User Guide

IM/SR100A_6

100mm Advanced Process Recorder

SR100A

ABB

ABB

The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

The UKAS Calibration Laboratory No. 0255 is just one of the ten flow calibration plants operated by the Company and is indicative of our dedication to quality and accuracy.

EN ISO 9001:2000

Cert. No. Q 05907

EN 29001 (ISO 9001)

Lenno, Italy – Cert. No. 9/90A

Stonehouse, U.K.

0255

Electrical Safety

This instrument complies with the requirements of CEI/IEC 61010-1:2001-2 "Safety requirements for electrical equipment for measurement, control, and laboratory use". If the instrument is used in a manner NOT specified by the Company, the protection provided by the instrument may be impaired.

Symbols

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

	**Warning –** Refer to the manual for instructions
	**Caution –** Risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal

	Direct current supply only
	Alternating current supply only
	Both direct and alternating current supply
	The equipment is protected through double insulation

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

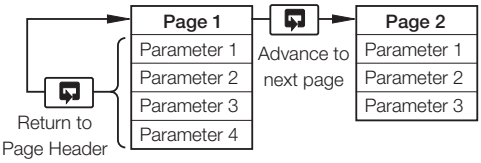
FRONT PANEL KEYS

Side Scroll Key

Moves between pages in menus

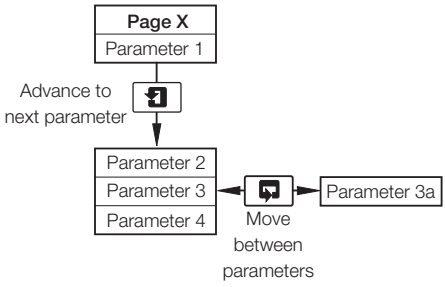
and…

between parameters in a page



Advancing to Next Page

Down Scroll Key



Moving Between Parameters

Up/Down Keys

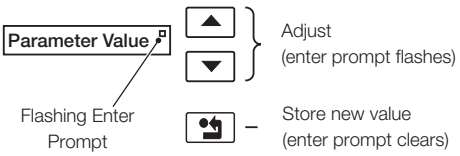
Adjust a parameter value

and…

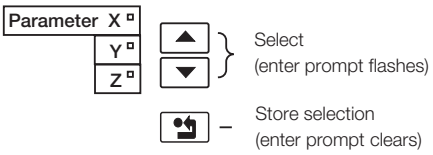
select a parameter choice

Enter Key

Stores a parameter value or selection



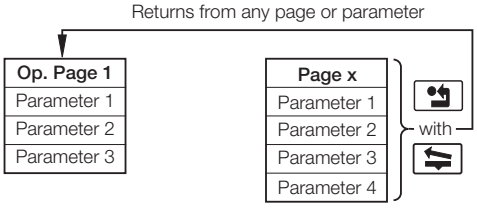
Adjusting and Storing a Parameter Value



Selecting and Storing a Parameter Choice

Pen Lift/Lower Key

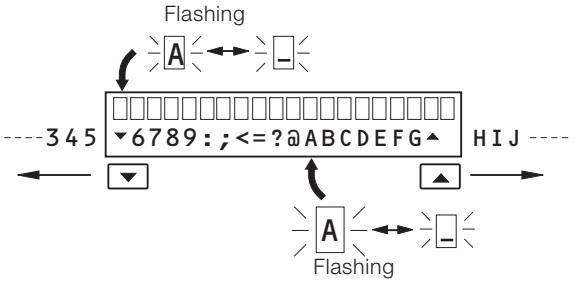
Lifts/lowers pen on alternate operations



Returning to Operating Page 1

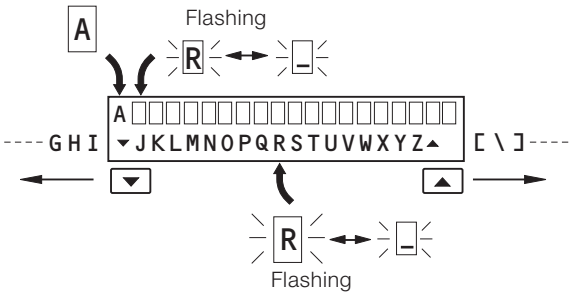
EDITING TEXT

(1) Select character using the ▲ and ▼ keys.



(2) Enter character using the ↵ key

(3) Select next character using the ▲ and ▼ keys.



(4) Enter character using the ↵ key

(5) Repeat (1) to (4) until message complete.

GETTING STARTED

The advanced process recorder provides accurate and reliable recording of up to 6 process signals on a 100mm wide chart. In-built text printing capabilities give clear annotation on the chart of time, date, scales and other process information.

Sterilization is probably the single most important step in the production of many food and drug products. Assurance of sterility requires accurate temperature monitoring. The advanced process recorder can assist pharmaceutical and food processing engineers measure sterilizing temperatures and compute equivalent sterilization times very accurately.

The simplicity of chart and pen replacement and the clear display of process status make the advanced process recorder easy to operate.

The recorder is designed for panel mounting and provides complete dust and water protection on the front face, making it suitable for use in very harsh environments.

The instrument can be configured for a wide range of input types and chart speeds and is ideal for most industrial recording applications.

This manual is divided into four Sections containing all the information required to install, configure and operate the instrument.

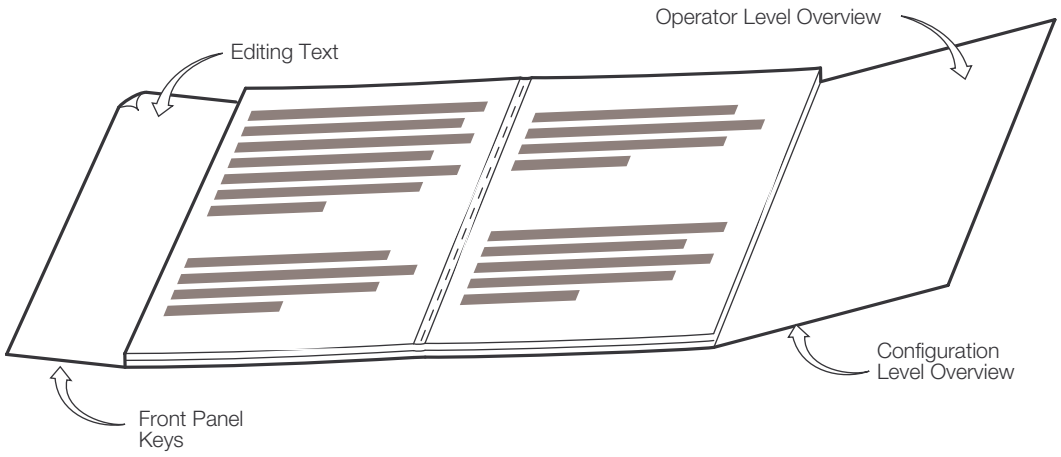
CHARTS AND PENS
- Chart Loading
- Fitting the Pen Capsule

CONFIGURATION
- Basic Configuration
- Advanced Configuration

OPERATION
- Basic Operation
- Advanced Operation

INSTALLATION
- Mounting
- Electrical Connections

Symbol Identification and Contents of Sections



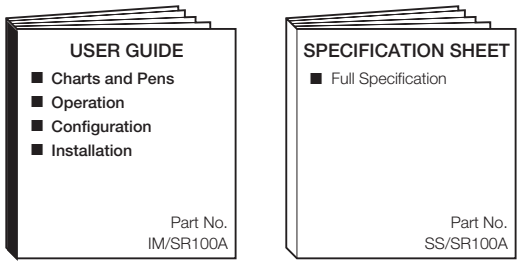
Front and Rear Fold-outs

Documentation for the advanced process recorder is shown below.

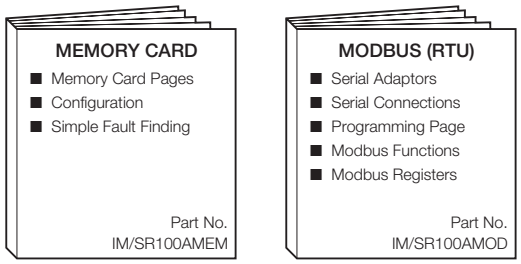
The **Standard Documentation Pack** is supplied with all instruments.

The **Supplementary Manuals** supplied depend on the specification of the instrument.

This manual contains information on the Configuration Level programming of the instrument. The password for Access Level 3 must be entered in the Security Access Configuration Page to make the configuration level available – see Section 5.5.1.

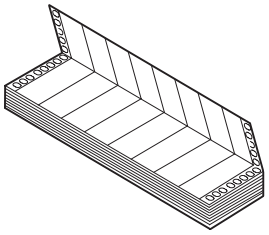


A – Standard Documentation Pack

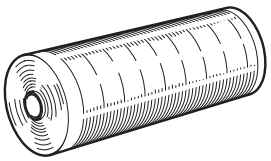


B – Supplementary Manuals

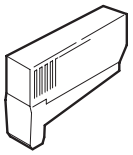
Documentation



Fanfold Chart



Roll Chart

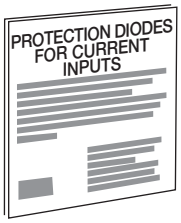


Print Head

Keys
(door lock versions only)

Cable Grommet

Diode
(one per channel)



Instruction card

Accessories

CONTENTS

1 CHARTS AND PENS

1.1 Chart Printout – Fig. 1.1

In addition to displaying up to six traces, the chart printout can contain text messages printed as events occur, such as process alarms, or at regular intervals, such as date/time and scale.

