4100G

100mm Graphic Recorders

Installation and Operation Manual

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Declaration of Conformity

Manufacturer's name:	**Eurotherm Recorders Limited**
Manufacturer's address	**Dominion Way, Worthing, West Sussex, BN14 8QL, United Kingdom.**
Product type:	**Industrial video recorder**
Models:	**4100G (Status level E6 or higher)**
Safety specification:	**EN61010-1: 1993 / A2:1995**
EMC emissions specification:	**EN50081-2 (Group1; Class A)**
EMC immunity specification:	**EN50082-2**

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

Signed: *PRd de la Nougerède*   Dated: 18-12-96

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

CE

IA249986U500 Issue 2 Dec 96

100 mm Graphics Unit

Installation and Operation Manual

Overall contents list

(Continued)

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Safety Notes

1. Before any other connection is made, the protective earth terminal ⏚ shall be connected to a protective conductor. The Mains (supply voltage) wiring must be terminated in such a way that, should it slip in the cable clamp, the Earth wire would be the last wire to become disconnected.


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

Note: In order to comply with the requirements of safety standard EN61010, the recorder shall have one of the following as a disconnection device, fitted within easy reach of the operator, and labelled as the disconnecting device.
a.   A switch or circuit breaker which complies with the requirements of IEC947-1 and IEC947-3
b.   A separable coupler which can be disconnected without the use of a tool
c.   A separable plug, without a locking device, to mate with a socket outlet in the building

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2. 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.
3. 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.
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. Signal and supply voltage wiring should be kept separate from one another. Where this is impractical, shielded cables should be used for the signal wiring. Where signal wiring is carrying (or could carry, under fault conditions) hazardous voltages *, double insulation should be used.
6. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.
7. In the case of portable equipment, the protective earth terminal must remain connected (even if the recorder is isolated from the mains supply) if any of the I/O circuits are connected to hazardous voltages*.
8. In the case of portable equipment, output relays should not be used to switch voltages greater than 30V RMS (42.4V peak) or 60V dc.

*   A full definition of 'Hazardous Voltages' appears 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
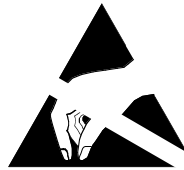
All circuit boards associated with the recorder contain components which are susceptible to damage caused by static electrical discharge of voltages as low as 60 Volts.

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

Touch screens

CAUTION

The touch-sensitive screen used in this product is designed for use by hand only. The use of sharp or pointed implements such as pens, keys and fingernails to operate the instrument must be avoided, or irreperable damage will be done to the surface material. When cleaning the touch-screen, a moist cloth should be used, if necessary with a minimal amount of mild soap solution.

ALCOHOLS SUCH AS ISO-PROPYL ALCOHOL MUST NEVER BE USED ON THE SCREEN.

SCREEN DIMMING

In order to maximise screen life, the brightness of the display is reduced, from its normal 60% of full brightness to 20% of full brightness five minutes after the last operation of the touch screen. The display returns to normal (60%) brightness as soon as the screen is touched again. The 'normal' and dim brightnesses and the 'time-to-dim' can all be edited in 'Instrument configuration' described in section 5.2.

Section 1

INSTALLATION

Section 1 Installation

1.1 UNPACKING THE RECORDER

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

1.2 INSTALLATION

1.2.1 Mechanical installation

Mechanical installation details are shown in figure 1.2.1

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

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

1.2.2 Electrical installation

Details for connecting the line supply and for signal wiring are shown in figure 1.2.2. Before carrying out wiring, read the safety notes in Section i above.

Configuration transfer wiring

The configuration port is located behind the lower cover flap as shown.

See section 4.12 for details of the configuration transfer facility.

Configuration transfer port

Inner: Terminal transmit

Outer: 0 Volts

Centre: Terminal receive

Jack plug wiring for transfer with host computer/dumb terminal

Recorder 1   Recorder 2

Inner   Receive   Receive   Inner

Centre   Transmit   Transmit   Centre

Outer   0 Volts   0 Volts   Outer
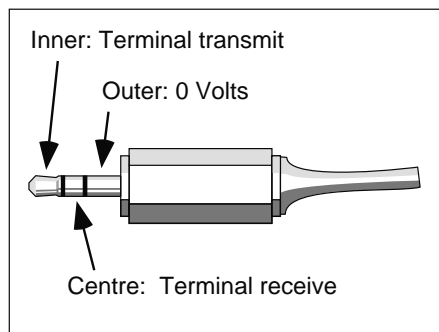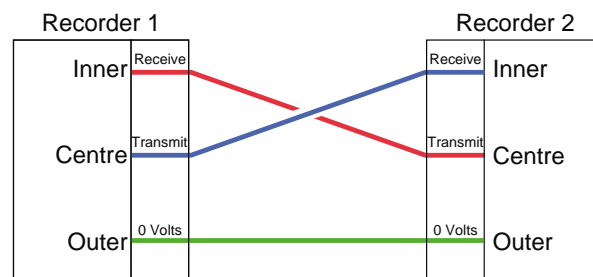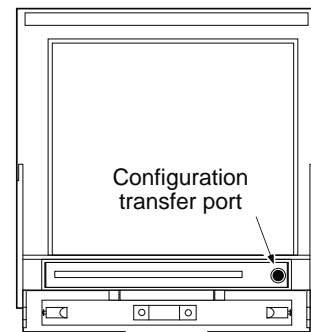
Jack - to - jack wiring for transfer between recorders

144 mm

144 mm

GRAPHICS RECORDER 10:53:10 30/01/98

Door securing bolt (if fitted) (2 - places)

Front view

Disk access lock

405 mm (LTC - open)

290 mm (LTC - closed)

251 mm (STC)

235 mm

215 mm

28 mm

Case clamp

Maximum panel thickness = 25 mm

View on right hand side

137 mm

1.75 mm

Panel cutout
138mm x 138mm
(− 0.0 + 1.0mm)

X

Y

Recommended minimum
inter-recorder spacing: X = Y = 35 mm

Alternative
location for case
clamp

137 mm

View on underside (STC shown)

STC = Short terminal cover (standard fit)
LTC = Long terminal cover (option)

a° b°

MAXIMUM INSTALLED ANGLE
Hard disk option: vertical panels only
Floppy disk option: a = b = 15 degrees max
Otherwise: a = b = 45 degrees max

Case clamping

Figure 1.2.1 Mechanical installation

6 - channel recorder

Line input: 90 to 264V (45 to 65 Hz)
OR, if Low voltage option fitted,
20 to 53 Vdc or ac (45 to 400 Hz RMS)

Safety cover not shown
for clarity

Earth Line Neutral
(DC +) (DC -)

(DC polarity not important,
but + terminal fused)

Option board(s)

Option board(s)

Input board

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
V+ V- I V+ V- I V+ V- I   V+ V- I V+ V- I V+ V- I
Ch1   Ch2   Ch3   Ch4   Ch5   Ch6

12 - channel recorder

Line input: 90 to 264V (45 to 65 Hz)
OR, if Low voltage option fitted,
20 to 53 Vdc or ac (45 to 400 Hz RMS)

Safety cover not shown
for clarity

Earth Line Neutral
(DC +) (DC -)

(DC polarity not important,
but + terminal fused)

Option board(s)

Input board 2

23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
V+ V- I V+ V- I V+ V- I   V+ V- I V+ V- I V+ V- I
Ch7   Ch8   Ch9   Ch10 Ch11 Ch12

Input board 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
V+ V- I V+ V- I V+ V- I   V+ V- I V+ V- I V+ V- I
Ch1   Ch2   Ch3   Ch4   Ch5   Ch6

Signal wiring

V+	V-	I

+   −

DC V (-2V<Vin<10V)
DC mV
Thermocouples

V+	V-	I

Shunt
assembly

+   −

DC mA

V+	V-	I

Attenuator
assembly

+   −

DC V
(− 20 to +100V)

V+	V-	I

**3-wire resistance
thermometer**

V+	V-	I

**2-wire resistance
thermometer**

V+	V-	I

Potentiometer

V+	V-	I

Minimum contact
closure time = 250 msec

**Contact closure
(not channel 1 or 7)**

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

Figure 1.2.2 Electrical Installation

1.3 PREVENTIVE MAINTENANCE

1.3.1 Maintenance schedule

3-yearly   Change battery

1.3.2 Changing the battery

The following procedure applies to recorders fitted with the replaceable coin-cell lithium battery (BR2330 or similar) available from the recorder manufacturer under part number PA261095. Such batteries have been fitted as standard since Status level T35 (November 1999)*. Recorders manufactured prior to this were fitted with a Nickel-Cadmium battery permanently mounted on a replaceable circuit board (Part No AH249860). If your recorder is fitted with such a board, it should be replaced with the new coin-cell board (AH261096), using kit LA261398. This kit contains full in-structions for the replacement.


Note: during the lifetime of this issue of manual, a re-designed battery holder will be introduced. This new design allows the battery to be slid in and out without any tools. See 'Battery replacement (2), below, for details.

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

EQUIPMENT REQUIRED

In addition to normal Pozidriv and slotted-head screwdrivers, the following tools are required.
1. Plastic tweezers (depending on battery holder type
2. 'Stubby' or 'offset' Pozidriv screwdriver (optional)
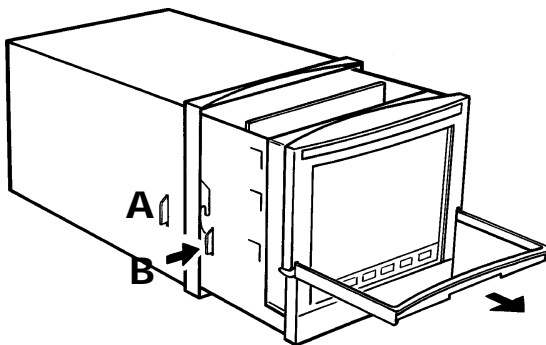
ACCESS TO THE BATTERY BOARD
1.
Lift handle and pull until catch A engages
2.
Push catch 'B' in, to unlatch the chassis. Ensuring that the internal flexi-cable is not strained, pull the chassis gently out of the case.
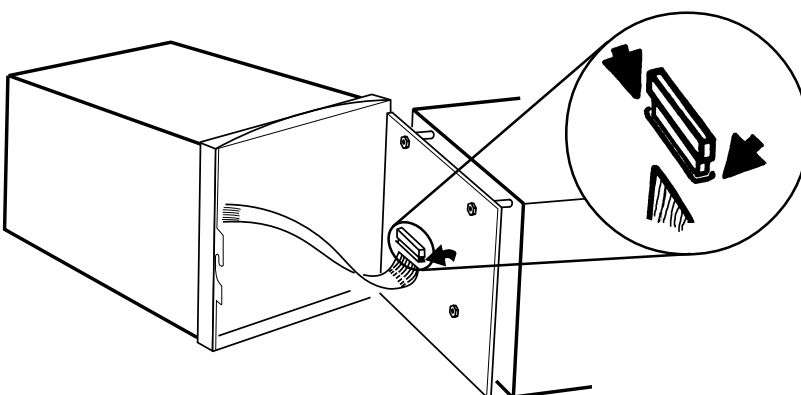
3.
Gently push connector 'ears down to release the flexi-cable from its connector.

ACCESS TO THE BATTERY BOARD (Cont.)
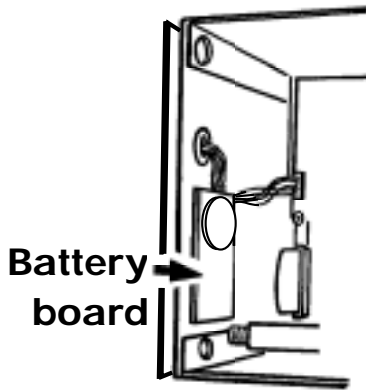
Battery board

4.

Remove the chassis from the case, and remove the battery board† by disconnecting the on-board connector and undoing the two screws*. Place the board on a non-conductive surface and replace the battery as shown below.

*See 'access to the battery board (additional instructions)' below, if these screws cannot be accessed.

† Note:
With the latest design of battery holder, it may be possible to slide the battery out of its holder and replace it, without removing the board. If such a procedure is followed, precautions should be taken to ensure that neither the new nor the exhausted abttery can be dropped into the recorder chassis.

BATTERY REPLACEMENT (1)

Once access to the board has been gained, this procedure is simply a matter of extracting the battery from its holder, as shown below, and pushing the replacement into place, ensuring correct polarity (+ to top),

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

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

2.
Grasp the battery and pull it out of its holder
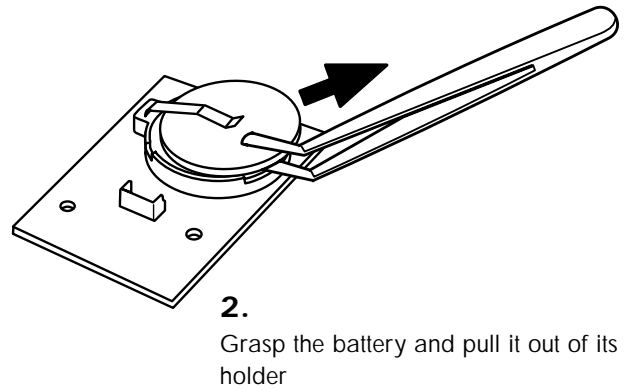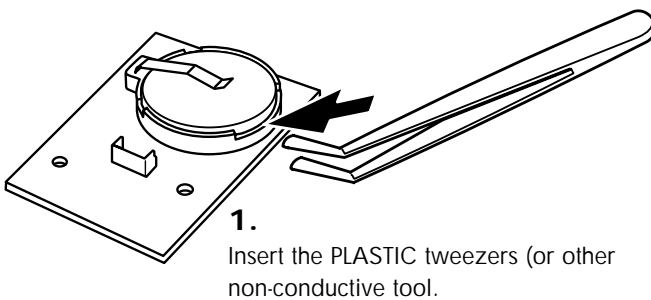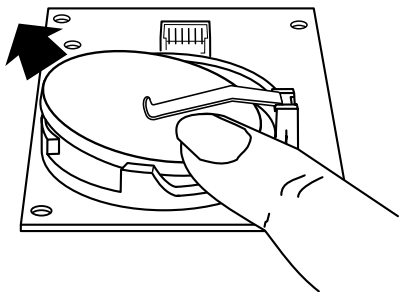
BATTERY REPLACEMENT (2)

Once access to the board has been gained, this procedure is simply a matter of extracting the battery from its holder, as shown below, and pushing the replacement into place, ensuring correct polarity (+ to top). The visual difference between the two types is also shown below.

Remove the exhausted battery by pushing it out of its holder

Original style battery holder   New battery holder

Newer style has cut-out here

Visible difference between battery holder types
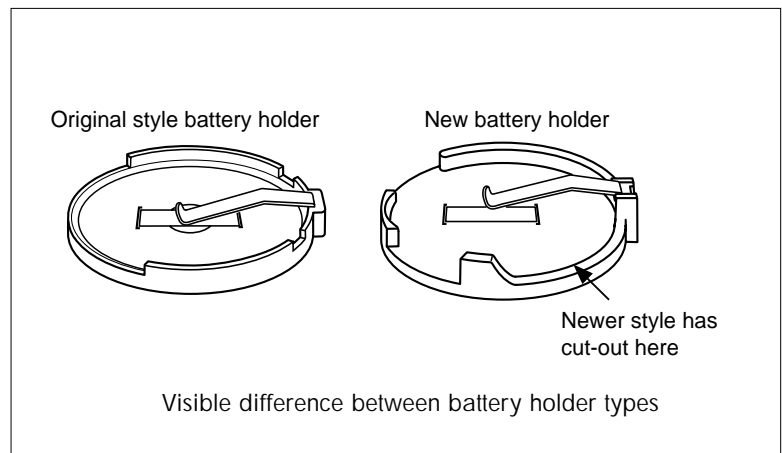
ACCESS TO THE BATTERY BOARD (Additional instructions)

If the battery board screws cannot be accessed, the back plate of the recorder can be removed as described below, and the battery replaced with the board in-situ.
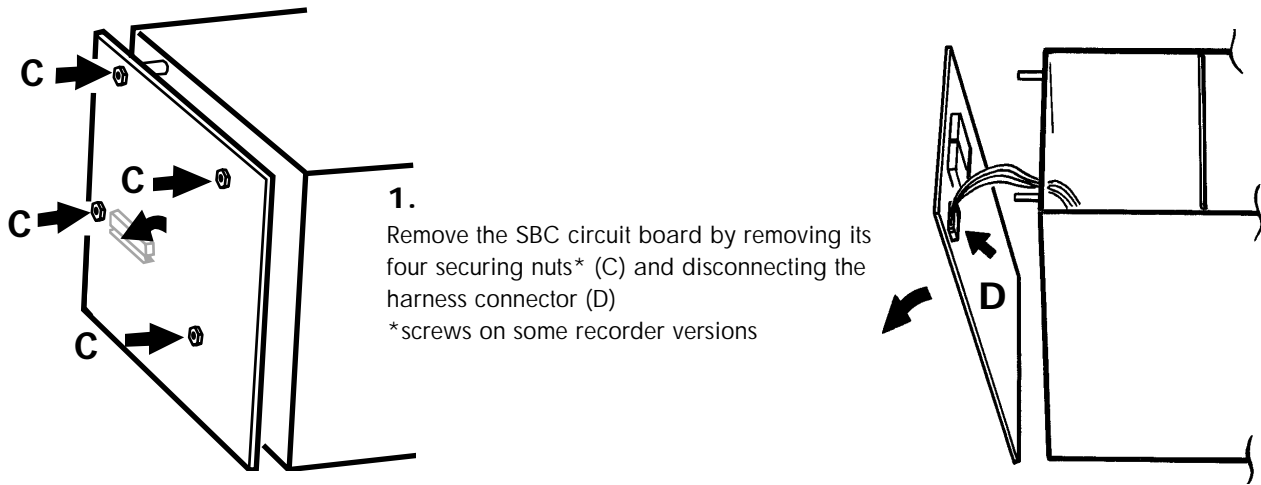
1.

Remove the SBC circuit board by removing its four securing nuts* (C) and disconnecting the harness connector (D)
*screws on some recorder versions
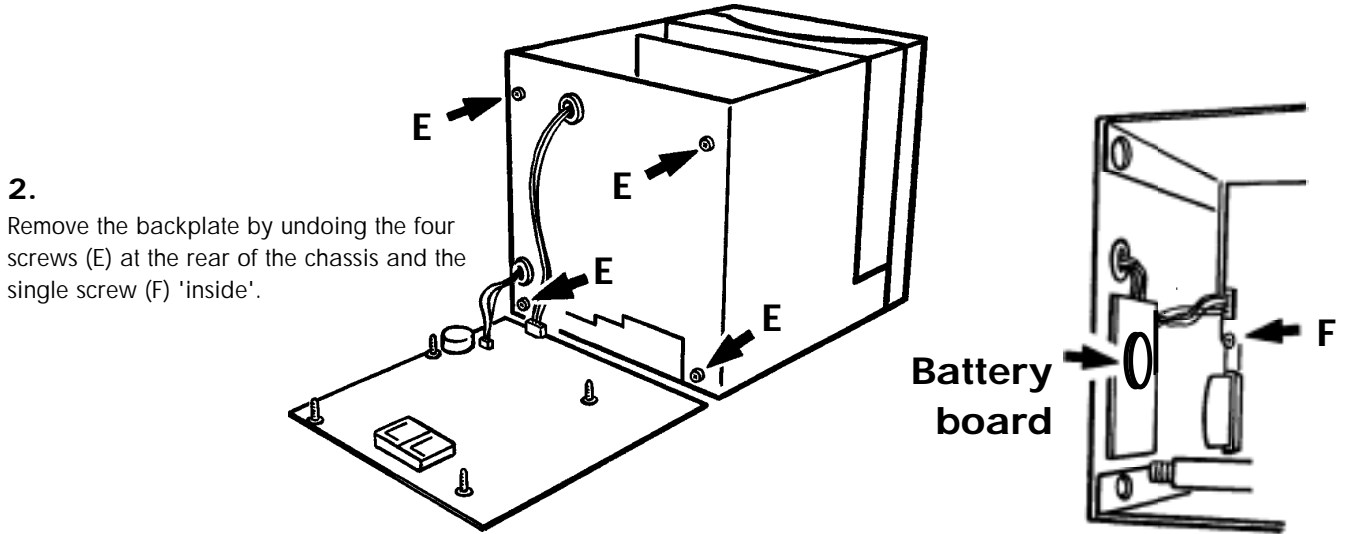
2.

Remove the backplate by undoing the four screws (E) at the rear of the chassis and the single screw (F) 'inside'.

Battery board

This page is deliberately left blank

Section 2: Basic Operation

Contents list

Section 2: Basic Operation

2.1 FIRST SWITCH ON

When power is first applied to the recorder, it sets itself up with data which was entered by the manufacturer. In order to make the recorder do what <u>you</u> want it to, this 'Default configuration' has to be modified to suit your particular needs. Figure 2 below shows the various push keys that you will need to do this.

The larger part of section 2 shows you how to set up a channel to an imaginary set of conditions. Once you have done this, setting up the recorder for your own needs should be straight forward. Sections 4 and 5 of the manual are reference guides to the Operator and Configuration display pages respectively so if there is any item which appears in these displays, which you need further information about, these sections should help. Section 3 shows the different ways in which you can display the recorded data.
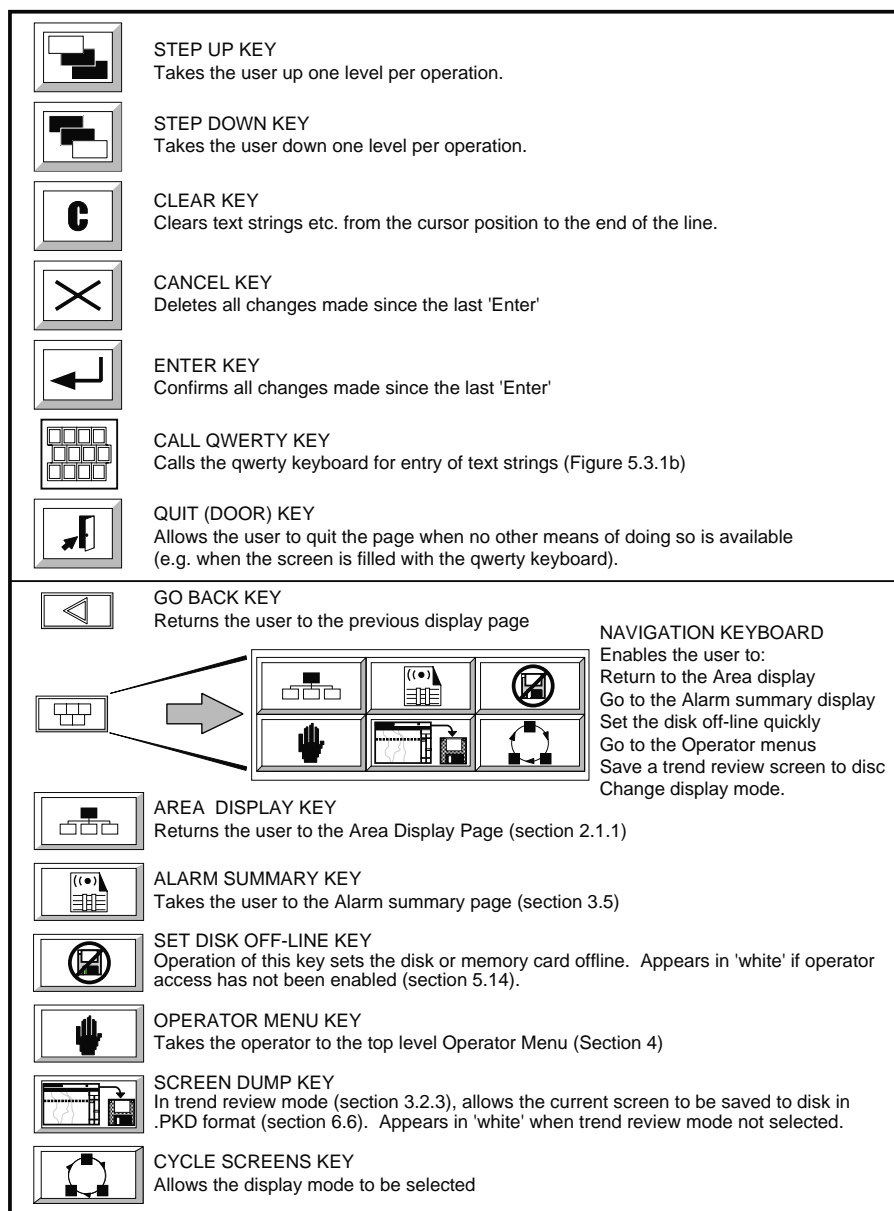
STEP UP KEY
Takes the user up one level per operation.

STEP DOWN KEY
Takes the user down one level per operation.

CLEAR KEY
Clears text strings etc. from the cursor position to the end of the line.

CANCEL KEY
Deletes all changes made since the last 'Enter'

ENTER KEY
Confirms all changes made since the last 'Enter'

CALL QWERTY KEY
Calls the qwerty keyboard for entry of text strings (Figure 5.3.1b)

QUIT (DOOR) KEY
Allows the user to quit the page when no other means of doing so is available
(e.g. when the screen is filled with the qwerty keyboard).

GO BACK KEY
Returns the user to the previous display page

NAVIGATION KEYBOARD
Enables the user to:
Return to the Area display
Go to the Alarm summary display
Set the disk off-line quickly
Go to the Operator menus
Save a trend review screen to disc
Change display mode.

AREA DISPLAY KEY
Returns the user to the Area Display Page (section 2.1.1)

ALARM SUMMARY KEY
Takes the user to the Alarm summary page (section 3.5)

SET DISK OFF-LINE KEY
Operation of this key sets the disk or memory card offline. Appears in 'white' if operator access has not been enabled (section 5.14).

OPERATOR MENU KEY
Takes the operator to the top level Operator Menu (Section 4)

SCREEN DUMP KEY
In trend review mode (section 3.2.3), allows the current screen to be saved to disk in .PKD format (section 6.6). Appears in 'white' when trend review mode not selected.

CYCLE SCREENS KEY
Allows the display mode to be selected

Figure 2 Key Functions

2.1.1 Area Display

This is the name given to the display page which appears when you first apply power to the recorder. It is possible to re-configure the recorder to start-up in any one of a number of displays - see section 5.2 for details.
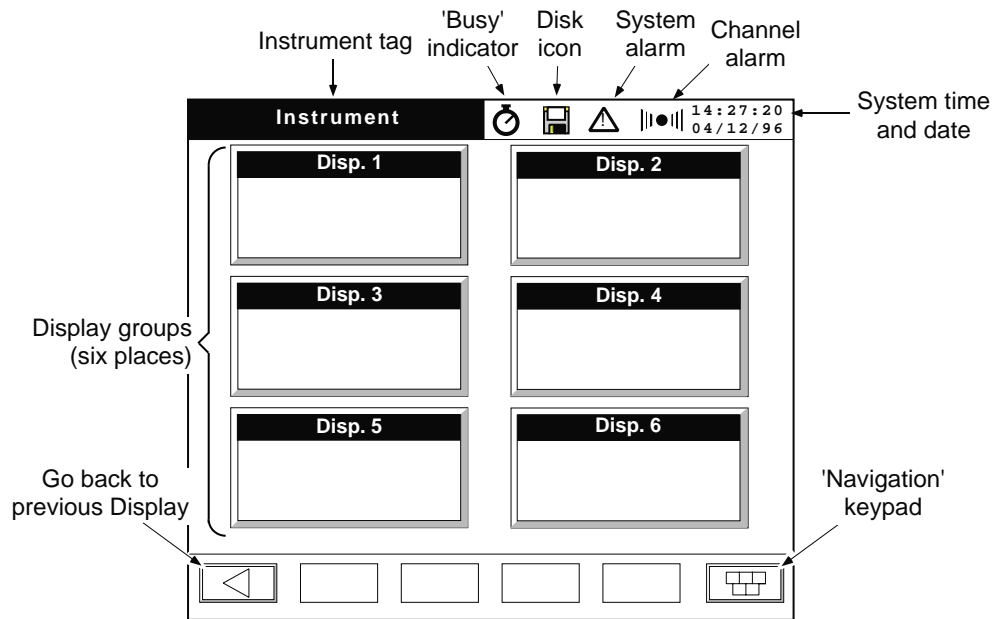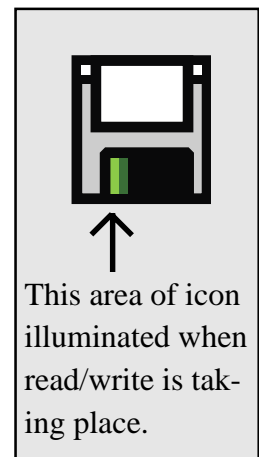

Figure 2.1.1 Area Display Page

As shown in figure 2.1.1 above, the Area display page contains 6 group displays (initially empty) and the following items in a 'Title' bar across the top of the page.

Instrument tag — The title bar initially contains the Instrument tag (up to 16 characters) as set up in 'Instrument' configuration. Other text strings (e.g. Group title) appear depending upon what the recorder is doing.

