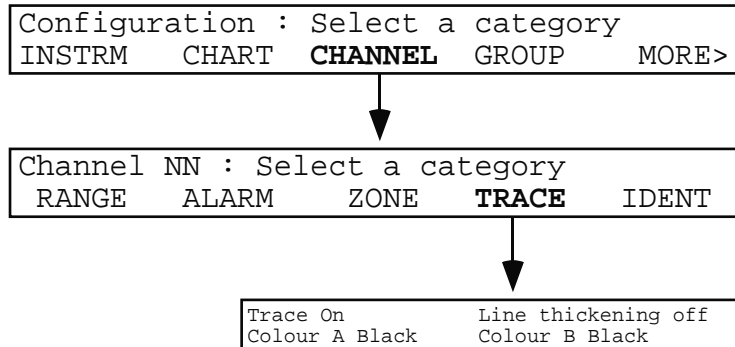
```
Configuration : Select a category
 INSTRM    CHART   CHANNEL   GROUP     MORE>
```

```
Channel NN : Select a category
  RANGE    ALARM     ZONE    TRACE    IDENT
```

```
Trace On              Line thickening off
Colour A Black        Colour B Black
```

Figure 4.4.5 Channel configuration: Trace

TRACE PARAMETERS

Trace	Allows the channel trace to be permanently ON, permanently OFF, or conditionally on or off as required by a 'job.' The field scroll keys are used to scroll through these choices.
Line thickening	Allows line thickening to be switched on or off. Line thickening produces an extra wide trace on the chart to aid long-distance viewing.
Colour A (B)	The field scroll keys are used to scroll through the available colours for the channel trace. Colour B is selected by job action. Available colours are: Black, Red, Orange, Green, Blue and Violet.

4.4.6 Channel configuration: Ident

Ident configuration allows channel descriptors (20 characters maximum), and tags (7 characters maximum) to be entered using the key board. The descriptor is entered at page one; the tag at page two. The group configuration described below (Section 4.5) defines whether the descriptor or the tag is included in the PV display and logs.
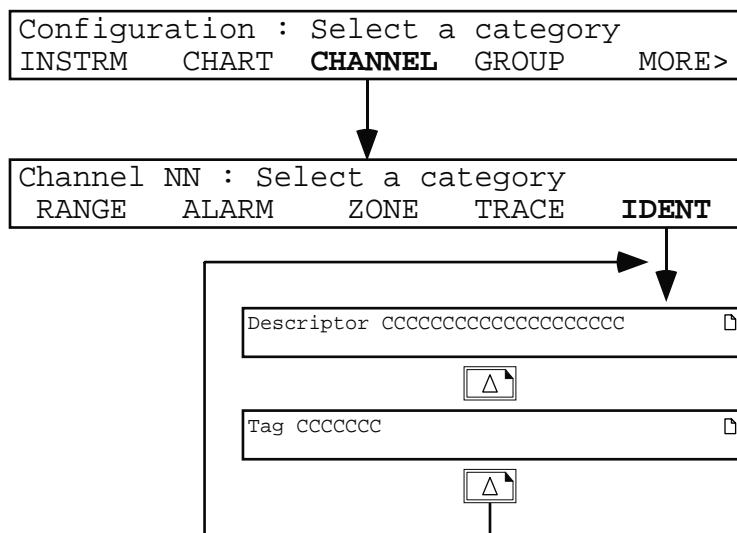
```
Configuration : Select a category
 INSTRM    CHART   CHANNEL   GROUP     MORE>
```

```
Channel NN : Select a category
  RANGE    ALARM     ZONE    TRACE    IDENT
```

```
Descriptor CCCCCCCCCCCCCCCCCCCC
```

```
Tag CCCCCCC
```

Figure 4.4.6 Channel configuration: Ident

4.5 GROUP CONFIGURATION

This allows group contents, format and titles to be set up. The selection of which group is to be displayed during normal operation is made at the DISPLAY page of the Operator menu (section 3.2.1).
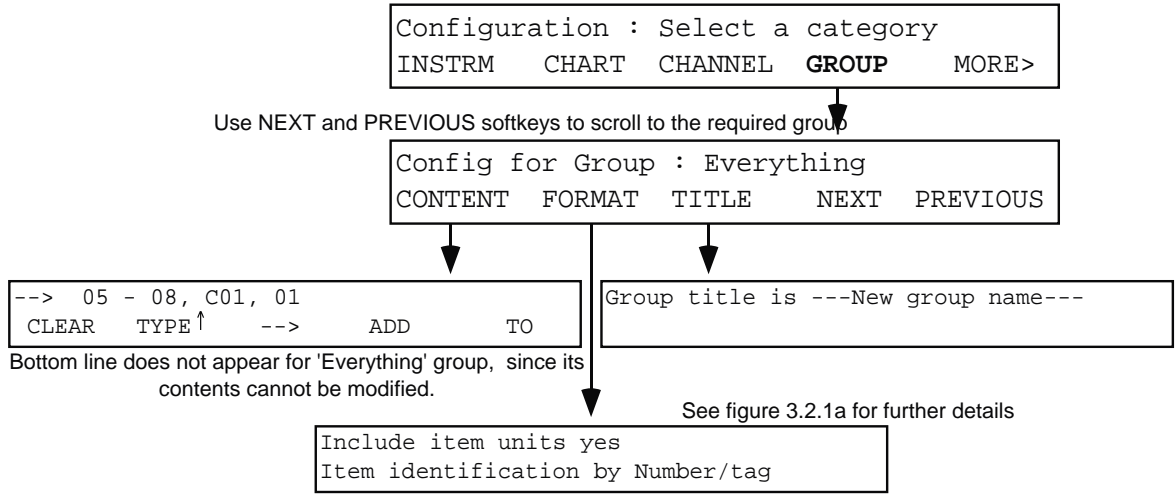
```
Configuration : Select a category
INSTRM    CHART   CHANNEL   GROUP     MORE>
```

Use NEXT and PREVIOUS softkeys to scroll to the required group

```
Config for Group : Everything
CONTENT   FORMAT   TITLE     NEXT   PREVIOUS
```

```
-->  05 - 08, C01, 01
 CLEAR   TYPE↑    -->    ADD      TO
```

Bottom line does not appear for 'Everything' group, since its contents cannot be modified.

```
Group title is ---New group name---
```

```
Include item units yes
Item identification by Number/tag
```

See figure 3.2.1a for further details

Figure 4.5 Group configuration

4.5.1 Group parameters

CONTENT (Note 5 below)	CLEAR	Deletes the cursor item from the group contents.
	TYPE ↑	Operation of this key scrolls through the types of PV which can be part of a group i.e. D (Derived channel), T (Totaliser), C (counter) and measuring channel (no prefix).
	ADD	Operation of this key causes a new entry (01) to be made. The numeric keys are used to enter the required number. The initial entry is a measuring channel. To change the entry to a derived channel, totaliser or counter, the TYPE softkey is used.
	TO	This key allows a range of inputs to be entered. For example, the keystrokes given below would enter measuring channels 9 to 24 .
		Add 9 To 2 4 Enter
FORMAT	Include item units	Allows the channel units string to be added to the PV identification. For Units entry, see section 4.4.2 (Channel configuration: Range).
	Item identification by	Allows 'Number only', 'Number / Tag', or 'Number / Descriptor' to be scrolled-through using the field scroll keys. This defines how the group channels are identified in logs, and at the display. For tag and descriptor entry, see section 4.4.6 (Channel configuration: Ident).
TITLE	Group title is	Allows a title of up to 20 characters to be entered for the currently selected group.
NEXT / PREVIOUS		Allows the groups to be scrolled through.

NOTES
1. The TO key can be used to toggle between 'from' and 'to' range limits.
2. Group items are scrolled-through in the order in which they are entered. To insert an item, the cursor is positioned below the item immediately to the left of where the new item is to appear, and the ADD softkey operated as usual. The new item is inserted to the right of the cursor.
3. A 'single' item can be changed to a range item by positioning the cursor below it and operating the TO key.
4. Multiple entries are allowed. This can be used for example, to ensure that a particular derived channel (e.g. Group Average) always appears at the bottom line of the display (in 2-line mode), by entering the derived channel as every other item in the group.
5. The 'Everything' group contents cannot be changed, so the lower line of the CONTENT page is blank.

4.6 INTERNAL EVENT CONFIGURATION

24 internal events are configurable, and each event allows up to four jobs to be initiated as the result of single source or as combinations of sources as described below. Source types include both channel alarms and system errors.

It should be noted that, although only two sources can be combined for any one event, events themselves can be sources for other events, allowing multiple AND / OR functions to be carried out.

4.6.1 Example

The buzzer is to be sounded if a) the chart paper is missing, OR b) Channel 13 alarm 1 is active OR c) Channel 15 alarm 1 is active. To achieve this, Event 1, say, can OR Channel 13 alarm 1 and Channel 15 alarm 1. Event 2 can then OR Event 1 and 'Chart paper out' sources to sound the buzzer if any of the three sources goes active.
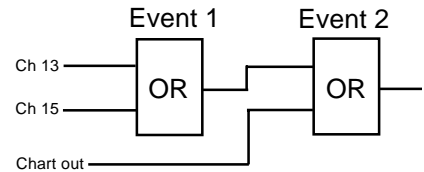


```
Configuration : Select a category
EVENTS   AUTODISP  LOGS    COPY     MORE>
```

```
Event 2 : select a category
 SOURCE   JOBS    IDENT
```

```
Chart paper out              Or
Event 1                      Enabled
```

```
Descriptor ChartOut; alms 13,15
```

```
J1 Alarm    Sound Buzzer
                   while active
```

```
J2 No action
```

```
J3 No action
```

```
J4 No action
```
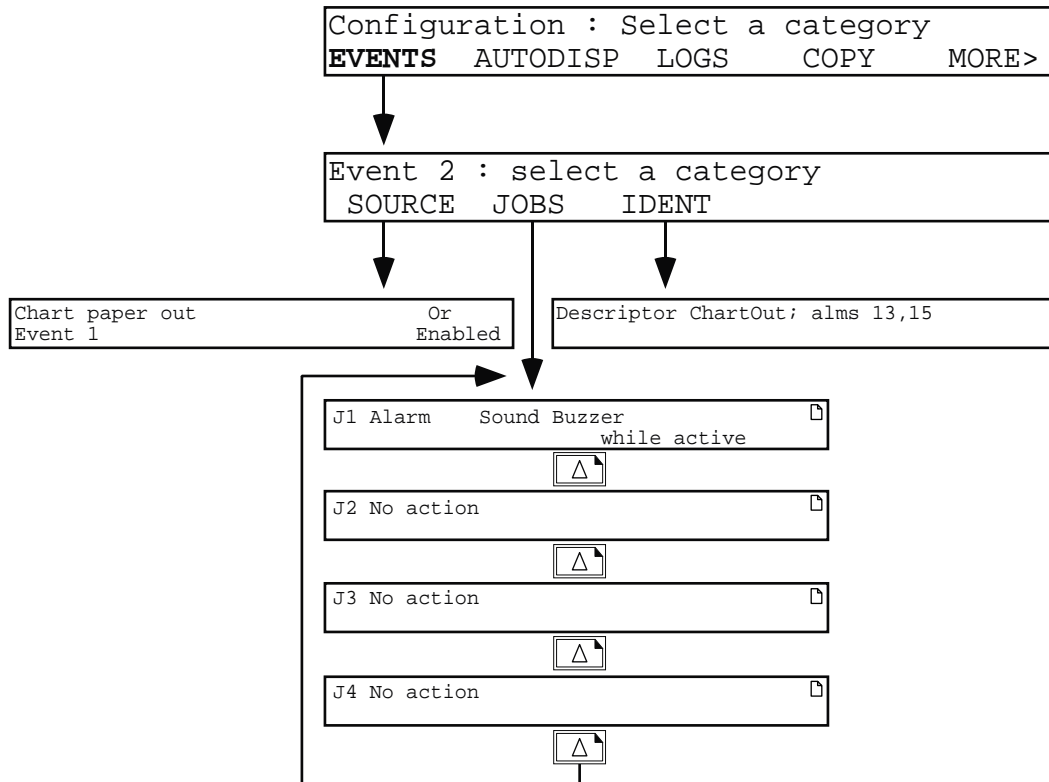
Figure 4.6 Event configuration: Typical pages

4.6 INTERNAL EVENT CONFIGURATION (Cont.)

4.6.2 Event parameters

SOURCE		Allows the event sources to be scrolled through using the Field Scroll keys. Each source can be active on its own or AND'ed or OR'd with another. Events can also be enabled or disabled. The event sources available, if all options are fitted, are:
	Manual key	The operator soft keys can act as event sources. The field scroll keys are used to scroll through the available softkeys .
	Channel alarm	Allows an alarm on a specific channel to be used as an event input.
	Channel alarm on group	Allows a group to be specified (field scroll). Any active alarm within this group will then act as an event source.
	Unack'ed group alarm	Allows any channel alarm in a specified group to act as an event source until the alarm is acknowledged.
	Input channel failure	Active if a failure in a specified input channel is detected.
	System error	Active if any of the following instrument alarms are active: Chart paper out, Writing system failure, Battery low, Clock hardware failure, Input channel failure, Invalid remote cold junction temperature, EEPROM failure, battery-backed RAM failure, cycle time exceeded.
	Chart paper out	Active when 'paper out' micro-switch detects the end of the chart.
	Writing system failure	Active if a failure in the chart drive or print head drive is detected.
	Battery low	Active when the RAM battery voltage drops below a safe voltage.
	Clock h/w failure	Active if the clock circuit fails.
	Invalid remote CJ temp	Active if a failure in the remote CJ sensing circuit is detected.
	Power up	Triggers at initialisation.
	Event	Allows one or more other events to be used as sources.
	Totaliser alarm	Active if a specified totaliser's alarm is active
	Group totaliser alarm	Active if any totaliser alarm is active in a specified group.
	Counter alarm	Active if a specified counter's alarm is active
	Group counter alarm	Active if any counter alarm is active in a specified group.
	Timer output	Allows one or more timers to be defined as event sources.
	Replaying memory	Active whilst data is being replayed from memory.
	Memory sampling	Active whilst data is being written into the memory.
	Memory full	Active when old data is being discarded to make room for new data.
	DV partial failure	Active when one or more (but not all) inputs to a group maths function (e.g. Continuous Max) fails.
	Mem. card battery low	The battery in the data card should be replaced as soon as possible.
	Mem. card battery flat	The battery is exhausted, and data will be lost when card is removed.
	Mem. card full	Active when the memory card is full.
	Mem. card NN% full	Active when the card is a configurable percentage full. See memory card manual.
	Mem. card fitted	Active whilst a memory card is fitted.
	Replaying file	Active during replay of a file from the memory card.
JOBS	Type	Allows a job category to be selected using the field scroll keys. Categories are: No action, Chart, Trace, Alarm, Message, Logging, Derived, Timer, Counter, Totaliser, Memory, Relay, Clock and M Card, assuming the relevant options are fitted.
	Action	The actions that can be scrolled through (using the field scroll keys), depend on the category selected - see section 4.1.4
	Trigger	This field allows the trigger types to be scrolled-through using the field scroll keys. The types are: On going active; On going inactive; On acknowledgement; While active; While inactive; While unacknowledged.
IDENT		Allows a 20-character descriptor to be entered for the event.

4.7 AUTODISPLAY CONFIGURATION

This function allows four items to be chosen for continuous display when 'Auto' display mode is selected by the operator. (See section 3.2.1 of this manual for further details of auto display.) The figure below shows a typical configuration.

The <D> key is used to define a channel as 'derived', and the <blank> key to return to input channels. Alternatively, the ± key can be used to toggle between 'input' and 'derived'.
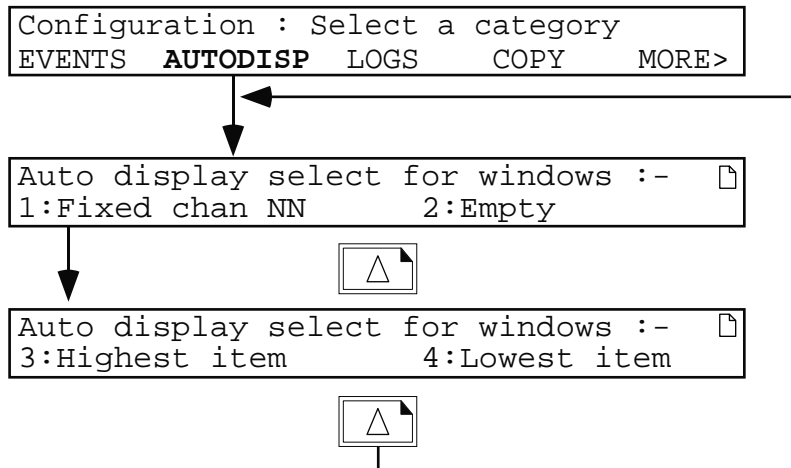
```
Configuration : Select a category
EVENTS   AUTODISP  LOGS     COPY     MORE>
```

```
Auto display select for windows :-    ▯
1:Fixed chan NN       2:Empty
```

△

```
Auto display select for windows :-    ▯
3:Highest item        4:Lowest item
```

△

Figure 4.7 Auto display configuration

For each window location (1, 2, 3 4) the field scroll keys can be used to scroll through:

Empty,
Fixed channel (numeric entry of channel number);
Highest item (of currently selected group);
Lowest item (of currently selected group).

Where 'highest' or 'lowest' are selected, these always look at the current group, and will change if a new group is selected by the operator. Up to four highest or lowest channels can be selected in any combination. For example if 'highest' is selected for windows 1, 3 and 4, and 'lowest' in window 2, then the three channels with the highest values in the group will be displayed in windows 1, 3 and 4, and the channel with the lowest value in the group will appear at window 2.