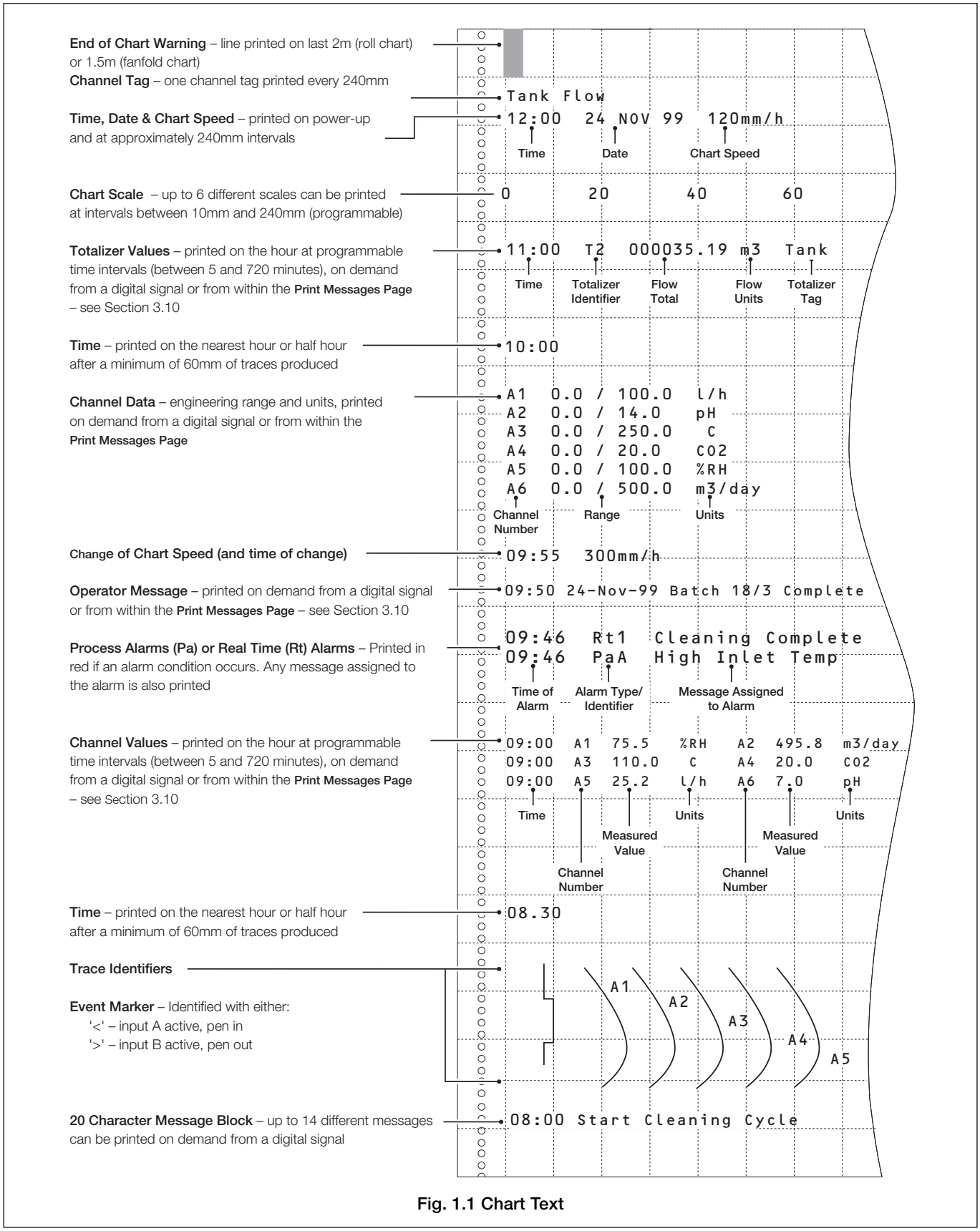


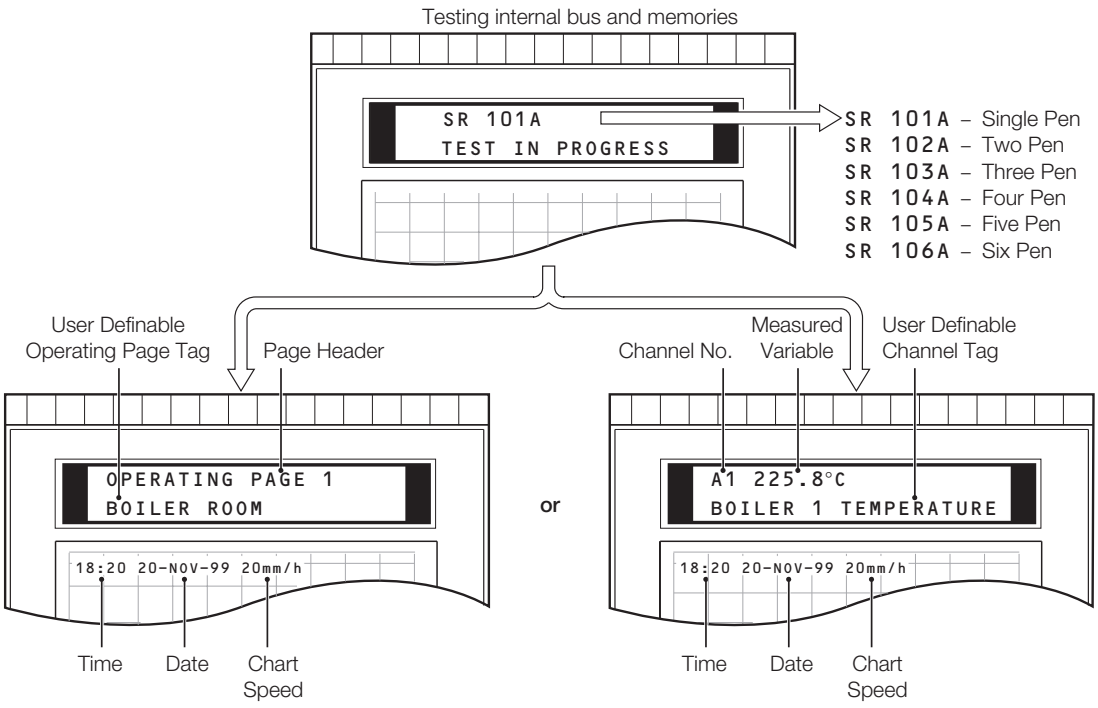
Fig. 1.1 Chart Text

1.2 Instrument Start-up – Fig. 1.2

Caution. Ensure that all connections, especially to the earth stud, are made correctly – see Section 7.

Switch on the supply to the instrument, the input sensors and any power-operated control circuits.

Information.
- When powering the instrument from a DC supply, a PSU with a minimum current rating of 5A is recommended.
- Ensure that the voltage supplied is above 10V. If a lower voltage is applied, the unit draws a higher current on power-up. If necessary, fit a switch in the supply line between the PSU and the instrument to ensure that the PSU is at the correct voltage before powering the instrument.



A – Operating Page Tag Enabled **B – Operating Page Tag Disabled**

Fig. 1.2 Start-up Displays

1.2.1 Autoscroll – Fig. 1.3

In the normal day-to-day operating mode, channel information is displayed sequentially (autoscroll).