'Busy' indicator — This 'stopwatch' is used only during trend history, and therefore does not appear on this Area display page - it is included here for completeness. The drawing of history traces is carried out in two stages: a set of initial traces for immediate viewing, replaced by the complete traces after a time period, the length of which depends on the complexity of the history. The stopwatch is displayed, with the hand rotating clockwise, for the duration of this time period.

Disk icon — Appears when a PC card is correctly inserted in the slot*. A small area of the icon illuminates when the card or disk is being read from or written to.

System Alarm — This appears if a System alarm becomes active. See section 4.7 for a list of possible causes.

Channel alarm — This icon appears if any channel alarm becomes active.

Time and date — System time and date appear at the top right of the display.

This area of icon illuminated when read/write is taking place.

Two further keys appear at the bottom of the screen:

Go Back — Although not used in this, our first page, pressing this area in any subsequent display causes the previously displayed page to be recalled.

Keypad — Contains a number of keys to help find our way through the displays. Figure 2.1.2 shows what happens if you press this area.

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*Note: With floppy disks, the icon does not appear until the disk is first accessed, after which it will remain on display until the disk is ejected.
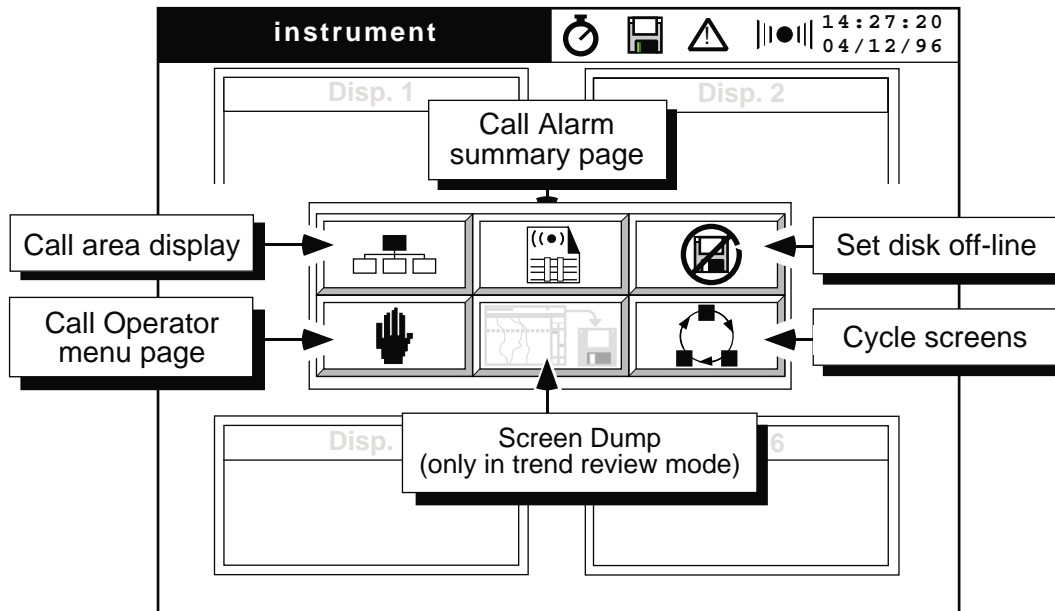

2.1.2 Keypad

Figure 2.1.2 Keypad functions

The keypad contains the following keys

Call area display	Available from any display other than the Area display itself.
Alarm summary	Takes the user directly to the 'Alarm summary' display which lists up to 256 alarm events in pages of 16. See section 3.5 for a fuller description.
Disk offline	Takes the user straight to the disk offline display page described in section 6.4.4. If the operator is not permitted to switch the disk on/off, the icon appears in 'white'.
Operator menu	Operation of this key calls the Operator menu page which allows access to all the recorder operation and configuration functions.
Cycle screens	This key allows the user to scroll through the different ways of displaying the recorder process variables (points). Not active from the Area page.
Screen dump	Appears only in Trend Review mode - see section 3.2.3

> **Process Variable (PV)**
>
> The generic name given to any input or derived channel, or totaliser or counter value.
> Process variables are also referred to as 'Points'

2.1.3 Display Groups

There are 6 display groups available, each of which can have 6 points associated with it. The content of each group is defined by the user in 'Group' Configuration. The points in one of these groups can be 'traced' on the display as though the display is a traditional chart, with a configurable number of divisions. Alternatively, the points can be displayed as bargraphs, or as digital values. See section 3 for further information.

As shown above, each group appears as a rectangle in the area display. When the recorder is delivered, all the groups are empty. Once a group is configured to have one or more points in it, these points are represented by smaller rectangles within the group icon (figure 2.1.3). If any of the points has an active alarm, its 'box' is filled red, either flashing (unacknowledged) or steady (acknowledged).
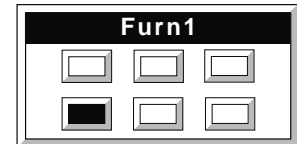

Fig 2.1.3
Group Display (Area Page)

The amount of tracing that the recorder can hold in its memory depends upon (amongst other things) what the total number of points is and what type of points they are (digital inputs take much less memory space than analogue inputs). The examples below show recording periods for some typical configurations, both for the standard recorder memory of 800kB and for the extra memory option (2.8 MB).

TRACE TIME EXAMPLES

Scan Rate (seconds)	1 point	3 points	6 points	12 points
1	1.5 days	16 hrs	9 hrs	4.2 hrs
2	2.9 days	1.3 days	17.25 hrs	8.4 hrs
5	7.3 days	3.3 days	1.8 days	21 hrs
10	14.6 days	6.5 days	3.7 days	1.8 days
30	1.5 months	19.5 days	11 days	5.3 days
60	2.9 months	1.3 months	22 days	10.5 days
120	5.8 months	2.6 months	1.5 months	21.0 days

Table 2.1.3a Approximate total trace times (standard 800 MB memory)

Scan Rate (seconds)	1 point	3 points	6 points	12 points
1	4.4 days	2 days	1.1 days	13 hours
2	8.8 days	3.9 days	2.2 days	1.1 days
5	21.9 days	9,8 days	5.5 days	2.6 days
10	1.5 months	19.5 days	11.0 days	5.3 days
30	4.4 months	2 months	1.1 months	15.8 days
60	8.8 months	3.9 months	2.2 months	1.1 months
120	17.5 months	7.8 months	4.4 months	2.1 months

Table 2.1.3b Approximate total trace times (optional 2.8 MB memory)

ADAPTIVE RECORDING

With slow trace speeds, it is possible for one screen pixel (dot) to cover a number of readings. Under normal trending conditions, the trace shows only the instantaneous value of the signal at the time the dot is placed and it is thus possible that fast transients can be missed. A feature called 'Adaptive Recording' solves this problem by placing extra dots on the screen (without 'chart' movement), effectively plotting the minimum and maximum values reached by the signal during one pixel height. Adaptive recording is enabled in Group configuration, and when enabled, it applies to every point in the group. This should be borne in mind as adaptive recording reduces the total trace time available, each point with adaptive recording being equivalent to two normal points of the same type.

Under normal tracing, the value shown on the faceplate is the instantaneous value of the trace whether adaptive recording is enabled or not. See also trend review - section 3.2.3.

2.1.4 Other groups

LOG GROUPS

If a disk archive option is fitted, two further groups Log 1 and Log 2 appear in the right hand pick list. The contents of these groups are defined in Group Configuration (section 5.4.1).

Two files (Archive 1 and Archive 2) are defined in Archive Configuration (section 6.6). The contents of log 1 are sent to the filename defined in Archive 1, and the contents of log 2 are sent to the filename defined in Archive 2.

Archiving can be initiated in three ways as follows:

OPERATOR INITIATION
As shown in section 4.9, the operator can use the 'Enter' key to log either log 1 or log 2 at any time.

JOB ACTION
Two jobs are available (Log 1 to archive 1 and Log 2 to archive 2) to initiate a log when the job goes active, goes inactive or on alarm acknowledgement.

AUTOMATICALLY (LOG 2 ONLY)
Two archive intervals ('A' and 'B') can be set up in Archive 2 configuration. The contents of log 2 are subsequently saved to the filename defined in Archive 2 at interval A unless archive interval B has been selected by job action. Setting the interval to 00:00:00 stops automatic archiving.

DV GROUP

If the relevant options are fitted, the DV group can be used to assemble derived channels, totalisers etc. to be averaged, group reset/preset etc.

2.2 CONFIGURING A CHANNEL

This section describes how to set up a channel to the following set of parameters:

Channel Number .... 3 (section 2.2.2)
Input range .... 0 to 900°C (section 2.2.3)
Input type .... Type K Thermocouple (section 2.2.3)
Chart span .... 400 to 800°C (section 2.2.3)
Input break response ...... Drive high (section 2.2.3)
Tag .... Furnace1 TempB (section 2.2.3)
Alarm type .... Absolute high, Latching (section 2.2.4)
Alarm threshold .... 780°C (section 2.2.4)
Alarm job .... Sound Buzzer until acknowledged. (2.2.4)
Trace type .... Green, 5 division, linear (section 2.2.5)
Group name .... Furn1 (section 2.2.6)
Chart divisions .... 5 (section 2.2.6)

2.2.1 Access to Configuration

Note: The recorder is despatched with the password 00010

From the Area Page, press the keypad icon, then the 'Hand' key.

This results in the appearance of the top level operator menu display.

Either press in the 'Op:Configuration' area, or run your finger down the array until 'Op:Configuration' is 'highlighted'

(Highlighted means that the background colour changes to yellow to indicate you have selected the correct area).

Note the appearance of three new keys at the bottom of the screen. Although not all of their icons are visible on this display page,, they are (from left to right) 'Step up', 'Step down' and 'Clear'

'Step up' takes you to a higher level of the menu structure that you are in.

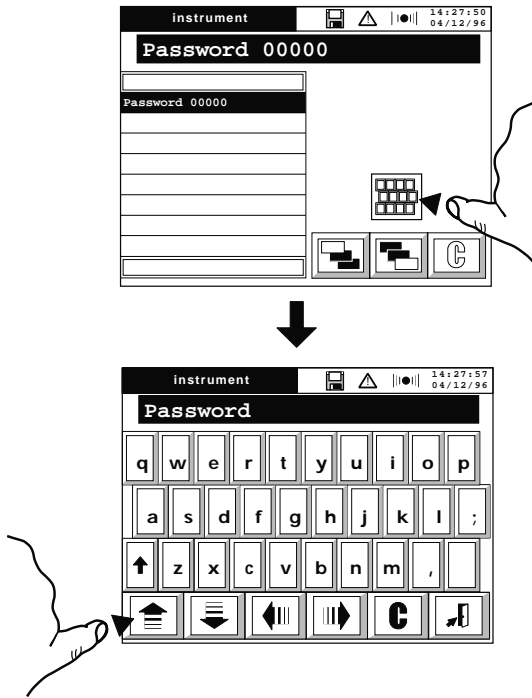'Step down' takes you to the next lowest level of menu

'Clear' is used when entering text or numerical strings.

Press the 'Step down' key.
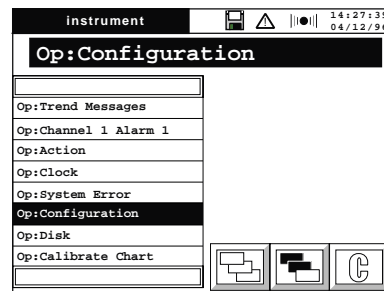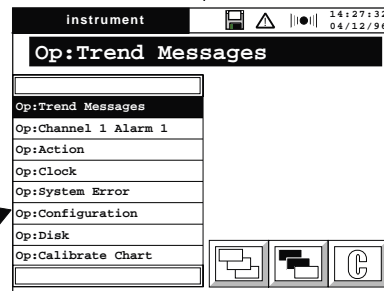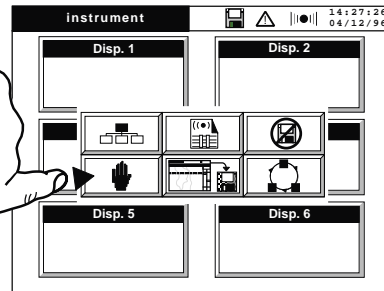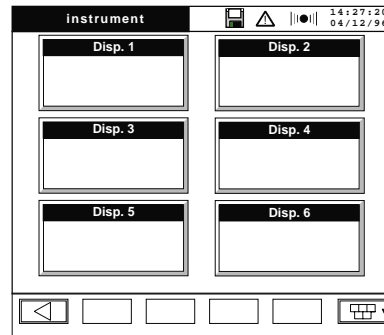
2.2.1 ACCESS TO CONFIGURATION (Cont.)

Press the 'Call Qwerty' icon to call the first of the keyboards to the display.

Operate the Up key to access the numeric keyboard. Enter 00010

Note that the configuration item and its current value are shown in the status line near the top of the display. If any change is made to this value, its colour changes from green to red to indicate that a change has taken place.
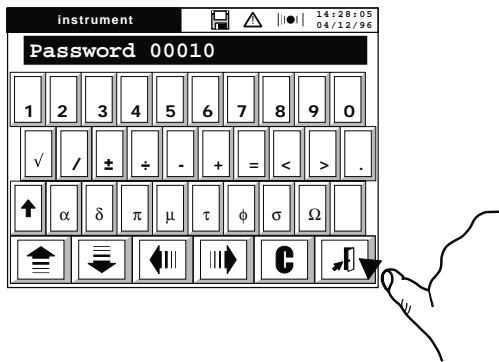
Press the door (quit) icon then the Enter key to call up the complete configuration list.

2.2.2 Channel number selection
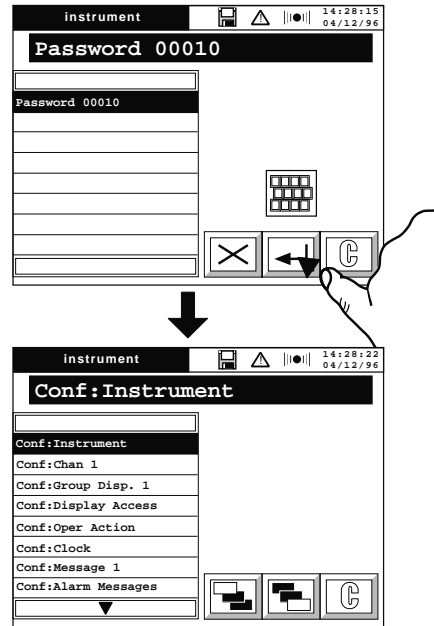
Press, or run your finger up the list to highlight the 'Conf:Chan 1' item. When selected, the right-hand side of the display shows a 'pick list' of all the available channel numbers with the current selection in a different colour from the others.
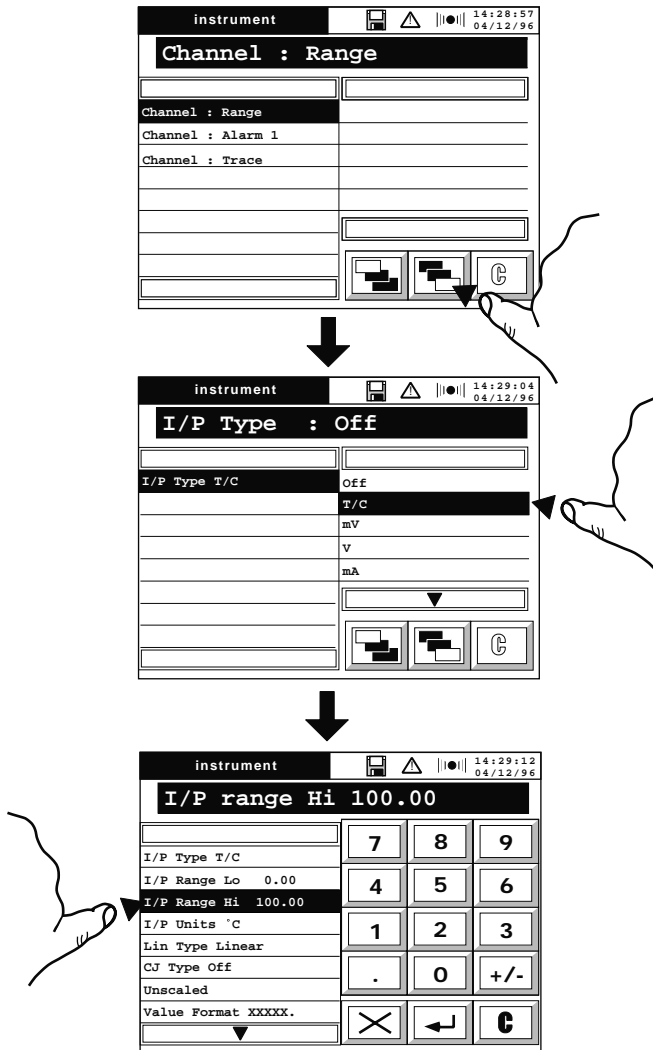
Channel N°3 is selected by pressing area 3 or running the finger up or down the list until '3' is highlighted. The selected channel's configuration is then accessed by pressing the Step down key.

Status line
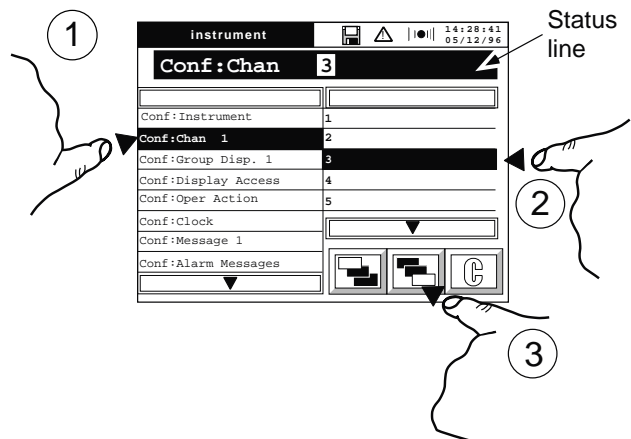
2.2.3 Input range configuration

INPUT RANGE

Enter Range Configuration using the Step down Key.

Select T/C (Thermocouple) as input type.

As can be seen, the default 'I/P Range lo' value is 0.00 which is as required, so select 'I/P range Hi'.

As soon as the 'I/P range Hi' area is highlighted, a keyboard appears to allow a value to be entered.

Type '900' using the keyboard, then as the default Inputs units are ˚C, which is what we want, we can go straight to Linearisation type.

LINEARISATION TYPE
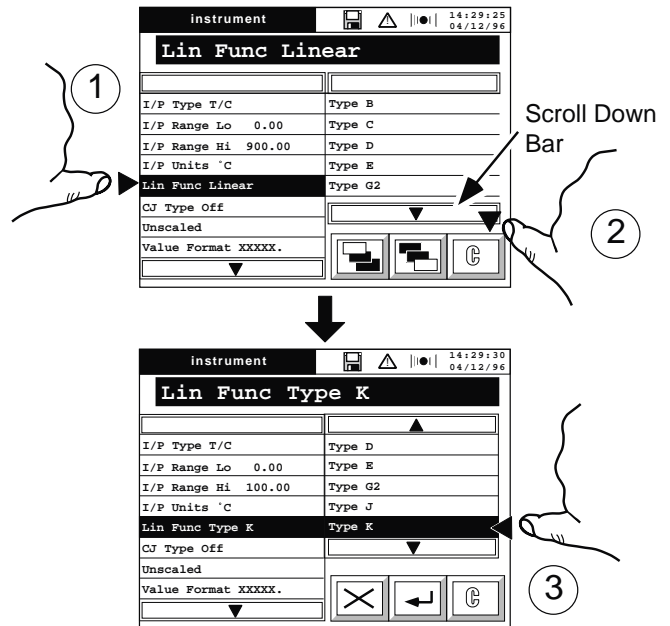
initial list. The down pointing arrow in the scrollbar below the list tells us that there are more items in the scroll list, and if you press the scroll bar a couple of times, 'Type K' will appear.

Select type K as the linearisation function.

CJC TYPE

Select CJC from the left side of the screen. The Right hand half of the screen contains the CJC types that are selectable.

Select 'Internal'.
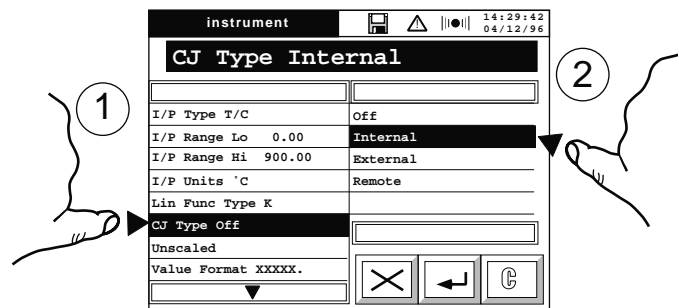
2.2.3 CHANNEL CONFIGURATION (Cont.)

As we don't want to scale the input, we can ignore this item ('Unscaled') and go straight to Value Format. The value format required is XXX.XX, so select this item from the right-hand column once you have selected 'Value Format' from the left-hand column.

Scroll Down Bar
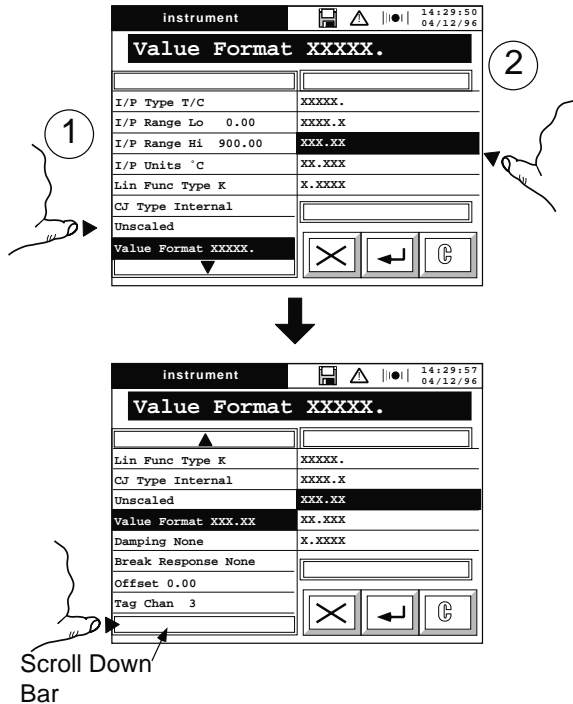
Look for any further 'hidden' fields, by pressing the scroll bar under the left column either repeatedly, or continuously.
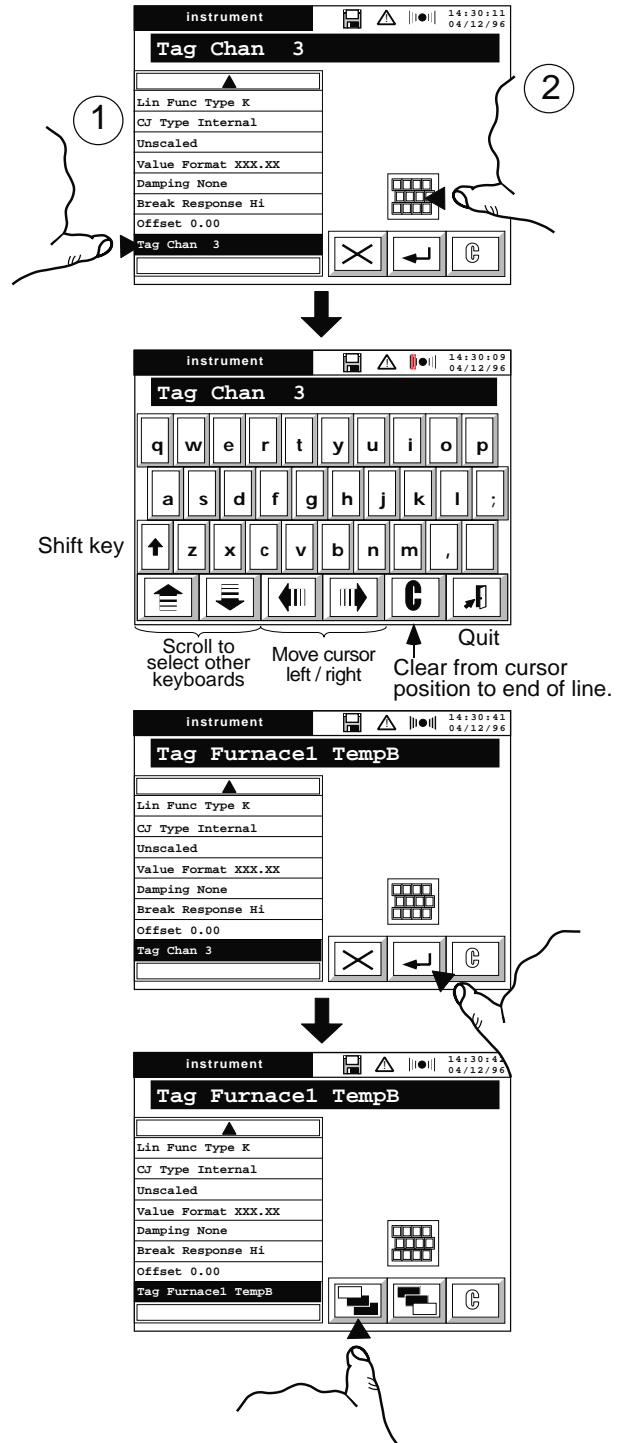
I/P BREAK RESPONSE

We are not interested in damping the input signal, so select 'Break Response' from the left-hand column, then 'Drive hi' from the right-hand column.
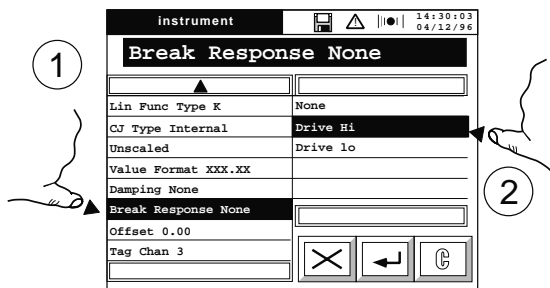
We are not going to enter an offset, so select 'Tag' in the left hand column, then press the 'Call qwerty' keyboard icon.

CHANNEL TAG

The text for the channel 3 tag (Furnace1 TempB) is entered using the qwerty keyboard that appears when you press the 'Call qwerty' key, together with the numeric keyboard which you can access using either the scroll up or the scroll down key. Section 5.3.1 shows you the complete character set available.

Shift key

Scroll to select other keyboards | Move cursor left / right | Clear from cursor position to end of line. | Quit

Return to the Top Level channel page by pressing the 'Step up' key.
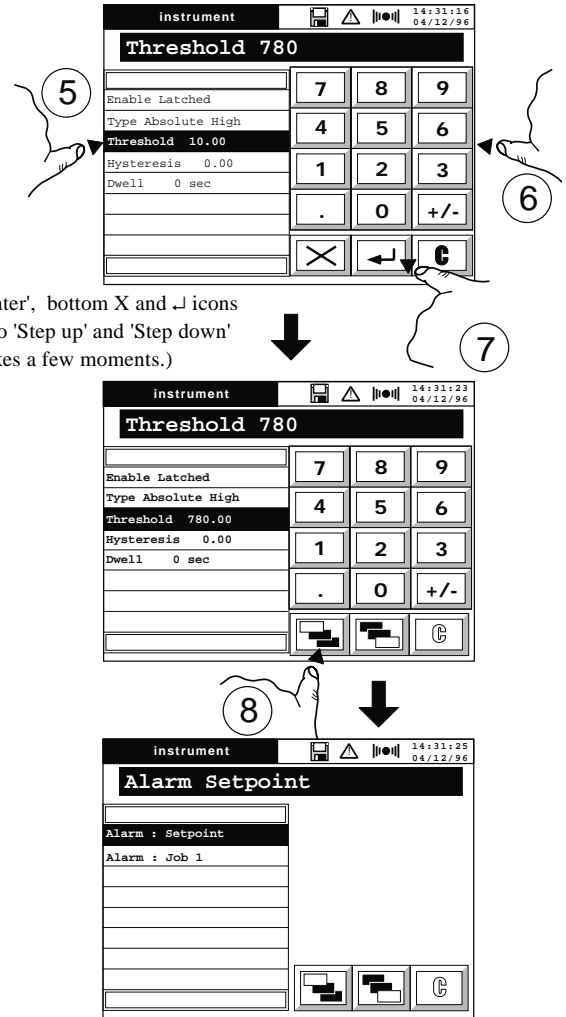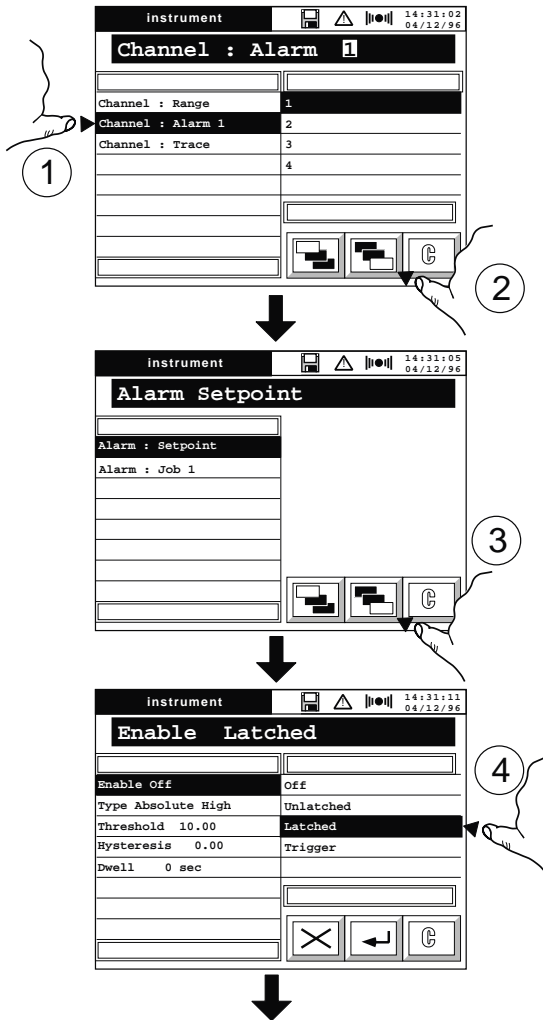
2.2.4 Alarm configuration

SETPOINT

Up to four alarm setpoints can be configured for each channel. Each of these setpoints can cause up to 2 jobs to be executed (see section 5.3.2 for full details).