Window 1   Window 2

```
Hi6   543.09 deg C Lo7   421.98 deg C
Hi5   542.95 deg C Hi8   432.09 deg C
```

Window 3   Window 4

Where more than one 'highest' ('lowest') is selected they appear in descending (ascending) value order. For example in the example above, if the value of channel 8 rose to 550 degrees, then it would move to window 1, whilst channels 6 and 5 would move to windows 3 and 4 respectively:

Window 1   Window 2

```
Hi8   550.00 deg C Lo7   421.98 deg C
Hi6   543.09 deg C Hi5   542.95 deg C
```

Window 3   Window 4

4.8 LOG CONFIGURATION

Allows a specific Group to be associated with each log, and the logs' destinations (chart or memory card) to be defined. Logs are initiated by operator action, by job or automatically at a fixed time periods. See section 4.1.5 of this manual, and the Memory Card manual for details.
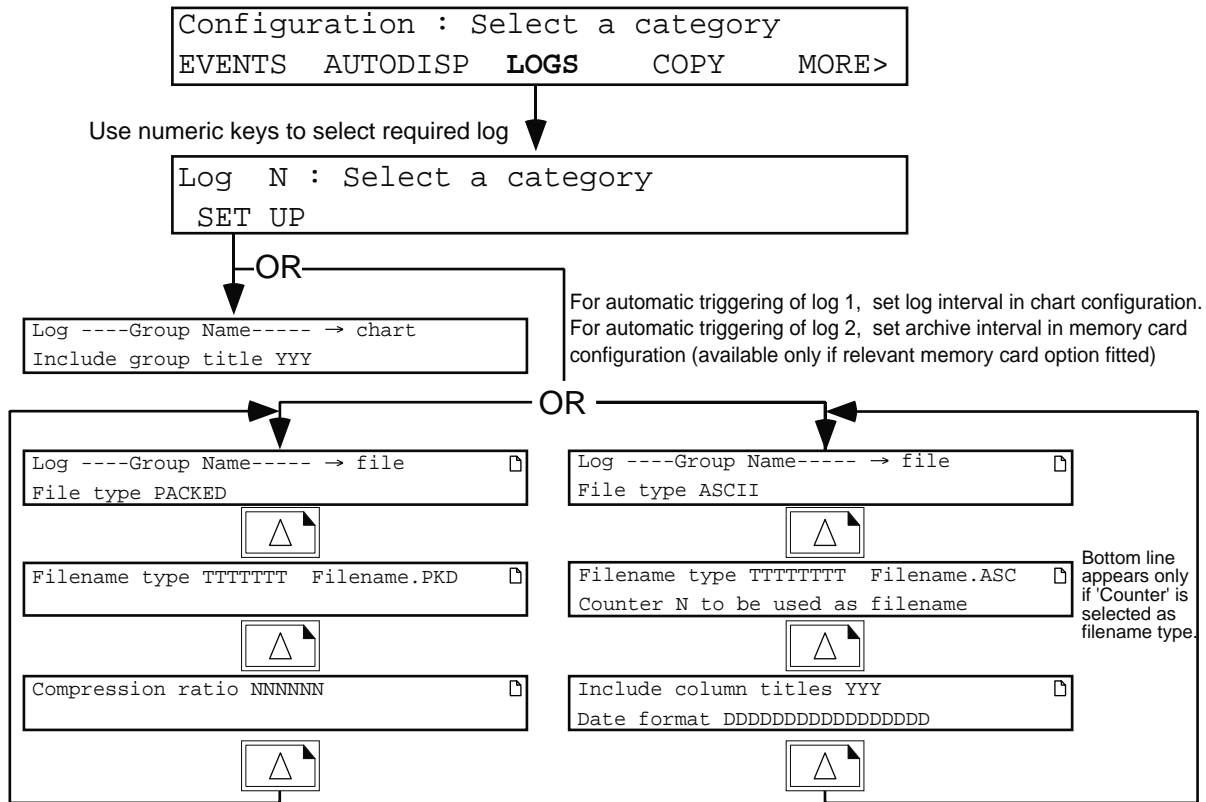
```
Configuration : Select a category
 EVENTS   AUTODISP   LOGS      COPY      MORE>
```

Use numeric keys to select required log ▼

```
Log  N : Select a category
  SET UP
```

──OR──

```
Log ----Group Name-----  → chart
Include group title YYY
```

For automatic triggering of log 1, set log interval in chart configuration.
For automatic triggering of log 2, set archive interval in memory card configuration (available only if relevant memory card option fitted)

OR

```
Log ----Group Name-----  → file
File type PACKED
```

```
Log ----Group Name-----  → file
File type ASCII
```

```
Filename type TTTTTTT  Filename.PKD
```

```
Filename type TTTTTTTT  Filename.ASC
Counter N to be used as filename
```

Bottom line appears only if 'Counter' is selected as filename type.

```
Compression ratio NNNNNN
```

```
Include column titles YYY
Date format DDDDDDDDDDDDDDDDD
```

Figure 4.8 Log configuration pages

4.8.1 Log Parameters

Group name → chart		The field scroll keys are used to scroll through the groups. The group is logged to chart.
	Include group title	The field scroll keys are used to scroll through 'yes' and 'no', to select whether the group name is to be included in the log.
→ file		If the PACKED data logging option is fitted, the field scroll keys are used to select PACKED or ASCII as log type. If ASCII data logging option is fitted, only ASCII is available. If neither option is fitted, the 'to file' menu item does not appear and the 'to chart' item is not editable. For full details of the PACKED and ASCII parameters refer to the Memory Card manual HA247361.
	PACKED	<u>Filename type</u>. Use the field scroll keys to scroll through text, hourly, daily or counter. <u>Compression ratio</u>. Use the field scroll keys to scroll between 'Normal' or 'High'.
	ASCII	<u>Filename type</u>. Use the field scroll keys to scroll through 'text', hourly, daily or 'counter'. <u>Include column titles</u> Use the field scroll keys to scroll between 'Yes' or 'No'. <u>Date format</u> Use the field scroll keys to scroll through 'Spreadsheet', 'Integer' or DD/MM/YY,HH:MM:SS.

4.9 COPY CONFIGURATION

This facility allows the copying of

a)   Measuring channel range and zone information,

b)   Alarm configuration, including jobs,

c)   Derived channel function and zone information, if the maths pack option is fitted.

Once the relevant sources have been selected, operation of the ENTER key initiates the copy process. During copying, a 'Please Wait' message is displayed. When copying is complete, the display returns to the previous channel, alarm or maths copy page.

To 'copy' the complete configuration from one recorder to another, see 'CONFIGURATION TRANSFER' in section 4.11.

```
Configuration : Select a category
EVENTS   AUTODISP   LOGS   COPY      MORE>
```

```
Configuration copy : Select a category
CHANNEL     MATHS     ALARM
```

Highlighted field is scrollable between (input) Channels and Derived channels (bottom line changes appropriately). All alarms and associated jobs are copied.

```
Copy channel nn's range/zone config to
channel(s) nn to nn
```
I/O channel's zone and range copied

```
Copy Channel nn's alarm/job config to
Channel(s) nn to nn
```

OR

```
Copy Derived ch nn's alarm/job config to
channel(s) Dnn to Dnn
```

```
Copy channel Dnn's funct/zone config to
channel(s) Dnn to Dnn
```
Derived channel's zone and range copied

```
Please wait
```

↵

Figure 4.9 Copy configuration

NOTES

1.   When copying alarm configuration,I/O channels can be copied only to other I/O channels, and derived channels can be copied only to other derived channels. The bottom line of the display always repeats the selection made in the top line.

2.   If, during copying of range/zone, the input type is to be changed to digital the alarm type defaults to OFF, Digital, Dwell 0 sec. If the input type is to be changed from digital to analogue, the alarm type defaults to OFF, Absolute high, Setpoint 10.00 .

3.   If an attempt is made to copy an alarm / job configuration, where the source and destination channel types are different (i.e. one digital and the other analogue), the copy will not be carried out, in order to avoid conflict between channel type and alarm type.

4.   16-channel board channels will not accept RTD or Ohms as input type; 'dig' as input type to channels 1, 8 or 16; input break drive lo(w).

5.   When copying 'dig' inputs from 8-channel boards to 16-channel boards, the damping is set to 'none'. When copying dig inputs from 16-channel boards to 8-channel boards, the copy is aborted if the damping is not set to 'none'.

4.10 OPTIONS CONFIGURATION

The maths pack, totaliser, counter, timer, rolling memory and Quality Monitoring options are described in section 5 of this manual.

Communications and Memory Card options are described in separate manuals, HA246958 and HA247361 respectively.

4.11 TRANSFER CONFIGURATION

This feature allows the transfer of configuration between recorders, or between a recorder and a host computer, using the nine-way connector located to the right of the chart illumination tube on the inside of the recorder door. Section 1.6 shows wiring details. The configuration transfer connections are designed for TTL (0 to 5V) signals. An RS232 converter may be required with some computers, to change the signals to 12 Volts.

CAUTION

The transfer function can be used to transfer a configuration to a 'destination' recorder. The existing configuration of this destination recorder is over-written, so ensure that you carry out the transfer in the correct direction (save from the source recorder; restore to the destination recorder) to avoid over-writing the configuration of the intended source recorder.

Note: Any adjustments made in the 'Adjust' section of configuration (section 4.15 of this manual) are lost during Configuration Transfer

---

Top level configuration menu

```
Configuration : Select a category
 MEMORY   COMMS   TRANSFER M CARD   MORE>
```

```
Configuration Save / Restore
  SAVE   RESTORE  SETTINGS
```

```
Baud rate 9600      Eight data bits
One stop bit        No parity
```
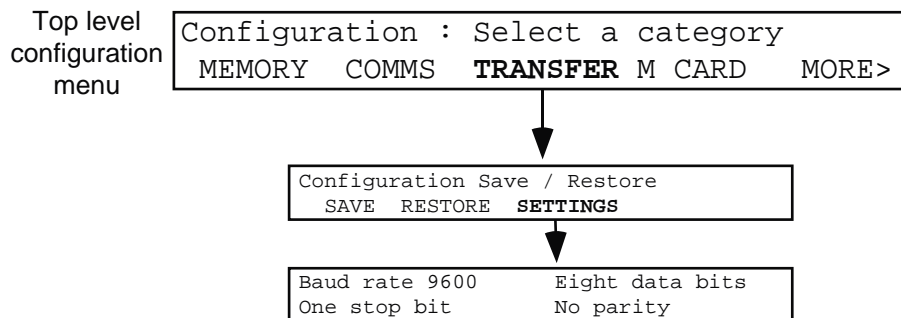
Figure 4.11 Configuration-transfer configuration

TRANSFER		Calls the configuration transfer page to the display. Before initiating transfer, ensure that a suitable cable is fitted between the recorder and the other device. See figures 1.6a/b
	SAVE *	Initiates an XMODEM transfer of the recorder configuration via the 9-way D-type port located beside the chart illumination tube on the inside of the door. This can be used to copy configuration to another 'destination' recorder (previously set to RESTORE), or to store the recorder's configuration in any device capable of XMODEM file transfer.
	RESTORE*	Allows a configuration to be loaded from a second recorder (set to SAVE) or from a PC or other configuration terminal.
	SETTINGS	Allows the field scroll keys to be used to set the Baud rate to 19,200, 9,600, 4,800, 2,400, 1,200, 600, 300 or 110 (must be the same at both devices). The other settings are fixed, as depicted in figure 4.11 above.

* A PC configuration tool is available from the recorder manufacturer.

4.12 DIAGNOSTICS

As shown in figure 4.12, operation of the DIAGS softkey calls the first of the diagnostics pages to the display. The following notes are intended to clarify the information contained in the figure.

4.12.1 SBC

This softkey allows the operator to determine the size of the current SBC, and thus the number of options which can be accommodated. See the technical specification (Annex A) for available types.

4.12.2 Board

Operation of this softkey calls board information for the board at address 1 to the display. The information is: Board type, Serial number and software version number. Board information for other addresses can be accessed by use of the page scroll keys.

4.12.3 Printer

Operation of this softkey calls a further display, allowing the user to check various parts of the writing system operation.

VALUES

Operation of this softkey causes the first of three display pages referring to the accuracy of the printhead to be called to the display. The first page displays:
a. Hexadecimal (Hex) values, for the opto-isolators used to determine printhead position across the chart. Any value other than 0 or F is acceptable. A value of 0 or F indicates that there is a problem with the opto.
b. Mark / space ratio (0 to 100%) within 3 %.

The second page, accessed by the page scroll up key, shows whether the maximum and minimum values for the opto currents are acceptable. The reported value (S in figure 4.12) is either N (opto is working correctly), or Y (opto or feedback strip is faulty).

The third page, accessed by use of the page scroll up key, shows the following:
a. The edge detector is working correctly (SSSS=Good) or is faulty (SSSS=Bad) (SSSS in figure 4.12.)
b. The backlash in the system in mm.
c. Quadrature phase error in degrees, between -90 and +90 (QQQ in figure 4.12).

DENSITY

Operation of this softkey causes the recorder to print lines of characters on the chart. Used as a part of the factory set-up process

RESET

This is used to attempt to clear any faults found.

4.12.4 Relays

Operation of this softkey causes a display of relay status for the relay board (if any fitted) with the lowest address. Status is shown as E (Not in alarm state) or D (In alarm state). Relays can be toggled between E (Energised) and D (De-energised) using the page keys. Other relay boards can be accessed using the page-scroll keys.
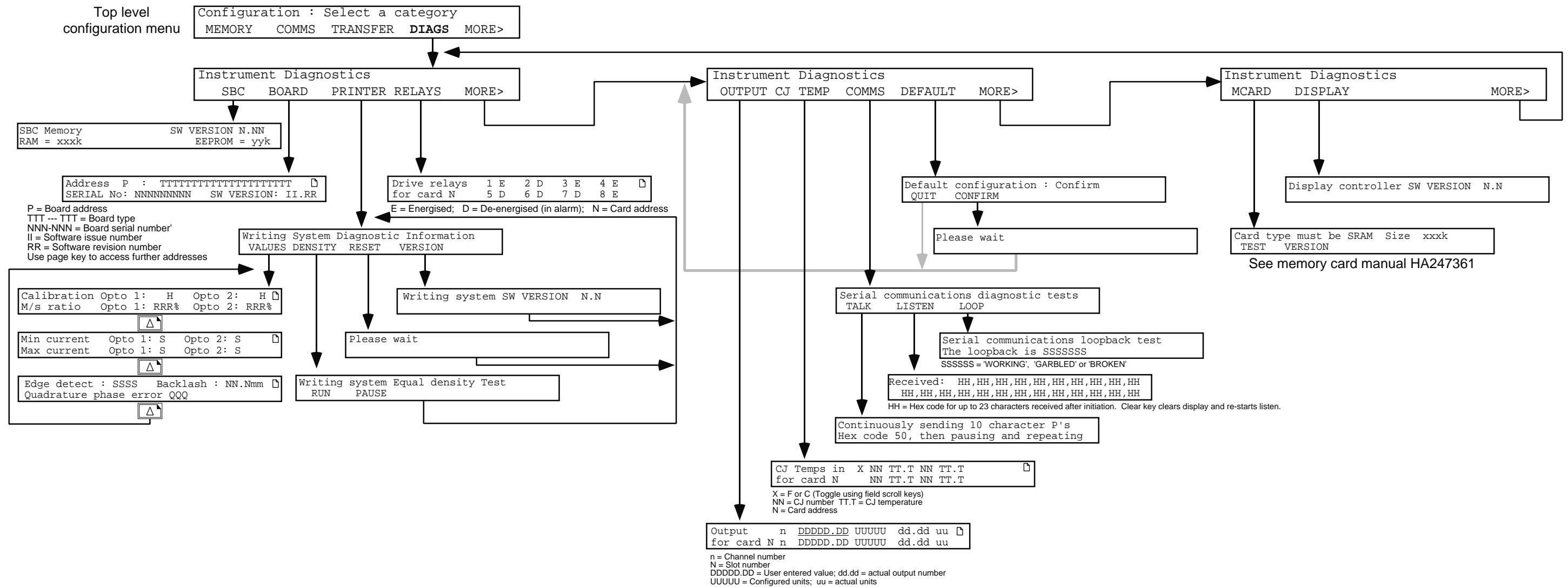
4.12 DIAGNOSTICS (Cont.)