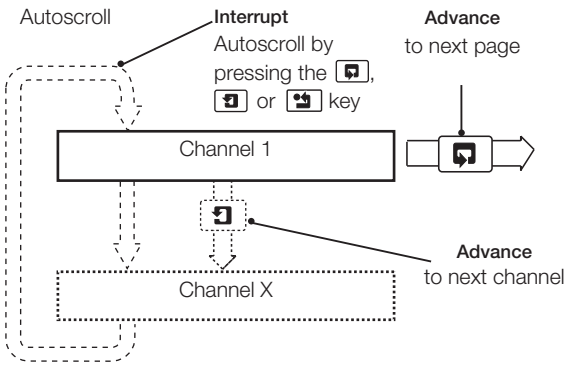


Fig. 1.3 Autoscroll

1.3 Chart Loading

1.3.1 Selecting the Load Chart Page – Figs. 1.4 and 1.5

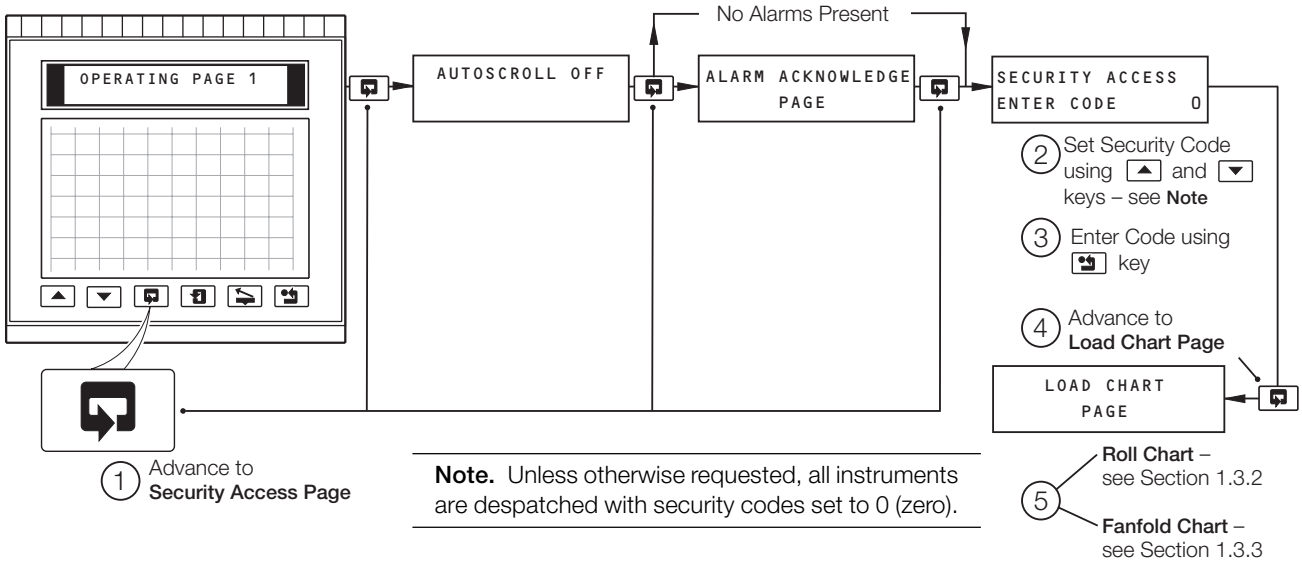


Fig. 1.4 Selecting Load Chart Page from Basic Mode

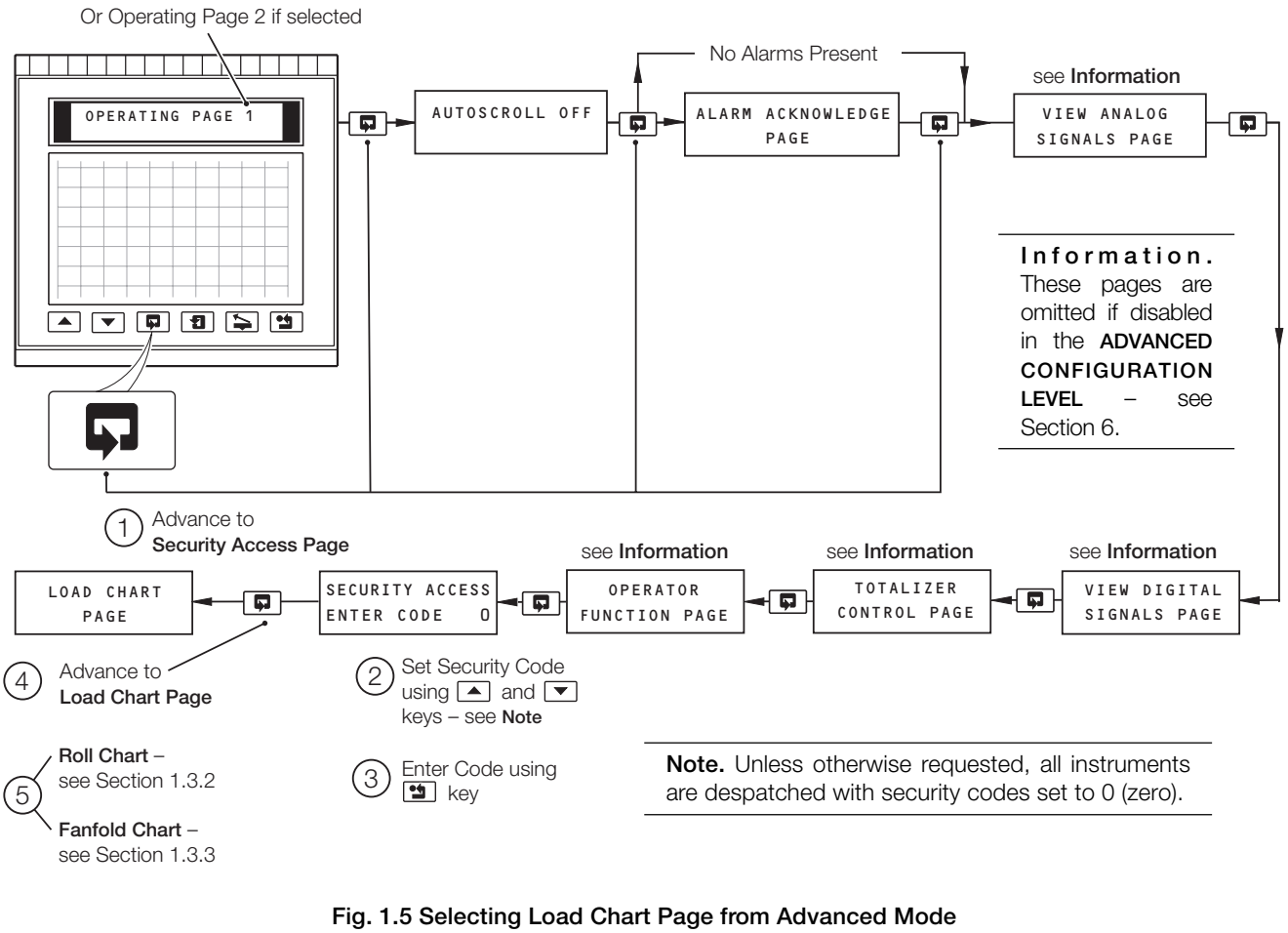
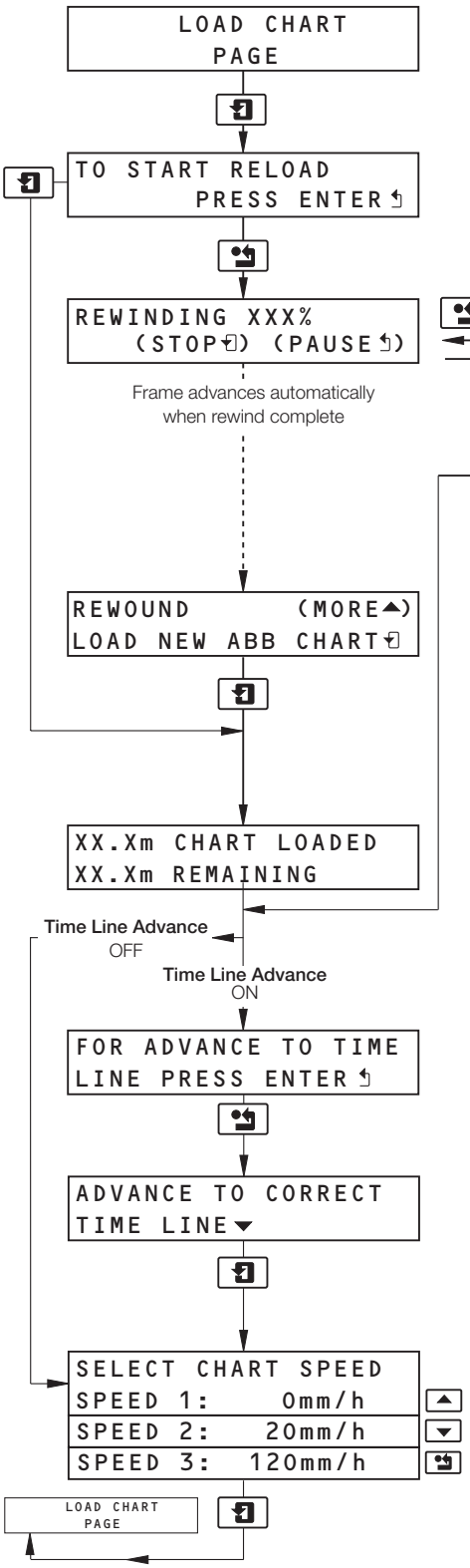


Fig. 1.5 Selecting Load Chart Page from Advanced Mode

1.3.2 Loading a Roll Chart – Fig. 1.6

Select the **Load Chart Page** – see Fig. 1.4 or 1.5.

Note. If automatic chart rewind has been enabled in the Chart Control Configuration Page (see Section 5.3.1), when the chart remaining counter reaches 0 the chart will begin rewinding automatically and the instrument display will show the `REWINDING XXX%` frame.



If an old chart is to be removed, press the key to start rewind. To pause rewind press the key again.

If the key is pressed whilst rewind is paused, rewind is aborted, the chart returns to its previous position and the instrument resumes recording.

This frame is displayed momentarily if rewind is aborted.

If all of the chart is rewound before the motor stops, press the key.

When rewind is complete there may still be some chart left to be rewound. If this is the case, press the key until all remaining chart is rewound.

Remove the old chart and load the new chart – see Fig. 1.6 for details. When a new chart is fitted and the cassette is replaced, press the key. The chart moves forward approximately 30mm to take up any slack.

This frame is displayed momentarily when chart loading is complete.

When the key is pressed, recording ceases and the chart stops.

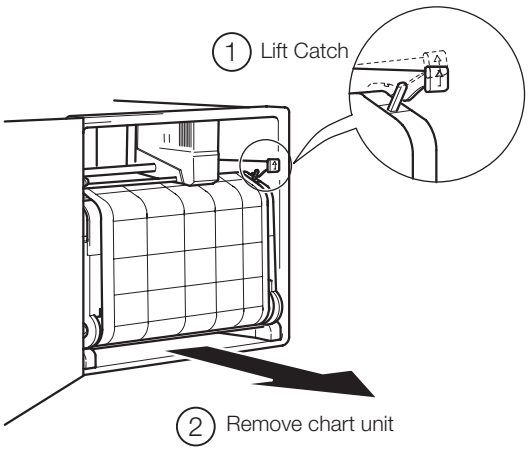
The print head moves from side to side printing at the 40% and 60% positions on the chart to enable adjustment onto the time line.

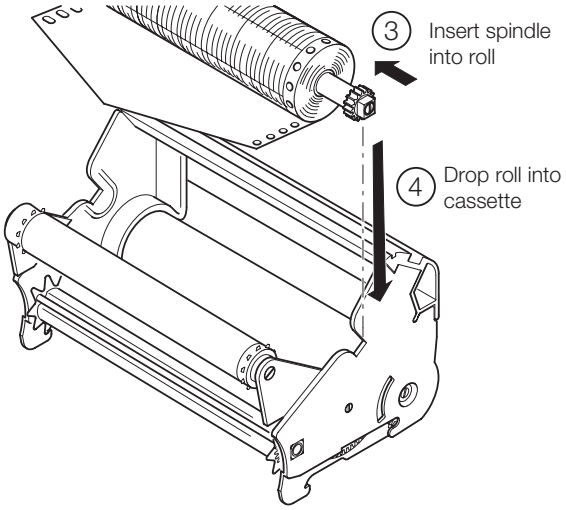
Press the key to move chart to the correct position to allow printing of time to correspond to major time lines. Recording resumes when the key is pressed.

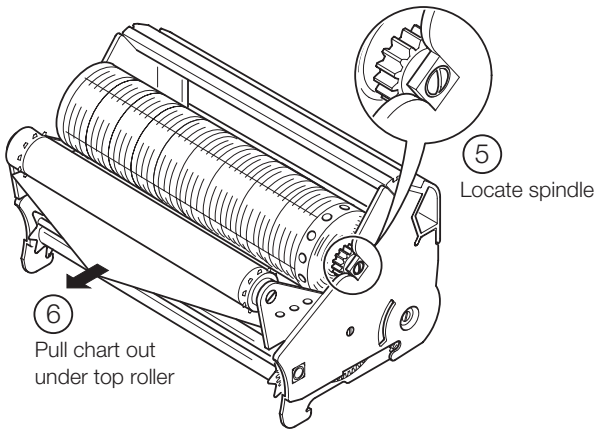
Select one of three pre-defined chart speeds. The values shown are the company standard settings.

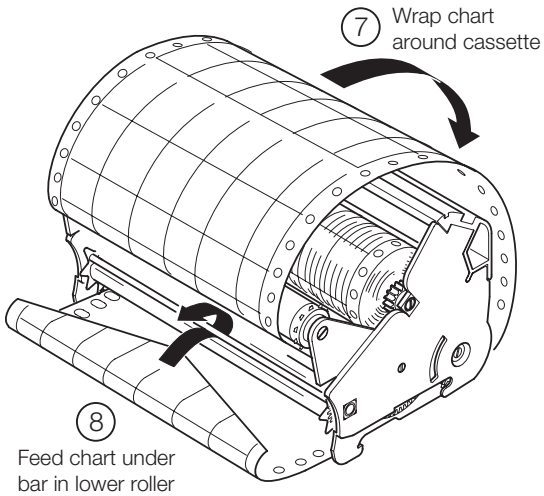
…1.3.2 Loading a Roll-chart – Fig. 1.6

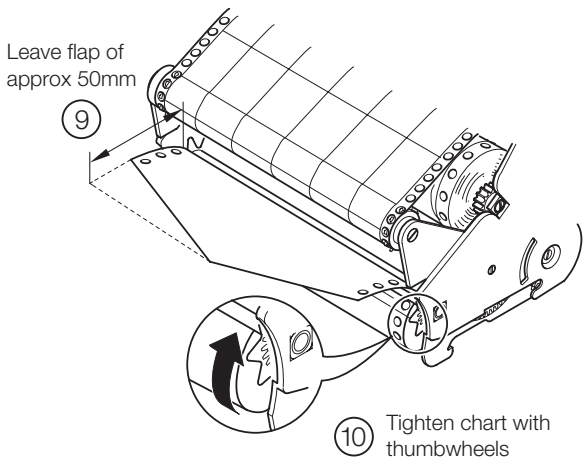
Caution. Ensure the correct chart type is set in the **Chart Control Configuration Page** – see Section 5.3.1.