From the top level channel configuration page, select 'Channel : Alarm 1', then press the Step down key.

The resulting top level alarm page shows 'Alarm : setpoint' highlighted. Press the Step down key.

As shown below, the Absolute high, Hysteresis, and Dwell items are as required, so all we have to do is set the 'Enable' to Latched and the threshold value to 780.
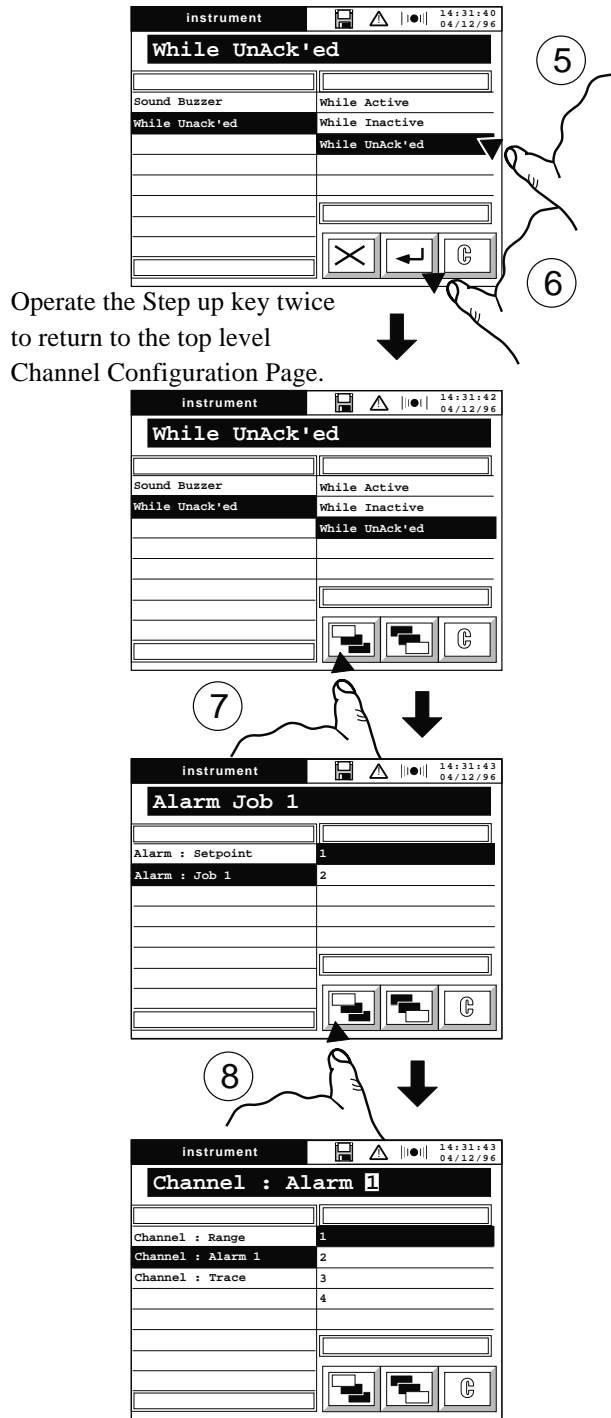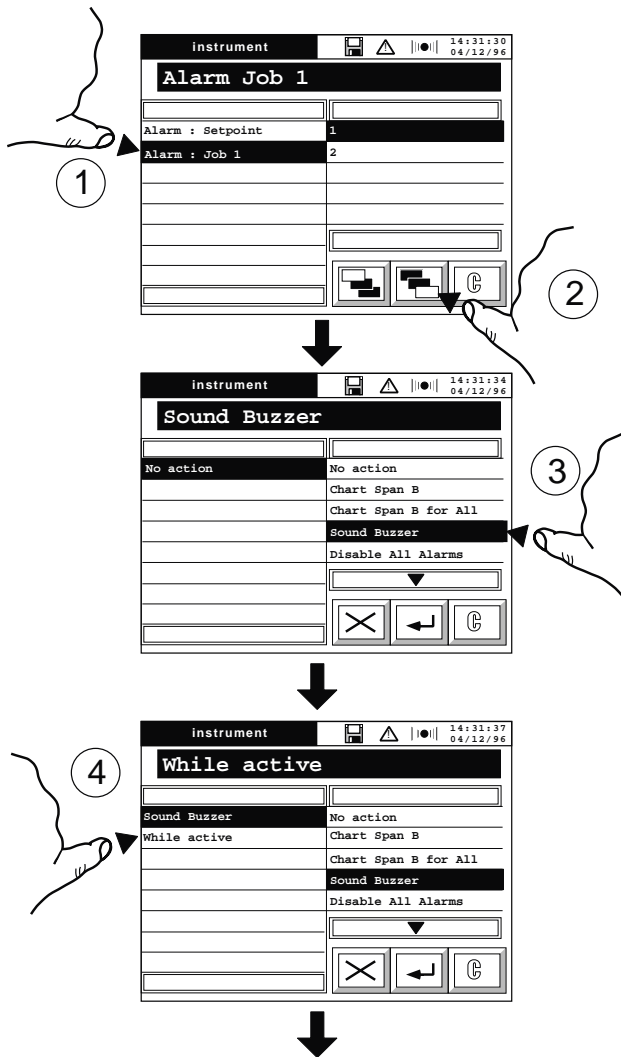
After 'Enter', bottom X and ↵ icons change to 'Step up' and 'Step down' keys (takes a few moments.)

2.2.4 ALARM CONFIGURATION (Cont.)

JOBS

Set Job 1 to 'Sound Buzzer' 'While Unacknowledged' as shown below.

Operate the Step up key twice to return to the top level Channel Configuration Page.

2.2.5 Channel Trace Configuration

From the top level Channel configuration page, select Channel Trace.

We want to select green as the trace colour, and 400 to 800 as span A. (Span A is the normal span used during recording; Span B can be switched to by Job action - for example if an alarm is triggered and you want to enlarge the area round the alarm value.)
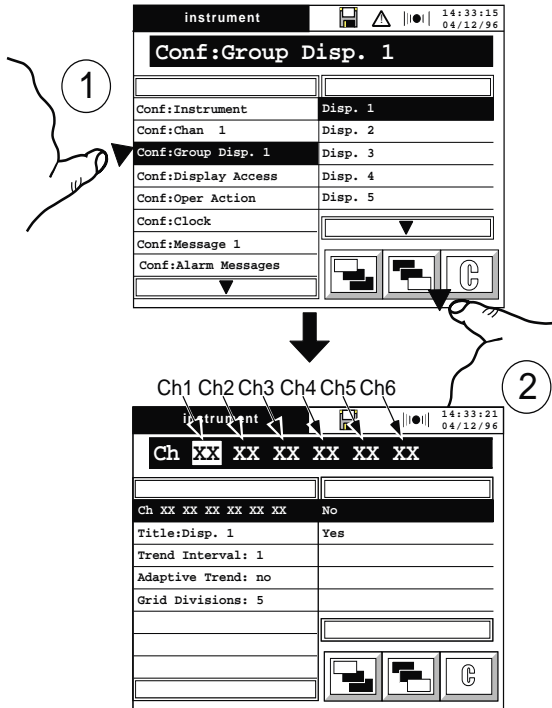
The scale type of linear, with 5 divisions is as required, so we don't need to change this.
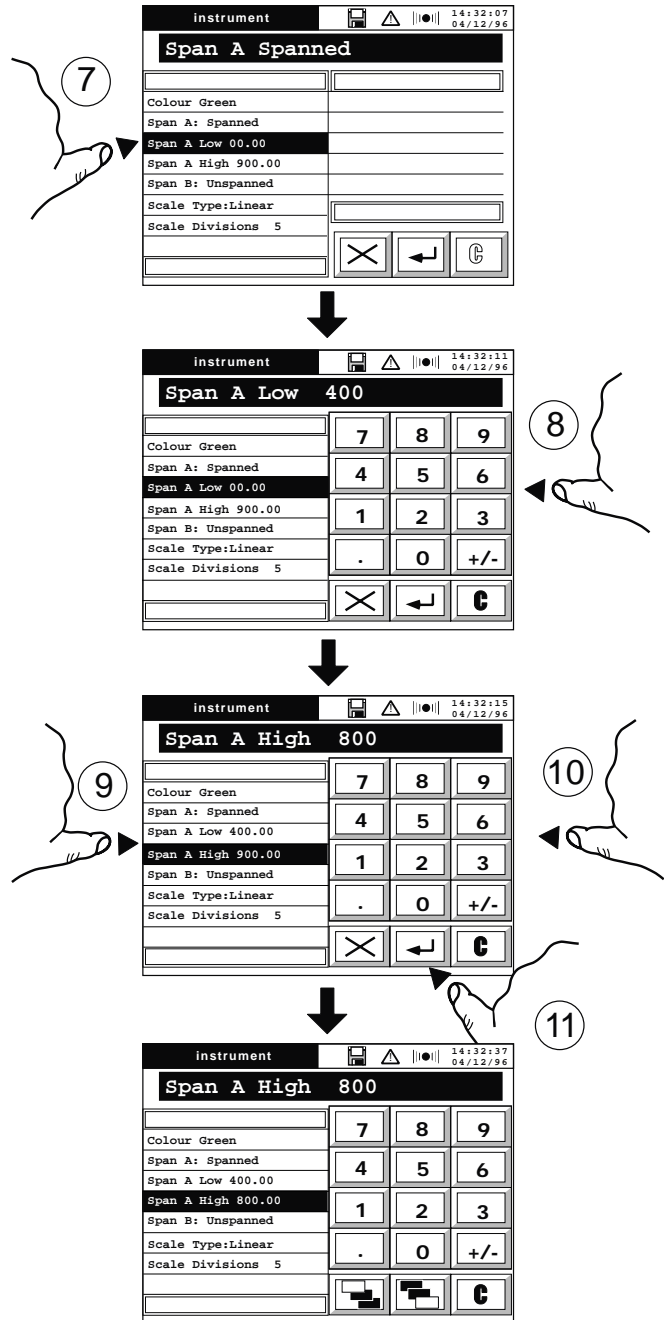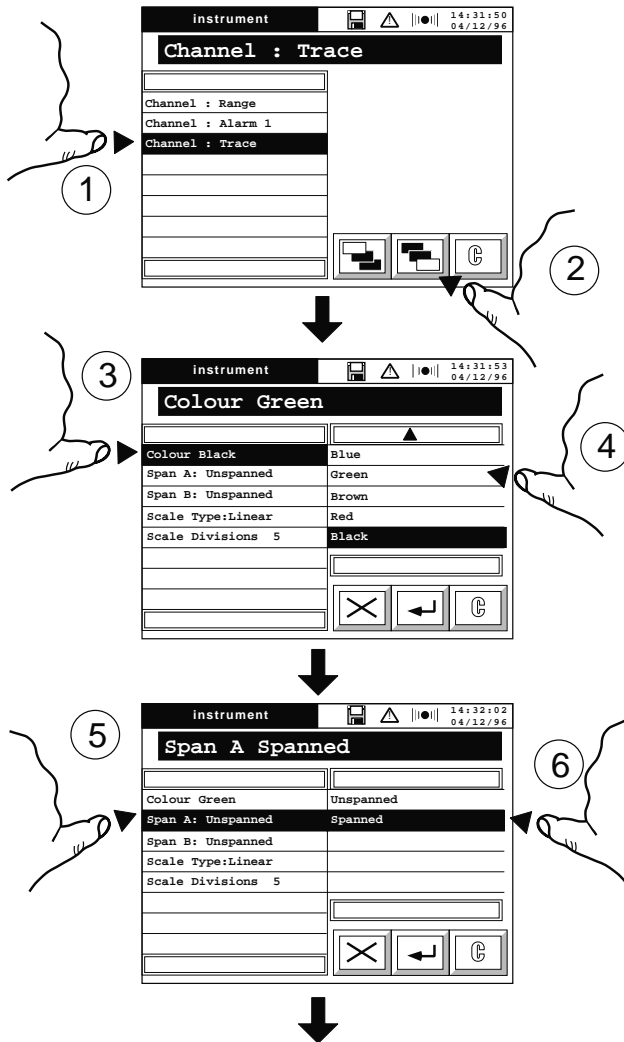
Operate the Step up key twice to return to the top level configuration page (not shown).

2.3 GROUP CONFIGURATION

We are going to enter channel 3 into the group currently called 'Disp. 1', and then we shall re-name the group 'Furn1'

The status line contains the channels 01 to 06 in order from left to right. Because none of them is currently included in the group, each channel number is represented by 'XX'.

To include channel 3, press the third 'XX' in the status line, then select 'Yes' from the 'pick list' on the right hand half of the display.
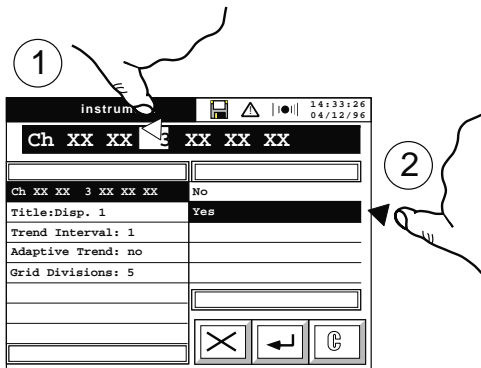
The title of the group is changed using the text entry techniques already discussed for the channel tag.
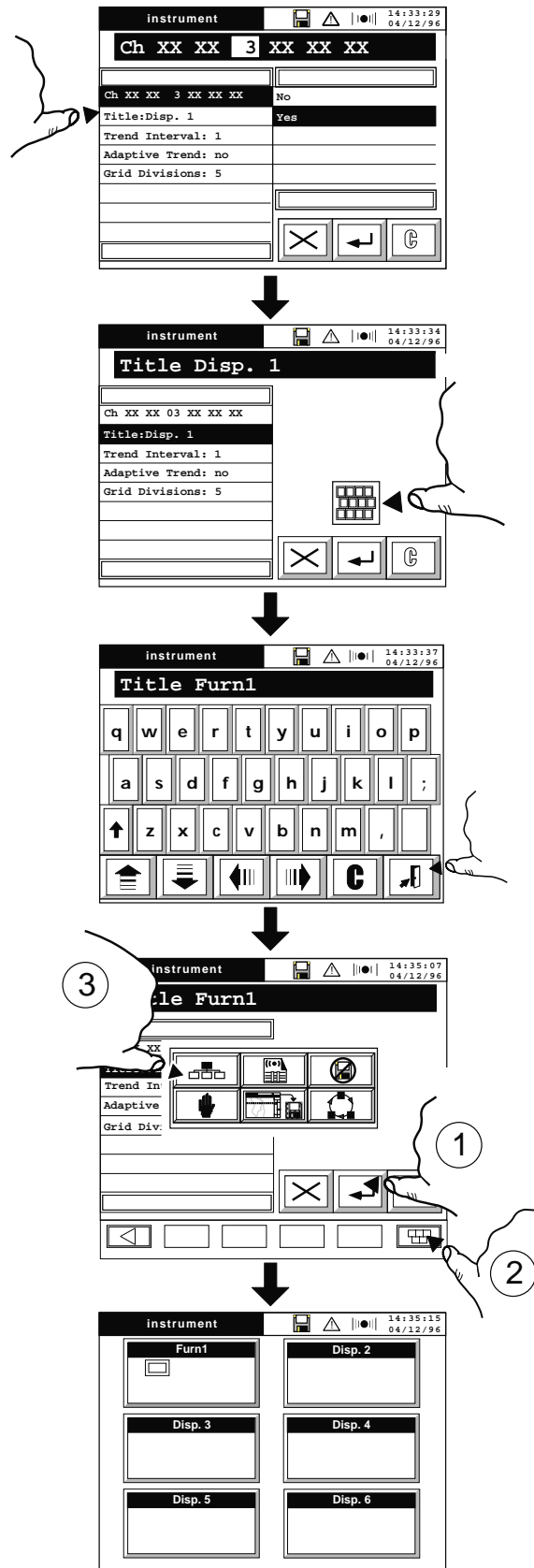
'Grid divisions' is already set to 5, as required, so when the group name has been entered, we can return to the area display.

Section 3 Display Modes

List of contents

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Section 3 Display Modes

3.1 INTRODUCTION

Once the recorder channels have been configured, they can be displayed in one of a number of formats. At first switch-on, three formats are available:, Vertical trend, Horizontal bargraph and Numeric and these formats can be scrolled-through at will, using the 'Cycle screens' key.   (The Cycle screens key is one item of the pop-up keyboard which appears when the keyboard icon (below the bottom right-hand corner of the display) is touched.)

The recorder has other display modes (Full vertical trend, Horizontal trend, Vertical bargraph) which can be set up to appear in the 'cycle screens' list: . All six modes can be put into or taken out of the scroll list as a part of Display Access configuration described in Section 5.5. Further to this, all the trend displays can be selected to have either white or black background as a part of the instrument configuration (Graph Colour) described in section 5.2. All items which appear black when white background is selected, are displayed in white if black background is selected.

Figure 3.1a shows how to select the default, vertical trend, mode from the Area page, by touching the required group icon. (The figure also shows the alternative black background version of the display). Figure 3.1b is an attempt to depict all six alternative display modes (with white-background trend displays).

At power off, the currently displayed 'page' and its display mode are 'remembered' by the recorder so that the same page is returned-to the next time the recorder is switched on.
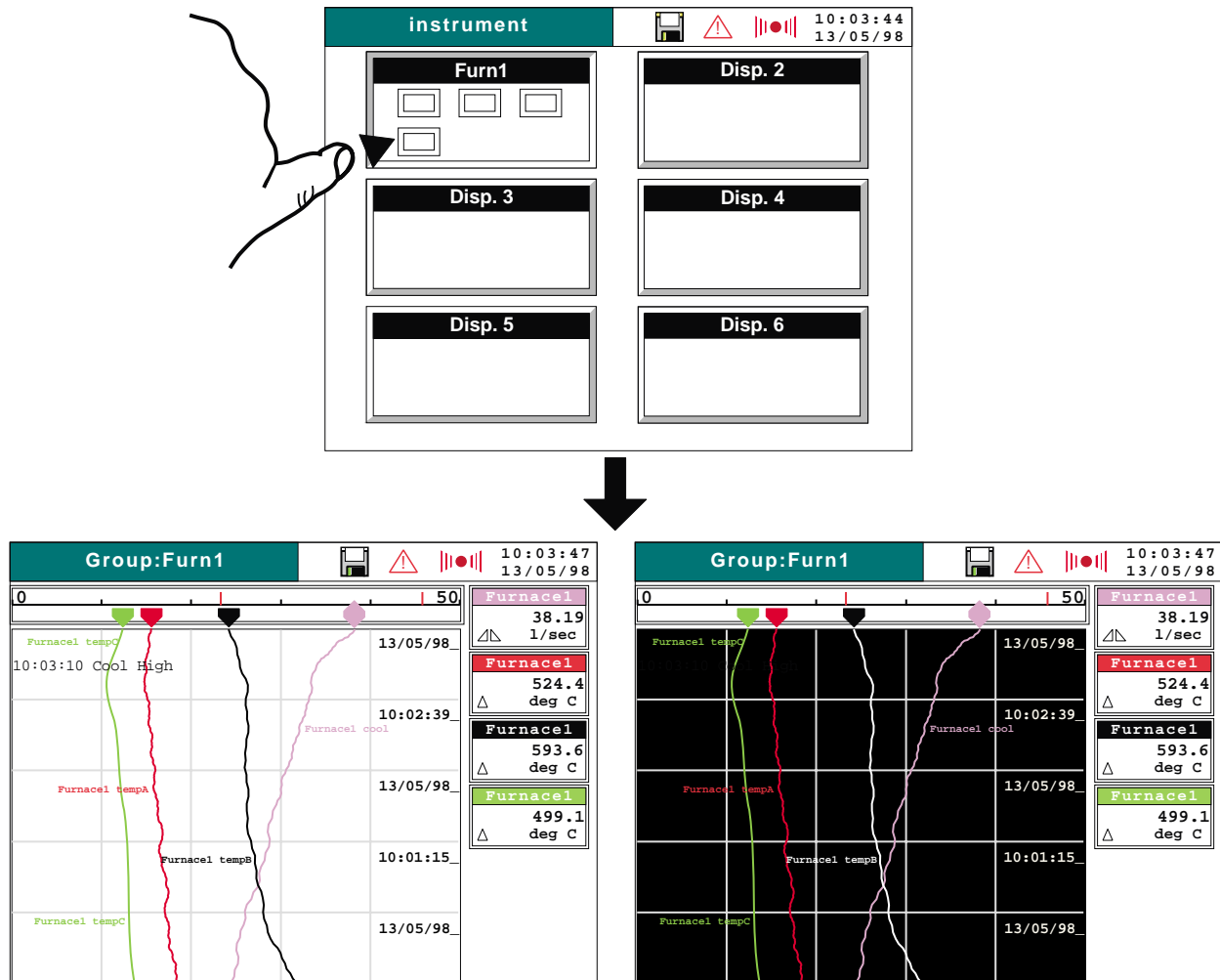
Figure 3.1a Accessing Trend display mode

3.1 INTRODUCTION (Cont.)

Vertical trend display

Vertical bargraph display

Full Vertical trend display

Horizontal bargraph display

Horizontal trend display

Numeric display

Alarm setpoint (threshold) indication
(Absolute and deviation alarms only)

Alarm setpoint (threshold) indication
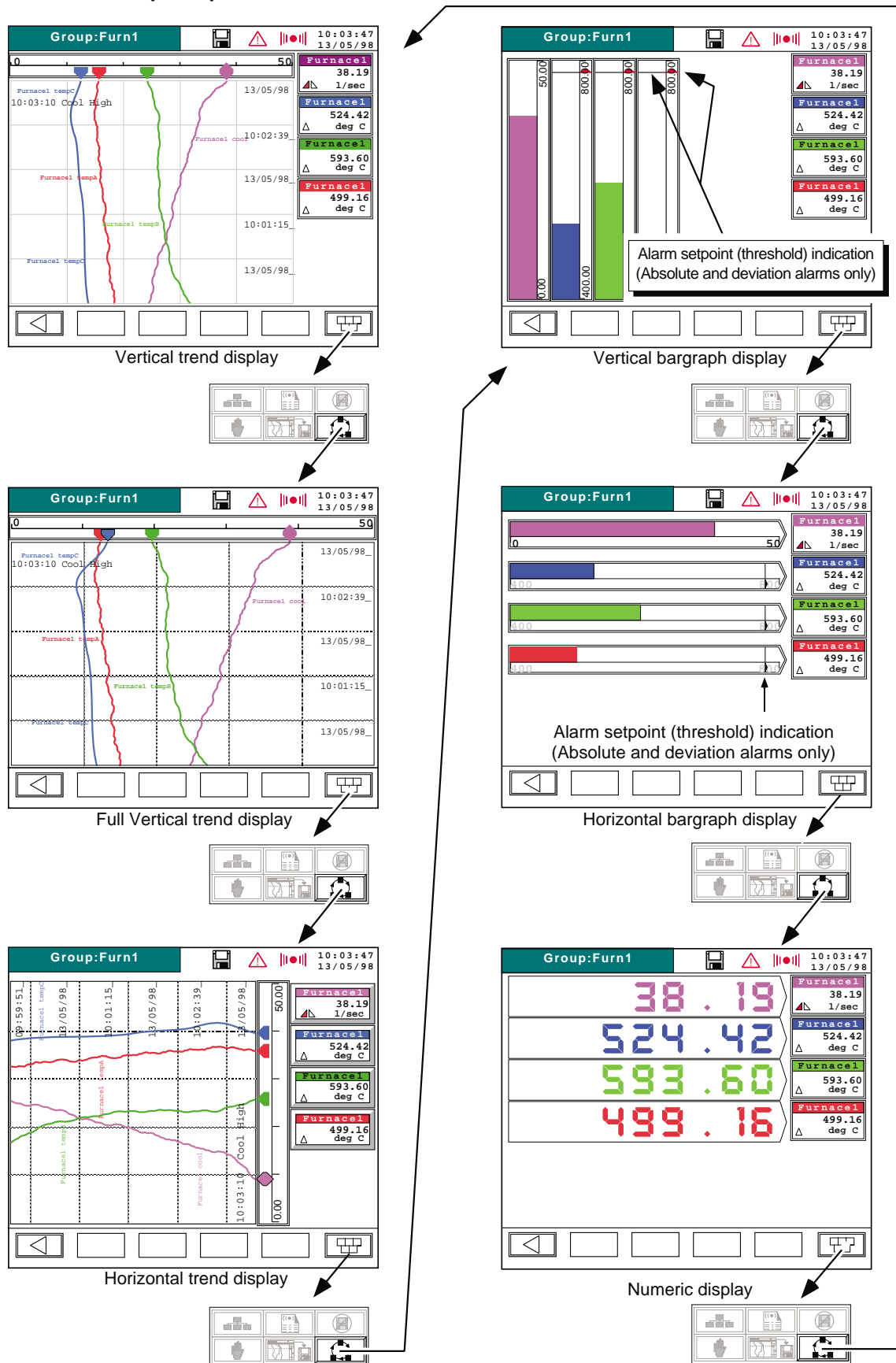(Absolute and deviation alarms only)

Figure 3.1b Selection of display mode

3.2 TREND DISPLAYS

Trend display backgrounds can have either white backgrounds (as shown in this section) or black backgrounds, as configured in Instrument configuration (section 5.2). All trend displays have the selected colour as background.

3.2.1 Vertical trend display

The default type of display is the 'Vertical trend' display, which shows one group-full of points as though they were being traced on a chart. As well as this analogue tracing, the 'Faceplates' show the current measured value of the points in the group digitally, and also contain alarm symbols showing the types of alarm configured for each point.
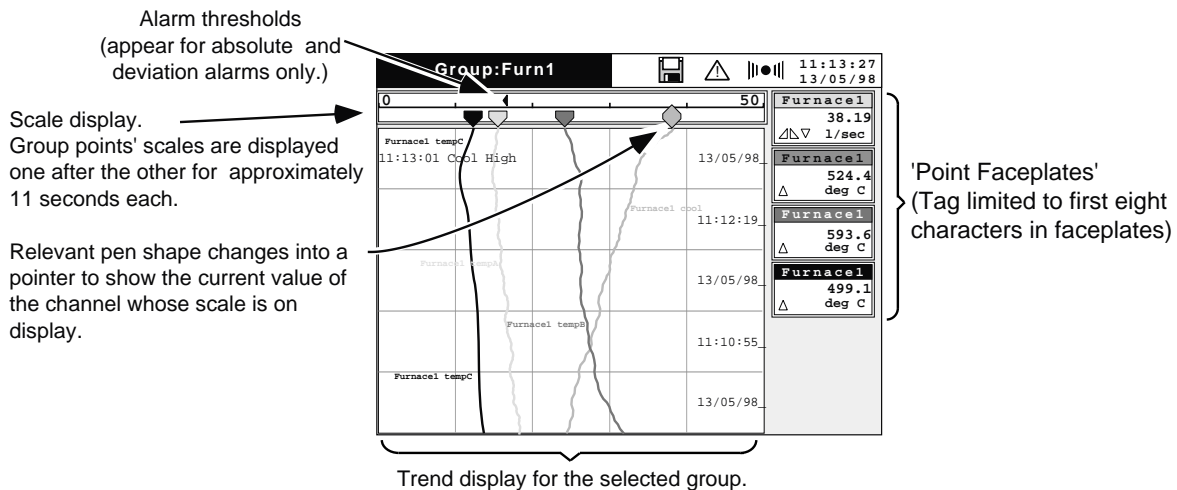
Alarm thresholds
(appear for absolute and
deviation alarms only.)

Scale display.
Group points' scales are displayed
one after the other for approximately
11 seconds each.

Relevant pen shape changes into a
pointer to show the current value of
the channel whose scale is on
display.

'Point Faceplates'
(Tag limited to first eight
characters in faceplates)

Trend display for the selected group.

Figure 3.2.1 Trend display

ALARM SYMBOLS

Symbols for non-active alarms are filled with a neutral colour. Symbols for active alarms are filled red, either steady or flashing, according as the alarm is acknowledged or not.