Top level
configuration menu

```
Configuration : Select a category
  MEMORY   COMMS  TRANSFER  DIAGS  MORE>
```

```
Instrument Diagnostics
   SBC   BOARD   PRINTER RELAYS   MORE>
```

```
Instrument Diagnostics
   OUTPUT CJ TEMP  COMMS  DEFAULT  MORE>
```

```
Instrument Diagnostics
   MCARD   DISPLAY                  MORE>
```

```
SBC Memory           SW VERSION N.NN
RAM = xxxk               EEPROM = yyk
```

```
Address P : TTTTTTTTTTTTTTTTTTTTTT
SERIAL No: NNNNNNNNN  SW VERSION: II.RR
```

```
Drive relays   1 E   2 D   3 E   4 E
for card N     5 D   6 D   7 D   8 E
```
E = Energised; D = De-energised (in alarm); N = Card address

```
Default configuration : Confirm
   QUIT   CONFIRM
```

```
Display controller SW VERSION  N.N
```

P = Board address
TTT --- TTT = Board type
NNN-NNN = Board serial number'
II = Software issue number
RR = Software revision number
Use page key to access further addresses

```
Writing System Diagnostic Information
   VALUES DENSITY RESET   VERSION
```

```
Please wait
```

```
Card type must be SRAM  Size  xxxk
   TEST    VERSION
```

See memory card manual HA247361

```
Calibration Opto 1:    H    Opto 2:    H
M/s ratio   Opto 1: RRR%  Opto 2: RRR%
```

```
Writing system SW VERSION  N.N
```

```
Serial communications diagnostic tests
   TALK    LISTEN    LOOP
```

```
Min current   Opto 1: S   Opto 2: S
Max current   Opto 1: S   Opto 2: S
```

```
Please wait
```

```
Serial communications loopback test
The loopback is SSSSSSS
```
SSSSSS = 'WORKING', 'GARBLED' or 'BROKEN'

```
Edge detect : SSSS   Backlash : NN.Nmm
Quadrature phase error QQQ
```

```
Writing system Equal density Test
   RUN    PAUSE
```

```
Received:   HH,HH,HH,HH,HH,HH,HH,HH,HH
            HH,HH,HH,HH,HH,HH,HH,HH,HH,HH,HH,HH
```
HH = Hex code for up to 23 characters received after initiation. Clear key clears display and re-starts listen.

```
Continuously sending 10 character P's
Hex code 50, then pausing and repeating
```

```
CJ Temps in  X NN TT.T NN TT.T
for card N     NN TT.T NN TT.T
```
X = F or C (Toggle using field scroll keys)
NN = CJ number TT.T = CJ temperature
N = Card address

```
Output     n  DDDDD.DD UUUUU  dd.dd uu
for card N n  DDDDD.DD UUUUU  dd.dd uu
```
n = Channel number
N = Slot number
DDDDD.DD = User entered value; dd.dd = actual output number
UUUUU = Configured units; uu = actual units

Figure 4.12 Diagnostics menu organisation

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4.12.5 Output

Allows two analogue output channels to be exercised so that their actual outputs can be compared with their required outputs. All other channels are set to their 'on error' status (section 4.4.2 - output channels).

```
Output      ±DDDDD.DD  UUUUU ±dd.dd  u
for card N  ±DDDDD.DD  UUUUU ±dd.dd  uu
```

N	Slot number	Initially, the lowest slot number containing an analogue output (AO) board. When all the channels of this board have been scrolled through (Page keys) the next slot with an AO board fitted will appear. When all AO channels have been scrolled through, the first AO board is returned to.
n	Channel number	Pairs of channels are scrolled through using the Page keys.
±DDDDD.DD	Control value	User entered control value in engineering (UUUUU) units.
UUUUU	Engineering units	The engineering units the channel is configured in.
±dd.dd	Actual value	The output value in Volts or mA (uu) as configured
uu	Actual units	The output type (V or mA) as configured

The only user accessible fields are the ±DDDD.DD fields which can be accessed using the cursor keys.

Notes:
1   All AO channels except the two on display are set to their 'On error' value
2   The message 'No analogue channels configured' appears if no analogue channels have been configured.

4.12.6 CJ Temp

Shows the temperatures being measured by the cold junctions associated with the first relevant I/O board address. The field scroll keys can be used to toggle between Fahrenheit and Celsius. Further boards are accessed by using the field scroll keys.

4.12.7 Comms

Operation of this softkey calls a further 'softkey page' allowing the user to send or receive data, and to check that the communications line is working correctly. **The communications tests are all run with the following parameters set: Baud rate = 9600; Data bits = 8; Stop bits = 1; Parity = None.**

TALK

Operation of this softkey causes a string of ten characters P (hex 50) to be transmitted, followed by a pause, then a further 10 characters P.

LISTEN

Operation of this softkey causes the next 23 transmitted characters to be displayed.   Operation of the Clear key clears the display before the next 23 characters are displayed.

(Continued)

4.12.7 COMMS (Cont.)

LOOP BACK

BEFORE INITIATING THIS TEST, THE Tx AND Rx CONNECTIONS SHOULD BE SHORTED TOGETHER AT SOME POINT IN THE TRANSMISSION LINE.

Operation of this softkey calls the loopback test page, showing that up to the point at which Rx and Tx are shorted, the link is working correctly (WORKING), working incorrectly (GARBLED) or not working at all (BROKEN).

4.12.8 Default

Operation of this softkey, followed by operation of the CONFIRM softkey, causes the factory configuration to be written to the recorder's data base.

This operation overwrites any customer-entered configuration data.

4.12.9 M Card

TEST

Allows testing of the memory card and the memory card controller (if fitted).

VERSION

Operation of this softkey displays the version number of the card controller software.

4.12.10 Display

Operation of this softkey displays the version number of the display controller software.

4.13 AUTOCONFIGURATION

When triggered, the auto-configuration facility causes the recorder to determine whether any I/O boards, options etc. have been added or deleted, and changes the configuration as appropriate. The validity of data is checked, and if any area of the configuration is no longer valid, it re-configures it to a default state.

Top level
configuration
menu

```
Configuration : Select a category
 DIAGS   AUTOCFIG ACCESS   ADJUST    MORE>
```

```
Auto configure - I/O, options, groups
QUIT    CONTINUE
```
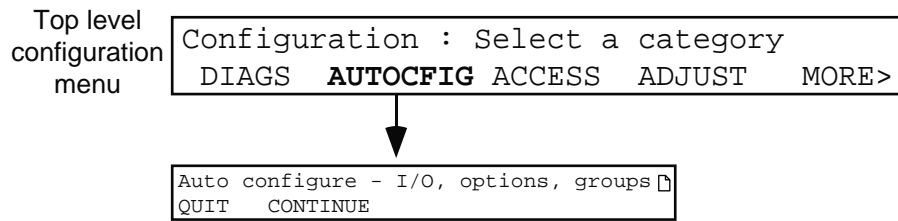
Figure 4.13 Auto-config configuration

QUIT	Returns to the previous 'Select a category' page.
CONTINUE	Causes the recorder to carry out automatic configuration.

4.14 OPERATOR ACCESS CONFIGURATION

This section shows how certain parts of the recorder's configuration, normally accessible via the Operator's menu, can be made inaccessible. Operation of the ACCESS softkey calls the first of the access category pages. Figure 4.14 shows the complete menu, allowing the items listed in table 4.14, below, to be toggled between 'Operator accessible' (yes) and 'Not accessible' (no). The table below gives the factory settings (defaults).

Chart	Speed A to Speed B (yes) Log interval A to Log interval B (yes) Mode A to Mode B (no) Printer on/off line (yes)	Counters	Preset counter (no)
		Totalisers	Preset totaliser (no)
Channel	Zone A to Zone B (no) Alarm setpoints (no)	Timers	Control timers (no)
Text	Edit operator messages (yes)	Rolling memory	Control memory (no)
Group	Select specified group for display (yes)	Memory Card	Format card (no) Save / Restore configuration (no) Display status / directory (no) Delete files (no) Configure report (no) Start / Stop replay (no) Select archive interval B (no) Control chart copy (no) Change file (no) Set memory card off line (no)
Log	Initiate logging of specified log (yes)		
Maths	Reset derived channels (no) Zone A to Zone B (no) Alarm setpoints (no)		

Table 4.14 Operator access parameters

4.14 OPERATOR ACCESS CONFIGURATION (Cont.)

Top level
configuration menu

```
Configuration : Select a category
 DIAGS  AUTOCFIG ACCESS  ADJUST    MORE>
```

```
Operator Permisions : Select a category
 CHART  CHANNEL  TEXT    GROUP    MORE>
```

Use field scroll keys to select required group

```
Select group Everything
 ACCESS                 NEXT  PREVIOUS
```

```
Group : Allow operator to :-
Select for display yes
```

```
Instrument Diagnostics
  LOG    MATHS   COUNTER TOTAL'R  MORE>
```

```
Text : Allow operator to :-
Edit operator text yes
```

```
Totaliser : Allow operator to :-
Preset value  no
```

```
Instrument Diagnostics
 TIMER   MEMORY  M CARD          MORE>
```

```
Channel : Allow operator to :-
Change : Zone  no  Alarms  no
```

```
Counter : Allow operator to :-
Preset value  no
```

```
Chart : Allow operator to :-        ▯
Change : speed yes Log int yes Mode  no
```

```
Maths : Allow operator to :-
Reset  no Change : Zone  no Alarms  no
```

Select log using numeric keys

```
Memory card : Allow operator to :-   ▯
Format  no  Save  no  Restore  no
```

```
Chart : Allow operator to :-        ▯
Turn printer on and off line yes
```

```
Select log NN
ACCESS
```

```
Timer : Allow operator to :-
Control timers  no
```

```
Memory card : Allow operator to :-   ▯
Display Status/Dir  no  Delete  no
```

```
Log : Allow operator to :-
Generate log yes
```

```
Memory : Allow operator to :-
Control rolling memory  no
```

```
Memory card : Allow operator to :-   ▯
Configure report
```

```
Memory card : Allow operator to :-   ▯
Replay  no  Stop replay  no
```

```
Memory card : Allow operator to :-   ▯
Change archive interval
```

```
Memory card : Allow operator to :-   ▯
Chart copy: control  no  change file  no
```

```
Memory card : Allow operator to :-   ▯
Turn memory card offline  no
```

Figure 4.14 Operator access configuration

This page is deliberately left blank

4.15 ADJUST

> Note: Any adjustments made in this section of configuration are lost during Configuration Transfer (described in section 4.11 of this manual).

This section describes how the input/output channels can be adjusted to compensate for tolerance errors, how the print head is aligned with the chart calibration marks, and how to calibrate input channels. The adjustments are in four subsections: Input, Output, Chart and calibration

4.15.1 Input adjust

APPLY

```
┌──────────────────────────────────────────┐
│ Configuration : Select a category        │
│ AUTOCFIG   ACCESS   ADJUST   PRINT   MORE>│
└──────────────────────────────────────────┘
                             │
                             ▼
┌──────────────────────────────────────────┐
│ Adjust : Select a category               │
│  INPUT    OUTPUT   CHART    CALIB         │
└──────────────────────────────────────────┘
                 │
                 ▼
┌──────────────────────────────────────────┐
│ Input Adjust : Select a category         │
│  APPLY   REMOVE   VIEW                    │
└──────────────────────────────────────────┘
   │
   ▼
┌─────────────────────────────────────┐   Enter required channel
│ Input adjust channel(s) NN to NN    │        number(s)
│  QUIT   CONTINUE                     │
└─────────────────────────────────────┘
   │
   ▼
┌─────────────────────────────────────┐
│ Set up sensor LOW point             │
│ CONTINUE                            │
└─────────────────────────────────────┘
   │
   ▼
┌─────────────────────────────────────┐   Channel number(s) can be
│ Monitor LOW point: ch NN  +DDD.DD   │   scrolled through to check
│ CONTINUE          NEXT    PREVIOUS  │      reading stability
└─────────────────────────────────────┘
   │
   ▼
┌─────────────────────────────────────┐   Enter required value
│ Reading at LOW point should be +DDD.DD │   (5 digits and sign)
│ CONTINUE                            │
└─────────────────────────────────────┘
   │
   ▼
┌─────────────────────────────────────┐
│ Set up sensor HIGH point            │
│ CONTINUE                            │
└─────────────────────────────────────┘
   │
   ▼
┌─────────────────────────────────────┐   Channel number(s) can be
│ Monitor HIGH point: ch NN  +DDD.DD  │   scrolled through to check
│ CONTINUE          NEXT    PREVIOUS  │      reading stability
└─────────────────────────────────────┘
   │
   ▼
┌─────────────────────────────────────┐   Enter required value
│ Reading at HIGH point should be +DDD.DD │   (5 digits and sign)
│ CONTINUE                            │
└─────────────────────────────────────┘
   │
   ▼
┌─────────────────────────────────────┐
│ Adjustment procedure complete       │    3-second display
└─────────────────────────────────────┘
```

Figure 4.15.1 Channel Input Adjust menu

To adjust one or more channels, the prompts are followed as shown in figure 4.15.1 above. Numbers of channels to be adjusted and required values are entered using the numeric keypad. The monitor pages can be used for scrolling through the channels to ensure that the readings are all steady before adjustment is applied.

4.15.1 INPUT ADJUST (Cont.)

REMOVE

> Note: It is possible to disable input adjustment, using the 'VIEW' page described below.

In order to remove any adjustment, the REMOVE softkey is operated to call the first 'remove' page:

```
Remove input adjust for ch(s) NN to NN
QUIT    CONFIRM
```

Operation of the CONFIRM softkey causes a return to the 'INPUT, OUTPUT, CHART, CALIB' page, via a 'fleeting' display page: 'Adjustment removal complete', which displays for three seconds.

VIEW

Operation of the VIEW softkey will call one of the two pages depicted below:

```
NN DDDDDDDDDDDDDDDDDDDD unadjusted      
```

```
NN DDDDDDDDDDDDDDDDDDDD adjusted        
Use adjustment YYY
```

In both cases, NN is the channel number, and DDD—DDD is the channel descriptor. The page scroll key can be used to scroll through the channel numbers.

The 'Use adjustment' field can be used to disable the adjustment, when set to 'no'. Use adjustment is set to 'Yes' as a default.

4.15.2 Output adjust

This allows the range of the analogue output to be adjusted to account for tolerance errors in external equipment. The technique used is:

1   To specify a low point, and then after a stabilisation time, to enter the value which is read by the external equipment.

2.   To repeat the above for a high point.

The ouitput board then calculates newoffsets and gains for the channel.

Notes:
1.   The CLEAR key is used to set the DDDDD.DD value to zero.
2.   Adjust REMOVE and VIEW operate in a similar way to that described for input channels above.
3.   Adjust is not available for channels with 'Constant' as their input source.

```
Configuration : Select a category
AUTOCFIG   ACCESS   ADJUST   PRINT    MORE>
```

```
Adjust : Select a category
  INPUT    OUTPUT   CHART    CALIB
```

```
Output Adjust : Select a category
  APPLY   REMOVE   VIEW
```

```
Output adjust channel NN                      Enter required channel
  QUIT   CONTINUE                                    number
```

```
Set up LOW output    ch NN   DDDDD.DD          Enter required value
 CLEAR  CONTINUE    -->                        (default = 10% span)
```

```
Enter LOW reading    ch NN   DDDDD.DD
 CLEAR  CONTINUE    -->                        Enter value measured
```

```
Set up HIGH output   ch NN   DDDDD.DD          Enter required value
 CLEAR  CONTINUE    -->                        (default = 90% span)
```

```
Enter HIGH reading   ch NN   DDDDD.DD
 CLEAR  CONTINUE    -->                        Enter value measured
```

```
Adjustment procedure complete                   3-second display
```

Figure 4.15.2 Output channel adjust menu

4.15.3 Chart adjust

Operation of the CHART softkey causes the recorder to go into pen calibration mode. The printhead continuously scans from zero to full scale, leaving a line of dots at or close-to the zero and full scale calibrations of the chart. The display changes as follows:

```
Chart paper calibration
<<ZERO    ZERO>>           <<SPAN SPAN>>
```

The <<zero and zero>> softkeys are used to align the printhead zero with the chart zero, and the <<span and span>> softkeys are used to align the printhead full scale with the chart full scale.

Operation of the Enter hard key causes the new zero and span to be read into the recorder. On the second operation of Enter, the display returns to the 'INPUT, OUTPUT, CHART, CALIB' page.

4.15.4 CALIB softkey

This feature allows the user to calibrate 8-channel universal input board channels to his or her own requirements. The facility is not available for the 16-channel dc input board. It is recommended that for maximum accuracy, the Input calibration be carried out before the Cold Junction calibration.

```
┌─────────────────────────────────────────────────┐
│ Configuration : Select a category                │
│ AUTOCFIG   ACCESS   ADJUST   PRINT    MORE>       │
└─────────────────────────────────────────────────┘
                              │
                              ▼
┌─────────────────────────────────────────────────┐
│ Adjust : Select a category                       │
│  INPUT    OUTPUT   CHART    CALIB                 │
└─────────────────────────────────────────────────┘
                              │
                              ▼
┌─────────────────────────────────────────────────┐
│ Channel Calibration : Select a category          │
│  IP CAL   CJ CAL   FACTORY    VIEW                │
└─────────────────────────────────────────────────┘
```

Calibrate channels NN to NN QUIT **CONTINUE** -->	Enter required channel number(s)
Input type to be calibrated TTTT QUIT **CONTINUE** NEXT PREVIOUS	Scroll between mV and Ohms
Input range to be calibrated range N QUIT **CONTINUE** NEXT PREVIOUS	Scroll through mV range 1 to 4 or Ohms range 1 to 3 as per table 4.15.3..
Apply zero **CONTINUE**	
Monitor ZERO point: ch NN +DDD.DD **CONTINUE** NEXT PREVIOUS	Channel number(s) can be scrolled through to check reading stability
Reading at ZERO point should be +DDD.DD **CONTINUE**	Enter required mV or Ohms value (5 digits and sign)
Apply SPAN **CONTINUE**	
Monitor SPAN point: ch NN +DDD.DD **CONTINUE** NEXT PREVIOUS	Channel number(s) can be scrolled through to check reading stability
Reading at SPAN point should be +DDD.DD **CONTINUE**	Enter required mV or Ohms value (5 digits and sign)
Calibration procedure complete	3-second display

Figure 4.15.4 Input channel calibration menu

The input ranges (range N) above, are given in table 4.15.4 below. The user must choose the lowest possible of the available ranges which will suit the application.

Range number	mV ranges	Ohms ranges
1	0 to 49 mV	0 to 180
2	0 to 200 mV	0 to 1,800
3	0 to 1,000mV	0 to 10,000
4	0 to 10,000mV	N.A.

Table 4.15.4 Input ranges

4.15.4 CALIB SOFTKEY (Cont.)

CJC CALIBRATION

Before this procedure can be carried out it is necessary to connect a thermocouple, (or thermocouple simulator) of a known type, held at a known reference temperature, to each of the input channels to be calibrated. The channels must then be configured for that type of thermocouple, and have 'internal' set as their cold junction compensation type.

Operation of the CJ CAL softkey calls the first Cold Junction calibration page to the display:

```
Calibrate cj(s) for channel(s) NN to NN
 QUIT    CONTINUE
```

The relevant channel number(s) are entered using the numeric keys.   'CONTINUE' calls the next page:

```
Apply reference temperature
 QUIT    CONTINUE
```

Continue calls the next page:

```
Monitoring reference : ch NN    +DD.DDD 🗋
 CONTINUE
```

The page scroll keys can be used to scroll through the selected channels to ensure that they are all stable, before the adjustment is applied. Continue calls the next page:

```
Reference temperature is TT.T C
CONTINUE
```

The known reference temperature (TT.T) is entered using the numeric keys.   CONTINUE initiates the calibration procedure.

```
CJ calibration procedure complete
```

RESTORE FACTORY CALIBRATION

Operation of the FACTORY softkey calls the 'Use factory cal' page to the display. The relevant channel numbers are entered using the numeric keys.

```
Use factory cal for channel(s) NN to NN
 QUIT    CONFIRM
```

Operation of CONFIRM returns the relevant channel(s) (including CJs) to factory calibration. A 'fleeting' display (Return to factory cal procedure complete) appears for three seconds.