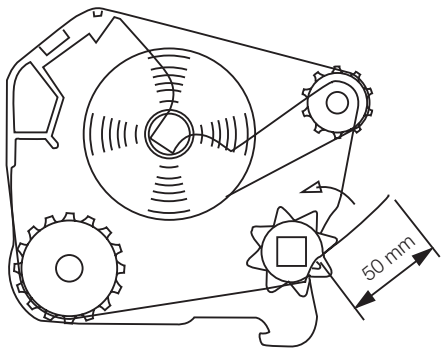
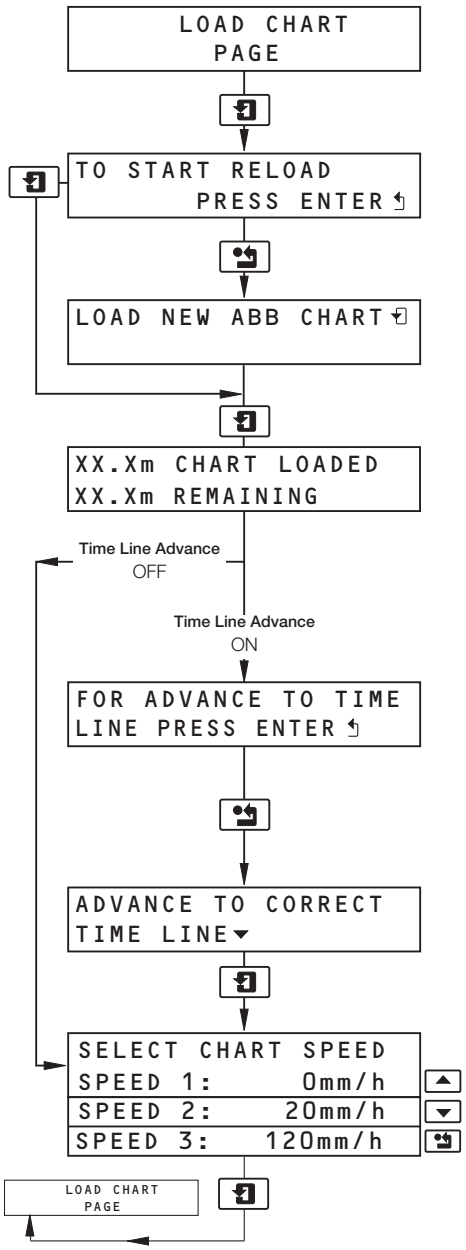


Chart Routing

Fig. 1.6 Loading a Roll-chart

1.3.3 Loading a Fanfold Chart – Fig. 1.7

Select the **Load Chart Page** –see Fig. 1.4 or 1.5.



To enable chart reload procedure press the key to stop recording. Remove the old fanfold chart from the cassette.

Load new fanfold chart – see Fig. 1.7 for details. When a new chart is fitted and the cassette replaced, press the key. The chart moves forward approximately 30mm to take up any slack.

This frame is displayed momentarily when chart loading is complete.

When the key is pressed, recording ceases and the chart stops.

The print head moves from side to side printing at the 40% and 60% positions on the chart to enable adjustment onto the time line.

Press the key to move chart to the correct position to allow printing of time to correspond to major time lines. Recording resumes when the key is pressed.

Select one of three pre-defined chart speeds. The values shown are the company standard settings.

…1.3.3 Loading a Fanfold Chart – Fig. 1.7

Caution. Ensure the correct chart type is set in the **Chart Control Configuration Page** – see Section 5.3.1.

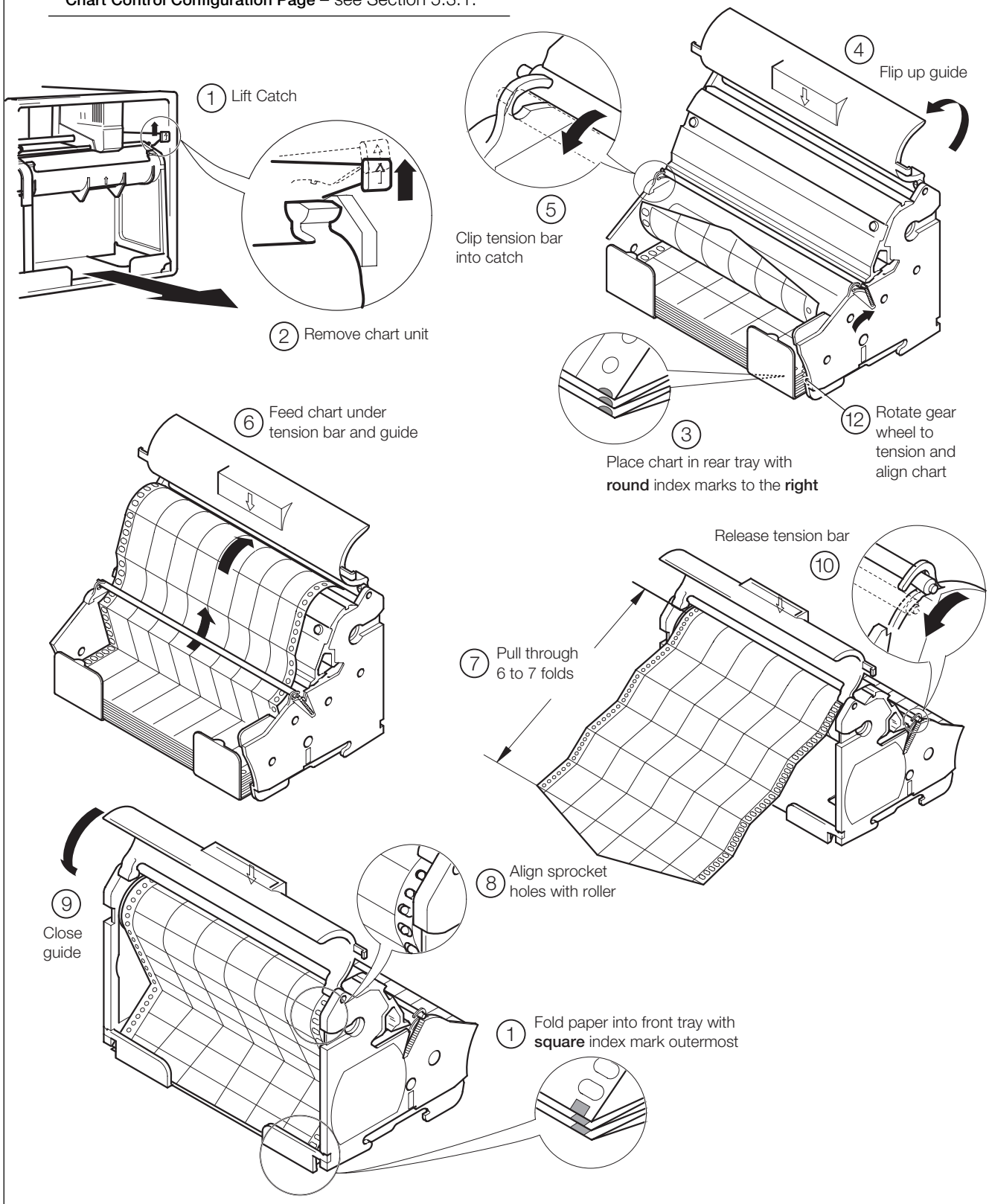


Fig. 1.7 Loading a Fanfold Chart

1.4 Fitting a Pen Capsule – Fig. 1.8

Ensure that the power supply is on.

Fit a new capsule as shown in Fig. 1.8.

Information. When pushing the new capsule firmly home on the carrier slides, some resistance may be felt as the spring clip locates in the capsule.

Note.

- After fitting a new capsule the ink flow takes a short time to achieve full color density.
- Two types of pen capsule are available, standard and high temperaure. The high temperature capsule is designed for use by recorders operating consistently at ambient temperatures above 30°C.

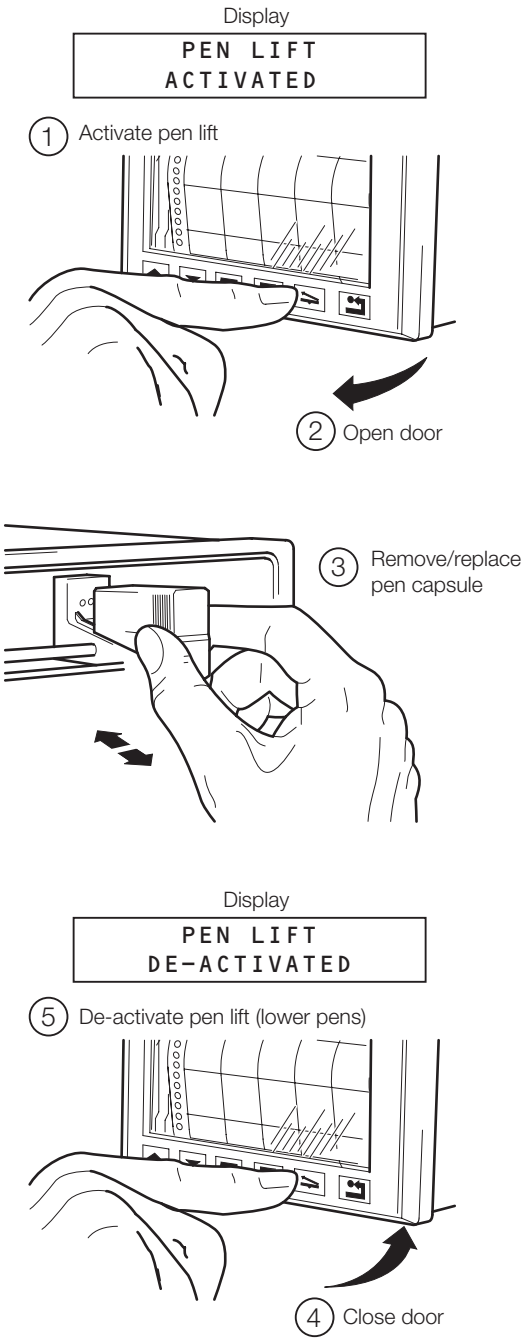
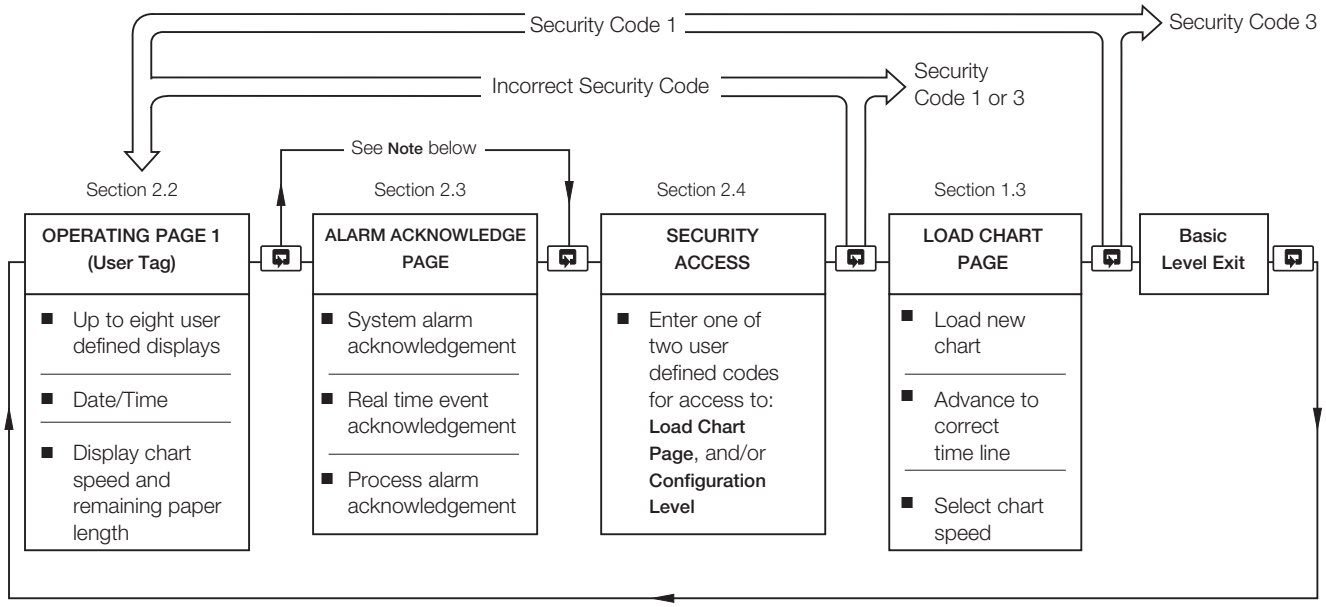