Table 3.2.1 shows the symbols which may appear against the type of alarm they represent. Alarm types and actions are discussed in section 5.3.2

Symbol	Meaning
△	Absolute high
▽	Absolute low
◿	Rate-of-change rising
◺	Rate-of-change falling
▷◁	Deviation in
◁▷	Deviation out
□	Digital alarm

Table 3.2.1 Alarm symbols

DISPLAY HEIGHT (IN SECONDS)

As discussed in 'Group configuration (section 5.4) a trend interval can be entered to set the time axis of the display. The display height is equal to 180 trend intervals. Thus, at the default Trend Period of 1 second, the display height represents 3 mins. At the maximum period (1200 sec), the display height is 180 x 1200 = 216,000 seconds or 60 hrs.

3.2.2 Point focus trend display

If a point's faceplate is pressed, the display changes to the 'Point Focus' display. The Point Focus display (figure 3.2.2) is similar to the trend display discussed above, with the following differences:

1. To emphasise the selected trace, all other traces are 'thinned'..
2. The scale/pen display no longer scrolls through all the points, but 'locks' onto the selected trace.
3. Only the selected point's faceplate remains on display.
4. Alarm faceplates appear to the right of the display. If operator permissions (section 5.14) allow, pressing an alarm faceplate calls the relevant operator page, allowing the user to change the thresholds. Entry of the new threshold value returns the user to the Point focus display.

To return to the standard Trend display, press the faceplate.

3.2.2 POINT FOCUS TREND DISPLAY (Cont.)

Operation of the cycle screens key causes a point focus version of whichever type of display is next on the scroll list. This is the only way of getting a full vertical trend point focus display (section 3.2.4)
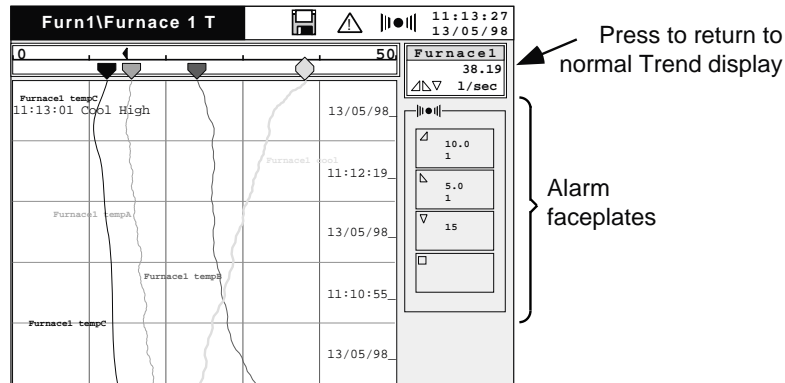

Figure 3.2.2 Point focus trend display

3.2.3 Trend review

This feature allows the entire recorded length of tracing to be scrolled through. Trend review is accessed from horizontal or vertical trend (including point focus) displays, by touching the display screen for 2 seconds. The screen changes as shown in figures 3.2.3a/b and remains static, although recording continues as normal as evidenced by the continuous movement of the History Position slider, as the current page becomes progressively older.

To return to the previous trend display, use the Go Back key below the lower left corner of the screen.

VERTICAL TREND REVIEW

When entered from a normal trend display, the point faceplate above the slider controls, and the scale over the 'chart' scroll through all the group points. When entered from a point focus display, the faceplate and scale show just the selected point (i.e. no scrolling occurs).

A cursor (initially at the very top of the 'chart') can be moved to any position by touching the screen and 'dragging'. The time and date displayed above the point faceplate relate to the cursor position
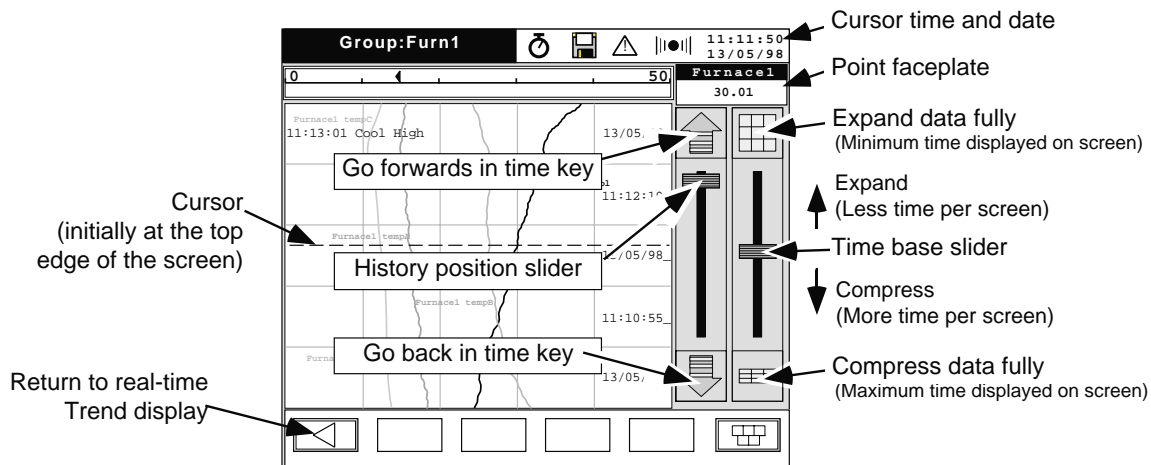

Figure 3.2.3a Trend review display (vertical tracing)

3.2.3 TREND REVIEW (Cont.)

HORIZONTAL TREND REVIEW

When entered from a normal trend display, the point faceplate in the lower right hand corner and the scale to the right of the 'chart' scroll through all the group points. When entered from a point focus display, the faceplate and scale show just the selected point (i.e. no scrolling occurs). When adaptive recording is in operation for the displayed group, the face plate contains two values (minimum and maximum) as described in 'Trend Review Operation' below.

A cursor (initially at the right hand edge of the 'chart') can be moved to any position by touching the screen and 'dragging'. The time and date displayed in the top right hand corner relate to the cursor position.
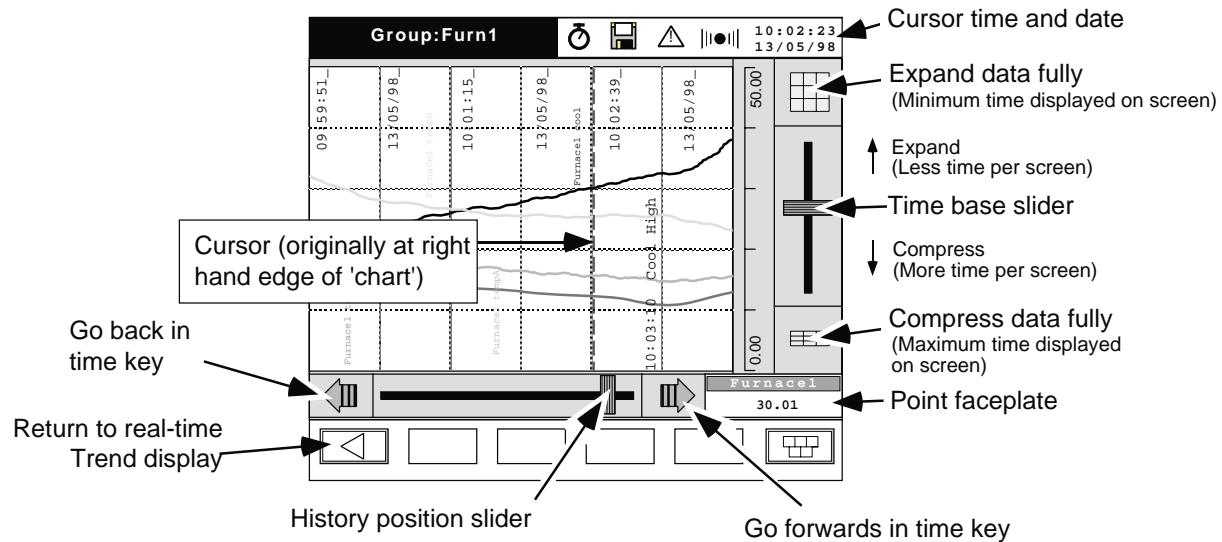

Figure 3.2.3b Trend review display (horizontal tracing)

TREND REVIEW OPERATION

Two sets of controls are provided:

a. <u>Timebase slider.</u> Expands/compresses the amount of data on the screen. When expanding data, the centre of expansion is the cursor. The keys above and below the time base slider allow you to show the screen data at maximum compression (Compress data fully) or minimum compression (Expand data fully) at a touch. A grey line is drawn across the screen at each time-base discontinuity, and at every power cycle.

> Note: Trend review supports a maximum of 100 time-base changes. Data previous to the 100th time-change-ago is lost. This should be taken into consideration when implementing the 'preset clock' job. The constraint does not apply to PC Review.

b. <u>History Position.</u> Allows the user to move backwards and forwards through the recorded history, either in fine steps (keys) or coarse steps (slider). The position of the slider 'knob' is linearly related to where the current screen is in the total history range; the nearer the top (right edge for horizontal trends) - the later the data.

Using these controls it is possible, for example, to use the two sliders to locate a particular item, time stamp etc. The cursor can then be moved to the item (by sliding a finger on the screen), and the area expanded about the cursor using the Timebase slider.

(Continued)

3.2.3 TREND REVIEW (Cont.)

TREND REVIEW OPERATION (Cont.)

Because each dot on the screen (pixel) is a fixed size, the amount of time 'covered' by each pixel varies according to scan rate and screen compression. When using the compression facility, the screen is redrawn immediately, so the trend review facilities can be used, but the recorder then calculates what the maximum and minimum values of the signal were during the time period covered by each pixel. Whilst it is doing this, a clock icon appears at the top of the screen. Once the calculation is complete, the screen is refreshed with each signal represented by two traces - one showing the minimum and one the maximum value reached. (Frequently, the two traces are so similar that they are indistinguishable.) If adaptive recording is enabled for the displayed group, the point faceplate contains the minimum and maximum values of the trace at the cursor time position as displayed in the top right hand corner of the screen.

SCREEN ARCHIVE

The contents of a trend review screen can be archived in .PKD format to a memory card/PC disk etc. To carry out the save, use the navigation keyboard as shown below in figure 3.2.3c. The data will be saved to a file called *Groupname*.PKD, PK1, PK2... etc. as explained in section 6.7.5. Any characters, other than those in the following list, which are used in the group name are replaced by underscore characters.

<div align="center">

A to Z, a to z, 0 to 9 à ê è ô ù # $ % & ( ) - _ ! ^ ' { } ~ â ë ï î ì ò û ÿ á í ó ú

</div>

With adaptive recording enabled, two items are saved to the archive file for each point, identified by the text 'MAX' or 'MIN' appended to the point's tag.

Where a power-off event, or a change in time base appears on the screen, an archive file is generated for each time segment.

Notes:
1. Screen archive is available only from trend history display.
2. Screen archive to PKD file is available on all recorders, whether the archiving option is fitted or not
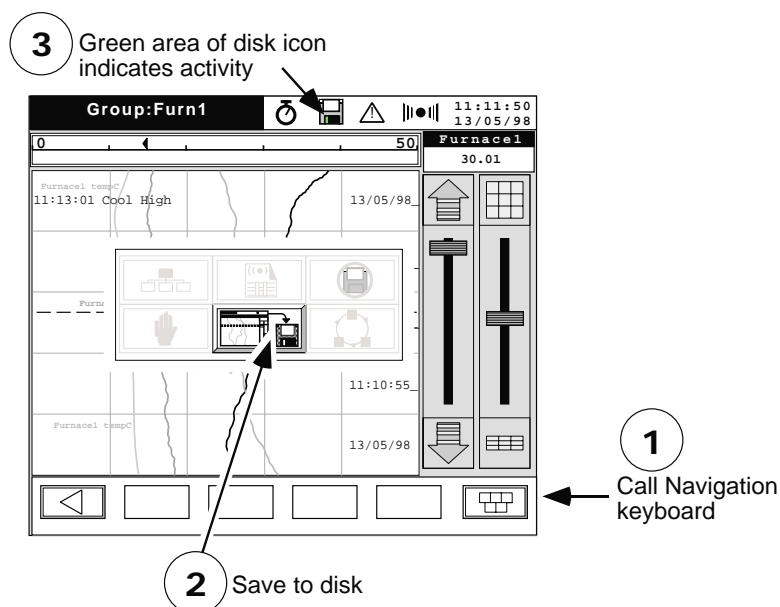

Figure 3.2.3c Saving the screen to disk

3.2.4 Full vertical trend display

> Note: To add this display mode to the 'Cycle screens' list the Display Access configuration must be entered, and 'Full Vert' set to 'yes'.

Similar to the normal Vertical trend display, this gives more resolution, by occupying the full width of the screen. The point 'faceplates do not appear, so point focus cannot be entered from this display but can be entered by going into point focus in another display mode, and then using the cycle screens key. Trend review is available as normal by touching the screen for two seconds. Figure 3.2.4 shows a Full Vertical Trend page.
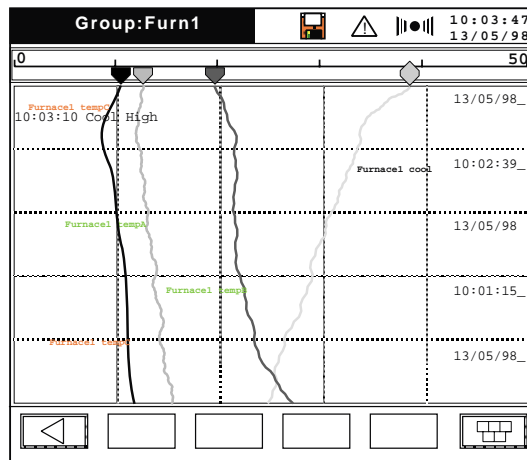

Figure 3.2.4 Full Vertical Trend display

3.2.5 Horizontal trend display

> Note: To add this display mode to the 'Cycle screens' list the Display Access configuration must be entered, and 'Horiz' set to 'yes'.

Again this display mode is similar to the Vertical trend mode, but the traces run horizontally instead of vertically. The point face plates operate in the same way as for vertical trending. Trend review is described above in section 3.2.3.
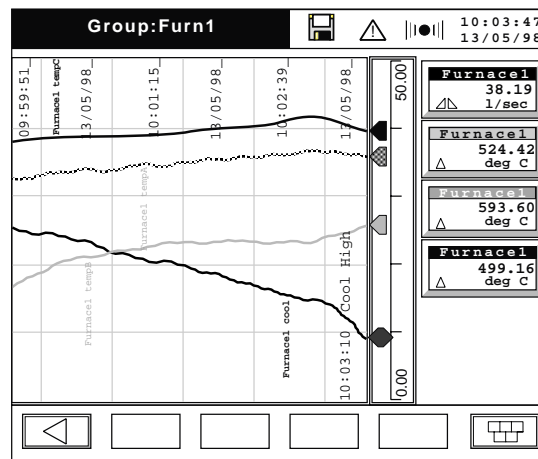

Figure 3.2.5 Horizontal Trend display

3.3 BARGRAPH DISPLAYS

Note: To add Vertical Bargraphs display mode to the 'Cycle screens' list the Display Access configuration must be entered, and 'Vert bars' set to 'yes'.

As described in section 3.1 above, the Cycle Screens key can be used to replace the trend display with a bargraph version of the group, as depicted in figure 3.3. As with the Trend display described above, pressing one of the point faceplates calls a bargraph version of the Point Focus display (figure 3.3b).

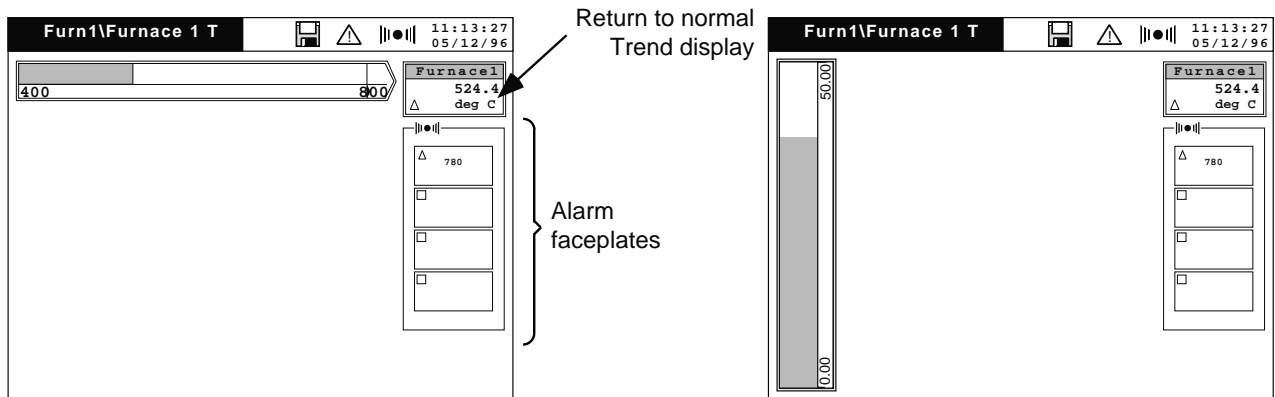To return from point focus to standard bargraph, touch the channel faceplate again.

Figure 3.3a Standard horizontal and vertical bargraph displays
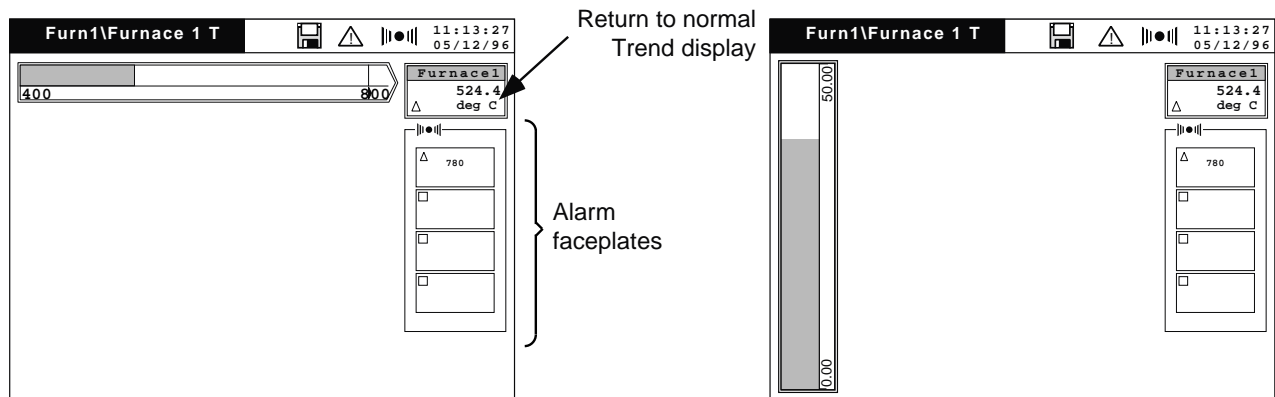

Figure 3.3b Point focus bargraph displays

As with the point focus trend display, the alarm faceplate can be used to change the threshold if the user has permission (section 5.14).

3.4 NUMERIC DISPLAYS

As described in section 3.1 above, the Cycle Screens key can be used to replace the bargraph display with a numeric display of the group points, as depicted in figure 3.4a. As with the Trend/Bargraph displays described above, pressing one of the point faceplates calls a numeric version of the Point Focus display (figure 3.4b).

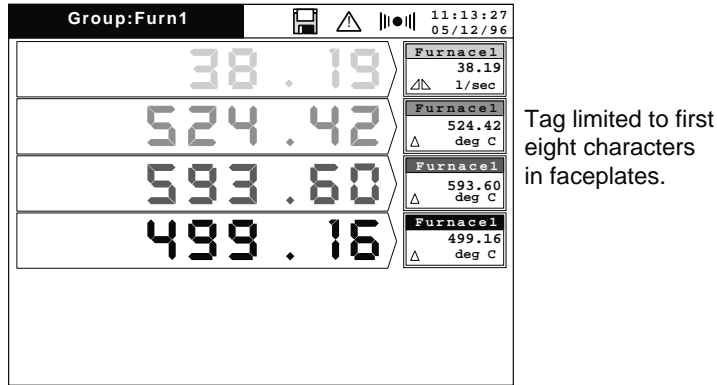To return from point focus, touch the channel faceplate again.

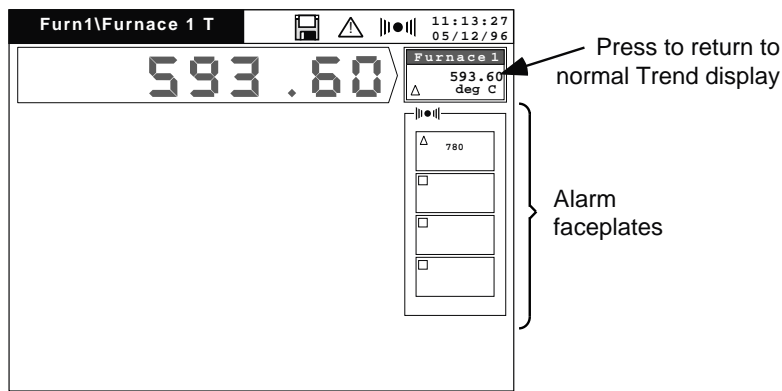Figure 3.4a Standard numeric display

Figure 3.4b Point focus numeric display

Note: In both the above displays, digital inputs would be shown as sets of switch contacts.

As with other point focus displays, the alarm faceplate can be used to change the threshold if the user has permission (section 5.14).

3.5 ALARM SUMMARY DISPLAY

The alarm summary page can be called from any other page, using the 'Page' item in the pop-up 'Navigation' keyboard.

The alarm summary page contains the latest 16 alarm events. 15 further pages can be called, which allows up to 256 alarm events to be viewed. When all the pages are full, further alarms will cause the oldest alarms to be discarded, whether or not they are active/acknowledged etc.

When first called, the page contains alarm events from all sources, showing alarm number and type, the date/time each alarm became active and (if relevant) the date/time it was cleared. Active alarms are highlighted with a red background, flashing if not acknowledged.

By selecting (touching in the Group column) an alarm event and then touching the 'Group' filter key (figure 3.5) then only those alarm events which are associated with the selected point's group will be displayed. In the same way, you can choose to display only those alarm events which are associated with the selected alarm event's point, by using the 'Point' filter key.

Figure 3.5 Alarm summary page

The alarm acknowledge key acknowledges all active alarms on display (i.e. All, Group, or Point alarms, according to which filter (if any) is in use).

The Next/Previous page icons appear only when appropriate.

Note: Only the first seven characters of the group name appear in the group column. This should be borne in mind when configuring the group title. For example, Group names 'Furnace1' and 'Furnace2' would both appear as 'Furnace'

3.5.1 Trend history skip

After an alarm event has been selected, a touch of the Trend History Skip key calls the trace history page for that group, with the alarm trigger point and cursor at the centre of the display. The message 'Trend Data Expired' appears instead, if the alarm trigger data has lapsed. The amount of trace stored depends on a number of things including the total number of points configured, scan rate, amount of memory etc. as discussed in section 2.1.3 above.

The trend history display will be vertical or horizontal depending on configuration, as detailed in table 3.5.1 below. An 'X' in a column means that it does not matter whether the entry is yes or no (i.e. X = don't care).

Currently selected Group Display mode	Enabled display modes			Resulting trend history mode
	Vertical trend	Horizontal trend	Bars	
Numeric	No	No	X	Vertical
Numeric	No	Yes	X	Horizontal
Numeric	Yes	No	X	Vertical
Numeric	Yes	Yes	X	Vertical
Vertical trend				Vertical
Full vertical trend				Vertical
Horizontal bars				Vertical
Horizontal trend				Horizontal
Vertical bars				Horizontal

Table 3.5.1 Vertical/horizontal trend history mode parameters.

Section 4: Operator pages

Contents list

Section **Page**

Section 4: Operator pages

4.1 INTRODUCTION

The display pages are divided into two sets; those which are accessible to any operator (called 'Operator pages' and those for which a password is required (called 'Configuration' pages and described in section 5). It is possible, in the 'Conf:Access' pages to enable or disable some of the items to which the operator has free access through the operator pages (e.g. the ability to change alarm thresholds). These items are listed in section 5.14.

The top level of Operator pages is accessed from the 'navigation keyboard' below the bottom right-hand corner of the display, as shown below in figure 4.2. The actual contents of this page depends on the number of options fitted to the recorder: for the purposes of this manual it will be assumed that the only option fitted is a disk drive. For details of all other options, reference should be made to the options manual.

4.2 TOP LEVEL OPERATOR PAGE

This page appears when the 'Hand' symbol of the pop-up keyboard is pressed, as shown in figure 4.2. The figure shows access from the Area page, but it is equally possible to call it from any other page (except of course, the page itself).

Each of the items which appears in the left hand column is accessed by touching the item, then using the 'Step down' key as described in section 2 above.
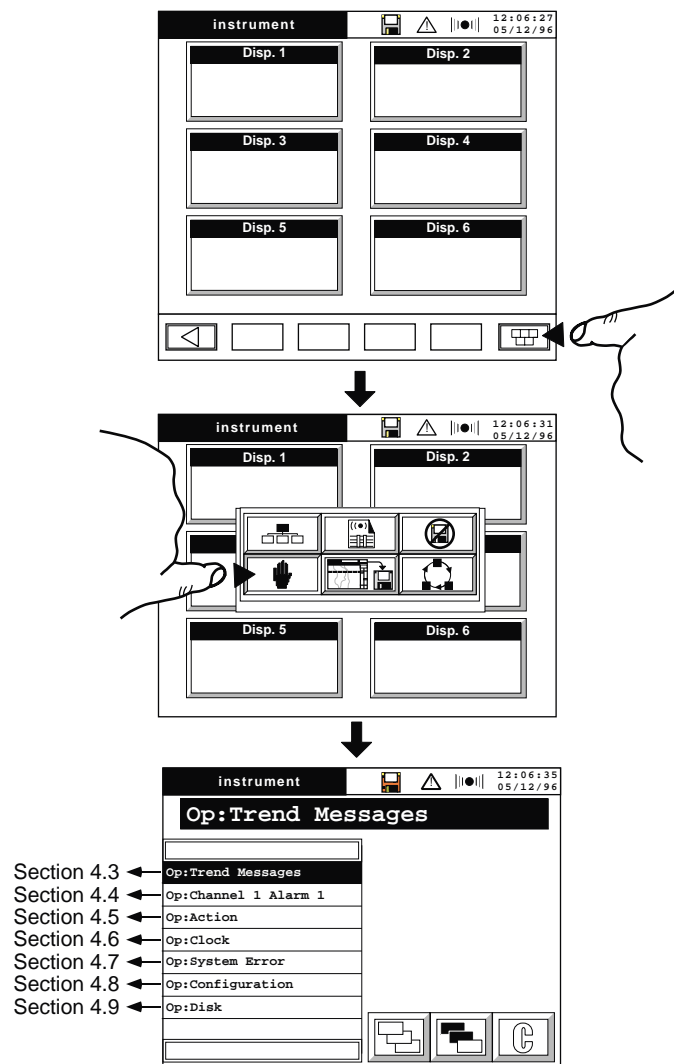

Figure 4.2 Access to top level operator page

Note: In common with the rest of this manual, shading in the figures is used only sparingly in order to optimise the quality of reproduction. As a result of this policy, the illustrations do not always match the actual display pages they are intended to represent.

4.3 TREND MESSAGES

This feature allows one of two 'Operator messages' to be queued for 'printing' on the display. The messages are fully editable by the operator and can include the current date, time, numeric value of a point etc. automatically. See 'Embedded sequences' in section 5.8 for further details.
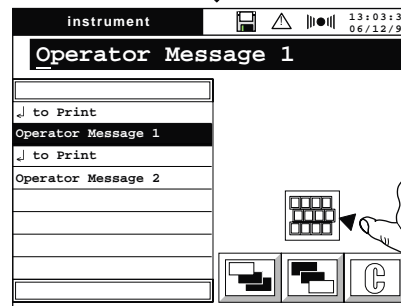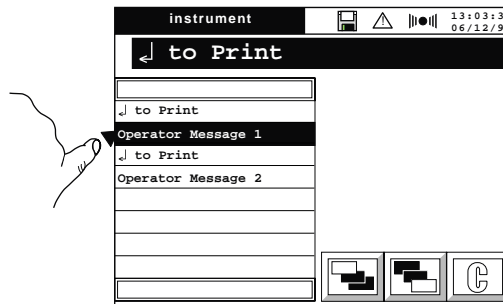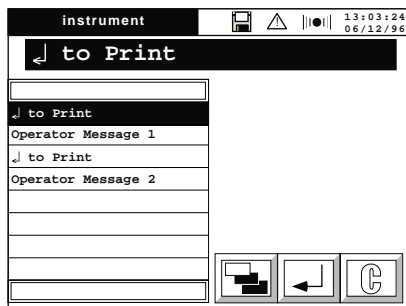
↵ to Print

Operation of the ↵ key causes Operator message 1 or 2 to be sent to the trend screen

Operator Message 1(2)

When this item is selected the 'Call qwerty' key appears. Touching this icon causes the screen to be filled with a qwerty keyboard.

Alternative character sets are available using the Caps key, and the scroll up/down keys (figure 5.3.1b). The left and right cursor keys allow the user to move to a selected character in the string for modification.

Once entry is complete, the Quit (Door) key is pressed, followed by the 'Enter' key to confirm the changes or the X key to remove the changes made.