4.15.4 CALIB SOFTKEY (Cont.)

VIEW

Operation of the VIEW softkey allows each channel to be scrolled through, to determine whether factory or field calibrations are in use for input and cold junction compensation.

```
NN DDDDDDDDDDDDDDDDDDDD cal being used ▯
Input : FFFFFFF Cold junction : FFFFFFF
```

where NN is the channel number, DDD — DDD is the channel descriptor and FFFFFFF is either 'Factory' or 'Field' as appropriate.

The page scroll keys can be used to view other channels.

4.16 PRINT CONFIGURATION

This allows the instrument configuration to be output to the chart. Operation of the 'ALL' softkey causes a full configuration print. Operation of any other softkey causes only that section to be printed.

```
Configuration : Select a category          Top level
PRINT                            MORE>     configuration
                                              menu

Configuration print : Select a category
  ALL    CHANNEL   TRACE    ALARM    MORE>

Configuration print : Select a category
 INSTRM  MSG'S    GROUP    EVENTS    MORE>

Configuration print : Select a category
 MATHS   TOTAL'R COUNTER   TIMER     MORE>

Configuration print in progress
STOP
```
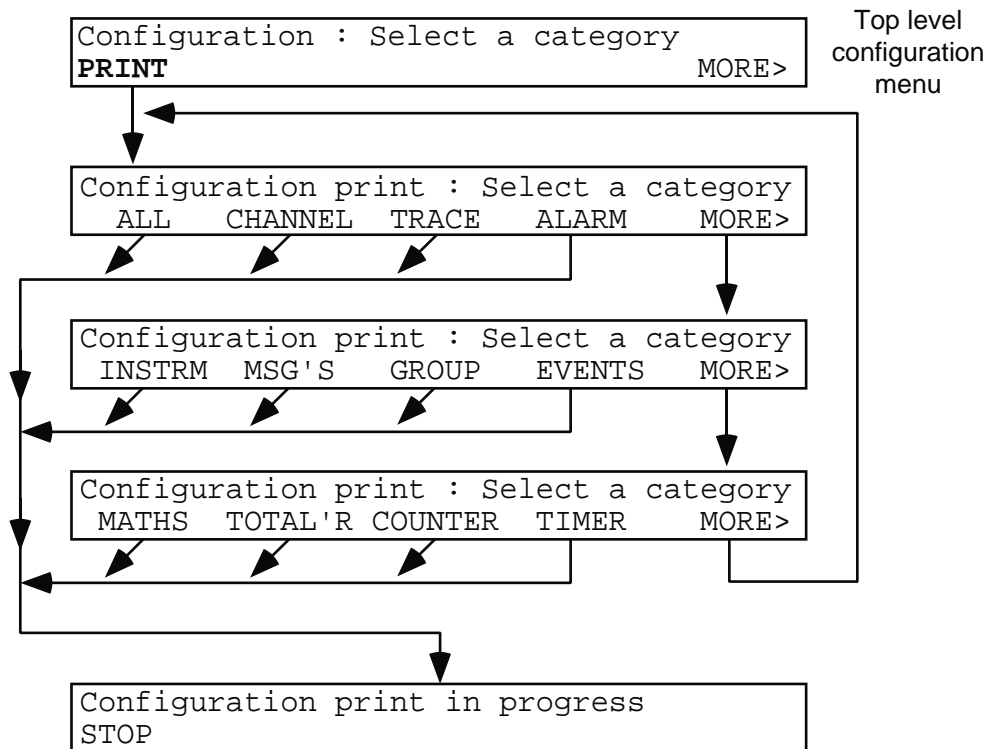
Figure 4.16 Configuration print

Section 5: Options

List of contents

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SECTION 5: OPTIONS

This section contains details of options other than Communications, Memory Card and Networking which are dealt with in separate manuals.

5.1 INSTALLING NEW OPTIONS

New options are fitted by inserting an 'Option Key' into a connector located near the front edge of the Single Board Computer (SBC) as shown in the diagram below. Up to six option keys may be fitted.

Once fitted, the 'Autoconfigure' facility (section 4.13) should be used to include the option in the data base.
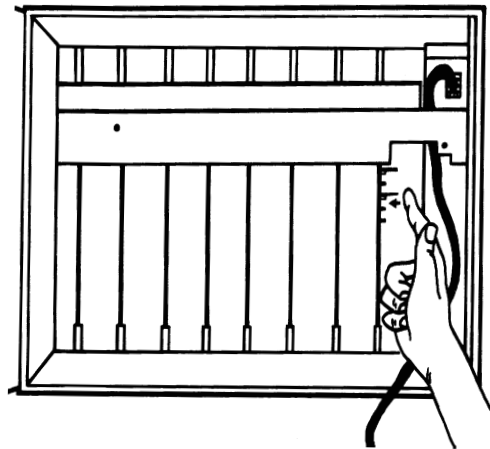
Figure 5.1 Option key location

5.2 TOTALISER/COUNTER/TIMER (TCT) OPTION

5.2.1 Totalisers

Each TCT option supplies 12, eight-digit totaliser functions, each of which is used to integrate a given measuring / derived channel's input, providing that it is above a low cut-off point, below a high cut-off point and within the channel's range.

A 'setpoint' value can be entered, and when the totaliser value exceeds this threshold, up to four actions (job list) are carried out. The jobs remain active until the totaliser is reset or disabled.

The function equation is:
$$tot_t = tot_{t-1} + \frac{ma_t}{PSF \, x \, USF}$$

Where tot_t = totaliser value at time t.
           tot_{t-1} = totaliser value last time
           ma_t = input value of source channel (Ca) at time t
        PSF = Period scaling factor
        USF = Units scaling factor (negative for decrement; positive or un-signed for increment).

CONFIGURATION

FUNCTION softkey

PAGE 1	
Enabled/Disabled	Allows the totaliser to be turned on or off.
Source	Number of the input or derived channel to be used as the totaliser source.
Period scaler (PSF)	Changes time units of input to seconds. E.g. If input is litres / hour then PSF = 3600.
Units scaler (USF)	Changes the counting scale. E.g. If Input = litres/sec and the output is to be litres x 10^3 (i.e. thousands of litres), then USF is set to 1000. Direction of count is defined by the sign of the USF, a negative USF causing the totaliser to decrement.
PAGE 2	
Group reset	Allows the totaliser to be susceptible to group reset (enable) or not (disable).
Preset	Allows entry of an eight-digit preset value, from which the totaliser will count after being preset
Cut off low	Value of the source channel (in engineering units) below which it is not to be totalised (can be negative).
Cutoff high	Value of the source channel (in engineering units) above which it is not to be totalised (must be positive).
PAGE 3	
Value format	Allows the number of decimal places to be selected for the displayed value.

ALARM softkey

SET PT Softkey	
Set Point	Eight digit value entered using the numeric keys to act as the trip point for the job list.
Limit	Scroll through 'High' or 'Low'. Defines whether job list is initiated when the totaliser exceeds the setpoint (High) or when it falls below it (Low).
JOBS Softkey	
	Allows jobs 1 to 4 to be selected from the list given in section 4.1.4. Can be used to reset totaliser.

IDENT softkey

	Allows a 20-character descriptor, a units string and a tag to be entered to describe the totaliser function.

TOTALISER CONFIGURATION (CONT.)

Top level
configuration menu

```
Configuration : Select a category
 MATHS TOTAL'R   COUNTER   TIMER     MORE>
```

Use numeric keys to select
required totaliser

```
Totaliser TNN : Select a category
 FUNCT     ALARM    IDENT
```

```
Enabled Source channel 1            ▯
Units scaler D.DDD   Period scaler   1s
```

```
Descriptor --Totaliser name----      ▯
```

```
Preset D.DDDDDDD  Group preset enable  ▯
Cut off low DDDD.DDD high DDDD.DDD
```

```
Units UUUUU                          ▯
Tag TTTTTT
```

```
Value format XXXXX.XX               ▯
```

```
Alarm : Select a category
 SET PT  JOBS
```

```
Setpoint D.DDDDDDD        Limit high
```

```
J1 Sound buzzer                      ▯
                While active
```

```
J2 No action                         ▯
```

```
J3 No action                         ▯
```

```
J4 No action                         ▯
```

Figure 5.2.1 Totaliser configuration

NOTE: Totaliser values are held in battery-backed memory and are thus retained even when power is removed. When, eventually, the battery pack has to be replaced, it is recommended that the recorder is left switched ON during the replacement procedure.

5.2.2 Counters

Each TCT option supplies 12, eight-character counters which are controlled from other recorder functions through job lists.   As shown in section 4.1.4, counter jobs are:

a.   Increment specified counter.

b.   Decrement specified counter.

c.   Preset specified counter or group of counters.

d.   Disable specified counter or group of counters.

Each counter is configured with a threshold to allow it to trigger up to four jobs itself.   A 'limit' input allows these jobs to be initiated either when the count value exceeds the threshold (Limit high) or when it falls below the threshold (Limit low).

Counters values are non volatile, i.e. the values are maintained with power removed from the recorder. In order to maintain this function, power must be maintained to the recorder whilst the batteries are being replaced (section 6.2).

COUNTER CONFIGURATION

The required counter (NN in figure 5.2.2) is selected using the numeric keys.

PRESET	Preset	Eight-digit value of preset, entered using the numeric keys. The value is loaded into the counter by 'preset specified counter' job (section 4.1.4), or by operator action.
	Group Preset enable	Scroll through 'enable' or 'disable' to define the counter as being susceptible to group Preset (enable) or not (disable).
ALARM	SET PT	Set Point An eight-digit value entered using the numeric entry keys. Acts as the trip point for the job list.
		Limit Scroll through 'High' or 'Low'. Defines whether job list is initiated when the counter exceeds the setpoint (High) or when it falls below it (Low).
JOBS		Allows up to four jobs to be set up to be initiated when the counter value passes the threshold value. See section 4.1.4 for job details.
IDENT	Descriptor	Allows the entry of a title of up to 20 characters, to describe the counter's use and to distinguish it from other variables.
	Units	Allows a units string to be entered for the counter value.
	Tag	Allows a 'tag' to be entered for the counter

COUNTER CONFIGURATION (CONT.)

Top level configuration menu

```
Configuration : Select a category
  MATHS TOTAL'R  COUNTER  TIMER    MORE>
```

Use numeric keys to select required counter

```
Counter CNN : Select a category
  PRESET   ALARM    IDENT
```

```
Preset DDDDDDDD Group reset enable
```

```
Descriptor ----Counter name----
```

```
          △
```

```
Units UUUUU
Tag TTTTTT
```

```
          △
```

```
Alarm : Select a category
  SET PT  JOBS
```

```
Set point DDDDDDDD  Limit high
```

```
J1 Sound buzzer
                While active
```

```
        △
```

```
J2 No action
```

```
        △
```

```
J3 No action
```

```
        △
```

```
J4 No action
```

```
        △
```

Figure 5.2.2 Counter configuration

5.2.3 Timers

Each TCT option supplies 12 timers, each of which can be configured to start at a specific time and date (according to the real-time clock in the recorder). The timer will then run for a configurable time period (duration), and will repeat at a configurable rate. Alternatively, the timer can be initiated by a job (see 'Timer' jobs in section 4.1.4), and it will then repeat at the configured repetition rate. Once initiated, the timer will re-start every repeat period until it is disabled.

Each timer can have up to four jobs allocated to it from the list in section 4.1.4. The jobs are active for the timer Duration Period.

Timer values are non volatile, i.e. the values are maintained with power removed from the recorder. In order to maintain this function, power must be maintained to the recorder whilst the batteries are being replaced (section 6).

TIMER CONFIGURATION

The required timer (NN in figure 5.2.3) is selected using the numeric keys.

FUNCT Page 1		
	Enabled	Scroll through 'Enabled' or 'Disabled' to enable or disable the timer respectively.
	Global reset enable	Scroll through 'enable' or 'disable' to define the timer as being susceptible to global reset (enable) or not (disable).
	Start at	Field scroll keys are used to enter time and date at which the timer is to start. (XX = 'Don't care' see note and example below). If all XXs are entered, the timer can be started only by job or operator action.
FUNCT Page 2		
	Repeat every	Days, hours, minutes and seconds values are entered using the numeric keys, to define repeat period. If entry is all zeros, the timer does not repeat.
	Duration	Numeric entry of timer duration.
JOBS		Allows up to four jobs to be set up to be active for the timer duration. See section 4.1.4 for job details.
IDENT	Descriptor	Allows the entry of a title of up to 20 characters, to describe the timer's use and to distinguish it from other variables.

Note... If no entry (i.e. XX) is made in the first field, then the timer operates every next smallest defined time period. For example, if no month is entered, but a day number of 01 is entered, then the timer will operate on the 1st day of each month. If no month or day value is defined, but an hours value of 12 is entered, then the timer will operate every day at noon.

EXAMPLE

To start a timer at mid day on the 1st of each month:

```
Enabled          Global reset enable    □
Start at XX/01 month/date 12:00 hr:mins
```

TIMER CONFIGURATION (CONT.)

Top level
configuration menu

```
Configuration : Select a category
 MATHS TOTAL'R  COUNTER  TIMER    MORE>
```

Use numeric keys to select
required timer

```
Timer NN : Select a category
  FUNCT    JOBS     IDENT
```

```
Enabled       Global reset enable
Start at XX/XX month/date XX:XX hr:mins
```
△

```
Repeat every 0 dys 1 hrs 0 mns  0s
Duration DDDDDs
```
△

```
Descriptor --Timer name----
```
△

```
J1 Logging  Generate log N
                on going active
```
△

```
J2 No action
```
△

```
J3 No action
```
△

```
J4 No action
```
△

Figure 5.2.3 Timer configuration

5.3 MATHS PACK OPTION

5.3.1 Introduction

The maths pack option is available in three versions called level 1, level 2 and level 3. Levels 1 and 2 support 32 derived channels which are identified as D1 to D32 in the displays and on the chart, and differ only in the number of functions available (section 5.3.3).

Maths pack level three (designed for Continuous Emissions Monitoring applications) supports 96 derived channels (D1 to D96) and contains Maths pack level two functions plus 12 totalisers, 12 counters and 12 timers.

In order to enter a derived channel number as the source of a maths function, the channel number must be preceded by a 'D'. In order to return to input channels, the channel number must be preceded by an operation of the <blank> key. Alternatively, operation of the ± key will toggle between input and derived channels.

The operation and configuration of derived channels are similar to that described for measuring channels, and share the following parameters.

Channel units   Five-character, user definable string
Zone   Spans, scales and print zones A and B as for measuring channels
Trace   On, off or conditionally on as for measuring channels
Colour   Colours A and B selectable as for measuring channels
Descriptor   20-character descriptor as for measuring channels
Tag   Seven-character tag as for measuring channels
Alarms   Types, setpoints, hysteresis etc. as for measuring channels, though derived channel alarms and measuring channel alarms are not mixed on the Operator's alarm overview page; Derived channel alarms appear as a separate list, after measuring channel alarms.
Jobs   Type and actions etc. as for measuring channels

Maths pack unique parameters are as follows:-

Value format   Each derived variable and associated parameters can be displayed in the following ways:
                     Five digits with configurable decimal point position
                     Seven digits with configurable decimal point position
                     Eight digit integer (no decimal places).
                     Scientific (X.XXX+ee) e.g. 12324 would be expressed as 1.232+04; 0.000012324 would be expressed as 1.232-05.

In addition, the following time/date formats are available:
                     Time as HH:MM:SS (Time part of Time Stamp function).
                     Date as DD/MM/YY or MM/DD/YY (Date part of Time Stamp function). Date format is specified as a part of 'Instrument (Clock)' configuration.
                     Elapsed time as HH:MM:SS. If the period is 100 hours or more, the format changes to HHHHH:MM.

Group reset enable   Allows the derived channel value to be reset as a part of a group reset.

5.3.2 Configuration

Figure 5.3.2 shows the configuration pages for the FUNCT softkey. After the FUNCT softkey has been operated, the function type is selected using the field scroll keys. Operation of the page scroll key results in the relevant configuration page for that function to appear. After all the necessary sources have been defined, the page scroll key is again operated to call the 'Group reset and value format' page to the display.

Alarm, Zone, Trace and Ident configuration are the same as for measuring channels.