Fig. 1.8 Fitting a Pen Capsule

2 OPERATION – BASIC

2.1 Introduction

The Operating Level can be configured for either Basic or Advanced operation. An overview of the Operator Level pages is contained on the Back Fold-out. The Basic format is shown in Fig. 2.1 and the Advanced in Fig. 3.1.



Note. The **Alarm Acknowledge Page** is displayed only if an alarm is present and an Alarm Acknowledgement other than **NONE** is selected in the **Alarm Acknowledge Configuration Page** – see Section 5.2.2.

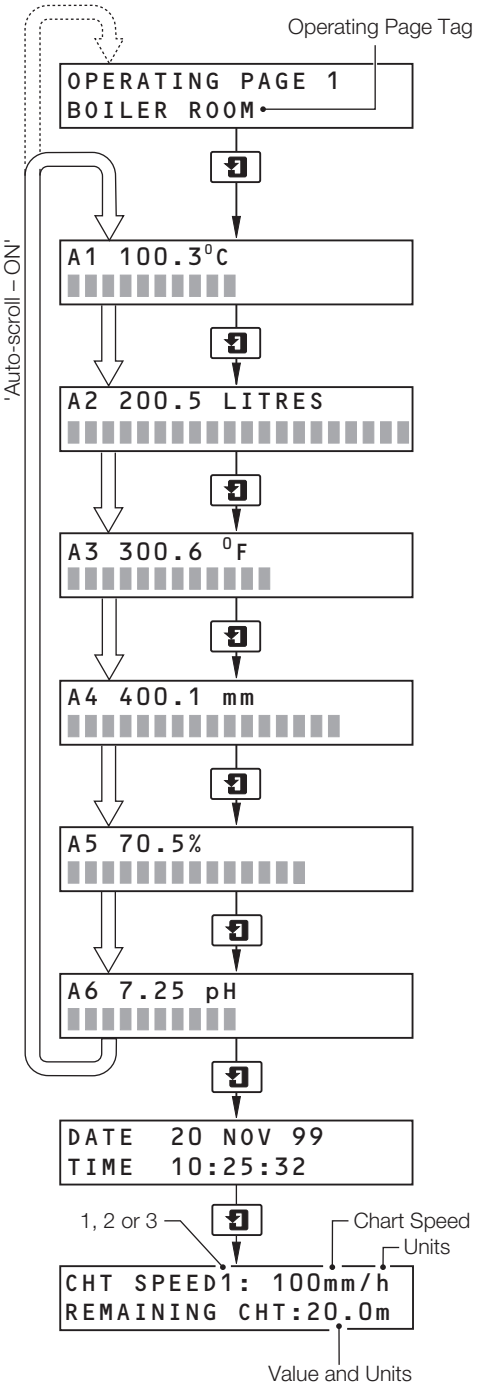
Fig. 2.1 Summary of Operator Pages – Basic

2.2 Operating Page

Operating page 1 is the default start page.

Note.

- Autoscroll is enabled on power-up. To disable/enable auto-scroll press the key. Pressing the or keys at any point in the autoscroll cycle also sets autoscroll off.
- The Operating Page Tag, Channel Identifiers, values and units shown in the following frames are examples only.
- The bargraph lower display line is the company standard display option. Refer to Section 2.2.2 for alternative display options.



Operating Page 1
This frame is displayed only if enabled in the **Operating Pages 1 and 2 Configuration Page** – see Section 6.3.2.
Upper Row – page title
Lower Row – operating page tag

Input A1
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A1

Input A2
Input A2 is not displayed on single pen recorders.
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A2

Input A3
Input A3 is not displayed on 1 and 2 pen recorders.
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A3

Input A4
Input A4 is not displayed on 1, 2 and 3 pen recorders.
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A4

Input A5
Input A5 is not displayed on 1, 2, 3 and 4 pen recorders.
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A5

Input A6
Input A6 is not displayed on 1, 2, 3, 4 and 5 pen recorders.
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A6

Date/Time
The current date and time are displayed.

Chart Speed and Remaining Paper Length
The current chart speed and remaining paper length are displayed.

2.2.1 Easy View Facility (roll chart only) – Fig. 2.2

The Easy View facility provides an instant view of the latest trace and text to be printed when operating at low chart speeds (120mm and below). The chart is wound forward 30mm for approximately 5 seconds to enable the latest information to be viewed. The chart is then rewound automatically to its former position and recording resumes. Any data recorded during the Easy View process is buffered and printed on the chart when recording resumes.

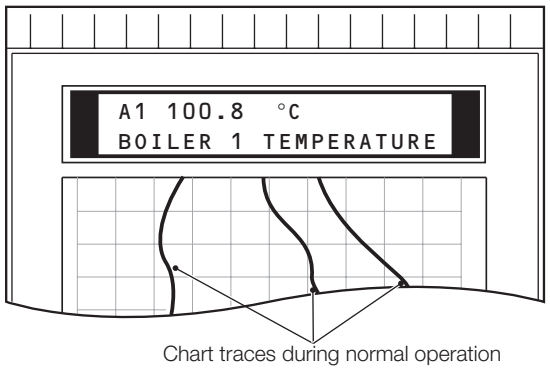
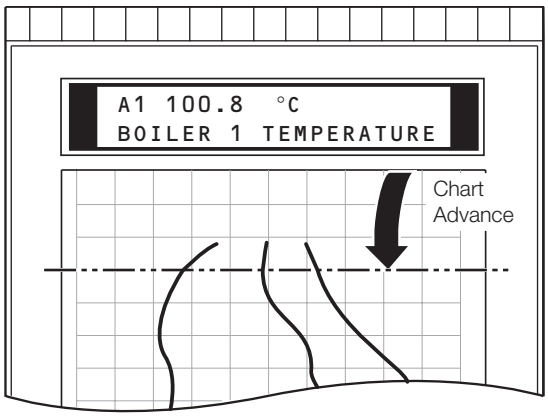


Chart traces during normal operation
(in Operating Page 1 or 2)



Note. The EASY VIEW facility can be disabled in the **Chart Control Configuration Page** – see Section 5.3.1.

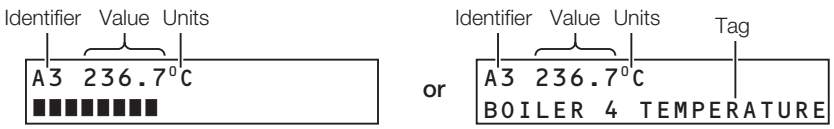
1. Operate the ▼ key to activate Easy View.
2. The chart advances approximately 30mm for 5 seconds and then rewinds to its original position and resumes recording.

Fig. 2.2 Easy View Facility

2.2.2 Operating Page Display Options

Alternative parameters can be displayed in the Operating Page. Up to 8 frames can be configured (within the autoscroll cycle) to display information in the following formats – see Section 6.3.2.

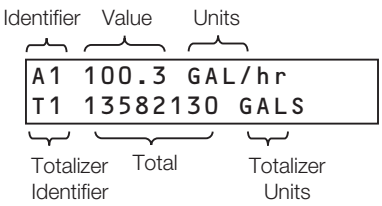
Standard Frame Type – Analog Input or Maths Result



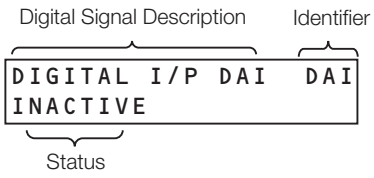
With Bargraph
(Company Standard Setting)

With Channel Tag

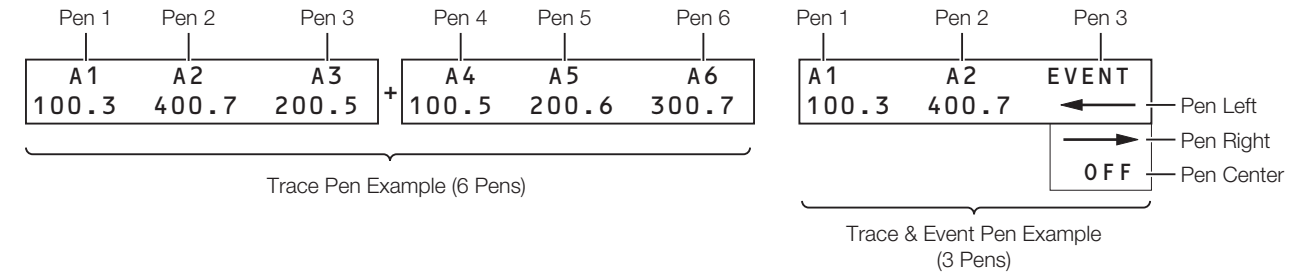
Totalizer Frame Type – Totalizer Value and Units



Digital Frame Type – Digital Signal



Pen Value Frame Type – Multi-display of Analog Inputs Assigned to Pens



2.2.3 Operator Page Messages

```
POWER FAILED
```

Power Failure
Alternates with top row of frame when the instrument is powered up. Press the ↵ key to acknowledge. This message is displayed only if **YES** is selected in the **Power Failure Indication Enable** frame – see Section 5.2.2.

```
PAPER LOW
HOURS REMAINING
```

```
PAPER OUT
```

Paper Low/Paper Out
Displayed when the remaining chart paper is running low. The frequency of display of this message increases as the paper length nears its end:

- >48 hours – no message.
- <48 hours – message flashes every 5 minutes.
- <12 hours – message flashes every minute.
- <2hours – message flashes alternately with **PAPER OUT** message.

```
A1 200.5°C
ZONE 2 TEMPERATURE
```

Alarms
A 🔔 flashes in the top right hand corner to indicate an alarm condition exists. When all active alarms are acknowledged, a steady 🔔 is displayed.