Figure 4.3 Trend message pages

4.4 ALARM VIEW

This feature is accessed by selecting the Op:Channel 1 Alarm 1 item in the top level operator page   This allows the user to select a channel and one of its associated alarms for viewing, and if the relevant operator permissions allow, to change the threshold value.

If access permission exists, a numeric keyboard fills the right-hand half of the screen to allow the existing value to be edited.

The alarm pick list is called by touching the alarm number character in the status line, once the required channel number has been selected.

Examples of the types of display that can occur are as follows:

Alarm is off
   This means that the alarm is disabled

Abs Hi (Lo) Thold 780.00
   The alarm is an Absolute High (Low) type with a threshold of 780.00

Dev In (Out) Ref 80.00
Deviation   1.00
   This is a deviation in (out) type alarm with a reference value of 80, and a deviation of ± 1.00

Roc Ris (Fall) Chg   1.00
Per second
   This means that the alarm is a Rate-of-Change Rising (Falling) type, with a change value of 1.00 and a period (within which the change is acceptable without triggering the alarm) of 1 second.

Full details of alarm types/actions etc. are to be found in section 5.3.2
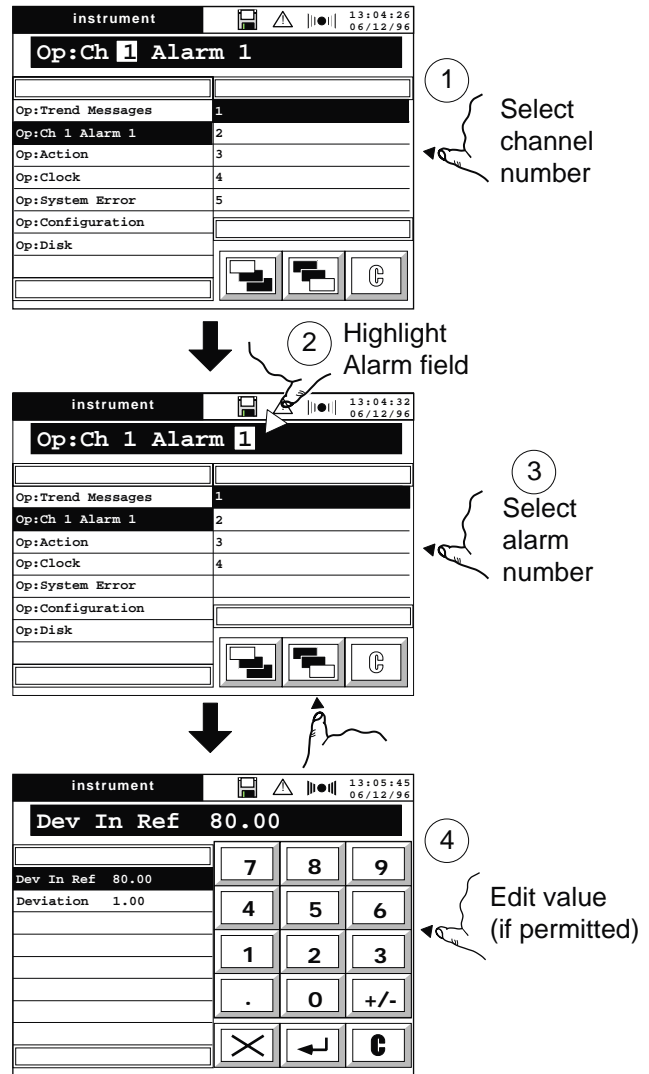

Figure 4.4 Alarm view pages

4.5 OPERATOR ACTION

This display consists of a single statement (default: ↵ to ACK ALL). In the case of this default, operation of the 'Enter' key acknowledges all active alarms.

4.5.1 To change the action

The way this function works is that from this page only, the 'Enter' key acts as a trigger to what is called an 'internal event'. In Event configuration (section 5.10) you will find that event 1 has 'Operator key' as its source, and 'Ack all alarms' as its Job Nº 1. By changing Job Nº1, or by adding a further action as Job Nº 2, you can change what happens when you operate the 'Enter' key on the Operator Action page.

4.5.2 To change the name

The Operator Action Configuration page (Section 5.6) allows you to change the text string from '↵ to ACK ALL' to the text of your choice, and also allows you to define the key's operation as latching or not.

4.6 CLOCK

This page displays the time and date as held in the recorder's real-time clock. To change the time, date, and date format, the Clock configuration page must be accessed (section 5.7).

4.6.1 Back-up battery

The system date and time, and any volatile maths or totaliser values are maintained under power-off conditions, by a replaceable coin-cell battery. For typical recorder usage, such as those described below, this battery will last for over two years. A replacement procedure is given in section 1.3 (Preventive Maintenance) above.

TYPICAL USAGE EXAMPLES

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

4.7 SYSTEM ERROR

This page displays any active system errors a selection of which is shown in figure 4.7.

Bad Remote CJ Temp
   This means that the remote CJ facility is enabled, but there is no 'GOOD PV' available as a remote CJ source.
↵ Clr Disk Overdrive
   This means that the internal archiving buffer is full. Cleared by touching ↵ key.
Battery Failure.
   This tells the user that the RAM support battery is no longer holding its charge and should be changed.
Clock Failure
   The internal clock was corrupt at power-up, or the time has never been set. The error is cleared by setting the current time and date. Can be caused by an exhausted battery, which would have a separate error (Battery Failure)
EEPROM DB defaulted
   Part of the configuration was found to be corrupt at start-up and the data base has been defaulted
Bat backed RAM cleared
   This appears if the back-up battery has failed and the unit has been switched off for more than 48 hours (typ) without the battery being replaced. This RAM maintains the real-time clock, and holds totaliser and counter values if the Totaliser/Counter/Timer option is fitted.
DV Run time error
   Occurs if there is a reason why a valid PV cannot be generated from a derived variable channel (e.g. the denominator in a division function passes through zero).
Output ch Failure
   Output channel hardware fault
Input Chan Failure
   Input channel hardware fault, or if configured to use a remote CJ, the remote CJ is disabled or not supplying a suitable signal.
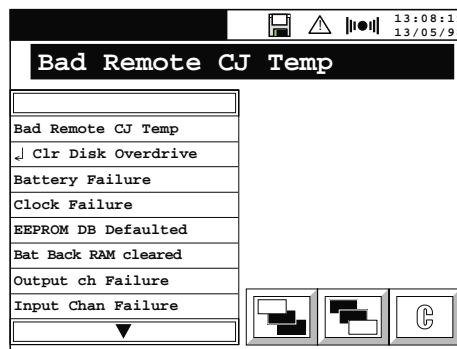

Figure 4.7 System error display page

4.8 CONFIGURATION

This allows the operator to access the configuration pages (section 5) of the instrument upon entry of the correct password. For further information see section 2.2.1 or section 5.2.1.

The factory entered password is 00010, but this can be edited in Instrument Configuration (section 5.2)

4.9 DISK PAGES

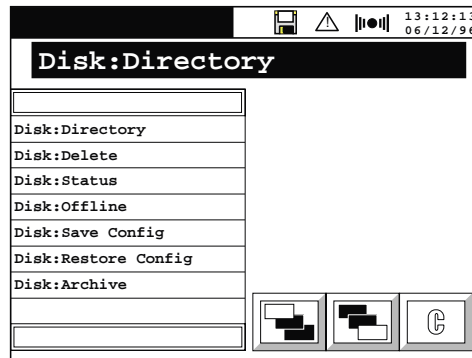
Figure 4.9 Disk pages

All these pages, except 'Disk:Archive' are fully described in Section 6.

Note:
1   Operator access must be enabled (section 5 .14) before disk fields other than 'Directory', Status' or 'Offline' become available to the operator.

4.9.1 Archiving to disk

Selecting 'Disk:Archive', then operating the step down key, calls the 'Enter to send log' page depicted below. Operation of the enter key causes the contents of the selected log to be sent to the relevant file on the disk. Log 1 is always saved to the file defined in the 'Archive 1' configuration page; log 2 is always sent to the file defined in the 'Archive 2' configuration page (see section 6).

The contents of logs 1 and 2 are set in group configuration (section 5.4), where Log 1 and Log 2 appear in the scroll list after display groups 1 to 6. (If the maths pack is fitted, the DV group comes between Log1 and Log 2 in the list.)

Either of the two logs can also be sent to disk by job action (section 5.3.2), and if an archive interval is set in 'Archive 2' configuration, then the contents of log 2 can be sent to disk automatically at that archive interval. Setting the interval to 00:00:00 stops automatic logging.
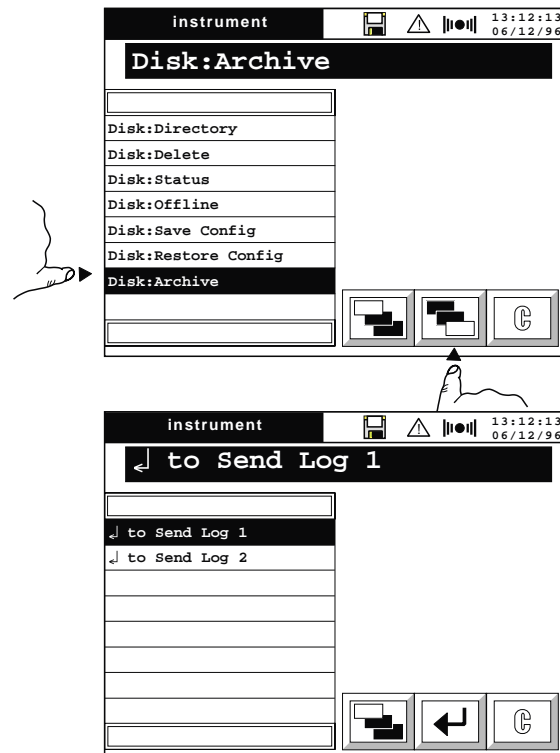

Figure 4.9.1 Enter to archive

Notes:
1   Before archiving, always ensure that a memory card or disk is fitted. No warning is given if an attempt is made to archive when no disk is present. The recorder will continue to try to send the data until a disk is fitted.
2   Any attempt to write to a write-protected floppy disk will result in an error message appearing on the screen

This page is deliberately left blank

Section 5: Configuration pages

List of Contents

(Continued)

LIST OF CONTENTS (Cont.)

Section 5: Configuration pages

5.1 INTRODUCTION

Section 5 describes the configuration pages associated with the unit. Configuration is entered by means of a password as described in section 2.2.1 above. This results in the appearance of the top level configuration pages as depicted in figure 5.1

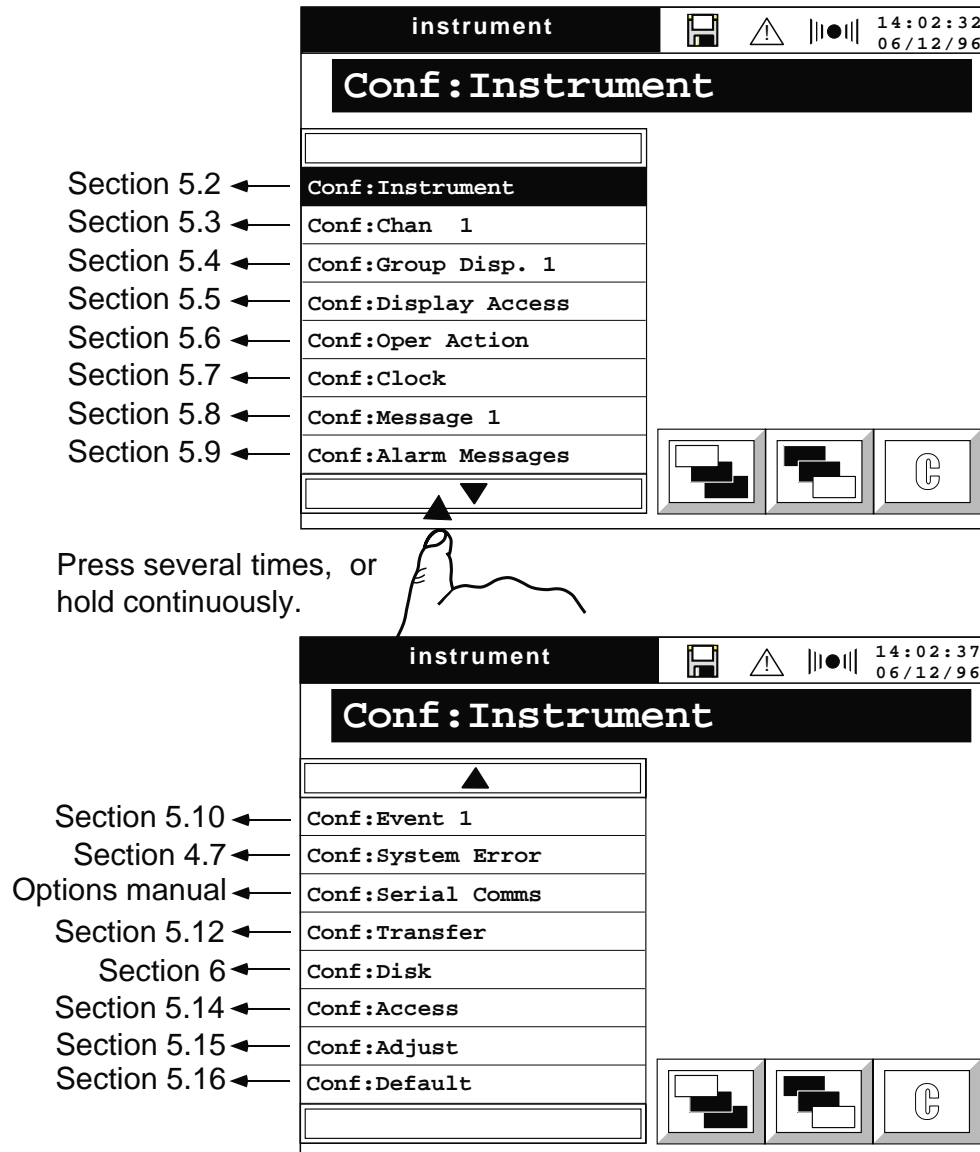Note: The unit is despatched from the factory with a password of 00010.

Figure 5.1 Top level Configuration pages

5.2 INSTRUMENT CONFIGURATION

Selection of Conf: Instrument, followed by the 'Step down' key calls the Top Level Instrument Configuration page.

5.2.1 Set Password

To enter a new password, the 'Call qwerty' key is used to call the first of the keyboards to the display. Use of the up and down arrow keys and the 'Caps' key allows the alternative character sets to be displayed. Enter any five-character alpha-numeric string. For full details of the character sets see figure 5.3.1b below.

Note: Setting the password to 00000 disables the password altogether, allowing immediate access from the 'OP:Configuration' item in the top level Operator page.
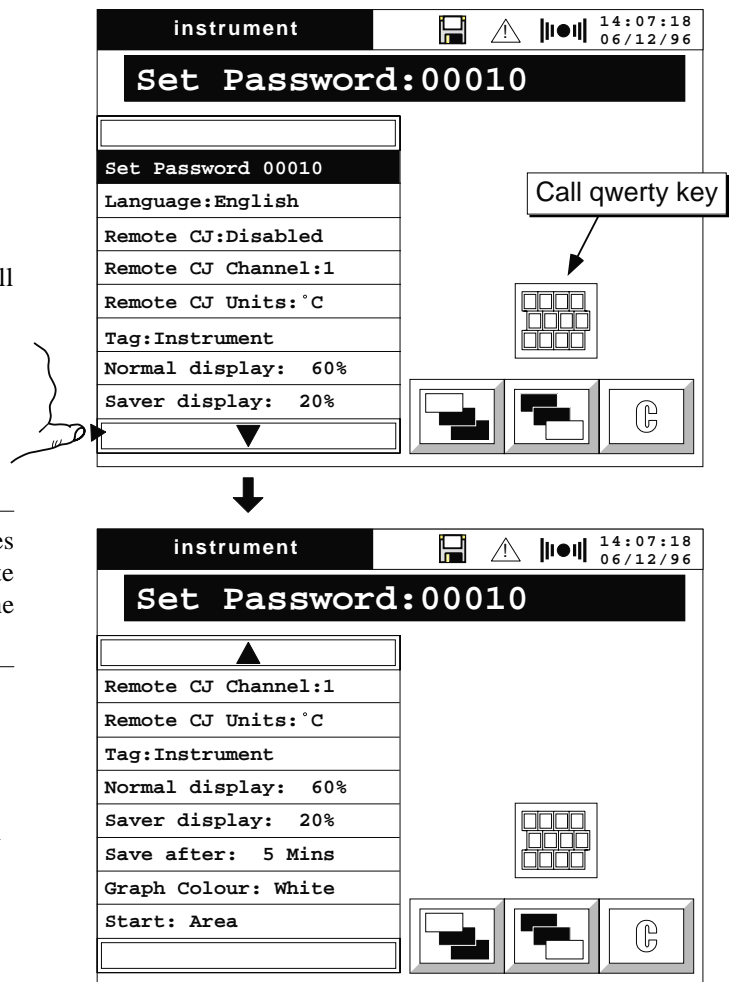
5.2.2 Language

Selection of this item shows that English, French or German can be chosen from the right-hand pick list. All further displays are in the selected language

5.2.3 Remote CJ

One of the configuration items for each thermocouple input channel, is 'CJC type' which can be set to Internal, External or Remote. It is here, in Instrument configuration that a separate channel can be defined to measure the remote CJ temperature. Remote CJ can also be enabled and disabled here, and its temperature units defined as Celsius, Fahrenheit, Kelvins or Rankine.

When configuring the channel which is measuring the remote CJ temperature, the temperature units must match the Remote CJunits.

5.2.4 Tag

As with the password, described above, the qwerty keyboards are used to enter an instrument descriptor of up to 20 characters, to appear in the Title Bar of the Area display and the Operator and Configuration display pages.

5.2.5 Normal/Saver display

As despatched from the factory, the normal operating brightness of the display is 60% of maximum. This changes to 20% of maximum after 5 minutes of 'no action'. Both the normal and 'saver' display brightnesses can be set between 20% and 100% in 10% increments, and the time-to-dim (Save after:) can be set in minute increments from 1 to 99 minutes.

5.2.6 Graph colour

This allows the background (chart) colour of all trend displays to be selected white or black. Figure 5.2.6 is an attempt to depict the two modes.

Any item which is black on the chart when Graph colour = White, is white on the chart when Graph colour = black..

This selection applies to all trend mode displays.
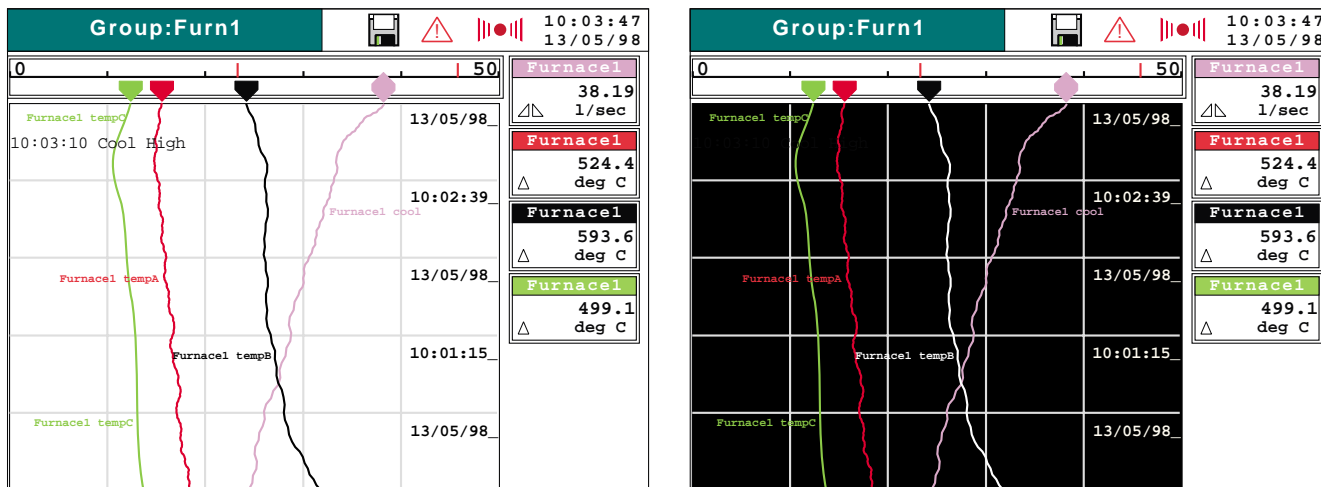
Figure 5.2.6 Trend displays with white and black backgrounds

5.2.7 Start

This allows the start-up screen type to be selected from Area, Alarm (history), or any of the display groups. For example, if display group 3 is selected as the Start-up screen, then at every subsequent power up, display group 3 will be presented, in whatever display mode was last selected for it (default is vertical trend mode).

Earlier versions of the recorder always start up in area display.

5.3 CHANNEL CONFIGURATION

Note: Changing input type to or from 'digital' will cause the history of any group which contains that channel to be lost.

Accessed by Selecting 'Conf:Channel 1' from the top level Configuration page, then choosing the required channel number from the pick list, then operating the Step Down key.

This brings the top level Channel Configuration page to the display. As can be seen from the figure, the channel configuration is split into three sections: Range, Alarms and Trace.

5.3.1 Channel range configuration

Input type

The default input type is OFF. The picklist on the right hand side allows one of the following input types to be selected: T/C (Thermocouple), mV, V, mA, RTD (Resistance thermometer), Ohms, Digital input, Comms. or Test.

Subsequent items appearing in the left and right hand columns depend to a certain extent on the input type selected. For this reason some of the items described below may not appear for some configurations (e.g. 'CJC Type' does not appear for RTD input type).

Input range

The low and high settings should match the lowest and highest values which will be applied to the channel. This allows the recorder to choose the best (i.e. most accurate) electronic range for your input. The values are entered using the numeric keyboard.

Shunt value

For mA type inputs only, this allows a shunt value to be entered. The entered value must match that of the fitted shunt, or gross errors will occur.

Input units

For T/C and RTD inputs only, allows Celsius, Fahrenheit, Kelvins or Rankine to be selected. For those channels using a Remote CJ, these input units must match the Remote CJ units set up in Instrument configuration (section 5.2.3 above).
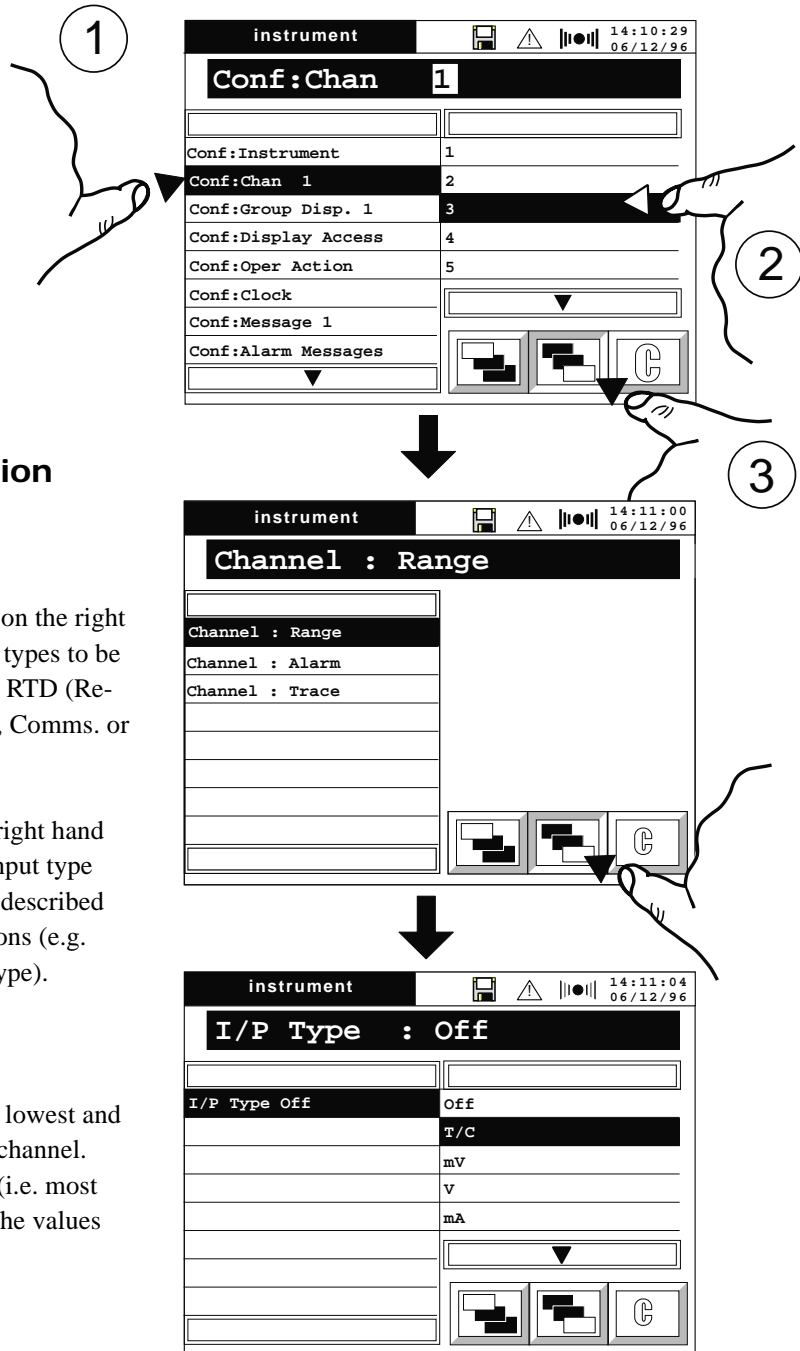
Figure 5.3.1a Entry to Channel range configuration

5.3.1 CHANNEL RANGE CONFIGURATION (Cont.)

Linearisation type

The linearisation types (if any) which appear on the scroll list depend on the Input Type selected. The complete list is:
Linear, square root, $x^{3/2}$, $x^{5/2}$,
Thermocouple types B, C, D, E, G2, J, K, L, N, R, S, T, U, Ni/NiMo, Platinel,
RTD types PT_{100}, Pt_{1000}, Ni_{100}, Ni_{120}, JPT_{100}, $Pt_{100}A$, Cu_{10}

CJC type

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

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

External is used where the cold junction of one or more thermocouples is maintained at a known temperature. When 'External' is chosen as CJC type, the known temperature is entered using the keyboard.

Remote uses a temperature sensor connected to a separate input channel to measure the cold junction temperature of one or more remote thermocouples. This allows copper cable to be used from the remote location to the recorder, instead of high cost compensation cable. The input channel for the CJ temperature measurement is set up in 'Instrument' configuration (Section 5.2.3).

Unscaled/scaled

This allows the input to be scaled (e.g. 4 to 20 mA input = 0 to 250 RPM). The scaling low (0 for this example) and high (250) values are entered using the keyboard. The Scale units (RPM) are entered using the qwerty keyboard.

Value Format

Allows the decimal point position to be chosen for the process value from the right-hand pick list.

Damping

For 'noisy' slowly changing signals, damping can be used to filter noise so that the underlying trend can be seen more clearly. 2, 4, 8, 16, 32, 64, 128 or 256 seconds can be chosen from the right hand pick list.

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

Effect of damping on step change in input signal
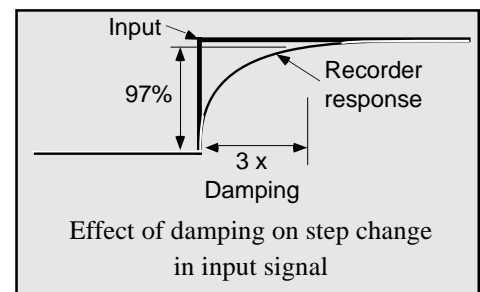
Break Response

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

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

5.3.1 CHANNEL RANGE CONFIGURATION (Cont.)

Open / Closed

For Input Type digital, the PV display consists of a text string. The strings to appear under open (logic low) and closed (logic high) conditions (Open, Close, Hi, Lo, On, Off) can be chosen from the pick list. If __–__ and _____ are chosen for Open and Closed, then the input will be shown graphically as a common/normally open pair of switch contacts on the point faceplate and in the Numeric display mode (see section 3)

Test Waveforms

When Input Type is selected as 'Test', the following test waveforms can be selected:

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

Tag

This allows a 14-character descriptive name (tag) to be associated with each channel using the qwerty keyboard(s). This tag is used both for display alongside the channel and for logging. It should be noted that on point faceplates (section 3), the tag is truncated to the first eight characters only. Thus 'Furnace1 TempA' and 'Furnace1 Cool' would both appear as just 'Furnace1'.