5.3.2 MATHS PACK CONFIGURATION (CONT.)

Top level configuration menu

```
Configuration : Select a category
  MATHS TOTAL'R  COUNTER  TIMER    MORE>
```

Use numeric keys to select required derived channel

```
Derived channel DNN : Select a category
 FUNCT    ALARM    ZONE    TRACE    IDENT
```

Use up/down arrow keys to select function, then 'page' key to gain access.

```
Function: Function type
Scale 0.000 to 10.00 Units
```

Stopwatch and timestamp functions

Enter value using numeric keys

CONSTANT
```
Constant value 25.00                   ◻
```

SAMPLE AND HOLD
```
On trigger sample and hold source      ◻
```

COPY
```
Copy from source                       ◻
```

CHANNEL MINIMUM
```
Minimum of source                      ◻
```

ADD
```
Add source 1 to source 1               ◻
```

Select group using up/down arrow keys   LATCHING MINIMUM
```
Latching min of ----Group name----     ◻
```

SUBTRACT
```
Subtract source 1 from source 2        ◻
```

Select group using up/down arrow keys   GROUP MINIMUM
```
Continuous min of ----Group Name----   ◻
```

MULTIPLY
```
Multiply source 1 by source 2          ◻
```

CHANNEL MAXIMUM
```
Maximum of source                      ◻
```

DIVIDE
```
Divide source 1 by source 2            ◻
```

Select group using up/down arrow keys   LATCHING MAXIMUM
```
Latching max of ----Group Name----     ◻
```

MODULUS
```
Take modulus of source                 ◻
```

Select group using up/down arrow keys   CONTINUOUS MAXIMUM
```
Continuous max of ----Group Name----   ◻
```

SQUARE ROOT
```
Take square root of source             ◻
```

POLYNOMIAL
```
Polynomial of chan NN  1.000 +00       ◻
A1   1.000 +00 A2  1.000 +00 A3  1.000 +00
```

CHANNEL AVERAGE
```
Average of source                      ◻
Time interval TTTT minutes
```

RELATIVE HUMIDITY
```
Wet temp  ch WW Dry temp  ch DD        ◻
Atm press ch AA Psych const 6.660 -04
```

GROUP AVERAGE   Select group using up/down arrow keys
```
Average of ----Group Name----          ◻
```

Fvalue
```
Temperature channel TT                 ◻
Sterilizing temp 99.0  z value 1
```

ROLLING AVERAGE
```
Rolling average of source              ◻
Sample: Interval SSSS  Points PPPP
```

LINEAR MASS FLOW
```
Flow ch  NN Temperature ch NN          ◻
Absolute press ch NN Constant 1.00
```

EXPONENT
```
Raise e to the power of source         ◻
```

SQUARE ROOT MASS FLOW
```
Differential press ch  NN Temp ch NN   ◻
Absolute press ch  NN Constant  1.00
```

LOG BASE e
```
Take natural log of source             ◻
```

ZIRCONIA PROBE
```
Probe temperature channel NN           ◻
Probe EMF channel   NN Reference 1.000 %
```

10^x
```
Raise 10 to the power of source        ◻
```

SWITCH
```
Switch : channel A NN    channel B NN  ◻
```

LOG BASE 10
```
Take log base 10 of source             ◻
```

HIGH SELECT
```
Higher of channels  NN and  NN         ◻
```

RATE OF CHANGE
```
Rate of change of source               ◻
Sample period PPPP s  Rate RRRR s
```

LOW SELECT
```
Lower of channels  NN and  NN          ◻
```

Group reset appears only with resettable functions

```
Value format XXXXXXX.X
Group reset DDDDDDD
```

Figure 5.3.2 Derived channel configuration

5.3.3 Maths functions

The following maths functions are available. Unless otherwise stated, the word 'channel' is used as a general term to include both input (measuring) and derived channels. Each maths pack level 1 and 2 supplies 32 derived channels. Maths pack level three supports 96 derived channels.

MATHS PACK LEVEL 1

Constant	Allows entry of a constant
Copy	Allows a totaliser or counter value to be imported.
Add	Adds two channels together.
Subtract	Subtracts one channel from another
Multiply	Multiplies two channels together
Divide	Divides one channel by another
Modulus	Takes the value of the input without the sign.

MATHS PACK LEVEL 2

Square root	Takes the square root of a channel.
Channel average	Takes the average of the value of an input channel. The time over which the average is taken, and the frequency with which it is updated can be configured.
Group average	Takes the average of a named group of channels.
Rolling average	Takes the average value of a specified channel over a specified time period.
Exponent	Provides the value of e raised to the power of a specified channel
Log_e	Takes the 'natural' log of a specified channel's value.
10^x	Output is 10 raised to the power of a specified channel.
Log_{10}	Take $\log_{10}$ of a specified channel's value
Rate of change	Determines the change in value of the source over a specifiable time period.
Sample and hold	Allows the value of a channel to be held as a result of a trigger input.
Channel minimum	Holds the minimum value reached by a specified channel since the function was started.
Latching minimum	Holds the minimum value reached, since the function was initiated, out of all the channels in a specified group.
Continuous min.	The current minimum value out of all the channels in a specified group.
Channel maximum	Holds the maximum value reached by the source channel since the function was started.
Latching maximum	Holds the maximum value reached, since the function was initiated, out of all the channels in a specified group.
Continuous max.	The current maximum value out of all the channels in a specified group.
Polynomial	Third order polynomial curve fit $A0 + A1(X) + A2(X^2) + A3(X^3)$, where X is the value of the source channel and A0 to A3 are constants.
Fvalue	Calculates F_O/F_H from temperature and z-value inputs
Relative humidity	Calculates relative humidity from wet and dry temperature inputs, atmospheric pressure input and psychrometric constant input.
Linear mass flow	Calculates mass flow from linear type transducer output.
Square root mass flow	Calculates mass flow from square root type transducer output.
Zirconia probe	Solves the Nernst oxygen equation.
Switch	Output copies either of two channels selected as input sources.
High select	Output is the higher of two source channels' values.
Low select	Output is the lower of two source channels' values.
Trace generator	If the Quality Monitoring option is fitted, selects one of six trace table profiles for generating a PV.
Stopwatch	Increments once per second whilst enabled.
Time Stamp	Holds current time and date value when triggered by a job.

MATHS PACK LEVEL 3

Level 2 functions but with 96 derived channels available and 12 counters, 12 timers and 12 totalisers.

5.3.4 Equations

CHANNEL AVERAGE

To provide the arithmetic mean of a channel over a specified time period.

$$A'_t = \frac{\sum\limits_{t=1}^{t=Tx60} ma_t}{Tx60}$$

Where, A'_t = Channel average at time t
             ma_t = Value of channel to be averaged at interval sample time t
               T = Time interval in minutes

GROUP AVERAGE

To provide the average value of all the channels in a group.

$$A_t = \frac{(ma_t + - - - - + mn_t + - - - - - + mx_t)}{R}$$

Where, A_t = Mean value of the specified group of channels at time t
             ma_t = Value of first channel in the group at time t
             mn_t = Value of nth channel in the group at time t
             mx_t = Value of final channel in the group at time t
               R = Number of channels in the group

ROLLING AVERAGE

To calculate the arithmetic mean of consecutive readings of a source channel, sampled at a specified time interval. The user configures the number or readings to be averaged, and the time between samples.

$$A_t = \frac{\sum\limits_{s=1}^{s=PT} ma_{(t-s)}}{P}$$

Where A_t = Rolling average of specified channel at time t.
           ma_{t-s} = Value of specified channel at time t - s.
               P = Number of valid samples taken.
               T = Sample interval in seconds.

At reset, the time period is restarted and P set to zero.

RATE OF CHANGE

$$A_t = \frac{(ma_t - ma_{(t-Ta)})xR}{P}$$

To calculate the rate of change (d/dt) of the value of a specified channel.
Where, A_t = Rate of change value
             ma_t = Current value of source channel
           ma_{t-Ta} = Value of source channel last time
               R = Rate multiplier in seconds to give rate per minute, per hour etc. from sample rates of minutes, seconds etc.
               P = Sample period in seconds (time between successive calculations).

5.3.4 EQUATIONS (CONT.)

RELATIVE HUMIDITY

To determine the percentage relative humidity using wet and dry temperature, and atmospheric pressure inputs.

> NOTE: The psychrometric constant used in the calculation (to be entered by the user) is generally 6.66×10^{-4}.

$$\% RH = \frac{VP_{Air}}{VP_{Sat}}$$

Where VP_{air} is the water vapour pressure in the atmosphere being measured, and VP_{sat} is the saturated water vapour pressure at the measured dry bulb temperature.

VP_{air} CALCULATION

VP_{air} is calculated as follows:

$$VP_{Air} = VP_{Wetsat} - \left\{ 6.66x10^{-4} \, xmc_t x(ma_t - mb_t) \right\}$$

where, ma_t = value of the channel measuring dry bulb temperature (C)
mb_t = value of the channel measuring wet bulb temperature (C)
mc_t = value of the channel measuring the atmospheric pressure (bar)
VP_{wetsat} = is the saturated water vapour pressure at the measured wet bulb temperature, calculated as follows:

$$VP_{Wetsat} = A0 + (A1xmb_t) + (A2xmb_t^2) + (A3xmb_t^3) + (A4xmb_t^4) + (A5xmb_t^5)$$

where,   A0 = 6.17204663 x 10^{-3}
A1 = 4.28096024 x 10^{-4}
A2 = 1.53342964 x 10^{-5}
A3 = 2.40833685 x 10^{-7}
A4 = 3.04249240 x 10^{-9}
A5 = 2.65867713 x 10^{-11}

VP_{sat} CALCULATION

VP_{sat} is calculated as follows, where ma_t, and A0 to A5 are as described for VP_{air}, above:

$$VP_{Sat} = A0 + (A1xma_t) + (A2xma_t^2) + (A3xma_t^3) + (A4xma_t^4) + (A5xma_t^5)$$

5.3.4 EQUATIONS (CONT.)

F$_{\text{VALUE}}$

To calculate the equivalent time at Sterilizing Temperature (for temperatures below, at and above Sterilizing Temperature) both in dry (F$_H$) and steam (F$_O$) sterilizing environments, using the following equation:

$$Fval_t = Fval_{t-1} + T \times 10^{\frac{ma_t - target\ temp}{Z}}$$

Where Fval$_t$ = F value at time t (minutes)
        Fval$_{t-1}$ = F value last iteration
        T = Internal recorder iteration rate (minutes)
        ma$_t$ = Value of temperature measuring channel
  Target temp = 121.1˚C for F$_O$; 170˚C for F$_H$
        Z = Temperature interval representing a factor-of-10 reduction in killing efficiency
         = 10˚C for F$_O$; = 20˚C for F$_H$

Application Notes

To ensure that sterilizer loads which contain materials with differing thermal inertias are thoroughly sterilized, a typical sterilizer has up to 12 different measuring points within the load. To ensure accuracy, the temperature sensors should be calibrated, and the channel adjustment facility used to compensate for any inaccuracies found.

If each of the inputs is used to compute an F value, each of these values can then be used as an input to a Group Continuous Minimum function, with a high absolute alarm set at the correct F value. The alarm can be used to sound a warning, or an associated relay can be linked into the autoclave control system to signify the end of a sterilization cycle.

5.3.4 EQUATIONS (CONT.)

MASS FLOW (LINEAR)

NOTE: The overall accuracy of a flow measurement installation depends on a number of factors outside the control of the recorder manufacturer. For this reason, the manufacturer takes no responsibility for the accuracy of results obtained using the mass flow equations implemented in the maths pack.
It is not recommended that the recorder be used for custody transfer.

$$Qm_t = \frac{K}{Rg \; x \; Z} \; x \; \frac{Flow_t \; x \; AbsP_t}{Temp}$$

where, Qm_t = mass flow in kg/sec.

$Flow_t$ = measured value from the flow meter at time t

$AbsP_t$ = absolute pressure of the fluid at time t in kPa(A).

$Temp_t$ = absolute temperature (Kelvin) of the fluid.

K = scaling factor (see below).

Rg = specific gas constant in J/(kg-K) (see below)

Z = compressibility factor (see below).

For the recorder user, the equation above becomes: *Mass flow = md x ma$_t$ x mb$_t$ ÷ mc$_t$* where

ma_t = the value, at time t, of the channel measuring the flow meter output.

mb_t = the value, at time t, of the channel measuring the absolute pressure of the fluid.

mc_t = the value, at time t, of the channel measuring the fluid temperature.

md = the constant value derived from the following:

$$Const = \frac{K}{Rg \; x \; Z}$$

SCALING FACTOR (K)

This is calculated from the following equation: $K = \dfrac{S}{ma_{max}}$

where S = the full scale output from the flow meter

ma_{max} = the full scale input of the channel reading the output from the flow meter.

SPECIFIC GAS CONSTANT (Rg)

The specific gas constant values are available from published tables.   For convenience, the Rg values for a number of common gases are given in table 5.3.4 below.

Gas	Rg (J/kg - K)
Air	287.11
Ammonia	488.2
Carbon dioxide	188.9
Carbon monoxide	296.8
Ethylene	296.4
Hydrogen	4116.0
Methane	518.4
Nitrogen	296.8
Oxygen	259.8
Propane	188.5
Steam	461.4

Table 5.3.4 Common gas constants

5.3.4 EQUATIONS (CONT.)

MASS FLOW (LINEAR) (CONT.)

COMPRESSIBILITY FACTOR (Z FACTOR)

The compressibility factor is a density related measure of how far a particular gas deviates from a 'perfect' gas under any set of temperature and pressure conditions, and is given by the equation.

$$Z = \frac{P}{T} \, x \, \frac{1}{\rho}$$

where,   Z = Compressibility factor
P = Absolute pressure of the gas
T = Absolute temperature of the gas
ρ = Gas density at pressure P and temperature T (from published tables)

Alternatively the Z-factor can be obtained experimentally.

MASS FLOW (SQUARE ROOT)

Note: The overall accuracy of a flow measurement installation depends on a number of factors outside the control of the recorder manufacturer.   For this reason, the manufacturer takes no responsibility for the accuracy of results obtained using the mass flow equations implemented in the maths pack.
It is not recommended that the recorder be used for custody transfer.

$$Qm_t = \sqrt{\frac{K^2}{Rg \, x \, Z}} \, x \, \sqrt{\frac{DeltaP_t \, x \, AbsP_t}{Temp_t}}$$

where, Qm_t = mass flow in kg/sec.
$DeltaP_t$ =   measured value of differential pressure across the orifice plate at time t, in kPa.
$AbsP_t$ = absolute pressure at the upstream tapping at time t, in kPa(A).
$Temp_t$ = absolute temperature at the upstream tapping at time t, in Kelvin.
K = Scaling factor (see below).
Rg = Specific gas constant in J/(kg-K)
Z = Compressibility factor

For the recorder user, the equation above becomes: $Mass \, flow = \sqrt{md \, x \, ma_t \, x \, mb_t \div mc_t}$ where
ma_t = the value, at time t, of the channel measuring the flow meter output.
mb_t = the value, at time t, of the channel measuring the absolute pressure of the fluid.
mc_t = the value, at time t, of the channel measuring the fluid temperature.
md = the constant value derived from the following:
Where,   K = scaling factor (see below)

$$Const = \frac{K^2}{Rg \, x \, Z}$$

Rg = Specific gas constant in J/kg-K (see mass flow (linear) above).
Z = Compressibility factor (see mass flow (linear) above).

SCALING FACTOR (K)

This is calculated from the following equation:

$$K = \frac{S}{\sqrt{ma_{max}}}$$

where,   S = the full scale output from the flow meter
ma_{max} = the full scale input of the channel reading the output from the flow meter.

5.3.4 EQUATIONS (CONT.)

ZIRCONIA PROBES

A Zirconia (oxygen) probe consists of two platinum electrodes bonded to a pellet or cylinder of Zirconia. At elevated temperatures, such a probe develops an electromotive force (emf) across it which is proportional to the probe temperature and to the log of partial pressure (oxygen) difference between its two ends.

OXYGEN CONCENTRATION MEASUREMENT

In order to measure oxygen concentrations, one end of the probe is inserted into the atmosphere to be measured, whilst the other end is subject to a reference atmosphere. For most applications, air provides a suitable reference (reference input = 20.95% for air).

The temperature of the probe is normally measured using a type K or a type R thermocouple. The temperature effect on the thermocouple is such that for successful operation with the recorder, the probe temperature must be greater than 700˚C.

The probe output obeys a law described by the Nernst oxygen equation:

$$E = 0.0496 \, x \, T \, x \log \frac{P1}{P2} \text{ or, } re-written \, P2 = \frac{P1}{10^{\frac{E}{0.0496 \, x \, T}}}$$

where, P2 = Partial pressure of oxygen in the sampled gas (%)
        P1 = Partial pressure of oxygen in the reference atmosphere (%) (20.95 for air)
         E = Electromotive force across the probe, in mV
         T = Probe temperature in Kelvin.

In order to obtain a useful result, it is necessary to scale the inputs and outputs correctly, the channel measuring the probe voltage will normally need a scale of 0 to 100 mV. The temperature measuring channel will probably be scaled at 300 to 1800K, whilst the output scaling will typically be 0 to 5% for boiler flues and 0 to 20% in kilns.

OXYGEN POTENTIAL MEASUREMENT

The oxygen potential of an atmosphere is a measure of its ability to oxidise or to reduce. For any element, a value of oxygen potential (free energy of formation) is known. Above this value, the material will oxidise, below it, no oxidation will occur.

Oxygen potential is given by the equation: $Op = 0.00457 \, x \, T \, x \log Op'$

where,   Op = Required oxygen potential (kilocalories)
          T = Probe temperature (Kelvin)
         Op´ = Partial pressure of oxygen in the reference atmosphere in atmospheres.

It can be shown that, because the oxygen potential of air is essentially constant over the temperature range 873 to 1473 Kelvins, the probe output is proportional to the oxygen potential of an atmosphere according to:

$$E = (10.84 \, T) + 40 \text{ mV between 873 and 1473 K}$$

It is thus possible to measure oxygen potential directly from a Zirconia probe, using a standard input channel, scaled in units of Oxygen potential.

A typical input range would be 40 to 1124 mV, with a scale of 0 to - 100 kilocalories.   Such scaling would be appropriate over the temperature range 873 to 1473K.

5.3.4 EQUATIONS (CONT.)

SWITCH

This function copies one of two input or derived channels' values according to the state of its 'Select channel B for Dnn' job. I.E. if a relevant switch job is active, copy the value of source channel B, otherwise copy the value of source channel A.

HIGH SELECT

This function has two input or derived channels as sources, and copies whichever has the higher value at the time.

LOW SELECT

This function has two input or derived channels as sources, and copies whichever has the lower value at the time.

STOPWATCH

The stopwatch starts counting as soon as the function is configured.   The stopwatch can be disabled by a maths pack 'job', and can also be reset to zero. **The value is normally displayed as a number of 1/4 seconds, but if one of the date / time formats described in section 5.3.1 is selected, the value is displayed in hours/minutes/seconds.**

TIME STAMP

When triggered by a maths pack 'job' becoming active, the time stamp reads the current time and date from the system clock and holds it. The time or the date can be displayed, according to the configured value format.