Note. The 🔔 alarm indicator is displayed only if **ON** is selected in the **Alarm Print Enable** frame – see Section 5.3.1. This allows alarms to be used for control of external devices as part of normal operation without indicating an alarm condition on the chart or the display.

```
NON-VOL ERROR
CHECK CONFIGURATION
```

Non-volatile Memory
Turn instrument off and on again. If error is still displayed, check configuration and correct any parameters which have been corrupted. Acknowledge and clear error by pressing the ↵ key.

```
DISPLAY COMMS ERROR
CONSULT USER GUIDE
```

Processor Board Fault
Consult factory.

2.3 Alarm Acknowledge Page

This page is displayed only when alarms are active and the **Acknowledge Type** is **NORMAL** or **LATCH**, see Section 5.2.2.

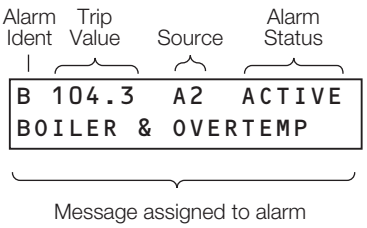
There are three types of alarms:

Process Alarms
Up to 12 alarms assignable to any analog input and activated by pre-defined set points – see Section 5.2.1.

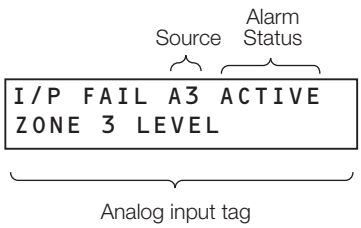
System Alarms
Up to 12 input failure alarms activated by an input being outside its pre-defined range.

Real Time Event
Up to 2 alarms activated at a pre-defined time – see Section 6.2.8.

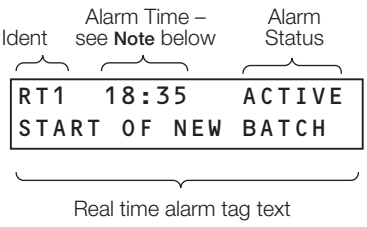
General Format



General Format



General Format



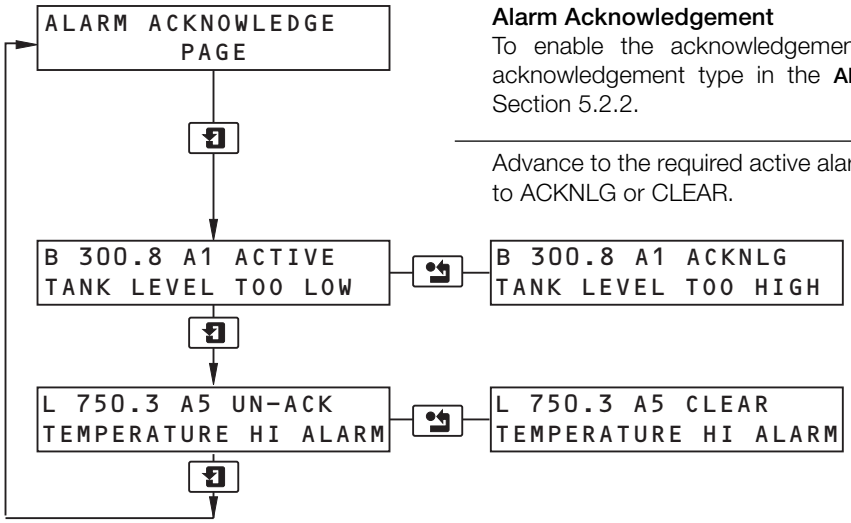
Note. ** is displayed instead of the hour when an alarm has been set to activate at a specific minute each hour – see Section 6.2.8.

Alarm Status

The five types of alarm status are detailed in the following table.

Alarm Status	Alarm Condition	Relay Condition
Active	Active and unacknowledged	Active
Clear	Previously active, acknowledged and now inactive	Inactive
Acknowledged	Active and acknowledged	Active
Latched	Previously active but now inactive	Active
Unack	Previously active but now inactive	Inactive

Note. An alarm status of **CLEAR** is displayed only if the **Alarm Acknowledge Page** is being viewed at the time the alarm becomes inactive.



Alarm Acknowledgement
To enable the acknowledgement facility, select either normal or latched acknowledgement type in the **Alarm Acknowledge Configuration Page** – see Section 5.2.2.

Advance to the required active alarm and press enter. The alarm status changes to ACKNLG or CLEAR.

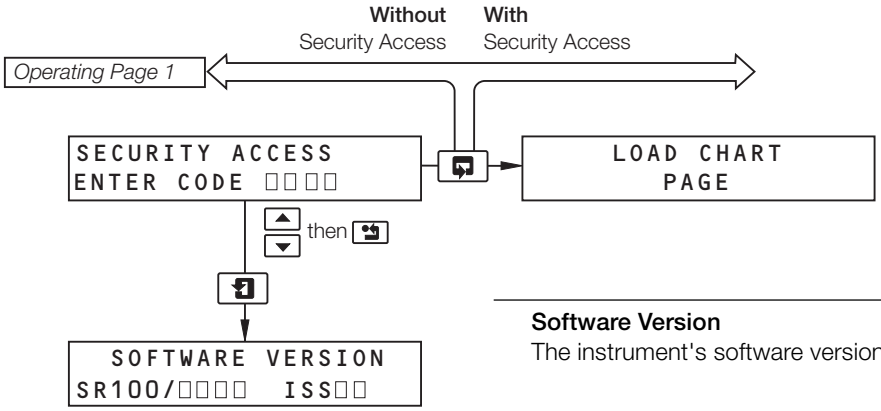
2.4 Security Access – Fig. 2.3

A security system prevents tampering with the secure parameters by utilizing three levels of access. Only levels 1 and 3 are applicable for basic operation. Level 2 is included in advanced operation only.

Security Level 1 – access to **Load Chart Page**.

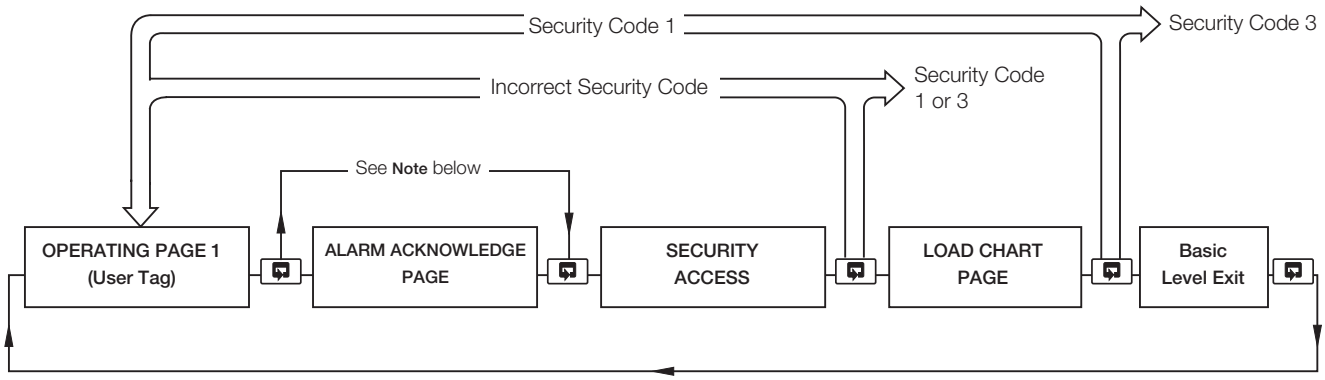
Security Level 3 – access to the **Configuration Level Pages**.

If necessary, Security Access can be disabled to allow entry to all pages by setting the code number to **0** – see Section 5.5.1. If access to Security Level 3 is not available contact the Customer Support Organization for further information.



Security Access
Enter code number 1 or 3 to obtain access to the **Load Chart Page** and/or the **Configuration Level**. Press the ↵ key to enter password.

Software Version
The instrument's software version is displayed.



Note. The **Alarm Acknowledge Page** is displayed only if an alarm is present and an Alarm Acknowledgement other than **NONE** is selected in the **Alarm Acknowledge Configuration Page** – see Section 5.2.2.

Fig. 2.3 Security Levels – Basic Operation

2.5 Load Chart Pages

Load chart pages (roll chart and fanfold chart) are detailed in Section 1.3.