The figure below shows the character set available to the user. To save space, both the normal and the shift sets are shown in the three diagrams. When the text string has been entered, the Quit key returns you to the page which called the keyboard, where the step up and step down keys are temporarily replaced with Cancel and Enter keys. These two keys allow you to Cancel the changes made, or to Confirm them, respectively.
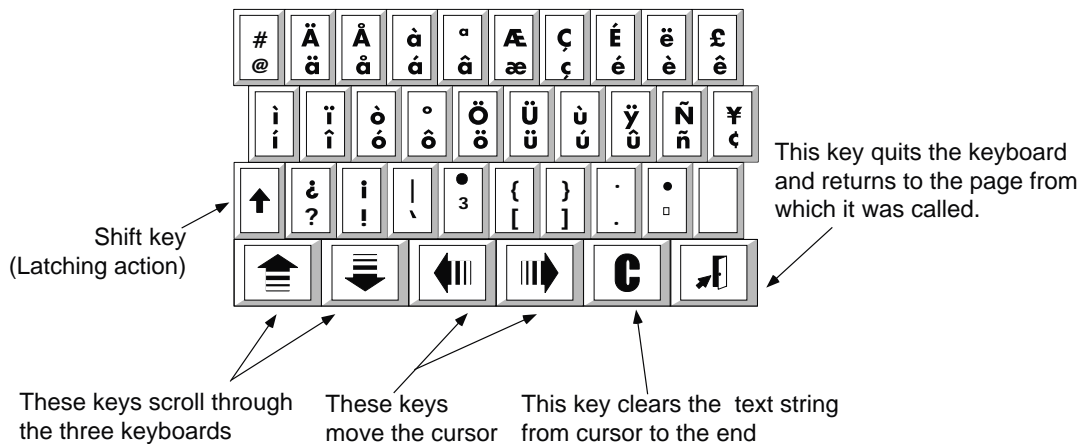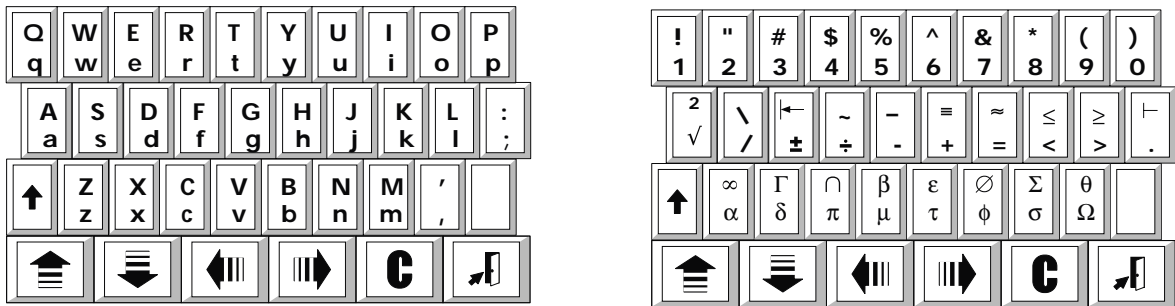

Figure 5.3.1b Character set

5.3.2 Alarm configuration

Up to four alarms can be configured for each channel.
For absolute and deviation alarms, a hysteresis value
can be entered to prevent spurious triggering should
the process value 'hover' around the alarm threshold.
For all types of alarm, a Dwell period can be config-
ured, and if the alarm clears within this period, the
alarm is ignored.

Each alarm can initiate up to two jobs, as described in
this section (Jobs configuration)

Setpoint configuration

Allows you to set up alarm type, threshold value,
hysteresis etc. Figure 5.3.2a shows the top level page
for absolute alarms. For deviation and rate-of-change
alarms, some of the menu items will be different from
those shown.

Enable

Off   The alarm is disabled

Unlatched   When triggered, the alarm stays active until the
triggering source returns to a non-alarm state.
Alarm indicators flash until acknowledged or
until the alarm clears. When acknowledged, the
indicator stays on permanently until the alarm is
no longer active. Alarm messages appear on the
trend display.

Latched   When triggered, the alarm stays active until it
has been acknowledged and the triggering source
returns to a non-alarm state. Alarm indicators
flash until acknowledged, then stay permanently
on until the alarm is no longer active. Alarm
messages appear on the trend display. Continu-
ous jobs (e.g. change chart speed) remain active
only until the triggering source returns to a non-
alarm state (whether acknowledged or not).

Trigger   When triggered, any jobs associated with the
alarm are initiated, and for continuous jobs (e.g.
sound buzzer) continue until the triggering
source returns to a non-alarm state. Trigger
alarms are not annunciated, nor do alarm mes-
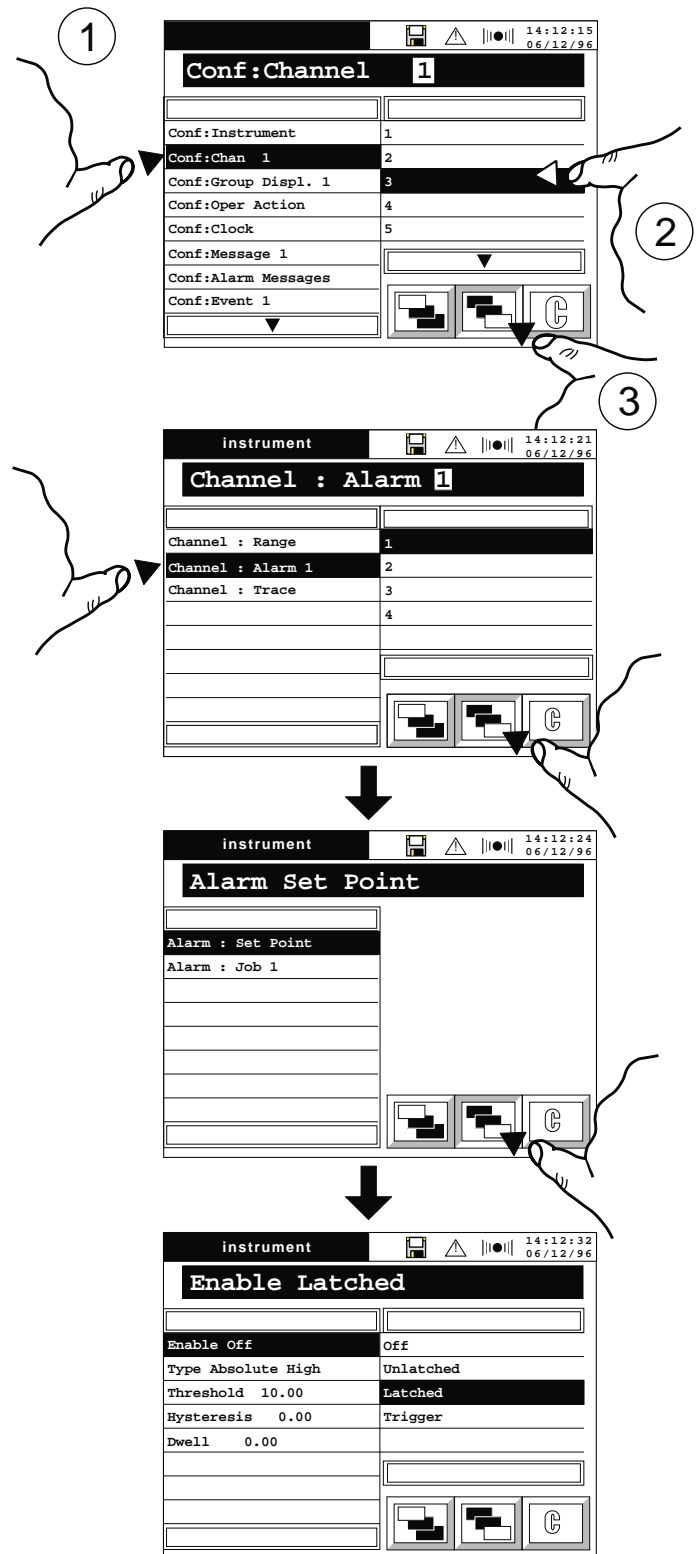sages appear on the trend display.

Figure 5.3.2a Entry to channel alarm configuration

5.3.2 ALARM CONFIGURATION (Cont.)

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

ALARM TYPES

Absolute alarms

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

An absolute low alarm becomes active when the PV value falls below the alarm threshold value. The alarm remains active until the measured value rises above (*setpoint + hysteresis*)
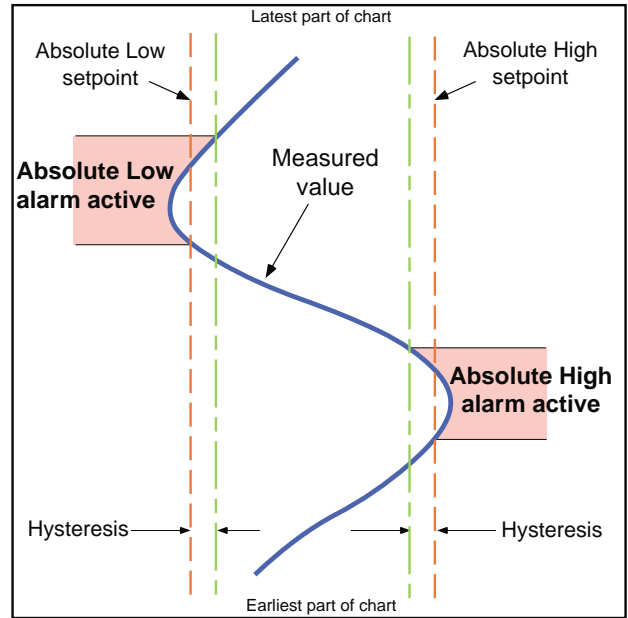
Figure 5.3.2b Absolute alarm definition

Deviation alarms

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

'Deviation out' alarms are active

a. when the PV value rises above (*Reference + Deviation*), and remains above {(*Reference + deviation*) - *hysteresis*}, or

b. when the PV value falls below (*Reference - Deviation*) and remains active until the PV value rises above. (*Reference - Deviation*) + *Hysteresis*.

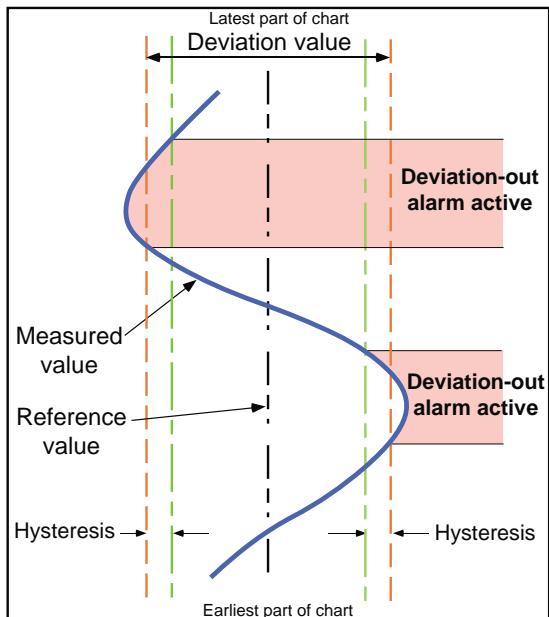'Deviation in' alarms are the inverse of the above, as shown in the sketch below.

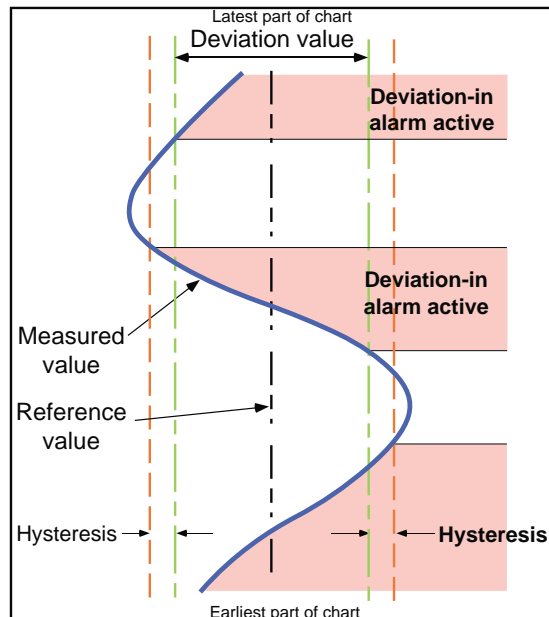

Figure 5.3.2c 'Deviation out' alarm definition

Figure 5.3.2d 'Deviation in' alarm definition

5.3.2 ALARM CONFIGURATION (Cont.)

Rate-of-change alarms

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

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

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

Figure 5.3.2e Rate of change alarm definitions

Alarm parameters

THRESHOLD
Sometimes called 'setpoint', this is the trip point for absolute alarms.

REFERENCE
For Deviation alarms, this sets a 'central' value on each side of which the Deviation Value (see immediately below) is to operate.

DEVIATION
For Deviation alarms only, this is a value each side of the reference value, within which a Deviation IN alarm is active, and outside which a Deviation OUT alarm is active. See figures 5.3.2c and 5.3.2d above.

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

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

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

HYSTERESIS
Allows a 'deadband' to be entered for absolute and deviation alarms, to prevent alarms being continuously triggered if the process variable value hovers around the trip point.

DWELL
This feature allows the triggering of any alarm to be delayed for a period configurable up to 2047 seconds. If the alarm source returns to a non-alarm state during the Dwell period, the alarm is ignored.
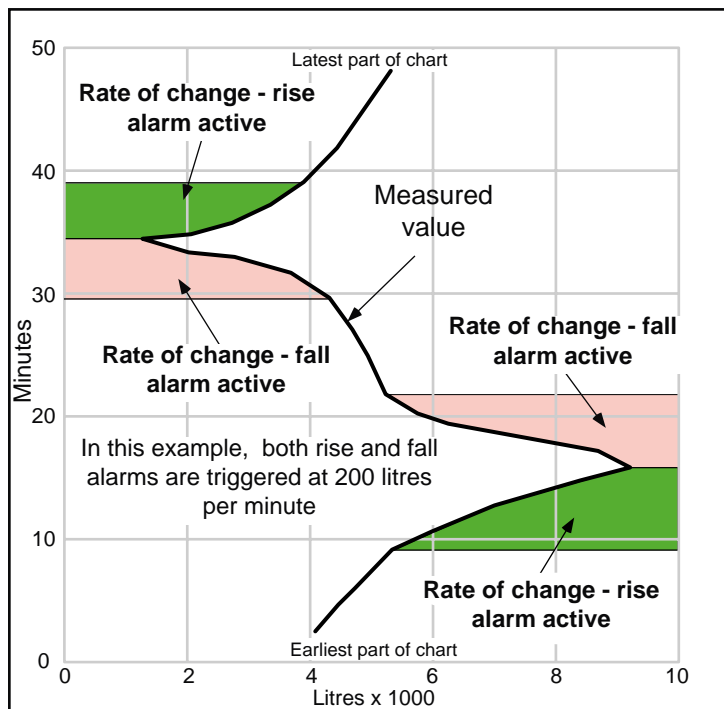
5.3.2 ALARM CONFIGURATION (CONT.)

Jobs Configuration

Each alarm can have two jobs associated with it, selected from the list in table 5.3.2 below. An example (to set Channel 3, alarm 2, job 2 to Print message 5 when the alarm is acknowledged) is given in figure 5.3.2f below.

Jobs cause the operation of the recorder to change as the result of an initiating trigger which can be an alarm going active, an event input, a totaliser reaching a previously specified value and so on. For definitions of maths pack, totaliser, counter and timer jobs, please refer to the options manual.

Notes:
1. The table below shows jobs for all options available at time of print. If an option is not fitted, its jobs do not appear in the scroll list.
2. DV = Derived variable (maths pack option); Tot = totaliser
3. Preset clock job sets the recorder clock to 12 noon. Trace history can support up to 100 time changes - data prior to the 100th time change ago is lost. This limitation does not apply to PC Review software.

.

No action	
Chart Span B Ch N	While Active, While Inactive, While UnAck'd
Chart Span B for all	While Active, While Inactive, While UnAck'd
Sound Buzzer	While Active, While Inactive, While UnAck'd
Disable all alarms	While Active, While Inactive, While UnAck'd
Ack All Alarms	On Going Active, On Going Inactive, On Acknowledge
Log 1 to archive 1	On Going Active, On Going Inactive, On Acknowledge
Log 2 to archive 2	On Going Active, On Going Inactive, On Acknowledge
Archive interval B	While Active, While Inactive, While UnAck'd
Print Message N	On Going Active, On Going Inactive, On Acknowledge
Display Message N	On Going Active, On Going Inactive, On Acknowledge
Message N to archive 1	On Going Active, On Going Inactive, On Acknowledge
Message N to archive 2	On Going Active, On Going Inactive, On Acknowledge
Reset DV N	On Going Active, On Going Inactive, On Acknowledge
Reset all DVs	On Going Active, On Going Inactive, On Acknowledge
Switch to B DV N	While Active, While Inactive, While UnAck'd
Disable DV N	While Active, While Inactive, While UnAck'd
Disable all DVs	While Active, While Inactive, While UnAck'd
Trigger DV N	On Going Active, On Going Inactive, On Acknowledge
Start Timer N	On Going Active, On Going Inactive, On Acknowledge
Reset Timer N	On Going Active, On Going Inactive, On Acknowledge
Increment Counter N	On Going Active, On Going Inactive, On Acknowledge
Decrement Counter N	On Going Active, On Going Inactive, On Acknowledge
Preset Counter N	On Going Active, On Going Inactive, On Acknowledge
Preset All Counters	On Going Active, On Going Inactive, On Acknowledge
Disable all Counters	While Active, While Inactive, While UnAck'd
Preset Tot	On Going Active, On Going Inactive, On Acknowledge
Preset All Tots	On Going Active, On Going Inactive, On Acknowledge
Disable All Tots	While Active, While Inactive, While UnAck'd
Add 1 hour	On Going Active, On Going Inactive, On Acknowledge
Subtract 1 hour	On Going Active, On Going Inactive, On Acknowledge
Preset clock*	On Going Active, On Going Inactive, On Acknowledge
* Sets the recorder clock to 12:00:00 (noon), leaving the date unchanged.	

Table 5.3.2 Jobs list

5.3.2 ALARM CONFIGURATION (Cont.)

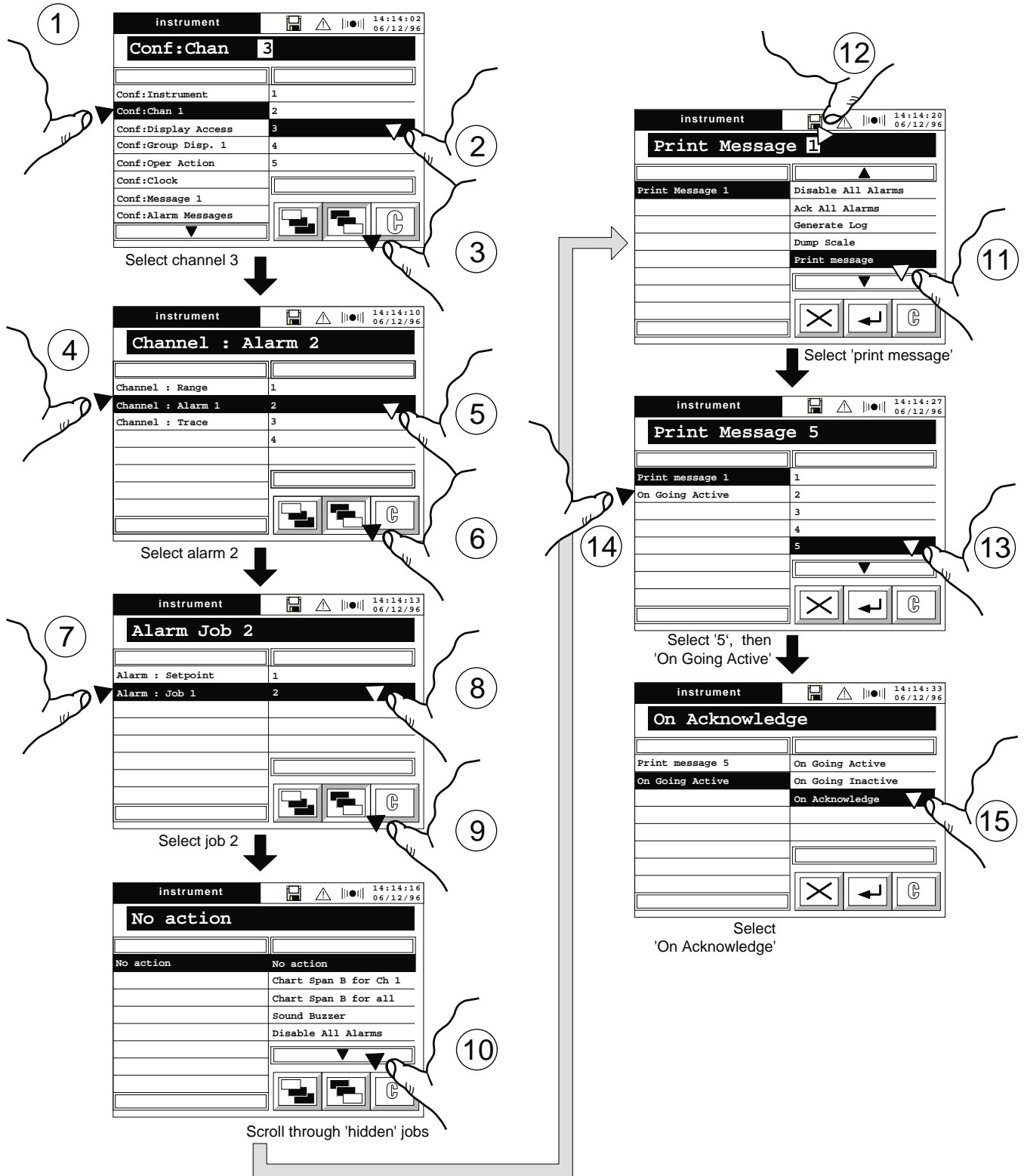### Job configuration (Cont.)

Figure 5.3.2f Job Configuration example
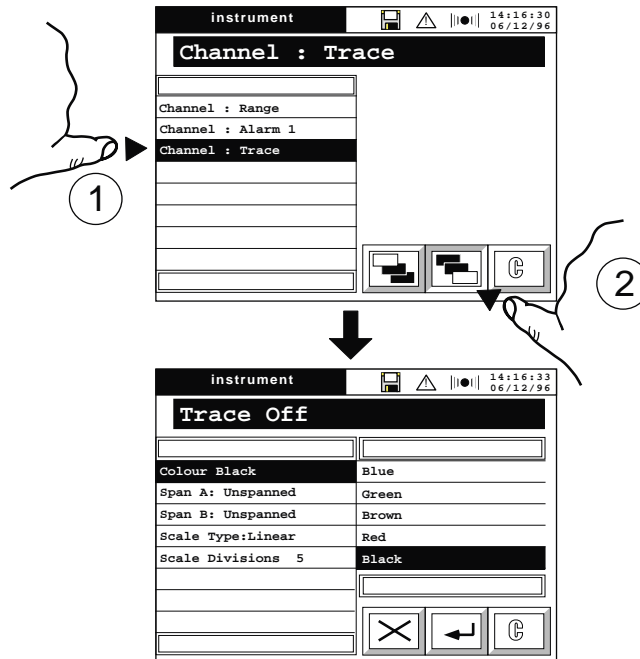
5.3.3 Channel trace configuration

Figure 5.3.3 Channel trace configuration

This section of configuration allows you to:

a. Select trace colour

b. Set spans A and B for the channel

c. Scale type and divisions

COLOUR

The following colours can be selected for each trace: violet, blue, green, brown, red and black. The channels' tags and scales are presented on the 'chart' in the same colour as the trace, allowing ready identification. Where channel traces cross, or where channels have identical traces, the trace associated with the higher channel number will overwrite the other(s). Derived variable traces overwrite input channel traces.

SPAN A/SPAN B

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

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

5.3.3 CHANNEL TRACE CONFIGURATION (Cont.)

Scale type

This allows the selection of linear or logarithmic as the scale type for the channel to appear at the top of the trend display pages. For linear scales, the number of divisions can be defined by accessing the 'Divisions' field below. For logarithmic scales, the divisions are decades. The figure shows linear (5 division) and logarithmic scales for the range 10 to 10000.

| 10 | | | | 10000 | Linear 5-division scale |

| 10 | | | | 10000 | Logarithmic scale |
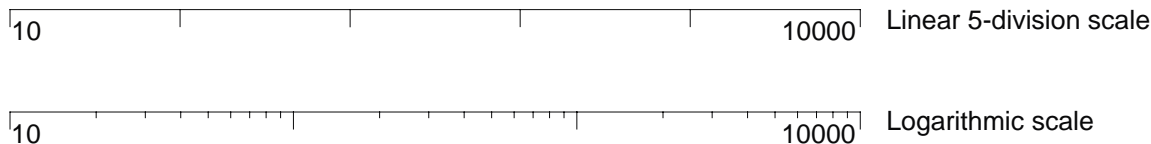
Note: Logarthmic scales must be entirely positive and non-zero. If a scale limit or process value is zero or negative, the trace is drawn at scale low.

Scale divisions

Allows any integer between 1 and 10 inclusive to be used for linear scales. This value is independent of the number of 'chart' divisions which appear on the screen and which is set up in Group Configuration (see section 5.4 below). For scales defined as logarithmic, the scale is divided into decades, as indicated above.

Linear scale divisions appear only in trend displays. Logarithmic scales also appear on bargraph displays.

5.4 GROUP CONFIGURATION

The basic recorder contains six display groups (groups 1 to 6) which contain groups of channels for trending on the screen.

If the maths pack option is fitted (options manual) a further DV group is added to allow groups of channels etc. to be averaged, reset etc. This group cannot be displayed.

If an archiving option is fitted (section 6) two log groups are added: Log 1 and Log 2, for sending logs to disk.

Group configuration allows the contents of each group to be defined, and for display groups, allows the 'trend interval' and group title to be set up as described below.

Adaptive recording (section 2.1.3) can be selected 'on' or 'off' for any display group, and applies to all points in that group. Grid divisions can be selected between 1 and 10, to vary the number of divisions across the 'chart'.

5.4.1 Group content

Initially, the groups are empty, so all channels and all relevant options (totalisers, counters, maths channels etc.) have to be added by the user, remembering that a maximum of six points can be placed in any one group.

Figure 5.4 shows a basic instrument with six input channels and no options having channel three added to display group 1. As can be seen, the selection of the item to be added is made from the 'status line' and then 'Yes' touched. (No is touched to remove previously entered items).

If options are fitted, they appear as extra lines in the left side of the screen, in the order:

Input channels (Ch) 1 to 6 (standard)
Input channels (Ch) 7 to 12
Derived channels (DV) 1 to 6
Derived channels (DV) 7 to 12
Derived channels (DV) 13 to 18
Derived channels (DV) 19 to 24
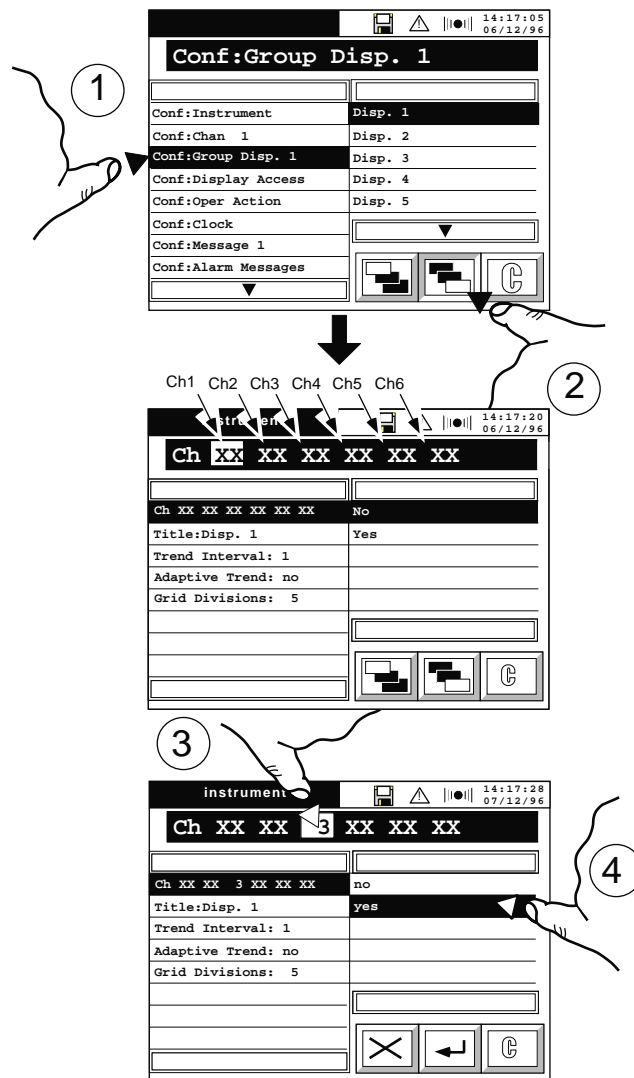Totalisers (To) 1 to 6
Counters (Co) 1 to 6

Figure 5.4 Access to group configuration

Note: Group history in trend review is lost if:
a   Group content is edited
b   The group sample interval is changed
c   The input type of any of the group's points is changed to or from 'digital'.

5.4 GROUP CONFIGURATION (Cont.)

5.4.2 Group title

For display groups only, allows a title of up to nine characters to be entered to describe the group. Characters are selected from the qwerty keyboards shown in figure 5.3.1b, above. When entering titles, the following should be borne in mind:

a   only the first seven characters of group titles appear in the alarm summary page.

b   When performing a screen dump of a trend review screen, non-valid characters are replaced by underline characters (see 'Screen archive' in section 3.2.3 for details).

5.4.3 Trend interval

Trend interval is entered using the numeric keyboard in whole seconds from 1 to 1200. This allows the amount of time per screen height to be set, there being 180 trend intervals per screen, Table 5.4.3 shows (a selection of) the resulting times which can be achieved. (See also section 2.1.3 for total storable trend time.)