Note: The display format selected affects only the value displayed, not the internal value of the channel. This internal value is a number of 1/4 seconds, either elapsed since enabled (stopwatch) or elapsed since 1st of January 1988 (Time Stamp). This allows time functions to be processed in the maths pack. For example, two channels, each with a time stamp as its value can be subtracted to give the time between the two time stamps, and this can be displayed as elapsed time if so configured in the Value Format page.

5.4 ROLLING MEMORY OPTION

5.4.1 Introduction

The Rolling Memory option offers 32kB of memory intended for use as a store from which data and messages can be replayed to the chart. For example:

    a. Data can be buffered in rolling memory while the chart is being changed, ensuring that no data is lost.

    b. Data from a single batch or experiment can be replayed several times, so that several masters can be made, or so that zones and scales can be changed to emphasise trace features as required.

    c. Data can be traced 'on event', but with data from before the event included.

Data is recorded in memory, either at regular intervals, or when requested by job action. Once the memory is full, the newest data over-writes the oldest (i.e. the memory is first in - first out (FIFO)). Replay to the chart is either by operator control or via job actions, and takes place at 1200mm/hr. chart speed.

5.4.2 Operator control of rolling memory
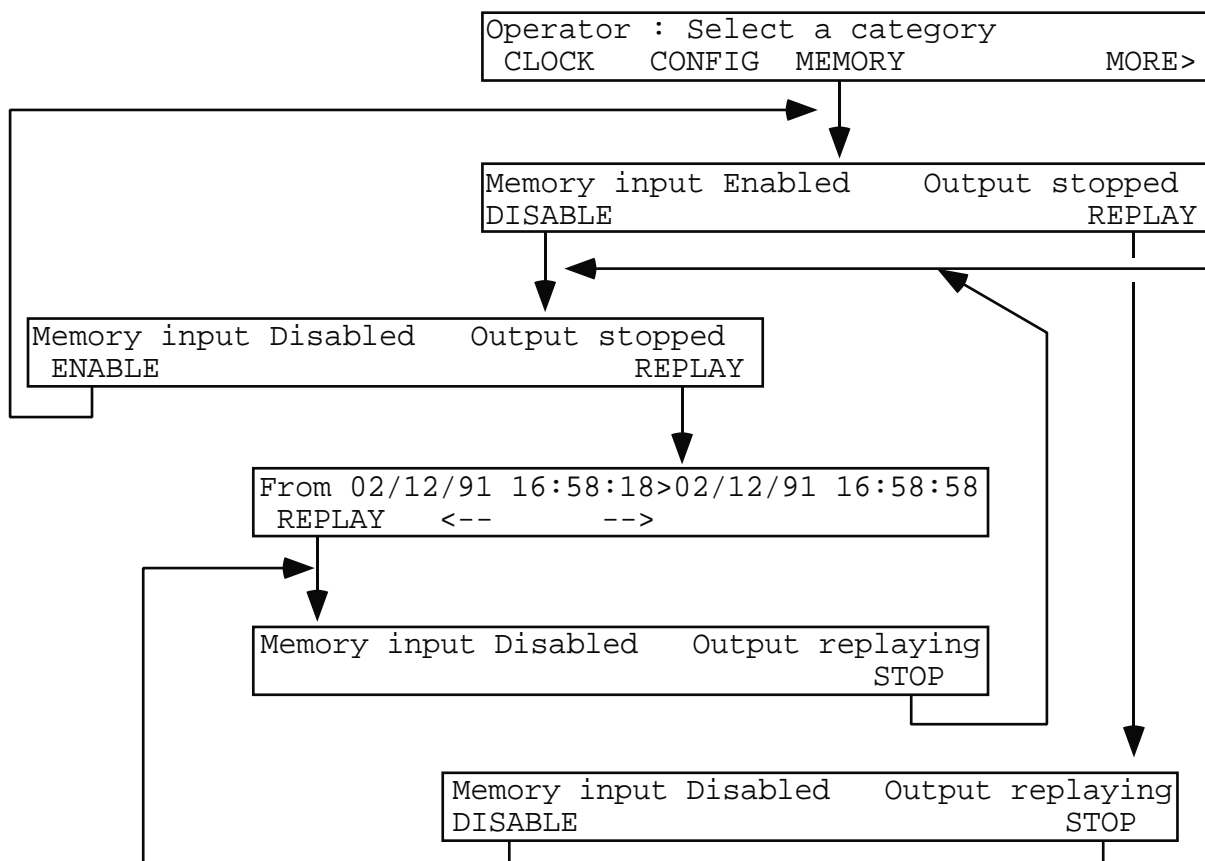
Figure 5.4.2 Rolling memory operator controls

Figure 5.4.2 shows that the operator has two 'toggle' softkeys for use in controlling the rolling memory, Enable / Disable and Replay / Stop. The functions of these softkeys are copied by memory 'jobs'.

5.4.2 OPERATOR CONTROL OF ROLLING MEMORY (CONT.)

ENABLE / DISABLE

At the moment that rolling memory input is enabled, the existing contents of the memory are erased, and new data is allowed to accumulate. When disabled, the 'Memory' status LED illuminates continuously and the existing contents of the memory are held (depending on a configurable pre-trigger value), for re-play if required. Note that the memory accumulation cannot be re-started without erasing the existing content.   See configuration section below for a description of the pre-trigger action.

REPLAY / STOP

Operation of the REPLAY softkey whilst the memory input is disabled causes the memory to be replayed to the chart, but remain unchanged. The operator may use the numeric entry keys and arrow softkeys to define a start time and date. The default times and dates are the oldest and newest samples' times and dates respectively.

Operation whilst the memory input is enabled, causes the contents of the memory, to be replayed from the oldest data until it has caught up with 'real' time. Memory sampling continues during replay.

In either case, the chart runs at 1200 mm/hr. during replay, and the 'Memory' status LED flashes. Because the sample rate is freely configurable, the 'effective' chart speed varies, but is printed on the chart at the start of replay. Table 5.4.2 gives some examples.

Operation of STOP causes replay to stop. Rolling memory status is unaffected, i.e. if it was enabled, it remains enabled, and *vice-versa*.

Interval (secs)	Effective speed (mm/hr)	Duration of replay *
1	1200	6.3 mins
2	600	12.5 mins
3	400	18.9 mins
4	300	25.2 mins
5	240	31.5 mins
6	200	37.8 mins
7	171.4	44.1 mins
8	150	50.4 mins
9	133.3	56.7 mins
10	120	63.0 mins
100	12	10.5 hours
1000	1.2	4.375 days

* For 12 channels in the sampled group

Table 5.4.2 Rolling memory effective chart speeds

5.4.3 Job control of rolling memory

ROLLING MEMORY JOBS

The following are available as memory jobs:
1. Memory enable input (copies operator function)
2. Memory disable input (copies operator function)
3. Memory replay (copies operator function)
4. Memory replay stop (copies operator function)
5. Trigger sample. Causes a data sample to be taken for the specified group. The sample interval must be set to 0.
6. Sample interval B. Selects interval B for the duration of the job.

5.4.3 JOB CONTROL OF ROLLING MEMORY (CONT.)

ROLLING MEMORY INTERNAL EVENT GENERATION

The following act as internal events for use as job sources.

1. Replaying memory. True whilst replay in action.
2. Memory full. True whilst rolling memory is full.
3. Sampling memory. True whilst data samples being taken.

    EXAMPLE: Automatic use of rolling memory when chart paper exhausted.

Event 1	Enabled	
	Source:	Chart paper out only
	Job 1:	Memory replay start on going inactive
	Job 2:	Memory enable input on going active

Event 2	Enabled	
	Source:	Replaying memory only
	Job 1:	Memory disable input on going inactive

5.4.4 Rolling memory configuration

```
Configuration : Select a category
 MEMORY   COMMS   TRANSFR  DIAGS   MORE>
```

```
Sample interval A  XXXXX   B XXXXX    S
from Group name              pretrig  100%
```

Field scroll key on
sample field

```
Sample on event
from Group name            pretrig   100%
```

Figure 5.4.4 Rolling memory configuration

Sample interval	Two sample intervals (A and B) may be entered. Sample A is used during normal operation. Sample interval B is selected by 'job' action, and remains active for the duration of the job. The intervals are in seconds and are entered using the numeric keys. See table 5.4.2 for examples. If the interval is set to zero, samples will be taken only when a 'Take sample' job is run.
Sample on event	An alternative to the sample period is 'Sample on event' accessed by using one of the field scroll keys, whilst the cursor is located below the 'Sample interval' field. Refer to section 4.1.4 for details of 'jobs'.
Group name	Allows the groups to be scrolled through. The data associated with the contents of the selected group is written to the memory at sample time.
Pretrig	Specifies the percentage of the total memory which is to be retained when the memory input is set to Disabled **using a job**. 100% stops memory sampling immediately; 75% stops memory sampling when 25% of the memory has been filled after Disable; 25% stops memory sampling when 75% of the memory is post-disable. If the memory input is disabled by operator action, the input is disabled immediately.

5.5 QUALITY MONITORING OPTION

This option has been designed to support the generation and replay of process limits associated with quality standards, furnace run -up, sterilizer validation and any other process using quality profiles. The option consists of the following:

Maths pack level 2
Trace generator function
Timers

The level two maths pack is as described in section 5.3, and the timers in section 5.2.3.

If chart copy is required, the Memory Card ASCII or Packed logging options are required. These are described in the Memory Card Manual)

5.5.1 Trace generator

This function generates an output according to one of six trace generator programs.   Each program can consist of up to 32 segments, of four types as described under 'configuration' below. Typically these traces can be used as the quality standard and be traced on the chart for comparison with actual process values.

The scale, start channel, decimal point position etc. are set up as a part of the maths pack configuration.   The program segments themselves are configured as a part of the instrument configuration, but are more fully described below.

OPERATION

On being configured, the function produces a value of NO DATA. This persists until a TRIGGER DV job becomes active, when the derived variable value is set to that of the specified start channel. If this channel is not producing GOOD PV at the time, the value will be set to the end value of the first segment.

If a further trigger occurs, the currently executing segment is aborted and the next segment is started.

Once all the segments have been run, the program stops, the output value is set to NO DATA and the generator stops, waiting for a further trigger to restart it.

5.5.1 TRACE GENERATOR (CONT.)

CONFIGURATION

Entry to configuration is via the TRC TAB softkey in the instrument configuration menu (section 4.2.1).

```
Trace table TTTTTTTT : Select a category
CONTENT   TITLE
```

The six possible tables' titles can be scrolled though using the page scroll key. If a new title is to be entered, operation of the TITLE softkey allows the user to enter the new text using the keyboards in the normal way.

The CONTENT softkey calls the first segment page for the selected table. The Segment numbers (1 to 32) and types (ramp, cycle, repeat, stop) can be scrolled through using the page and field scroll keys respectively.

RAMP SEGMENT

```
Trace table TTTTTTTT        Segment NN
Ramp to +V.VVVV+EE in HH:MM:SS then AAAA
```

Each ramp segment (NN) consists of a target value (V.VVVV+EE), a time period HH:MM:SS and an action (AAAA). The output value will be ramped to the target value linearly over the specified time period, then either wait for a further trigger or go on to the next segment. (AAAA = 'wait' or 'next'). The ramp may be either positive or negative, and the time periods entered can be between 1 second (00:00:01) to almost 100 hours (99:59:59) inclusive.

When configuring the table, the page scroll keys are used to scroll through the segments (NN).

CYCLE SEGMENT

```
Trace table TTTTTTTT        Segment NN
Cycle back to seg MM, RR times then AAAA
```

Each cycle segment causes a return to a previous RAMP segment (MM) any number of times up to RR = 99 before either waiting for a further trigger or proceeding to a further segment. If more than 99 returns are required, then two or more cycle segments may be used consecutively to return to the same ramp segment, or a repeat segment may be used (See below). Note that it is not possible to cycle to anything other than a ramp segment.

REPEAT SEGMENT

```
Trace table TTTTTTTT         Segment NN
Repeat from segment MM
```

A repeat segment acts like a cycle segment, but with no maximum number of iterations. I.E. it goes on 'for ever'. In order to quit the trace, it is necessary to reset the derived variable.

STOP SEGMENT

```
Trace table TTTTTTTT
Segment NN Stop
```

When this segment becomes active, the derived variable is reset, with its value set to NO DATA.

SECTION 6: SERVICE

LIST OF CONTENTS

Refer to the technical manual for the product, for full servicing and maintenance details

6.1 PREVENTIVE MAINTENANCE

Operation of the recorder is generally maintenance free. It is recommended however, that

a. Every time the chart is changed, any accumulations of paper dust are removed.
b. Every six months, the print head reaction bar (A in figure 6.1) is cleaned of paper dust, and then smeared with a small amount of a light lubricant, applied using a lint-free cloth.
c, Every six months, the reaction bar (A in figure 6.1) securing screws (one at each end) are undone approximately half a turn, the bar rotated a few degrees, and the securing screws re-tightened.

CAUTION

On no account should the print head guide bar (B in figure 6.1) be lubricated, as to do so will damage the 'oilite' bearing in the printhead carriage.
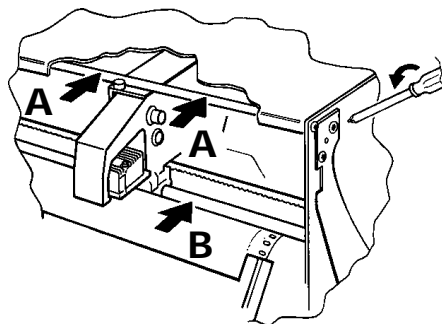
Figure 6.1 Reaction Bar location

6.2 CHART ILLUMINATION LAMP REPLACEMENT

WARNING !

The recorder should be isolated from mains (line) power before any attempt is made to replace the fluorescent tube used fro chart illumination.

WARNING !

The exhausted tube must be disposed of carefully. Should the tube break, inhalation of the powdery material on the inside of the tube should be avoided.

Isolate the recorder from line power. Open the recorder door, and remove the plastic cover/reflector which surrounds the fluorescent tube. Rotate the tube 90˚ and pull it 'away' from the door, out of its end connections, and dispose of carefully.

Rotate the new tube such that the pins at each end will enter the connectors located at the door. Carefully push the tube home, and rotate the tube 90˚*. Spring the plastic cover / reflector into place. Re-apply mains (line) power, switch the recorder on, close the door and check that the chart illumination is working.

* CAUTION

The tube must be rotated 90˚, otherwise a heater circuit will not be completed, leading to early failure of the new tube.
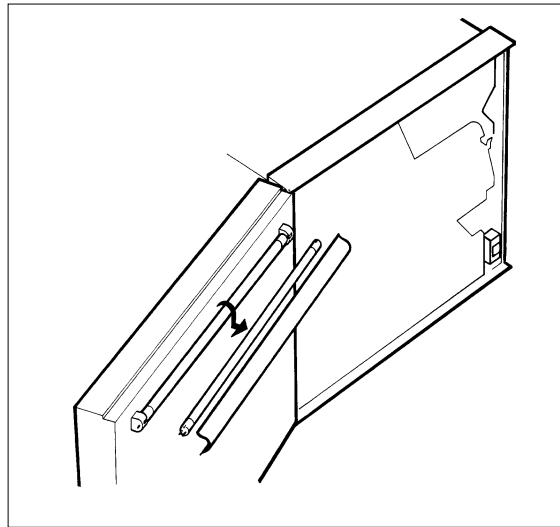
Figure 6.2 Chart illumination lamp replacement

6.3 BATTERY REPLACEMENT

At the rear of the recorder, remove the battery cover, and with power applied to the recorder (see note 2 below), disconnect the battery pack, and fit the replacement.

Re-fit the battery cover.

Notes...
1. The connector is polarised, so reverse connection is not possible.
2. Clock and totaliser data will be lost if the battery is changed with power removed from the recorder.
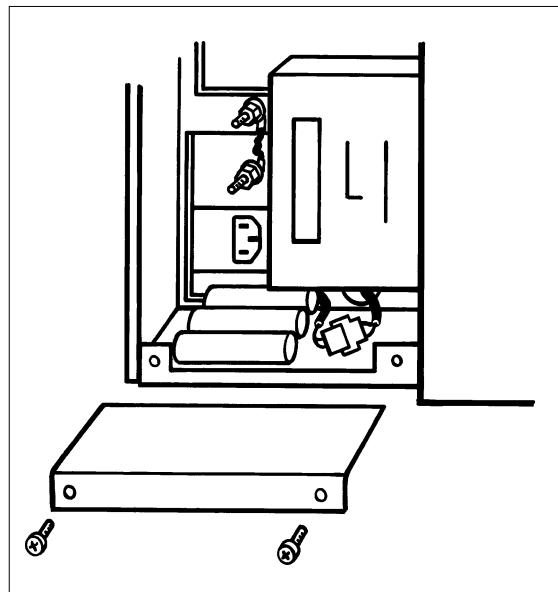
Figure 6.3 Battery replacement

SECTION 7 REFERENCE

LIST OF CONTENTS

7.1 RECORDER MESSAGES

This section gives interpretations for messages, which appear at the display for the guidance of the user. The messages are 'fleeting', i.e they appear for approximately 3 seconds, before the previous display page is re-called.