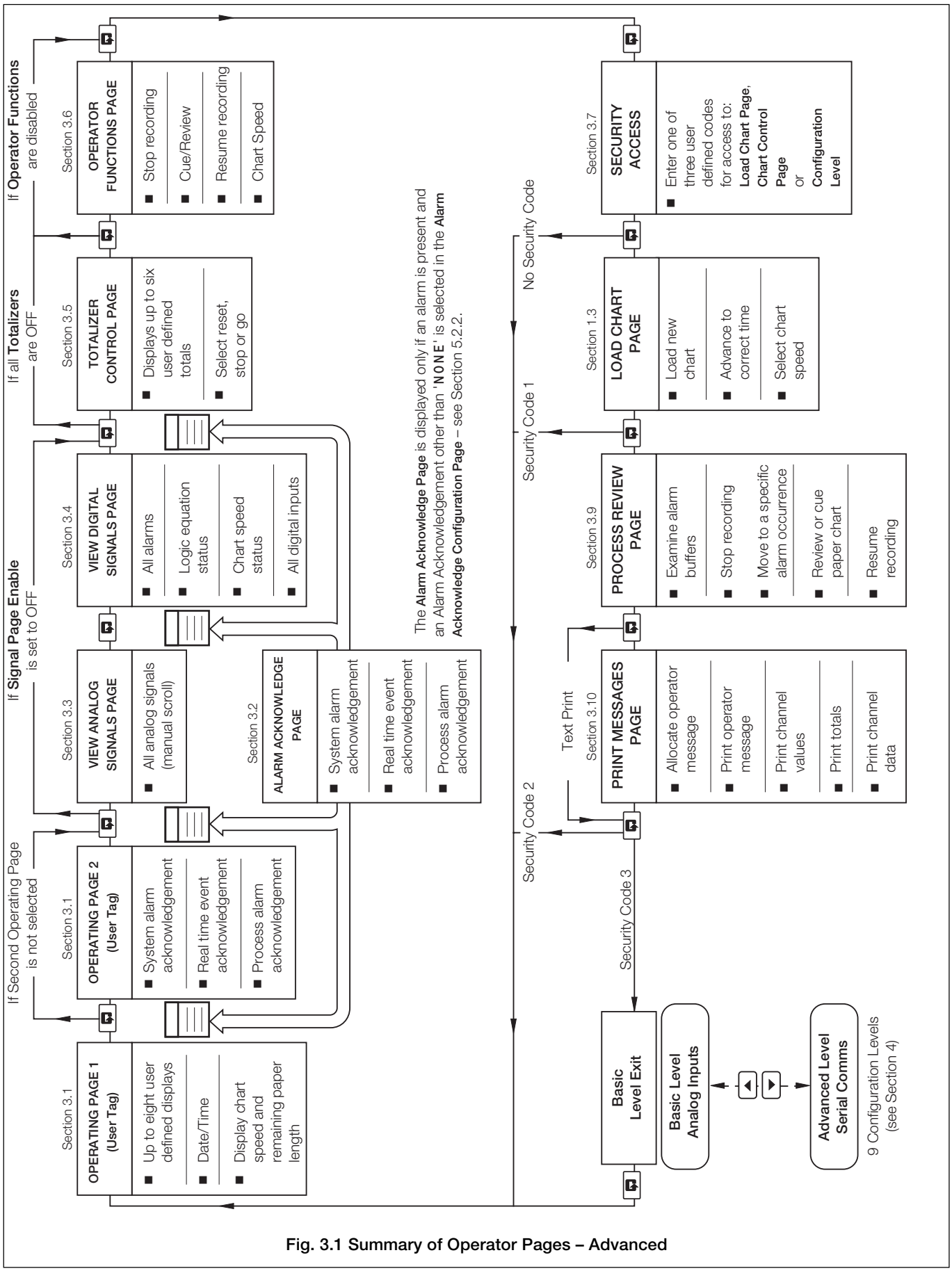


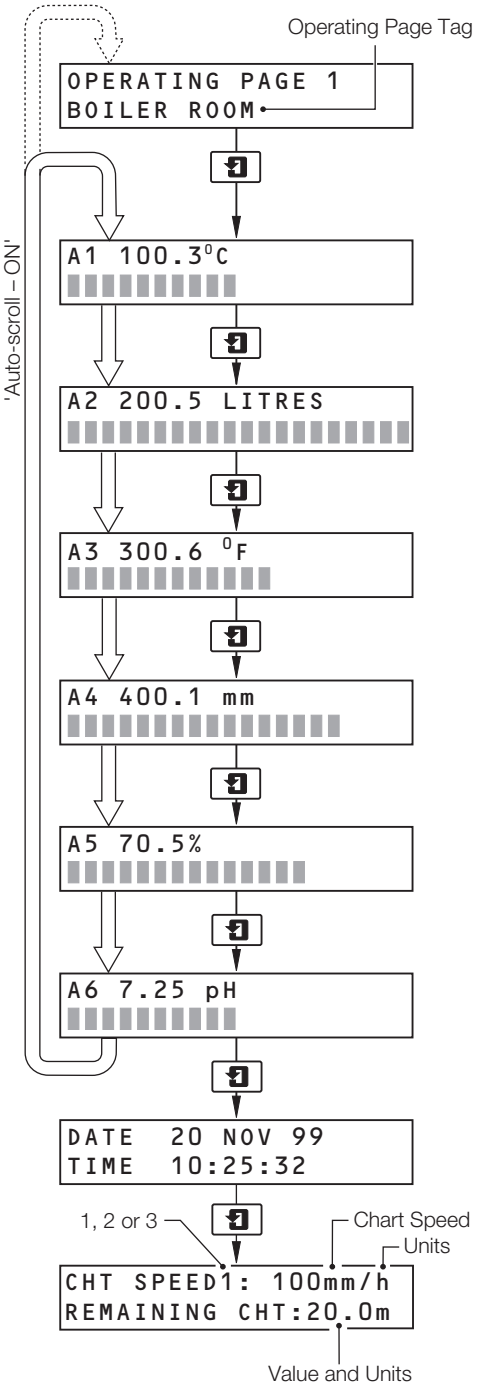
Fig. 3.1 Summary of Operator Pages – Advanced

3.1 Operating Pages 1 and 2

Operating page 1 is the default start page. Operating Page 2 has identical features to Operating Page 1.

Note.

- Autoscroll is enabled on power-up. To disable/enable auto-scroll press the key. Pressing the or keys at any point in the autoscroll cycle also sets autoscroll off.
- The Operating Page Tag, Channel Identifiers, values and units shown in the following frames are examples only.
- The bargraph lower display line is the company standard display option. Refer to Section 3.1.2 for alternative display options.



Operating Page 1
This frame is displayed only if enabled in the **Operating Pages 1 and 2 Configuration Page** – see Section 6.3.2.
Upper Row – page title
Lower Row – operating page tag

Input A1
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A1

Input A2
Input A2 is not displayed on single pen recorders.
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A2

Input A3
Input A3 is not displayed on 1 and 2 pen recorders.
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A3

Input A4
Input A4 is not displayed on 1, 2 and 3 pen recorders.
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A4

Input A5
Input A5 is not displayed on 1, 2, 3 and 4 pen recorders.
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A5

Input A6
Input A6 is not displayed on 1, 2, 3, 4 and 5 pen recorders.
Upper Row – Channel number, value and units
Lower Row – bargraph representation of Input A6

Date/Time
The current date and time are displayed.

Chart Speed and Remaining Paper Length
The current chart speed and remaining paper length are displayed.

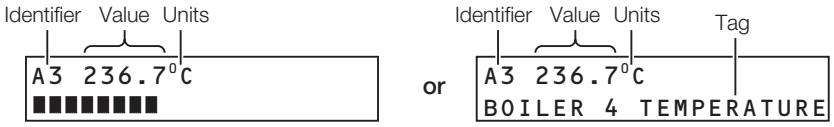
3.1.1 Easy View Facility (roll chart only) – Fig. 2.2

The Easy View facility provides an instant view of the latest trace and text to be printed when operating at low chart speeds (120mm and below). Refer to Section 2.2.1 for full details.

3.1.2 Operating Page Display Options

Alternative parameters can be displayed in the Operating Page. Up to 8 frames can be configured (within the autoscroll cycle) to display information in the following formats – see Section 6.3.2.

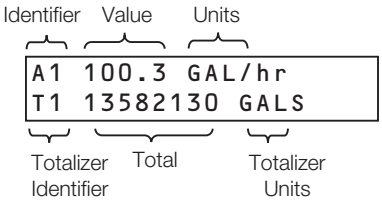
Standard Frame Type – Analog Input or Maths Result



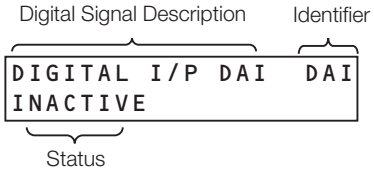
With Bargraph
(Company Standard Setting)

With Channel Tag

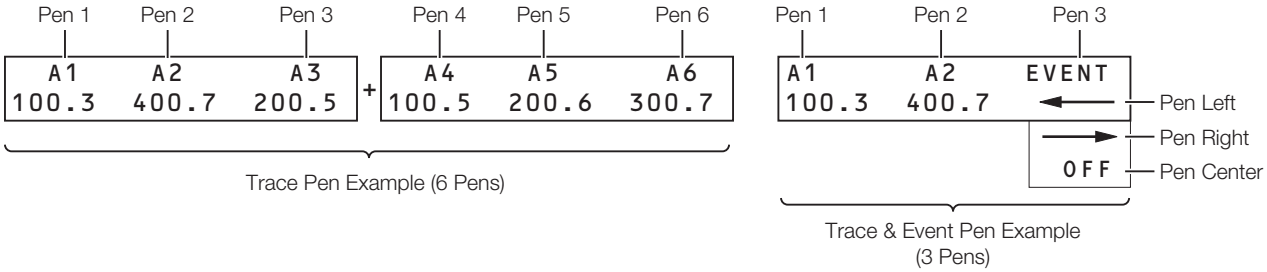
Totalizer Frame Type – Totalizer Value and Units



Digital Frame Type – Digital Signal



Pen Value Frame Type – Multi-display of Analog Inputs Assigned to Pens



3.1.3 Operator Page Messages

POWER FAILED	**Power Failure** Alternates with top row of frame when the instrument is powered up. Press the ↵ key to acknowledge. This message is displayed only if **YES** is selected in the **Power Failure Indication Enable** frame – see Section 5.2.2.
PAPER LOW HOURS REMAINING	**Paper Low/Paper Out** Displayed when the remaining chart paper is running low. The frequency of display of this message increases as the paper length nears it end: >48 hours – no message. <48 hours – message flashes every 5 minutes. <12 hours – message flashes every minute. <2hours – message flashes alternately with **PAPER OUT** message.
PAPER OUT	
A1 200.5°C ZONE 2 TEMPERATURE 🔔	**Alarms** A 🔔 flashes in the top right hand corner to indicate an alarm condition exists. When all active alarms are acknowledged, a steady 🔔 is displayed. **Note.** The 🔔 alarm indicator is displayed only if **ON** is selected in the **Alarm Print Enable** frame – see Section 5.3.1. This allows alarms to be used for control of external devices as part of normal operation without indicating an alarm condition on the chart or the display.
NON-VOL ERROR CHECK CONFIGURATION	**Non-volatile Memory** Turn instrument off and on again. If error is still displayed, check configuration and correct any parameters which have been corrupted. Acknowledge and clear error by pressing the ↵ key.

3.2 Alarm Acknowledge Page

This page is displayed only when alarms are active and the **Acknowledge Type** is `NORMAL` or `LATCH`, see Section 5.2.2.

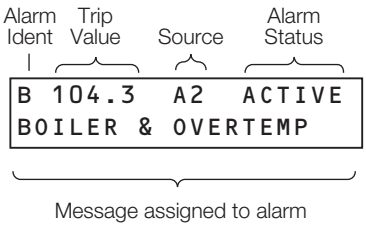
There are three types of alarms:

Process Alarms
Up to 12 alarms assignable to any analog input and activated by pre-defined set points – see Section 5.2.1.

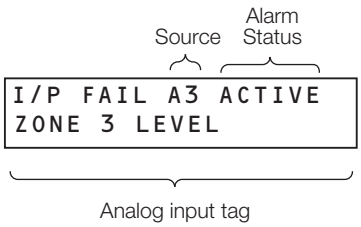
System Alarms
Up to 12 input failure alarms activated by an input being outside its pre-defined range.

Real Time Event
Up to 2 alarms activated at a pre-defined time – see Section 6.2.8.