As can be seen, the screen height increases by 3 minutes for each extra second of trend interval or by 1 hour for every extra 20 seconds etc.

Although, for reasons of space, the table does not include every possible trend interval, it is possible to work out non-included times/screen by simple arithmetic. For example if you want 24 hrs per screen, you can add the trend intervals for 20 hrs (400 secs) and for 4 hours (80secs) to give a trend interval of 480 seconds, or you can multiply the trend interval for 4 hours (80secs) by six and so on.

Interval	Time per screen height		
(secs)	seconds	minutes	hours
1	180	3	0.05
2	360	6	0.1
3	540	9	0.15
4	720	12	0.2
5	900	15	0.25
6	1080	18	0.3
7	1260	21	0.35
8	1440	24	0.4
9	1620	27	0.45
10	1800	30	0.5
20	3600	60	1
30	5400	90	1.5
40	7200	120	2
50	9000	150	2.5
60	10800	180	3
70	12600	210	3.5
80	14400	240	4
90	16200	270	4.5
100	18000	300	5
200	36000	600	10
300	54000	900	15
400	72000	1200	20
500	90000	1500	25
600	108000	1800	30
700	126000	2100	35
800	144000	2400	40
900	162000	2700	45
1000	180000	3000	50
1100	198000	3300	55
1200	216000	3600	60

Table 5.4 Trend interval *versus* screen height

5.4.4 Adaptive recording

As explained in section 2.1.3, it can sometimes be useful to ensure that short term or 'fast' transients are not missed, particularly at slow trend rates. Setting 'Adaptive Trend' to 'on', will enable adaptive recording for every point in the group.

Notes:
1. adaptive recording applies only to display groups
2. each point with adaptive recording enabled counts as two when calculating the total trend time in memory (table 2.1.3)

5.4.5 Grid divisions

This allows the number of grid divisions which appear on the 'chart' to be entered. Any number between 1 and 10 can be entered. An entry of '1' produces grid lines at 0% and 100% only. Setting the value to '2' divides the chart into halves with a grid line at 50% and so on, up to 10, which produces grid lines every 10% from 0 to 100% inclusive.

5.5 DISPLAY ACCESS CONFIGURATION

This allows the operator to select which of the display modes (section 3) to have in the 'Cycle Screens' scroll list.

All the available trend, bar and numeric modes can be selected to appear (yes) or not (no) as required, with 'Vertical Trend', 'Horizontal Bars' and 'Numeric' set to 'yes' as defaults.
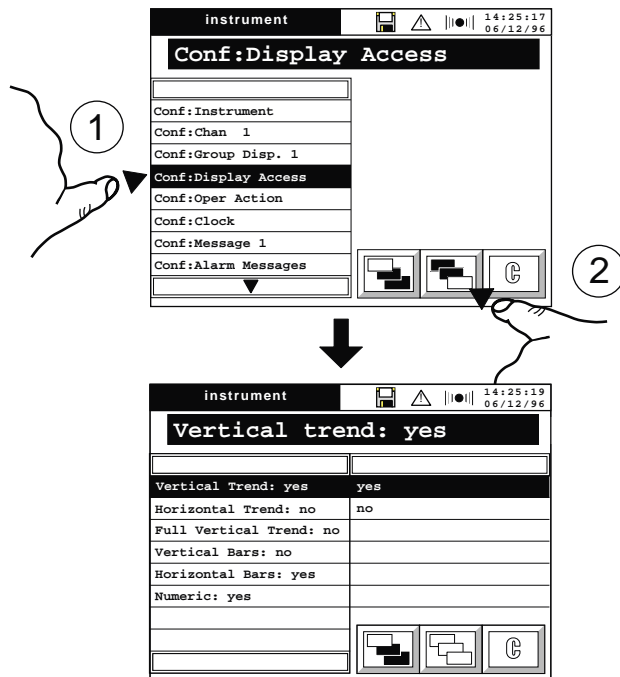
Figure 5.5 Display access pages

5.6 OPERATOR ACTION CONFIGURATION

This defines the text string (↵ to ------) which appears in the Operator Action page (section 4.5), and whether the trigger is to be latching or non-latching. Text entry is carried out using the qwerty keyboards (figure 5.3.1b).

When used from the Operator Action page, the 'Enter' key acts as a trigger to an 'internal event', and can initiate up to two jobs. See section 5.10 (Events) for more details
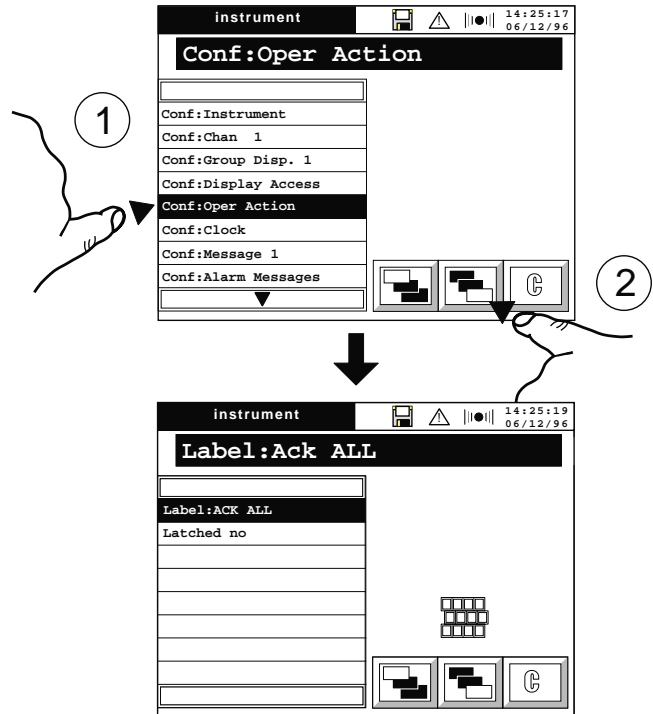

Figure 5.6 Operator action configuration

5.7 CLOCK CONFIGURATION

This part of the recorder's configuration allows you to set the current time and date using the keyboard, and the date format (Day/Month/Year or Month/Day/Year) from a pick list.

A valid date must first be set before the format can be changed.

The time and date are maintained, under power-off conditions, by a battery as described in section 4.6.1
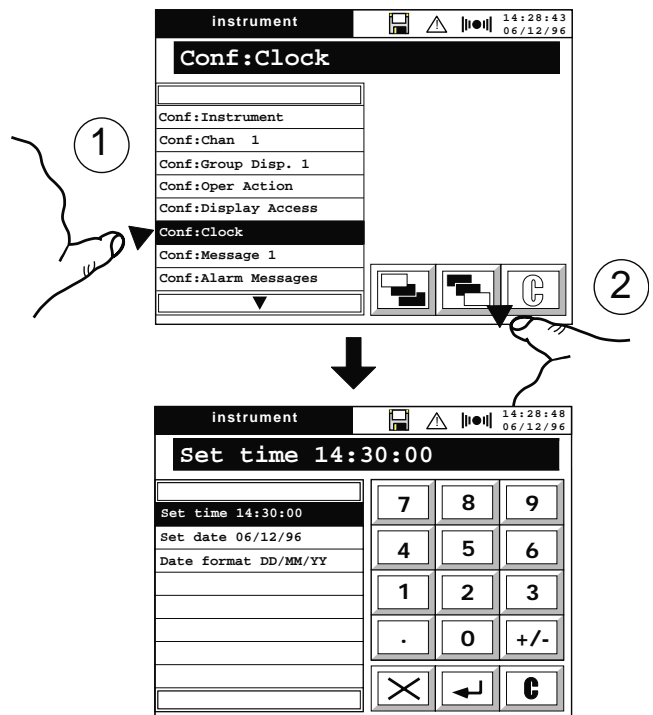

Figure 5.7 Clock configuration

5.8 MESSAGE CONFIGURATION

This part of the configuration allows up to 20 messages to be entered, for display and/or to appear on the 'chart' as the result of operator or Job action. Entered using the qwerty keyboards shown in figure 5.3.1b, these messages can include 'embedded sequences' as described below, including the operator messages described in section 4.3.

5.8.1 Embedded sequences

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

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

ONE PART SEQUENCES

<TIME>	Embeds the current time in hh:mm:ss format
<DATE>	Embeds the current date in the format (DD/MM/YY or MM/DD/YY) defined in clock configuration (section 5.7)
<OP1>	Embeds operator message Nº1. If this itself contains embedded sequences, these are not expanded.
<OP2>	As for OP1 above, but for operator message Nº2.

TWO PART SEQUENCES

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

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

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

EXAMPLES

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

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

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

5.9 ALARM MESSAGES

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

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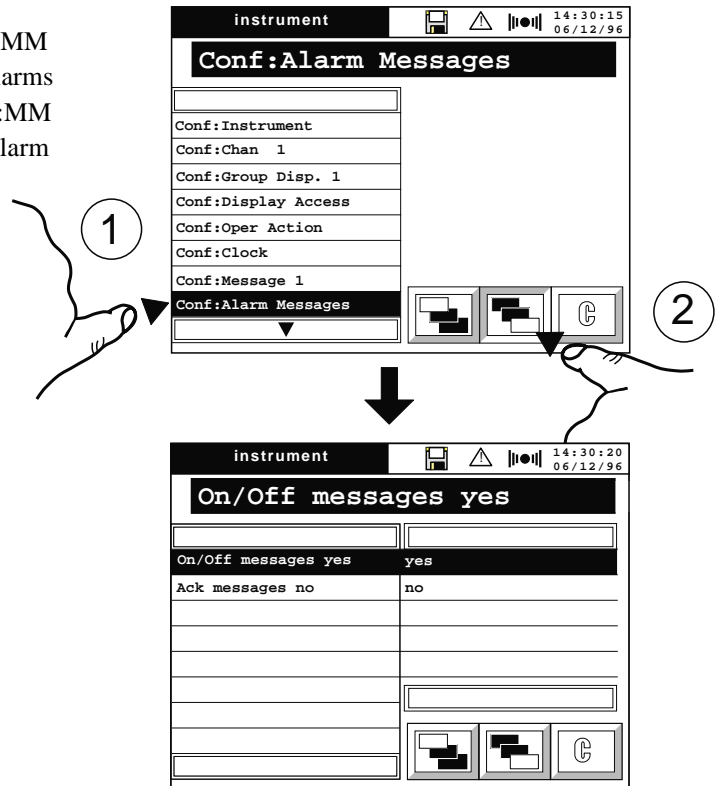alarms are acknowledged.

Figure 5.9 Alarm message on/off displays

5.10 INTERNAL EVENTS

There are six internal events, which can be triggered by one or more stimuli, and which can generate up to two jobs
each when active. Input sources can be ANDed or ORed, so multiple logical inputs can be used. For example, to
sound a buzzer only when channel 1 and channel 2 and channel 4 are all in alarm, we could set up events 1 and 2 as
follows:

Event 1:

   Enabled

   Source 1 (S1) AND Source 2 (S2)

   S1:Alarm on ch 1.

   S2:Alarm on ch 2.

Event 2:

   Enabled

   S1 AND S2

   S1:Alarm on ch 4

   S2:Event 1

Event 2, Job 1

   Sound Buzzer

   While active.

5.10.1 Event sources

Event sources are:

Operator Key (See sections 4.5 and 5.6 - Operator action)

Alarm on Ch N (Alarm on specified channel)

Glb Channel alarm (Alarm on any channel)

Glb UnAck Ch Alm (Unacknowledged alarm on any channel)

System error (Section 4.7)

Clock failure

Event N (Another specified event)

Power up

5.10 EVENT CONFIGURATION (Cont.)

5.10.2 Event Jobs

Each event can have up to 2 jobs associated with it. These jobs and their configuration are as described in section 5.3.2 above

5.11 SYSTEM ERROR DISPLAY

This is identical with the Operator System Error Display described in section 4.7

5.12 CONFIGURATION TRANSFER

This facility allows the transfer between recorders, or between the recorder and a host computer using a jack socket located to the right of the disk slot (behind the 'flap' below the display). Section 1.2.2 gives wiring details.

 Only the Baud rate is configurable at the recorder. If you are transferring to and from a host computer, the other settings needed are: Eight data bits, One stop bit and No parity.

The configuration transfer circuit is designed for use with TTL (0 to +5V) signals. A converter may be required with some host computers to change the signals to 12 Volts.
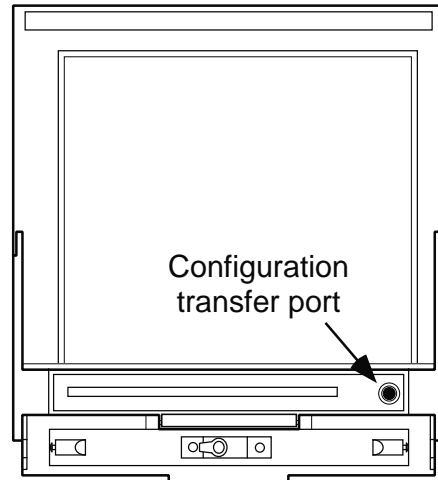
Figure 5.12a transfer port location

The Transfer function will overwrite the destination recorder's configuration, ensure that the transfer is carried out in the correct direction (i.e. from save to restore)

↵ **to Save config**

Operation of the enter key causes the configuration to be saved to another recorder (set to 'Restore') or to a host computer.

↵ **to Restore Config**

Operation of the enter key causes a new configuration to be retrieved from another recorder (set to 'Save') or from a host computer.

Baud Rate

Specifies the number of characters per second at which the transfer will take place. The setting (1200, 1800, 2000, 2400, 4800, 9600 or 19200) must be the same for both sending and receiving devices.
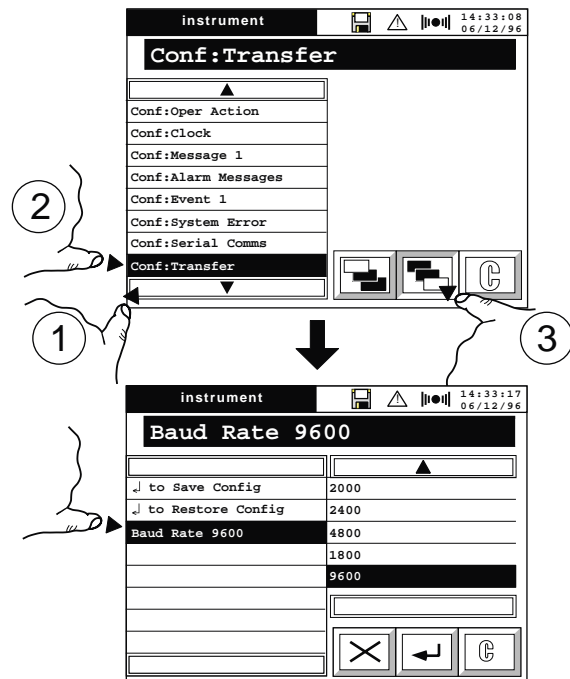

Figure 5.12b Configuration transfer pages

5.13 DISK

See section 6

5.14 OPERATOR ACCESS

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

Edit / print messages: default = Yes
Initiate Log: default = Yes
Adjust alarm thresholds: default = No
Disk functions:
    View directory = Yes
    Delete files = No
    View status = Yes
    Set disk offline = Yes
    Save config = No
    Restore config = No
    Archive data = No

5.15 ADJUST

5.15.1 Input adjust

This feature allows input channels to be adjusted to make allowance for non standard inputs. The technique used is to apply a known input at the low end of the input range for each channel in question. Once the reading displayed by the recorder has stabilised, the 'correct' value is entered. The process is repeated for a value near the high end of the input range.
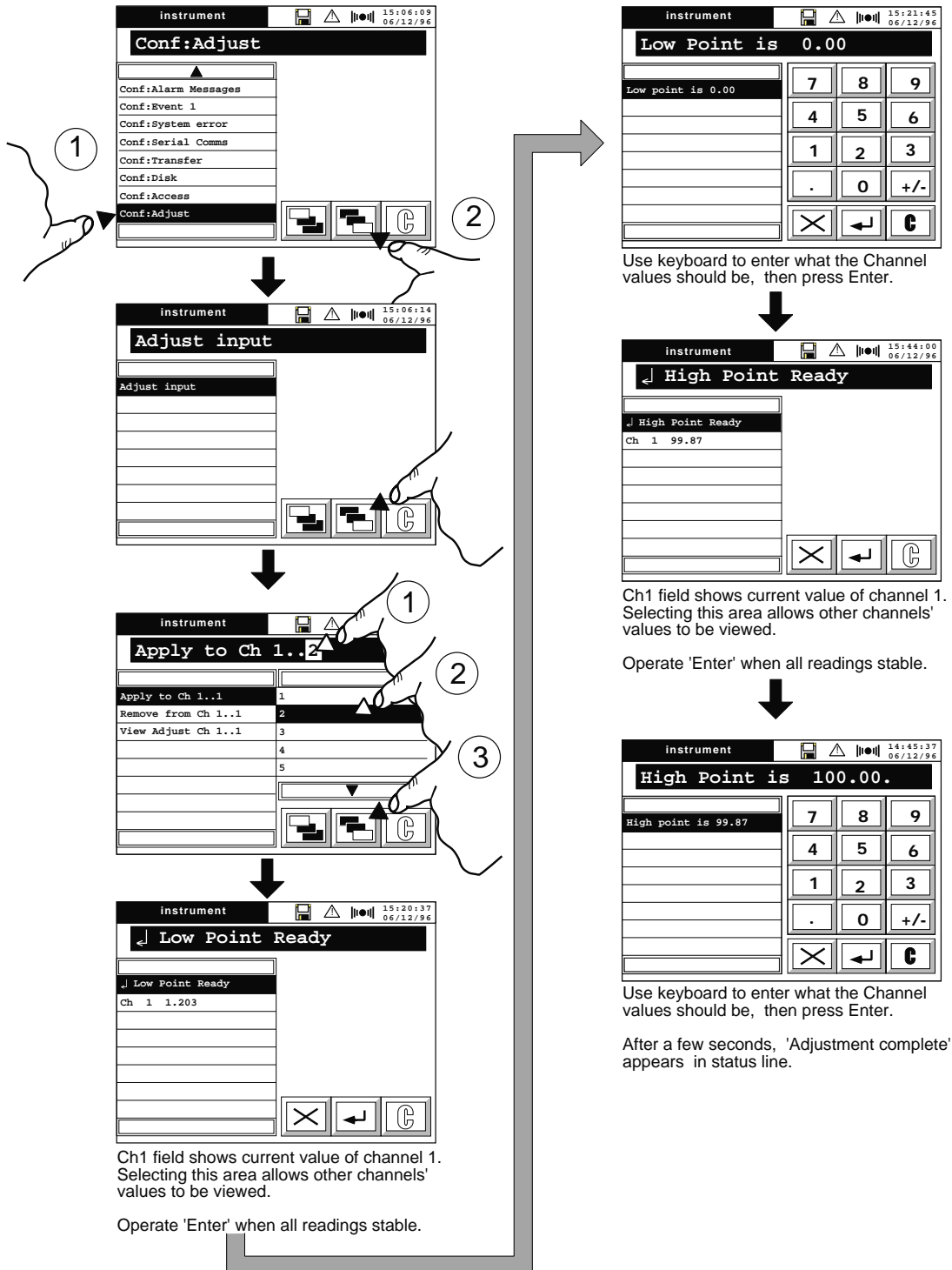
Figure 5.15.1a Input adjust configuration pages

5.15.1 INPUT ADJUST (Cont.)

Adjustments can be removed, and channels can be checked to see if they are 'adjusted' as shown in figures 5.15.1b and 5.15.1c respectively.
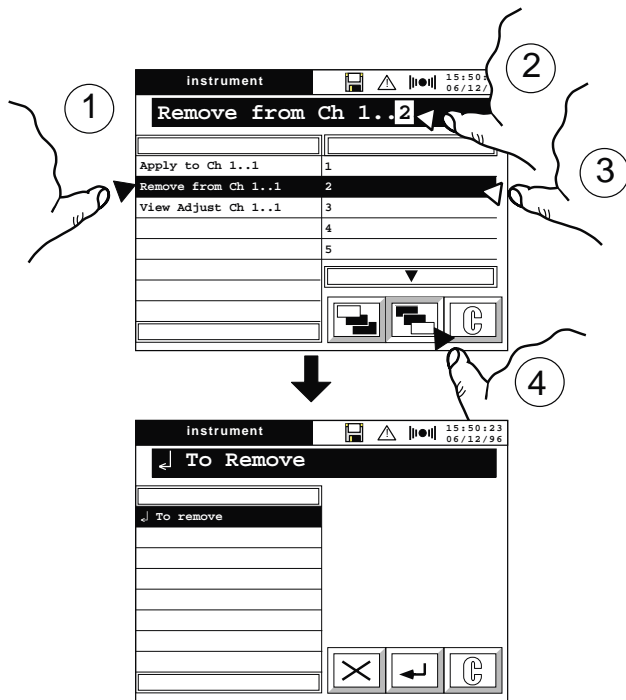
Figure 5.15.1b Adjustment remove
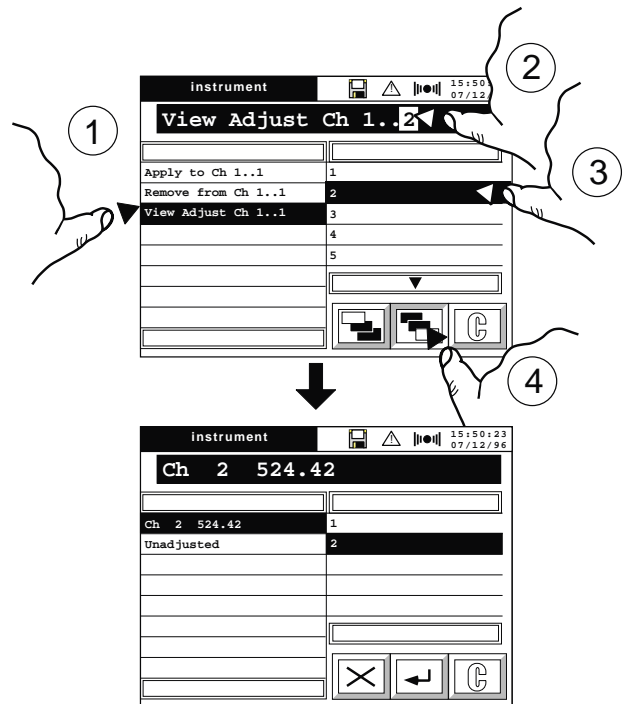
Figure 5.15.1c Adjustment view

5.16 DEFAULT CONFIGURATION

This feature returns the recorder's configuration to its default state. All user-entered adjustments are lost, and if required must be re-entered after the default configuration has been returned to.

Operating the Enter key from the '↵ to default config' page, causes a '↵ sure?' confirmation request to appear.

If you wish to procede with restoring the configuration, operate the Enter key from the confirmation page. If not, use the 'Go back to previous display' key (bottom left below the screen) or the navigation keyboard to quit the page.

If you do go ahead, by operating the Enter key, a 'Please wait' message appears for about 1 minute, after which a display language has to be selected. Once this has been done, the recorder re-initialises itself.
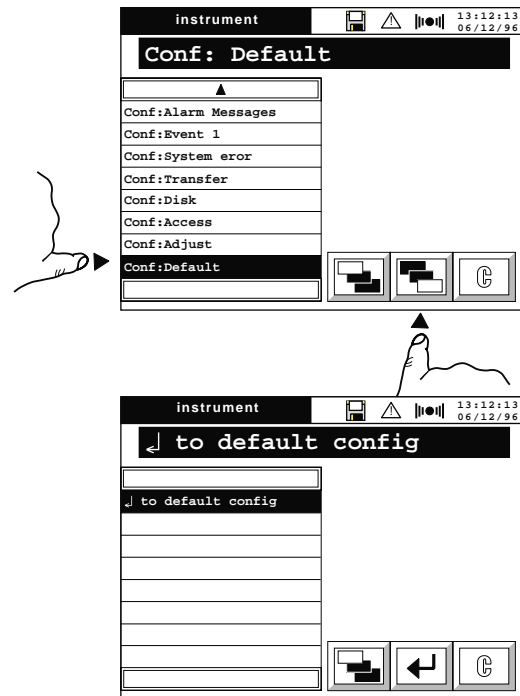

Figure 5.16 default configuration

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Section 6 Mass Storage

Contents

HARD DISK OPTION ESSENTIAL INFORMATION

Caution

Although the hard disk is designed for use in an industrial environment, it can be damaged if not handled correctly. Therefore:
1. Please do not drop the hard disk
2. Please do not expose to extremes of heat, humidity or magnetic field strength.
3. Please do not remove the disk whilst data is being read from or written to it. To do so might result in irreparable sector corruption.
4. Because of temperature considerations, ATA Hard disks are not specified for use in instruments fitted with the portability case option.

Notes:
1   When not in use, the disk should be kept in the protective pouch provided.
2   The DOS format used on disks imposes a limitation on the number of files which can be placed in the root directory. This limit depends on where and how the disk is formatted and is outside the control of the recorder manufacturer. If the maximum number of files is reached, the disk behaves as though it is full; Configuration saves will report 'Media full' and, when archiving, the oldest archive file on the disk will be deleted to make room. If your application requires the storing of large numbers of files on one disk, each disk should first be investigated to see how many files can be stored. Typical maximum numbers of files are as follows:

<div align="center">

PC card hard disk = 511

PC card ATA flash = 127

Floppy disk = 223

</div>

---

6 MASS STORAGE

6.1 INTRODUCTION

Notes:

1   Some disk functions are not accessible to the operator until they have been enabled in 'Operator Access' configuration as described in section 5.14

2   When using a floppy disk as the storage medium, any data logged within the 30 seconds prior to a power failure to the recorder, will be lost. Using other media, only data logged within the second before a power failure may be lost.

3.   Before changing media, the disk drive MUST be switched Off-line, or data will be corrupted.

4.   Only formatted disks may be used, otherwise the message 'Disk insert failed - please reinsert it' appears.

5.   If a write-protected (locked) disk is inserted, the message 'Disk protected' appears if any attempt is made to write to it.

Files are stored in DOS format, and configuration software, available from the manufacturer, to run on a PC, can be used in conjunction with the disk (and a suitable reader) to create or modify configurations for subsequent down loading to the recorder.

Most disk functions are available both from the configuration menu and from the operator menu (unless access permission has been denied - see section 5.14).   The major functional options are:

Save and restore option: Configuration save and restore
ASCII log option: As Save and Restore option but with ASCII Data logging.
Compressed log option: As ASCII log option but with PACKED data format.

Reformatting software is available to convert PACKED format data logs to ASCII format thus allowing manipulation of the data in PCs.

'Graphical replay' software is also available to run under Windows™, to allow data from one or more graphics units to be stored indefinitely and to be presented graphically using well-known techniques.

6.2 DISK INSERTION

The disk or PC card is inserted into a slot located behind the lower cover flap at the front of the recorder (figure 6.2). When correctly inserted, the disk icon appears at the top of the screen after a few seconds*.   Disk orientation is as indicated on the disk label.

If an unrecoverable disk error occurs on insertion,   a 'Disk insertion failed' message appears and the recorder restarts.

To remove the disk, operate the push-button disk ejector adjacent the card slot.
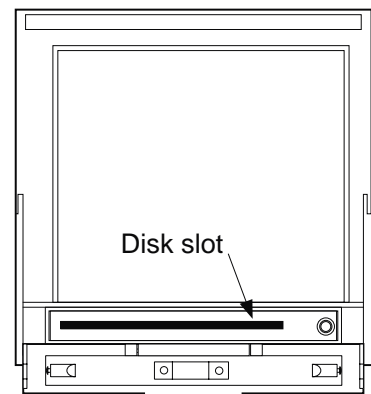

Figure 6.2 Disk slot location

* Note: For PC disks only: with floppy disks, the disk icon does not appear until the disk is first accessed, after which the icon remains on display until the disk is ejected.

6.3 TOP LEVEL MENU

Operation of either the OP:Disk or the Conf:Disk items results in the top level Disk page being displayed.

Note: Initially, operator access to disk functions other than 'Directory', 'Status' and 'Off-line' is denied, and if this is not changed (section 5.14) other functions do not appear in the operator top level menu.

Figure 6.3 Top level disk menu

To enter any part of the menu structure, the relevant item is selected in the left hand column, then the Step down key is operated.

6.4 GENERAL FUNCTIONS

6.4.1 Directory

The display shows the name of the first file on the disk, together with its size in Bytes and the time and date of the file's creation.

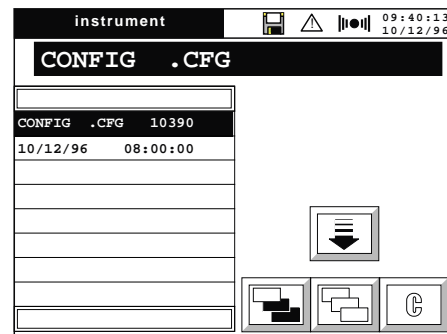The down arrow key allows the user to scroll through other file names held on the disk.

Figure 6.4.1 Directory function display pages

6.4.2 Delete

As shown in figure 6.4.2, the display shows an '↵ erase oldest file' statement.

The down arrow key allows the user to scroll through the file names held on the disk.