FAILURE TO ADJUST

This message appears during input adjust procedure (section 4.15.1) if the channel being adjusted is not an analogue input type, or if there is a hardware or an internal communications failure within the recorder.   If the channel is definitely an analogue input, a service engineer should be contacted.

```
Failed to adjust channel NN
CONTINUE
```

Operation of the CONTINUE key will call any further channels for which the adjustment failed. When all channels have appeared, the adjustment complete message appears:

```
Adjustment procedure complete
```

FAILURE TO CALIBRATE

This message appears during the input calibration procedure (section 4.15.3) if the channel being calibrated is not an analogue input type, if there is a hardware or internal communications failure within the recorder or if the calibration limits are exceeded. The message also appears during CJ calibration, if the associated channel input type is not a thermocouple. The configuration of the channel should be checked, and if correct, a service engineer should be contacted.

```
Failed to calibrate channel NN
CONTINUE
```

Operation of the CONTINUE key will call any further channels for which the calibration failed. When all channels have appeared, the calibration complete message appears:

```
Calibration procedure complete
```

```
CJ Calibration Procedure complete
```

FAILURE TO REMOVE ADJUSTMENT OR CALIBRATION

This message appears if an attempt is made to remove an adjustment or calibration previously entered (sections 4.15.1 and 4.15.3), i f the input channel has been switched off or removed, if a hardware or internal communications failure has appeared or if the channel is not an analogue input type.

```
Failed to remove adjustment on ch NN
```

```
Failed to return ch NN to factory cal
```

INVALID INDEX

This message appears if a channel / totaliser etc. number is entered which is greater than the maximum number of channels / totalise rs etc. fitted.

```
Invalid index
```

INVALID CONFIGURATION

This message appears if one part of the configuration conflicts with another e.g. if the linearisation type does not match the input type.

```
Invalid configuration
```

PRINTER MUST BE ON LINE

This message appears if a 'Quick Scale print' (section 3.2.2) is requested with the printer off line. The operator CHART category must be entered (also section 3.2.2), and the chart switched on-line.

```
Printer must be on line
```

PRINTER MUST BE OFF LINE

This message appears if chart calibration (section 4.15.2) or configuration print (section 4.16) is requested with the printer on line. The operator CHART category must be entered (section 3.2.2), and the chart switched off- line.

```
Printer must be off line
```

CONFIGURATION ACCESS DISABLED BY COMMS

This message appears if an attempt is made to enter configuration after a 'DP' command mnemonic has been received by the recorder over the serial communications link. Configuration Dec not be entered until an 'EP' command mnemonic has been received. See Communications manual HA246958 for details.

```
Configuration access disabled by comms
```

7.2 COSHH DATA

The following COSHH information is derived from general data sheets produced by the manufacturer to cover all products. For this reason the information may refer to part numbers other than those relevant to this product.

7.2.1 Inked Ribbons

Product:	RECORDER INKED RIBBONS		
Part numbers: LA232380 LA243101			

HAZARDOUS INGREDIENTS			
Name	% Range	TLV	Toxicological data
Inked fabric and ribbon	Not applicable	Not applicable	Not applicable

PHYSICAL DATA			
Boiling point	Not applicable	Specific gravity	Not applicable
Vapour pressure	Not applicable	Solubility in water	Not applicable
Odour	None	Colours	Various

FIRE AND EXPLOSION DATA			
Flash point (deg C) (Method used)	Not applicable	FLAMMABLE LIMIT	
Extinguishing media	Water, foam, powder	LEL Not applicable	UEL Not applicable
Special fire-fighting procedures	The cassette is moulded from a halogen-free self-extinguishing polymer material		
Unusual fire and explosion hazards	None		

HEALTH HAZARD DATA		
Threshold limit value	Not applicable	
LD 50 Oral	Not applicable	LD 50 dermal
Skin and eye irritation	In extreme cases, irritation can occur	
Over-exposure effects	Not applicable	
Chemical nature	Inked nylon ribbon in self-extinguishing plastic moulded cassette. In contains animal, vegetable or mineral oils and synthetic colourants. NON DANGEROUS GOODS	

7.2.1 INKED RIBBONS (CONT.)

HEALTH HAZARD DATA (Cont.)	
FIRST AID PROCEDURES	
Eyes and skin	Remove ink from eyes by irrigation. Use soap solution to remove ink from skin. Obtain medical aid if symptoms persist.
Ingestion	Not applicable
Inhalation	Not applicable

REACTIVITY DATA			
STABILITY			Conditions to avoid
Stable	Yes	Unstable	None
Hazardous decomposition products	None		
Hazardous polymerisation	Will not occur		

SPILL OR LEAK PROCEDURES
Dispose of waste in accordance with existing environmental control regulations.

SPECIAL PROTECTION INFORMATION	
Respiratory	None required
Ventilation	Not applicable
Protective clothing	Use good working practise to avoid ink contamination of skin or clothing
Other	Contains no hazardous materials. Ink can irritate in extreme cases.
	Use disposable gloves when handling ribbon.

7.2.2 Nickel cadmium batteries

Product:	BATTERY PACK (SEALED NICKEL-CADMIUM BATTERIES)		
Part numbers:			
PA244816			

HAZARDOUS INGREDIENTS			
Name	% Range	TLV	Toxicological data
Negative electrode (cadmium metal, cadmium hydroxide, nickel sinter)	Not established	Not established	Highly toxic
Positive electrode (nickel hydroxide, cobalt hydroxide, nickel sinter)	Not established	Not established	Highly toxic if ingested
Electrolyte (potassium hydroxide)	30 to 45%	Not established	Highly toxic Highly corrosive

PHYSICAL DATA			
Boiling point	N/A	Specific gravity	N/A
Vapour pressure	N/A	Solubility in water	N/A
Odour	N/A	Colours	N/A

FIRE AND EXPLOSION DATA			
Flash point (deg C) (Method used)	N/A	FLAMMABLE LIMIT	
		LEL	UEL
Extinguishing media	Any	N/A	N/A
Special fire-fighting procedures	N/A		
Unusual fire and explosion hazards	Batteries can explode due to excessive pressure build-up which might not be self-venting. Toxic fumes (cyanogen) may be generated.		

HEALTH HAZARD DATA			
Threshold limit value	N/A		
LD 50 Oral	N/A	LD 50 Dermal	N/A
Skin and eye irritation	If cells leak, the leak material will be a caustic solution. Avoid contact.		
Over-exposure effects	N/A		
Chemical nature	See above. There are no risks in normal use		

7.2.2 NICKEL CADMIUM BATTERIES (CONT.)

HEALTH HAZARD DATA (Cont.)		
FIRST AID PROCEDURES		
Eyes and skin	If leakage occurs, wash the affected area with plenty of water and cover with dry gauze. If affected, wash eyes with plenty of water. Seek medical assistance.	
Ingestion	If leakage occurs, do NOT induce vomiting. Give plenty of milk to drink. Obtain immediate medical assistance, stating 'nickel cadmium battery'.	
Inhalation	N/A	

REACTIVITY DATA				
STABILITY			Conditions to avoid	
Stable	Yes	Unstable		Mechanical damage, overcharging, shorting terminals. Storage temperatures outside the range 0 to 40 deg C.
Hazardous decomposition products	None			
Hazardous polymerisation	Will not occur			

SPILL OR LEAK PROCEDURES
In normal conditions of use, there is no risk of leakage unless batteries are abused. Abuse can lead to the leaking of a caustic alkaline solution which corrodes aluminium and copper. The leak material should be neutralised by a weak acidic solution such as vinegar, or washed away with copious amounts of water.

CONTACT SHOULD BE AVOIDED

SPECIAL PROTECTION INFORMATION	
Respiratory	N/A
Ventilation	N/A
Protective clothing	N/A
Other	In addition to the electrolyte (potassium hydroxide), nickel-cadmium batteries contain cadmium, cadmium hydroxide and nickel hydroxide all of which are highly toxic.

7.3 LIST OF EFFECTIVE PAGES

This (issue 15) manual consists of the following pages at their stated issue numbers.

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

Data acquisition	A general term describing the successful reading of an input signal. The term Data Acquisition Unit describes those units which are able to read input signals and act upon them (*alarms retransmission* maths functions etc) without necessarily having the facility of displaying or recording them.
Derived channel	A 'pseudo' channel which contains the results of maths pack operations so they can be traced on the chart, logged etc.
Derived Variable (DV)	The result of one or more *input channel* or *derived channel* being acted upon by a *mathematical function* (e.g. Channel average).
Digital (discrete) input	An input which has only two states (on or off). Examples are switch inputs or voltage pulse inputs.
Event input	A discrete (switch) or digital (voltage level) input. When active, an event input can initiate a *job list*.
Graphics recorder/unit	A recorder or display unit which uses a touch-sensitive liquid crystal display both as its operator interface, and to display traces as though on a chart. Recorders can come with or without charts; chartless recorders using electronic storage rather than paper to save information.
Hysteresis	When an *input signal* is 'hovering' near a *setpoint*, then an annoying and potentially damaging series of *alarms* can be generated, instead of just one alarm which can be acknowledged and the cause dealt with if necessary. To avoid this, a 'hysteresis' value can be entered in the alarm configuration, which effectively puts a dead band round the set point. For example an absolute high alarm with a set point of 100 and a hysteresis value of 10, would be triggered when the input signal value rose above 100, but would not re-trigger again until after the alarm had been 'cleared' by the process value falling below 90. An attempt to depict this example is given in the figure below.

Input channel	An input circuit which accepts voltage, current or digital *input signals* from the user.
Input signal	A voltage, current or digital input applied to the recorder input circuits. See also Analogue input and Digital (discrete) input.
Job list	A set of actions to be carried out by the recorder, when the job list becomes active. Typical 'jobs' are to activate a *relay*, display a message, change chart speed etc.
Linearisation table	Most *transducers* produce an output which is not directly proportional to the input. For example, the voltage output from a *thermocouple* does not vary linearly with the temperature it is exposed to. The recorder uses a 'look-up' table to find a temperature value for any mV input from a specified thermocouple type. Similar tables exist for other transducers such as *resistance thermometers*. In most modern instruments, the user can enter one or more tables of his/her own.
Log	Logging allows *process variable* values to be printed numerically in tabular form on the chart. Alternatively, logs can be sent to the *memory card* (if fitted).
Mathematical function	With the maths pack option(s) fitted, a number of mathematical functions become available to the user. For example, you may want to look at the difference between two *input signals*, in which case a simple Subtract function would be used. The resulting *Derived Variable* can be traced, using a *derived channel*, or could be used to trigger a *job list* if the difference between the two input signal became too great or too small, and so on. A complete list of functions is given below, but not all are available on all instruments.

MATHS FUNCTIONS (CONT.)

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

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

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

ANNEX A

RECORDER SPECIFICATION

LIST OF CONTENTS

INSTALLATION CATEGORY AND POLLUTION DEGREE

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

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

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

ANNEX A RECORDER SPECIFICATION

A1 GENERAL SPECIFICATION

I/O Board types

Input board types	8-channel universal input; 16-channel dc input
Output board type	8-channel relay output; 4/8 channel analogue output
Max. number of I/O boards per type	7 off 8-channel i/p, 4 off 8-channel analogue o/p, 7 off 4-channel analogue o/p, 7 off relay o/p; 6 off 16-channel i/p
Max number of inputs	96 dc inputs; 56 resistance inputs; 78 contact closure.
Max number of outputs	Relays: 8 x no of free slots; Analogue outputs: 32 in any combination of 4- or 8-channel boards
Maximum number of traced channels	45 in any combination of input, output and derived channels.

SBC memory size

AH243487U200	Type 2:	128kB RAM + 32kB EEPROM
AH243748U300	Type 3:	256kB RAM + 64kB EEPROM

Memory protection

	EEPROM (for configuration)
	Battery-supported RAM for clock, totalisers etc.
RAM / clock-support battery type	Nickel-Cadmium (rechargeable)
Support period (no power to recorder)	3 months min. at 25 ˚C; 1 month min. at 50 ˚C.

Environmental Performance

General		To BS2011: 1981
Temperature limits	Operation:	0 to + 50 ˚C
	Storage:	-20 to +70 ˚C
Humidity	Operation/Storage:	5 to 85% RH; non-condensing
Maximum altitude		< 2000 metres
Protection		IP54 (door and bezel); IP31 (sleeve).
Shock		BS EN61010 1990 (safety); IEC 873: 1986
Vibration		BS EN61010 1990 (safety); IEC 873: 1986.
		Also recovers from 2g peak at 10 to 150 Hz

Electromagnetic compatibility (EMC)

Emissions	BS EN50081-2
Immunity	BS EN50082-2

Electrical Safety

To BS EN61010: 1990 class 1.

Power requirements:

Line voltage (45 to 65 Hertz)	90 to 132 Volts or 180 to 264 Volts (User selectable).
Maximum power	120 W
Fuse type	Ceramic 20 mm. 3.15 Amp. Fast blow.
Interrupt protection	100 ms at 60% load.

Physical

Bezel size	288 mm. high x 360 mm. wide x 53 mm. deep.
Panel cutout size	273.5 mm high x 348 mm. wide. (+ 1.4 mm. - 0 mm.)
Depth behind bezel rear face	450 mm. (inc. rear cover); 410 mm. (no rear cover)
Weight (Eight-channel instrument)	20 kg. max.
Panel mounting angle	Up to ± 30˚ from vertical.

(Continued)

* DC inputs are defined as Volts, mV, mA, thermocouple and contact closure, but do not include resistance inputs.

A.1 GENERAL SPECIFICATION (CONT.)

Performance

Maximum scan and update rate	All parameters in 1 second
Maximum print rate (trending)	45 channels per second
Maximum chart speed	1500 mm/hr.
Clock accuracy	Better than 50 ppm

Printing system

Type	14-needle dot matrix printhead with six colour disposable ribbon cartridge.
Trace colours	Red, orange, green, blue, violet and black
Ribbon life	> 5 million dots per colour; > 1 million black text characters.
Print needle diameter	0.35 mm.
Dot spacing (vertical)	0.083 mm. (chart speed < 300 mm/hr.); 0.17 mm (600 mm/hr);
	0.33 mm. (1200 mm/hr.); 0.42 mm (1500 mm/hr)
Dot spacing (horizontal)	0.4 mm.
Characters per line	104
Noise level	55 dBA max. (door closed).
Maximum print rate	45 channels / second (trending)

Paper transport

Type	Tractor feed with selectable chart speed from 1 to 1500 mm/hr. (0.4 to 60 inches/hour)
Chart length	22 metres (z-fold - fold depth 75 mm.); 32 metres (roll)
Chart width	274.5 mm. overall; 250 mm. calibrated.
Chart visible length	155 mm.
Resolution (horizontal)	± 0.2 mm.
Pen-to-paper accuracy	0.25% of calibrated chart width
Transport accuracy	Better than 10 mm. in 32 meters

A2 UNIVERSAL 8-CHANNEL INPUT BOARD SPECIFICATION

General specification

Number of inputs	8
Termination	Edge connector / terminal block
Input types	DC Volts, dc millivolts, dc milliamps (with shunt).
	Thermocouple, Resistance thermometer (2- or 3-wire), Ohms, Contact closure
Input type mix	User selectable during channel configuration.
Measurement frequency	All channels in 1 second
Step response to within resolution	2 seconds
Noise rejection Common mode:	150dB above 45 Hz. (channel-channel and channel-ground.)
Series mode:	67dB above 45 Hz.
Maximum common mode voltage	250 Volts
Maximum series mode voltage	10 mV at lowest range; 500 mV peak at highest range.
Isolation (dc to 65 Hz; BS EN61010)	Installation category II; Pollution degree 2 (See page A -1 for definitions)
	300 V channel-to-channel (double isolation) and channel-to-ground (basic isolation)
Dielectric strength	2350 V ac (channel – channel) 1350V ac (channel – ground) (both 1 minute type-tests)
Insulation resistance	50 MΩ at 500V dc.
Input impedance	>10 MΩ (68.8kΩ for 10V range)
Over-voltage protection	60 Volts peak, 500 V through 50 kΩ resistor
Open cct. detection (to 200 mV range)	65 nA current max.; 8 seconds recognition time (max.); 40 MΩ minimum break resistance.

DC input ranges

Ranges available	-10 to +40 mV; -50 to 200 mV; -500 mV to +1 V; -5 V to +10 V (100V with attenuator)
Temperature performance (worst case)	
-10 t o +40mV	80ppm/˚C pf reading + 27.9ppm/˚C of range
-50 t o +200mV	80ppm/˚C pf reading + 12.4ppm/˚C of range
-500mV to +1V	80ppm/˚C pf reading + 2.1ppm/˚C of range
-5V to +10V	272ppm/˚C pf reading + 4.7ppm/˚C of range
Shunt/Attenuator Fitting method:	Resistor modules mounted on user's terminal block
Additional errors:	0.1% (shunt); (0.2% attenuator)

Range	Resolution	Performance (worst case) in instrument at 20 ˚C
−10 mV to + 40 mV	1.4 µV	0.083 % reading + 0.056 % range
− 50 mV to + 200 mV	14 µV	0.072% reading + 0.073% range
− 0.5 V to + 1 V	37 µV	0.070% reading + 0.032% range
− 5 to + 10 V	370 µV.	0.223% reading + 0.034% range

Thermocouple data

Linearisation errors	0.15 ˚C or better
Bias current	<2 nA (<10 nA at 70 ˚C)
Cold Junction (CJ) types (selectable)	Off, internal, external, remote.
CJ error	0.5 ˚C or better
CJ rejection ratio	25:1 minimum
Remote CJ	Via any user-selected input channel.
Upscale/downscale drive	Configurable for each channel

T/C type	Range (˚C)	Standard
B	+ 200 to + 1800	IEC584.1:1977
C	0 to + 2300	Hoskins
E	- 200 to + 1000	IEC584.1:1977
J	- 200 to + 1200	IEC584.1:1977
K	- 200 to + 1370	IEC584.1:1977
L	-200 to + 900	DIN 43710
N	- 200 to + 1300	IEC584.1:1977
R	- 200 to + 1760	IEC584.1:1977
S	- 50 to + 1760	IEC584.1:1977
T	- 250 to + 400	IEC584.1:1977
U	- 100 to + 600	DIN 43710-85
NiMoNiCo	- 50 to +1410	ASTM E1751-95
Platinel II	-100 to + 1300	Engelhard R83

Note: Previous versions of the recorder came with NiNiMo linearisation instead of NiMoNiCo.

A.2 UNIVERSAL 8-CHANNEL INPUT BOARD SPECIFICATION (CONT.)