For each filename on display, operation of the 'Enter' key generates a request for confirmation of erasure. A further operation of the 'Enter' key removes the file from the directory.
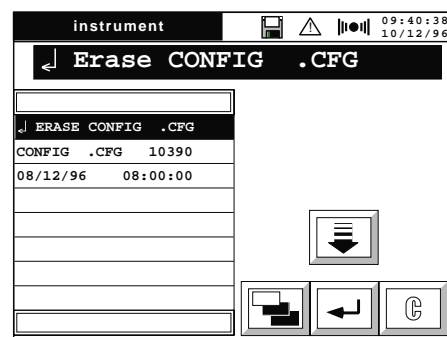

Figure 6.4.2 Delete file display pages

6.4.3 Status

This display tells the user how much of the storage capacity is currently used (11kB in the example) out of the total available (1.4MB in the example).

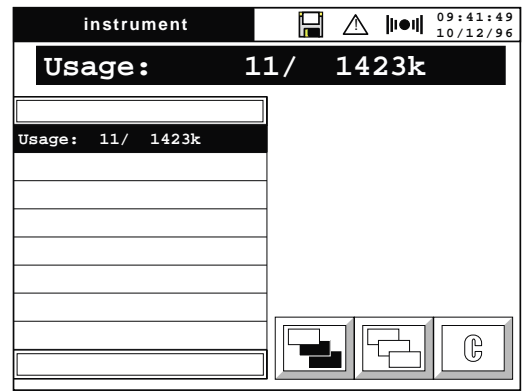Note: 'Empty' disks/cards use some space for format data,

---

Figure 6.4.3 Status display pages

6.4.4 Off-line

In order to ensure that no corruption of data takes place whilst changing media, access to the disk must be inhibited whilst replacement is carried out.

This is done by setting it off-line either by selecting Disk:Offline from the left hand column, then operating the Step Down key, or by operating the Disk off-line key of the navigation keyboard.

In either case, the message 'Flushing Disk Cache' is displayed for some seconds.

The storage medium remains off line until the Step Up key is operated.

Should an attempt be made to change the disk without first setting the drive off line, a 'dialogue box' might appear as below, and if so, it is possible that some data has been lost. This box remains on display until the CLEAR key is touched.
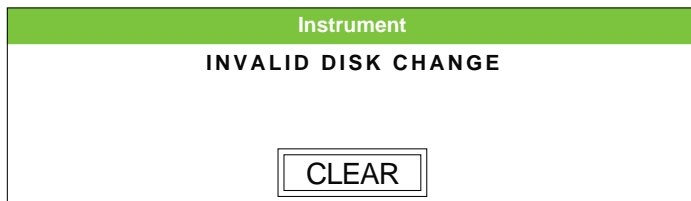
Note: in order to maximise the transmission rate when using the MODEM (Remote Operation option), the disk might occasionally be placed off line for short periods (under user control). Should this occur and a write to disk is required, a 'disk overdrive' message will appear.
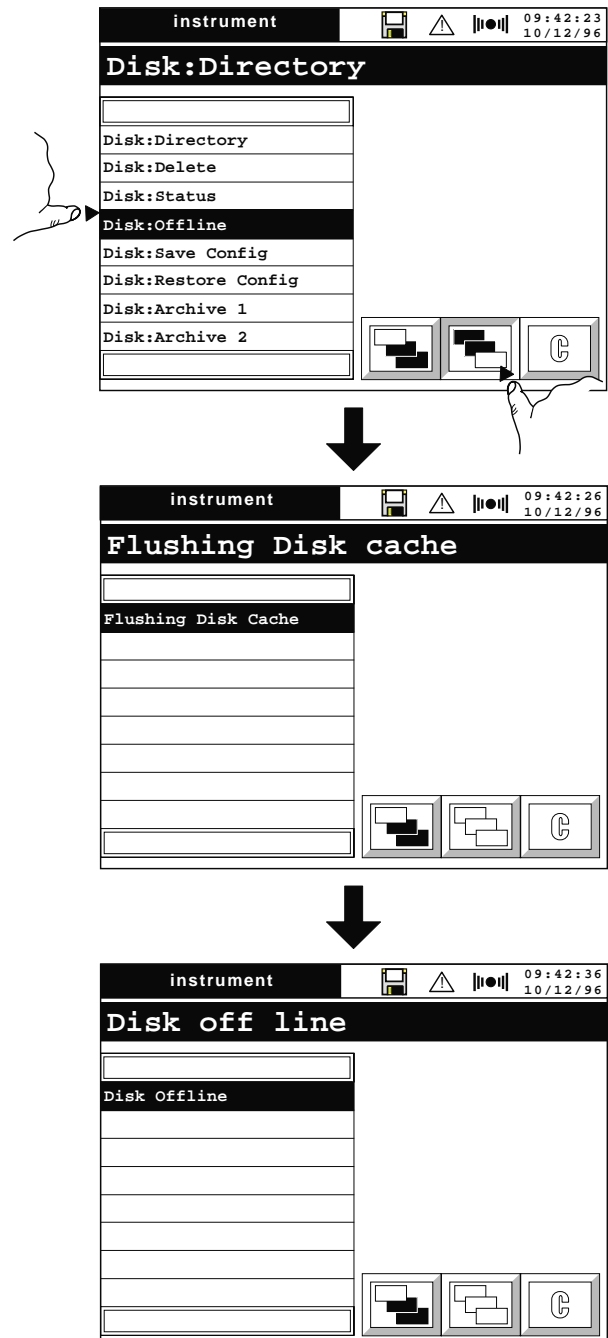

Figure 6.4.4 Setting the disk off line

6.5 CONFIGURATION SAVE AND RESTORE

6.5.1 Save

The 8-character filename can be edited using the qwerty keyboard.

All configuration files have the non-editable extension '.CFG'.

Should the filename already exist, an overwrite confirmation is requested. 'Enter' confirms overwrite, or 'Step up' returns to the original filename.

Note that only DOS format file names are allowed. Section 6.7.1 gives the permitted character set.

When the required filename has been entered, operate the quit (door) key.

The filename is confirmed and the save initiated by pressing the Enter key.

During the save, the text 'Saving Config' appears at the status line (not shown in figure 6.5.1).

When the save is complete, a 'pop-up' box appears with the message 'Config Save Complete'.
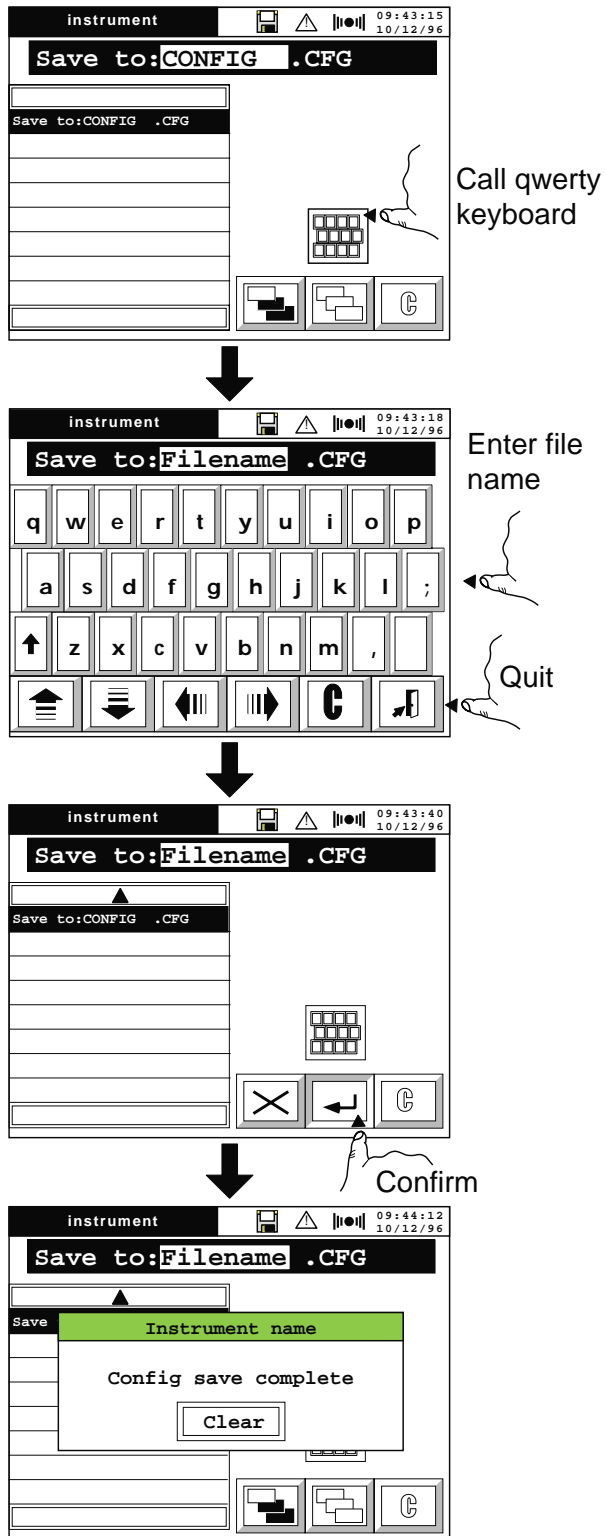

Call qwerty keyboard

Enter file name

Quit

Confirm

Figure 6.5.1 Save Configuration displays

6.5.2 Restore

This allows the names of all the files held on the card to be scrolled through using the down arrow key. Configuration files can be identified as they have .CFG as their extension

Once the required file name is displayed, operation of the 'Enter' key causes the configuration to be read from the disk.

Whilst the configuration is being read, the message 'Restoring config.' is displayed.
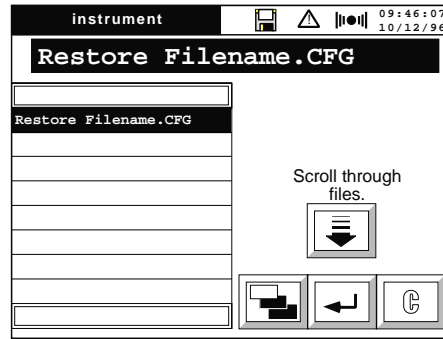
Figure 6.5.2 Restore configuration display

Once the configuration read is complete, the recorder re-initialises itself and returns to the 'Area' display.

6.6 DATA LOGGING (ARCHIVE)

This feature allows archiving of the contents of the Log 1 and Log 2 groups to the disk. Two file configurations are set up, called Archive 1 and Archive 2. The contents of Log 1 group are saved to the filename defined in Archive 1; Log 2 being sent to the filename defined in Archive 2.

As described in section 2.1.4, logging to file can be initiated by job, through operator action, or (for log 2 group only) automatically at configurable period. According to which of the archiving options is fitted, data can be logged in ASCII format (both options) or in PACKED format which is a compressed format for high density data archiving. Reformatting Software for running on a PC, is available from the manufacturer to allow conversion of the compressed data into ASCII comma-delimited format, suitable for direct use with PC spreadsheet or word processing packages.

See section 6.7 for details of permissible file names / types.

6.6.1 Top level menu

Figures 6.6.1a and b show the top level Archive 1 and Archive 2 pages for ASCII (figure 6.6.1a) and PACKED (figure 6.6.1b) formats.
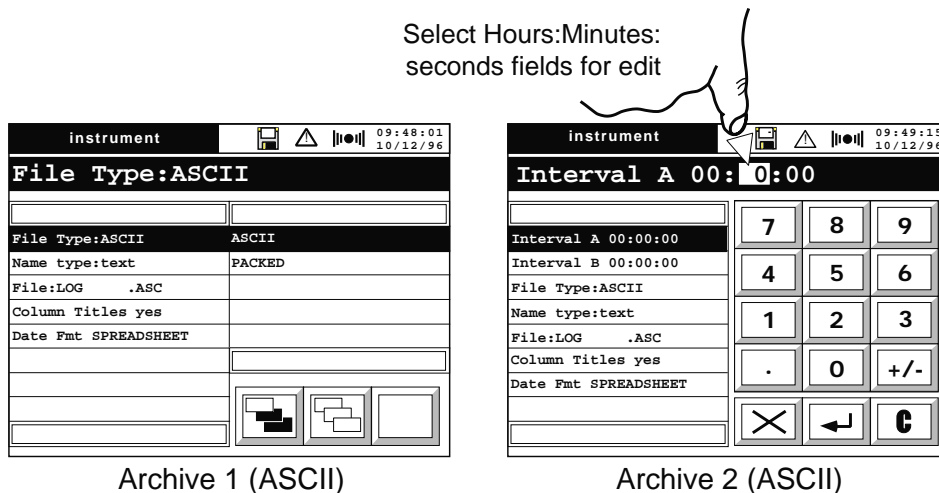
Archive 1 (ASCII)   Archive 2 (ASCII)

Figure 6.6.1a Top level archive menu (ASCII)

6.6.1 TOP LEVEL ARCHIVE MENU (Cont.)

Select Hours:Minutes: seconds fields for edit

Archive 1 (PACKED)   Archive 2 (PACKED)
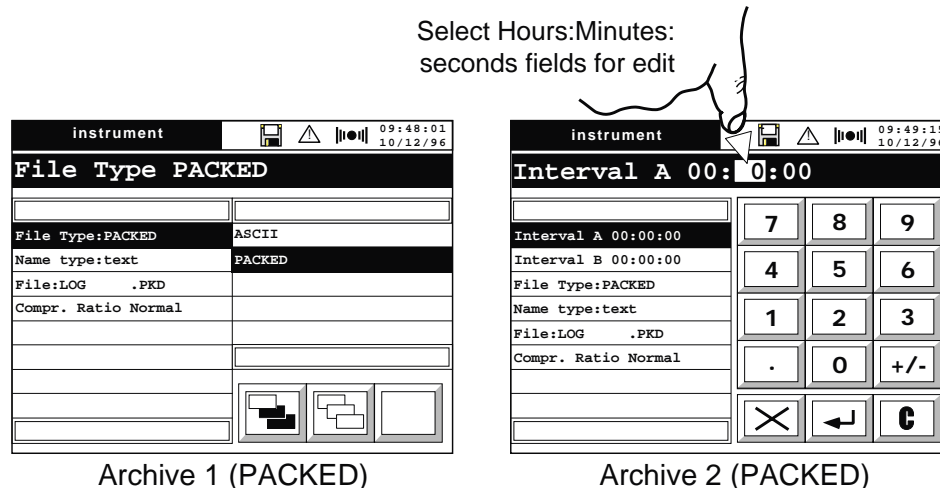
Figure 6.6.1b Top level Archive menu (PACKED)

6.6.2 Archive parameters

Parameter	Choices	Definition
Archive Int.		For Archive 2 only, allows hours, minutes or seconds to be selected for edit from the status line. Value entered using the keyboard. Entry of 00:00:00 inhibits logging.
File type	ASCII	Produces comma delimited columns of data. File name extension is .ASC (See table 6.6.2 below for examples)
	PACKED	Proprietary format. Data is stored in a compressed manner which requires a reformatting tool to extract data from it. File name extension is .PKD
Name type	Text	Fixed file name - see section 6.7.1.
	Hourly	New file opened hourly - see section 6.7.2.
	Daily	New file opened daily - see section 6.7.3.
	Counter	File name takes counter value - see section 6.7.4.
File		See section 6.7
Column titles (ASCII)	Yes/No	If YES, comma delimited column titles are sent if 'Item tag' is selected 'yes' in Group Format - Log1 (2).
Date format (ASCII)	DD/MM/YY,HH:MM:SS	First two columns used to specify time and date of archive. (DD/MM/YY might be MM/DD/YY according to the date format selected in Clock configuration
	Spreadsheet	Single, floating-point number. The integer part is the number of days since 0 hrs on the 31st Dec 1899, the decimal part is the proportion of the day since midnight. For example, Noon on the 1st Jan 1900 would be represented by a value of 1.5, whilst a value of 35236.25 would represent 6 am on the 31st July 1996.
	Integer	Compresses time and date as YYMMDDHHMMSS, so that 6 am on the 1st June 1996 would be represented as 960601060000.
Compr. Ratio (Packed)	Normal	Compresses the data, but provides an exact copy.
	High	Compresses the data more than NORMAL. Input channel values are saved to 0.02% accuracy, Totalisers, counters and derived channels are saved to 0.000004% of display accuracy (4 parts in 10^8)

6.6.2 ARCHIVE PARAMETERS (Cont.)

File containing two input channels (2 and 3) including item tag, with DD/MM/YY,HH:MM:SS date format. Column headers (Channel tags) included:

```
"XXXXA", ,"2","3"
"DD/MM/YY","HH:MM:SS","˚C","Bar"
"Log 1",,"TempVes1","PresVes1"
29/02/96,12:15:06,28.93,0.989
29/02/96,12:16:04,28.71,0.963
```

(Where XXXXA is the recorder model number)

File containing two input channels (1 and 3) NOT including tags or units, with DD/MM/YY,HH:MM:SS date format.

```
"XXXXA", ,"1","3"
,,
"Log 1",,
29/02/96,12:15:06,39.94,0.905
29/02/96,12:15:06,28.71,0.963
```

(Where XXXXA is the recorder model number)

Table 6.6.2 Examples of ASCII format files

6.6.3 Automatic file deletion

Should the disk or card become full whilst chart copy or data logging / archiving activities are being carried out, the oldest data logging / archiving file on the card is deleted. (The oldest file will be deleted whether or not it is of the same type as the one being written.) **Existing configuration files (.CFG) are not deleted.**

Should the disk/card become full whist a Configuration Save is being attempted the Save will be aborted and the message 'Err:Card full' will be displayed until cleared by the 'Clear' key.

6.7 FILE NAMES

As shown in figure 6.7, the following types of file name may be used when archiving data.
1. Text
2. Daily (Uses the recorder's real-time clock)
3. Hourly (Uses the recorder's real-time clock)
4. Counter value.

The file names consist of up to eight characters, followed by a three-character non-editable extension.

6.7.1 Text file names

With 'Name type' selected as 'Text', the NN—NN field can be freely edited with alphanumeric characters as shown below. The use of any other character (including blank spaces) will result in a fleeting 'Invalid config' message.

A to Z, a to z, 0 to 9 à ê è ô ù # $ % & ( ) - _ ! ^ '{ } ~ â ë ï î ì ò û ÿ á í ó ú

6.7.2 Hourly file names

With 'Name Type' set to 'Hourly', only the first two characters (NN) can be edited.   The remainder of the file name will be the time and date on which the copy was initiated. Thus if an ASCII log were started some time between nine and ten a.m. on the 3rd of August, then the file name would be NN080309.ASC.

6.7.3 Daily file names

Daily filenames are similar to hourly filenames except that they contain the date rather than the time at which the file is opened   Only the first two characters (NN) can be edited; the remainder of the file name will be the date on which the file was initiated.   Thus if an ASCII log were initiated some time on the 3rd of August 1996, then the file name would be NN960803.ASC.

6.7.4 Counter file names

Applicable only to recorders with the TCT (Timers/counters/totalisers) option fitted,

With ''Counter' filenames, none of the filename characters can be edited; the file name being the value of counter N. This allows, for example, a separate archive to be made for individual batches, if counter N is set up to hold the batch number. Should the counter be incremented during data transfer, the file will be closed at an appropriate point, and a new file opened with the counter's new value for a file name.

6.7.5 File name extensions

 All logging file names have extensions ASC or PKD according as they are ASCII or PACKED format (section 6.6).

If an ASCII archive is attempted to a file which already exists, then the extension is 'incremented' from ASC to AS1. If AS1 also exists, the extension will be incremented to AS2, AS3 — A10 — 100, and so on (up to 999),   until an unused file name is found. PKD extensions are treated in exactly the same way.

Configuration file names (.CFG extensions) are different in that if an attempt is made to create a configuration file which already exists, a warning message appears asking for overwrite permission, and if this is given, the existing file will be overwritten and lost.

6.8 OTHER INFORMATION

6.8.1 Error messages

In the event of an error occurring during disk use, a message will appear either for a few seconds, or until an associated 'CLEAR' key is operated.   The following error messages are possible, if all disk/card options are fitted: Note that the word 'disk' is used for both floppy disks and hard drives ('PC Cards').

Bad filename	Disk reader fault
Directory empty	Disk read failure
Disk overdrive	Disk write failure
Disk changed	Disk data corrupted
Disk not formatted	Disk full
Disk not fitted	Disk worn - please replace
File write protected	Disk corrupt - please replace
Invalid disk change	Disk protected

Though many of the above are self explanatory, the following information may be useful.

BAD FILENAME

Appears if non-usable characters (e.g. spaces, slash characters) are used when entering file names for configuration files. See section 6.7.1 above for the acceptable character set.

DISK CORRUPT - PLEASE REPLACE

This message appears when the disk is damaged to the extent that a write cannot be performed properly. In such cases, it is possible that some data has been lost. If the damaged area is in the system part of the disk, it might appear to the recorder to be unformatted, and the disk icon will disappear. The disk should be replaced immediately.

DISK OVERDRIVE

Data from the recorder is stored temporarily in an internal (buffer) memory, before being transferred to the disk. (This cuts down on the number of read/write operations performed on the disk, and thus increases its life.) Should the disk be unavailable for this transfer, the buffer memory will become full and 'overflow'. When this happens the Disk Over-drive' message is generated.

The disk might be unavailable because (for example) it is off line, it is damaged or, it is missing. Note that the disk can be switched off line for short periods by the Remote Operation Option (under user control) in order to maximise the MODEM transmission rate.

DISK WORN - PLEASE REPLACE

Appears when a number of attempts had to be made before a write to disk was successful. No data is lost, but it is recommended that the disk be replaced as soon as is practicable.

INVALID DISK CHANGE

This message occurs when the disk is removed without it's having been switched off-line first, and indicates the possibility that data has been lost.

DISK PROTECTED

This message appears if an attempt is made to write to a write-protected (locked) disk. Before data can be saved to the disk, it must be ejected, and the lock/unlock slider moved to the 'unlocked' position (such that the square aperture is obscured).

Section 7 Reference

Contents

7.1 ERROR MESSAGES

See section 6.8.1 for Mass Storage Media error messages

BAD REMOTE CJ Temp

This message appears at any time if a channel measuring a remote temperature is OFF or is not generating a valid output. The message remains until cleared by the operator

BAT BACK RAM Cleared

This appears if the back-up battery has failed AND the unit has been switched off for more than 48 hours (typical) without a replacement being fitted. The battery maintains the real-time clock and supports the RAM which holds totaliser and counter values (if the Totaliser/Counter/Timer option is fitted).

BATTERY FAILURE

This message appears when the RAM support battery is no longer holding its charge and should be replaced.

CLOCK FAILURE

This message appears at power-up if
a. the clock has lost date or time (or the clock has never been set), or
b. if the battery is exhausted (see 'Bat Backed RAM Cleared' above) or
c. there is a hardware fault in the clock circuit.

The error is cleared by setting time and date.

DV RUN TIME ERROR

This is printed on the chart when a derived variable cannot calculate a value. Examples are if the divisor in a divide function passes through zero, or if the input value to a square root extraction function goes negative.

EEPROM DB DEFAULTED

This message appears at power up if any part of the database is found to be corrupt at power-up, and the database has been defaulted.

INPUT CHAN FAILURE

Input channel hardware fault, or if configured to use a remote CJ, the remote CJ is disabled or is not providing a suitable signal.

INVALID INDEX

This message appears if a channel / totaliser etc. number is entered which is greater than the maximum number of channels / totalisers etc. fitted.

INVALID CONFIG

This message appears if one part of the configuration conflicts with another e.g. if the linearisation type does not match the input type.

MODEM FAILURE

Occurs if:
a. Modem not fitted/powered-on
b. Wiring to Modem incorrect
c. Incompatible type of Modem in use
d. User-entered initialisation string not recognised.

7.1 ERROR MESSAGES (Cont.)

OUTPUT CH FAILURE

Output channel hardware fault

> RANGE

This appears whenever the value of the I/O signal lies above the currently selected hardware range.

< RANGE

This appears whenever the value of the I/O signal lies below the currently selected hardware range.
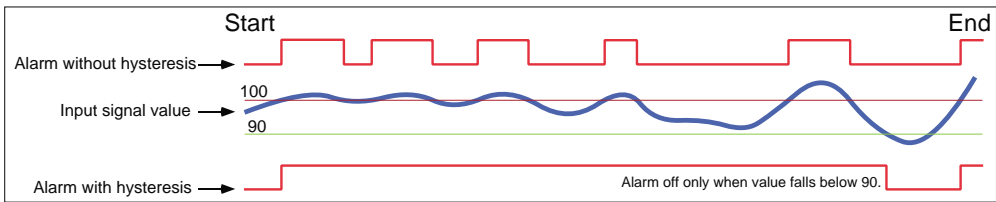
7.2 LIST OF EFFECTIVE PAGES

This (issue 11) manual consists of the following pages at their stated revision levels.

7.3 GLOSSARY OF TERMS

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

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

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

TECHNICAL SPECIFICATION

INSTALLATION CATEGORY AND POLLUTION DEGREE

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

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

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

A1 TECHNICAL SPECIFICATION (Recorder)

Board types (I/O)

Universal input board (standard)

3-Changeover relay output board (optional)

4 Normally open relay output board (optional)

4 Normally closed relay output board (optional)

2 channel analogue output (retransmission) board (optional)

Options (See options manual)

Host Communications

Event inputs

Custom Linearisation

Transmitter Power Supply (TRS)

Totalisers/Counters/Timers (TCT)

Maths pack

Additional 'Flash' memory

Environmental Performance

Temperature limits	Operation: 0 to 50˚C (0 to 40˚C if PC Card hard disk fitted). Storage: −20 to + 70˚C
Humidity limits	Operation: 5% to 80% RH (non-condensing). Storage: 5% to 90% RH (non condensing)
Altitude (max.)	<2000 metres
Protection	Door and Bezel: IP54. Sleeve: IP20. Transmitter power supply rear cover: IP10
Shock	BS EN61010
Vibration	10 Hz to 150Hz at 2g peak

Physical

Panel mounting	DIN43700
Bezel size	144 x 144 mm.
Panel cutout dimensions	138 x 138 (both – 0 + 1 mm)
Depth behind bezel rear face	215 mm (No terminal cover); 251 mm (with terminal cover)
Weight	<3.5 kg
Panel mounting	
Recorders with hard disk option:	Vertical panels only
Recorders with floppy disk option:	Vertical ± 15 degrees max.
Other recorders:	Vertical ± 45 degrees max.

Electromagnetic compatibility (EMC)

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

Power requirements

Line voltage	45 to 65 Hz	90 to 264V (standard)
		90 to 132V (Enhanced interrupt protection variant)
	low voltage option	20 to 53V dc or peak ac, (45 to 400Hz)
Power (Max)		100VA
Fuse type		None
Interrupt protection	standard	40 msec. at 75% max. instrument load
	enhanced	120 msec. at 75% max. instrument load

Operator interface

Display type	5.5 inch Colour TFT LCD with cold cathode backlighting.
Display resolution	320 x 240 pixels
Touch screen	Resistive, analogue, toughened membrane

A2 TECHNICAL SPECIFICATION (Input board)

General

Termination	Edge connector / terminal block
Maximum number of inputs	6 (standard); 12 with second input board (option).
Input ranges	- 8 to + 38 mV, - 30 to + 150 mV; - 0.2 to + 1 Volt, - 2 to + 10 Volts (0 to +10 Volts for channel 1)
Input types	DC Volts, dc millivolts, dc milliamps (with external shunt), thermocouple, 2 / 3-wire resistance temperature detector (RTD), Ohms, Contact closure (not channel 1) (Minimum contact closure = 250msec)
Input type mix	Freely configurable
Noise rejection (48 to 62 Hz)	Common mode: >140dB (channel - channel and channel - to - ground). Series mode: >60dB.
Maximum common mode voltage	250 Volts continuous
Maximum series mode voltage	45 mV at lowest range; 12 Volts peak at highest range.
Isolation (dc to 65 Hz; BS EN61010)	Installation category II; Pollution degree 2 (See page A-1 for definitions)
	300 V RMS or dc Channel - to - channel (double isolation), Channel to common electronics (double isolation) and channel - to - ground (basic isolation)
Dielectric strength	Channel - to ground =1350 Vac for 1 minute; Channel - to - channel = 2300 Vac for 1 minute.
Insulation resistance	>10 MΩ at 500 V dc
Input impedance	38mV, 150 mV and 1 V ranges: >10 MΩ; 10 V range: 68.8 kΩ
Overvoltage protection	50 Volts peak (150V with attenuator).
Open circuit detection	± 57 nA max.
Recognition time	500 msec.
Minimum break resistance	10 MΩ

DC Input ranges

Shunt	Externally mounted resistor modules
Additional error due to shunt	0.1% of input

Performance

Low Range	High Range	Resolution	Maximum error (Instrument at 20˚C)	Worst case temperature performance
-8 mV	38mV	1.4µV	0.085% input + 0.06% range	80ppm of input per deg C
-30 mV	150mV	5.5µV	0.084% input + 0.04% range	80ppm of input per deg C
-0.2 Volt	1 Volt	37µV	0.084% input + 0.05% range	80ppm of input per deg C
-2 Volts	10 Volts	370µV	0.275% input + 0.04% range	272ppm of input per deg C

Resistance inputs

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

Types and ranges

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

Accuracy and resolution

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

A2 TECHNICAL SPECIFICATION (Cont.)

Thermocouple data

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

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

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