3-wire RTD data

RTD linearisations	Pt100, Pt1000, Cu10, Ni100, Ni120
Linearisation errors	0.012 ˚C or better
Influence of lead resistance error:	0.15 % of lead resistance
mismatch:	1 ohm per ohm.

RTD type	Range (˚C)	Standard
Pt 100	- 200 to + 850	IEC751: 1981
Pt1000	- 200 to + 850	Based on IEC751: 1981
Cu 10	-20 to + 250	General Electric
Ni 100	- 50 to + 170	DIN43760
Ni 120	- 50 to + 170	Based on DIN 43760

Pt100 figures (worst case)

Range ˚C	Resolution	Performance (worst case) in instrument at 20 ˚C
- 200 to + 200	0.02 ˚C	0.033% reading + 0.32 ˚C
- 200 to + 1000	0.14 ˚C	0.033% reading + 1.85 ˚C

Ohms ranges

Ranges available	0 to 180Ω; 0 to 1.8kΩ; 0 to 10.0kΩ
Temperature performance (worst case)	
0 to 180Ω	35ppm/˚C of reading + 34.3ppm/˚C of range
0 to 1.8kΩ	35ppm/˚C of reading + 14.6ppm/˚C of range
0 to 10kΩ	35ppm/˚C of reading + 1.9ppm/˚C of range

Range	Lead resistance	Resolution	Performance (worst case) in instrument at 20 ˚C
0 to 180 Ω	10 Ω	5 mΩ	0.033% reading +0.070% range
0 to 1.8 kΩ	10 Ω	55 mΩ	0.033 % reading + 0.041 % range
0 to 10 kΩ	10 Ω	148 mΩ	0.037 % reading + 0.020 % range

Other linearisations

Tables available	√ value; (value)$^{3/2}$; (value)$^{5/2}$; User defined tables (up to 3 off)

Contact closure (switch) inputs

Type	Volt-free contact
Wetting voltage	2.5 Volts nominal
Minimum latched pulse width	125 ms.
De-bounce	Inherent 1 second.

A3 16-CHANNEL DC INPUT BOARD SPECIFICATION

General specification

Number of inputs	16
Termination	Edge connector / terminal block
Input types	DC Volts, dc millivolts, dc milliamps (with shunt). Thermocouple, Contact closure (not channels 1, 8, 16)
Input type mix	Software selected on configuration for each channel*.
Measurement frequency	All channels in 1 second
Step response	1.5 seconds
Noise rejection Common mode:	150dB above 45 Hz. (channel-channel and channel-ground.)
Series mode:	> 60dB between 10 to 100 Hz.
Maximum series mode voltage	Hardware range +50 mV.
Safety isolation (BS EN61010)	Installation category II; Pollution degree 2 (See page A-1 for definitions)
	300 V channel-to-channel (double isolation) and channel-to-ground (basic isolation)
Dielectric strength	2350 V ac (channel – channel); 1350V ac (channel – ground) (both 1 minute type-tests).
Input impedance	> 10 MΩ (68.8kΩ for 5V range)
Over-voltage protection	60 Volts peak, 500 V through 50 kΩ resistor
Open cct. detection (85 mV range only)	65 nA current (max.); 8 seconds recognition time (max.); 40 MΩ minimum break resistance.
Damping	2, 4, 8, 16, 32, 64, 128 or 256 secs. time constant, as configured.
	Damping improves o/p noise and performance figures listed in the table below.

DC input ranges

Ranges available	-15mV to +85 mV; -1.0 V to +5 V
Temperature performance (worst case)	
-15 to +85mV	80ppm/˚C of reading +12.9 ppm/˚C of range.
-1V to +5V	272ppm/˚C of reading +7.8 ppm/˚C of range.
Shunt	Resistor modules mounted on user terminal block
Additional error due to shunt	0.1%.

Range	Resolution	Performance (worst case) in instrument at 20˚C
−15 mV to + 85 mV	± 5.5 µV	0.072% reading + 0.071% range
− 1.0V to + 5 V	± 280µV	0.223% reading + 0.055 range

Thermocouple data (in addition to the above)

Linearisation errors	0.15 ˚C or better
Bias current	< 2 nA (< 10 nA at 70 ˚C)
Cold Junction (CJ) types (selectable)	Off, internal, external, remote.
CJ error	1 ˚C or better
CJ rejection ratio	25:1 minimum
Remote CJ	Via any user-selected input channel.
Upscale drive	Configurable for each channel

Note: Previous versions of the recorder came with NiNiMo linearisation instead of NiMoNiCo.

* Maximum of eight different linearisations (seven + linear) allowed per board.

  Contact closure inputs not available on channels 1, 8 and 16.

T/C type	Range (˚C)	Standard
B	+ 200 to + 1800	IEC584.1:1977
C	0 to + 2300	Hoskins
E	- 200 to + 1000	IEC584.1:1977
J	- 200 to + 1200	IEC584.1:1977
K	- 200 to + 1370	IEC584.1:1977
L	-200 to + 900	DIN 43710
N	- 200 to + 1300	IEC584.1:1977
R	- 200 to + 1760	IEC584.1:1977
S	- 50 to + 1760	IEC584.1:1977
T	- 250 to + 400	IEC584.1:1977
U	- 100 to + 600	DIN 43710-85
NiMoNiCo	- 50 to +1410	ASTM E1751-95
Platinel II	-100 to + 1300	Engelhard R83

A.3 16-CHANNEL DC INPUT BOARD SPECIFICATION (CONT.)

Other linearisations

Tables available	$\sqrt{}$ value; (value)$^{3/2}$; (value)$^{5/2}$;User defined tables (up to 3 off)

Contact closure (switch) inputs (not available for channels 1, 8 and 16)

Type	Volt-free contact
Wetting voltage	2.5 Volts nominal
Minimum latched pulse width	250 ms.
De-bounce	Inherent 1 second.

A4 RELAY OUTPUT BOARD SPECIFICATION

No of relays per board		Eight
Contact format		Single pole change-over (single set of common, normally open and normally closed contacts)
Estimated life at 60VA load*		1,000,000 operations
Max contact voltage*		250 Volts ac.
Max contact current*	Make:	8 Amps
	Continuous:	3 Amps
	Break:	2 Amps
Maximum switchable power*		60 watts or 500 VA
Isolation (BS EN61010)		Installation category II; Pollution degree 2
		250V ac channel-to-channel (double isolation) and
		channel-to-ground (basic isolation)
Dielectric strength (1 minute type-tests)		1350V ac (contact to contact)
		2350V ac (channel to channel)
		1350V ac (channel to ground)
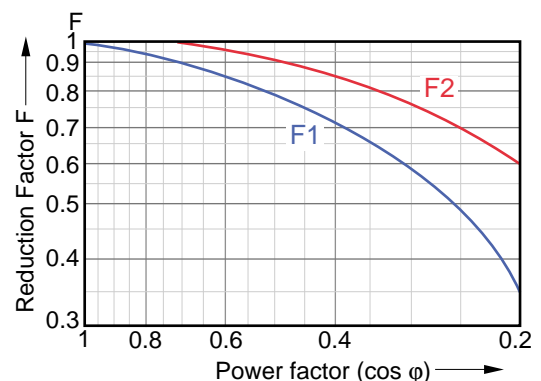
Figure A4 Derating curves

* With resistive loads; derate with reactive or inductive loads as per figure A4, in which:

F1 = Actually measured on representative samples

F2 = Typical values (according to experience)

Contact life = Resistive contact life x Reduction factor.

A5 ANALOGUE OUTPUT BOARD SPECIFICATION

General specification

Number of outputs		Four or eight as ordered
Termination		Edge connector / terminal block
Output types		Current or Voltage as configured for each channel
	Current:	0 to 25mA max. at up to 24 V
	Voltage:	-1 to 11V at up to 5 mA
Output frequency		All channels in 1 second
Output damping		250 msec rise time (10% to 90%)
Resolution		0.025% full scale, monotonic.
Isolation (dc to 65 Hz; BS EN61010)		Installation category II; Pollution degree 2 (See page A1 for definitions)
	Channel to channel:	250V RMS or dc (double isolation)
	Channel-to-ground:	250V RMS or dc (basic isolation)
Dielectric strength (BS EN61010)		(1 minute type tests)
	Channel to channel:	2350 V ac
	Channel to ground:	1350V ac
Insulation resistance		50 MΩ at 500V dc.

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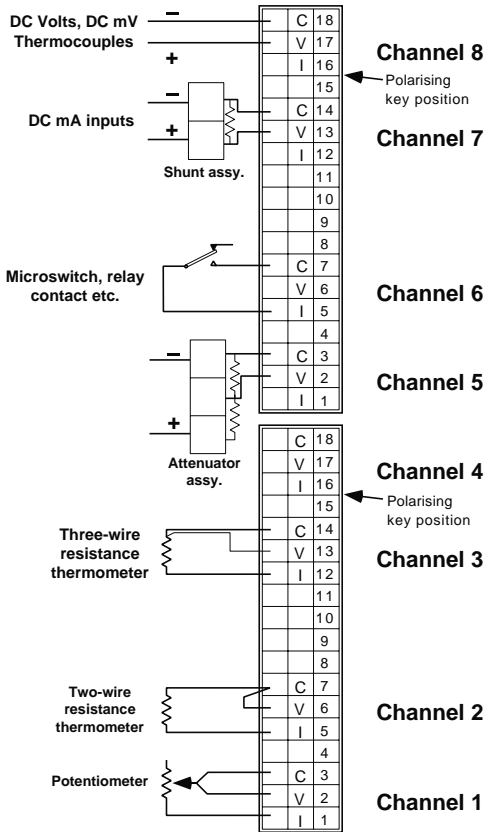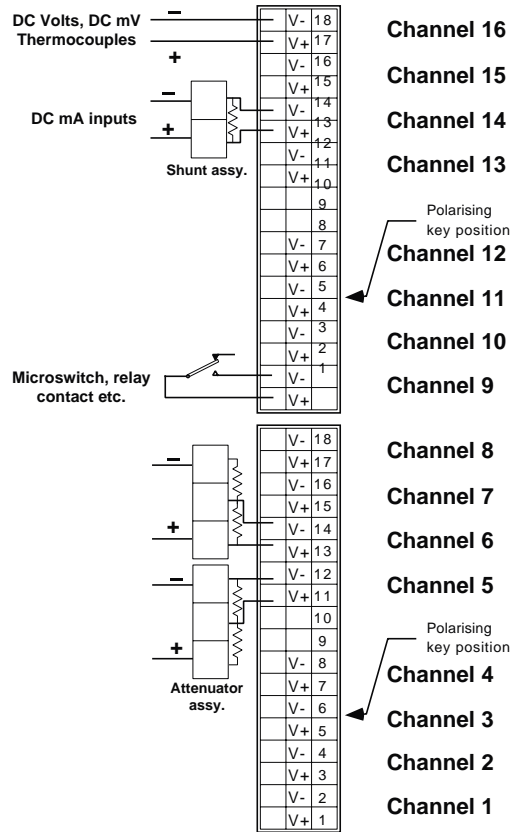http://www.chessell.com

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8 - Channel dc input board
(typical input signal wiring)

DC Volts, DC mV −
Thermocouples V 17 — Channel 8
  I 16
  C 18
  + I 16
  15 ← Polarising key position
DC mA inputs − C 14
  + V 13 — Channel 7
  I 12
Shunt assy. 11
  10
  9
  8
Microswitch, relay C 7
contact etc. V 6 — Channel 6
  I 5
  4
  − C 3
  V 2 — Channel 5
  + I 1
Attenuator assy.

  C 18
  V 17 — Channel 4
  I 16
  15 ← Polarising key position
Three-wire C 14
resistance V 13 — Channel 3
thermometer I 12
  11
  10
  9
  8
Two-wire C 7
resistance V 6 — Channel 2
thermometer I 5
  4
Potentiometer C 3
  V 2 — Channel 1
  I 1

**In order to prevent mis-mating, a polarising
key can be located between contacts 15 and 16.**

16 - Channel dc input board
(typical input signal wiring)

DC Volts, DC mV − V- 18
Thermocouples V+ 17 — Channel 16
  − V- 16
  + V+ 15 — Channel 15
DC mA inputs − V- 14 — Channel 14
  + V+ 13 — Channel 13
Shunt assy. V- 12
  V+ 11 — Channel 13
  V+ 10
  9
  8 ← Polarising key position
  V- 7 — Channel 12
  V+ 6
  V- 5 — Channel 11
  V+ 4
  V- 3 — Channel 10
Microswitch, relay V+ 2
contact etc. V- 1 — Channel 9
  V+

  V- 18 — Channel 8
  V+ 17
  V- 16 — Channel 7
  V+ 15
  + V- 14 — Channel 6
  V+ 13
  − V- 12 — Channel 5
  V+ 11
  10
  + 9 ← Polarising key position
  V- 8 — Channel 4
Attenuator V+ 7
assy. V- 6 — Channel 3
  V+ 5
  V- 4 — Channel 2
  V+ 3
  V- 2 — Channel 1
  V+ 1

See inside front cover for shunt/attenuator part numbers

**In order to prevent mis-mating, a polarising
key can be located between contacts 5 and 6.**

4/8 channel analogue output board
(top connector not wired for 4-channel version)

Voltage output − C 18
  Vo 17 — Channel 8
  + Io 16
  15
  − C 14 ← Polarising key position
  Vo 13 — Channel 7
  + Io 12
  11
  10
  9
  8
  C 7
  Vo 6 — Channel 6
  Io 5
  4
  C 3
  Vo 2 — Channel 5
  Io 1

  C 18
  Vo 17 — Channel 4
  Io 16
  15
  C 14 ← Polarising key position
  Vo 13 — Channel 3
  Io 12
  11
  10
  9
  8
  C 7
  Vo 6 — Channel 2
  Io 5
  4
  C 3
  Vo 2 — Channel 1
  Io 1
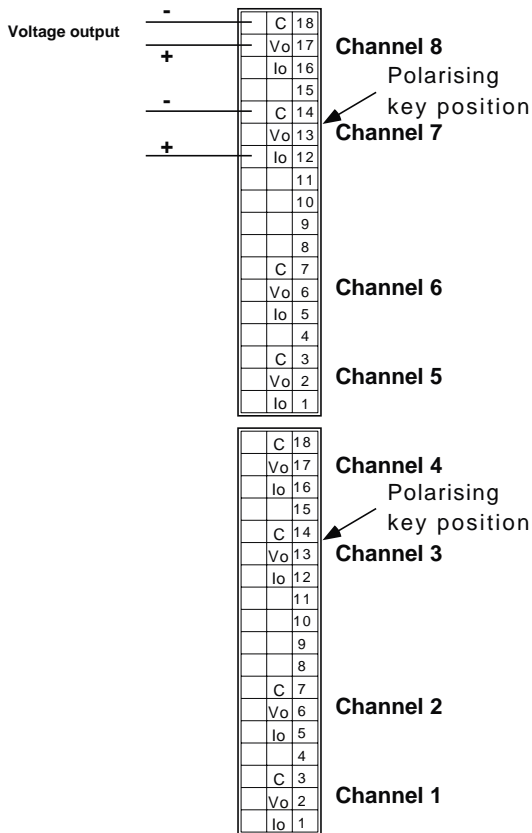
**In order to prevent mis-mating, a polarising
key can be located between contacts 13 and 14.**

Relay output board

Relay shown in alarm (de-energised) state

Channel 8 NO 18
  NC 17
  C 16
  15
Channel 7 NO 14
  NC 13
  C 12
  11
  10
  9
  8
Channel 6 NO 7
  NC 6
  C 5
  4 ← Polarising key position
Channel 5 NO 3
  NC 2
  C 1

Channel 4 NO 18
  NC 17
  C 16
  15
Channel 3 NO 14
  NC 13
  C 12
  11
  10
  9
  8
Channel 2 NO 7
  NC 6
  C 5
  4 ← Polarising key position
Channel 1 NO 3
  NC 2
  C 1

**INTERNAL WIRING
(ONLY ONE CHANNEL SHOWN
FOR CLARITY)**

nc
com — no

Relay coil operated
by JOB as set up
in Channel / Event
etc. configuration
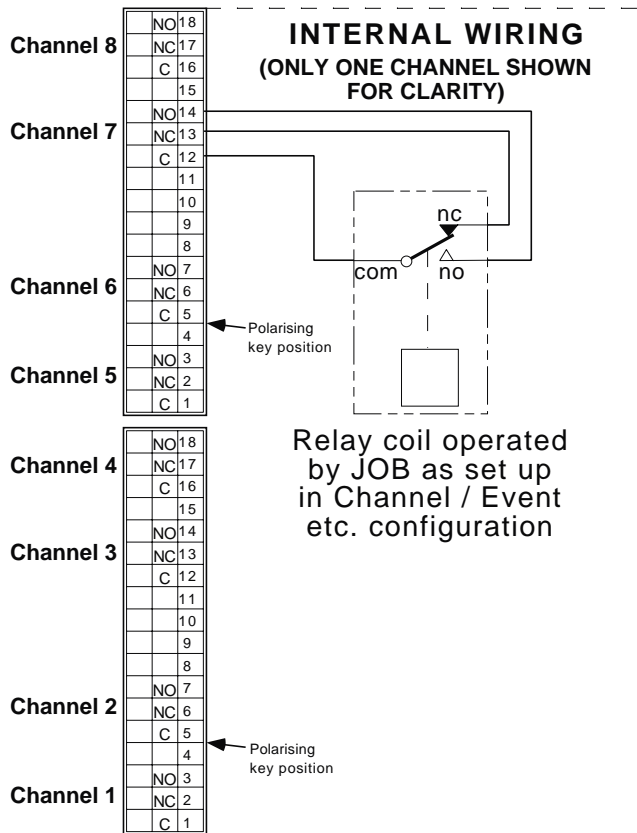
**In order to prevent mis-mating, a polarising
key can be located between contacts 4 and 5.**

Slot 1 is the left-most slot when viewed from the back of the recorder.