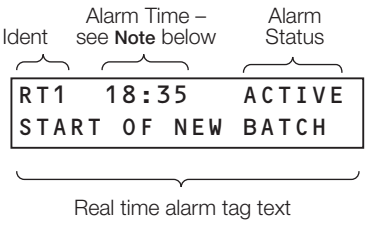
General Format



General Format



General Format



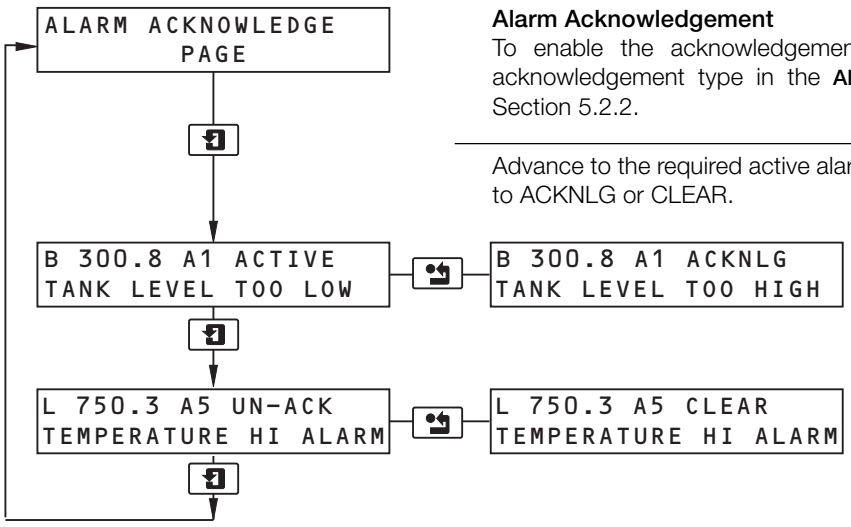
Note. ** is displayed instead of the hour when an alarm has been set to activate at a specific minute each hour – see Section 6.2.8.

Alarm Status

The five types of alarm status are detailed in the table below.

Alarm Status	Alarm Condition	Relay Condition
Active	Active and unacknowledged	Active
Clear	Previously active, acknowledged and now inactive	Inactive
Acknowledged	Active and acknowledged	Active
Latched	Previously active but now inactive	Active
Unack	Previously active but now inactive	Inactive

Note. An alarm status of `CLEAR` is displayed only if the **Alarm Acknowledge Page** is being viewed at the time the alarm becomes inactive.

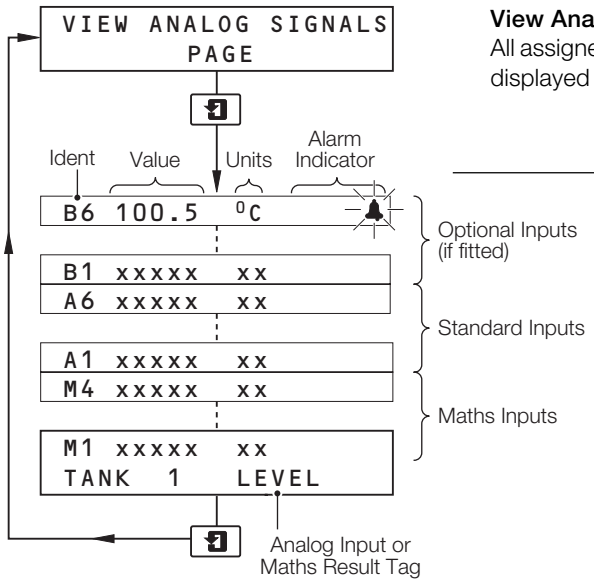


Alarm Acknowledgement
To enable the acknowledgement facility, select either normal or latched acknowledgement type in the **Alarm Acknowledge Configuration Page** – see Section 5.2.2.

Advance to the required active alarm and press enter. The alarm status changes to ACKNLG or CLEAR.

3.3 View Analog Signals Page

This page and the **View Digital Signals Page** are included only if **YES** is selected in the **Signal Page Enable** frame – see Section 6.3.1.



View Analog Signals Page

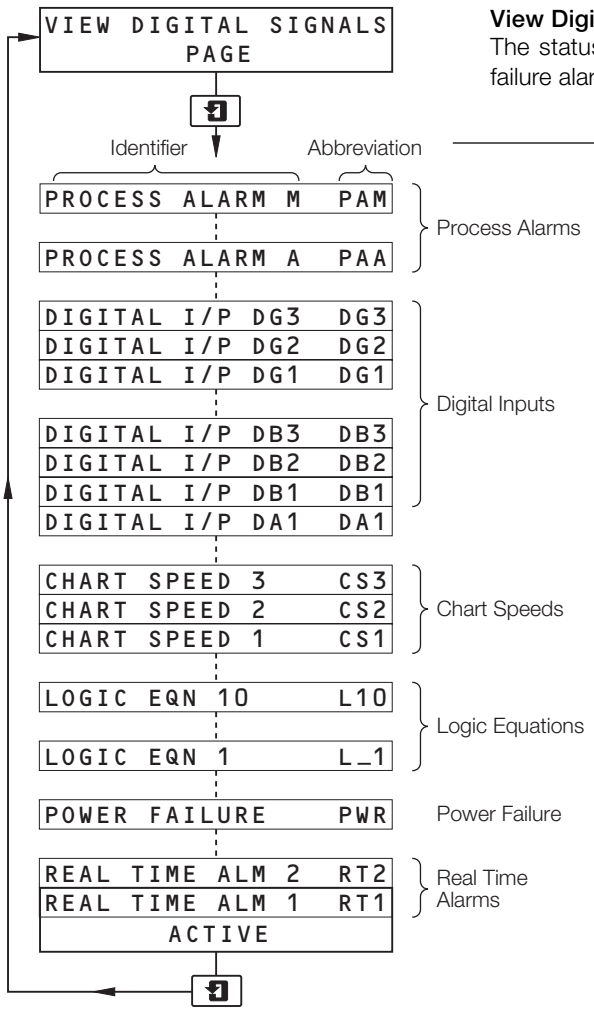
All assigned analog inputs and math blocks can be viewed including any input not displayed in **Operating Pages 1 and 2**.

Analog Input/Math Block

Use the ▲ and ▼ keys to select the analog input or math block to be viewed.

3.4 View Digital Signals Page

This page and the **View Analog Signals Page** are included only if **YES** is selected in the **Signal Page Enable** frame – see Section 6.3.1.



View Digital Signals Page

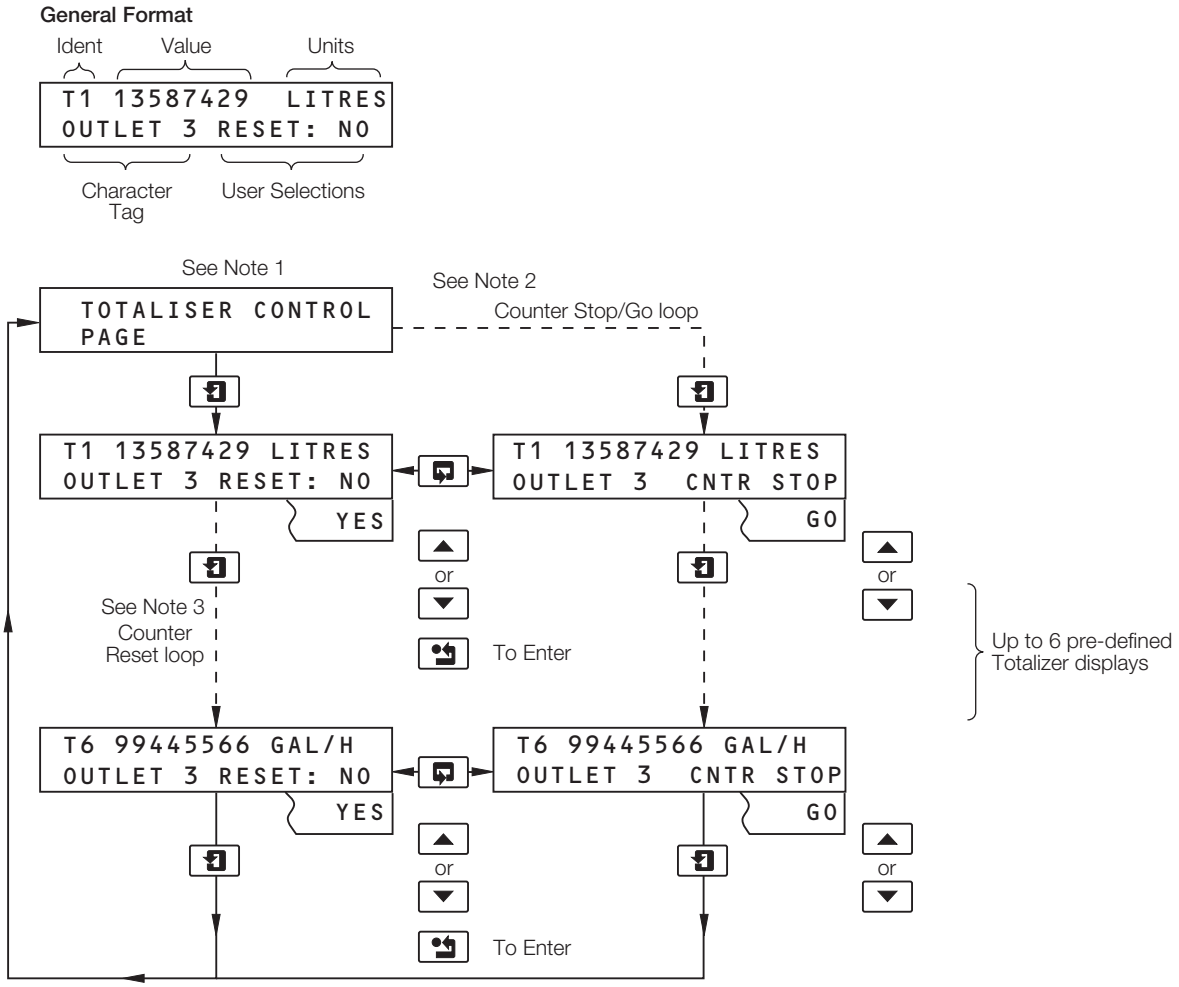
The status of all assigned digital inputs, process and real time alarms, power failure alarm, logic equations and chart speeds can be viewed.

Digital Input and Status

Use the ▲ and ▼ keys to select the digital signal to be viewed. The Input status is shown in the lower display – **ACTIVE**, **INACTIVE** or **OFF**.

3.5 Totalizer Page

This page is omitted if all 6 of the Totalizer Sources are set to **NONE** (totalizer OFF) in the **Totalizer Configuration Page** – see Section 6.4.2.



Notes.

1. Each totalizer defaults to **GO** when set up in the **Totalizer Configuration Page** – see Section 6.4.2.

2. ***Counter Stop/Go***

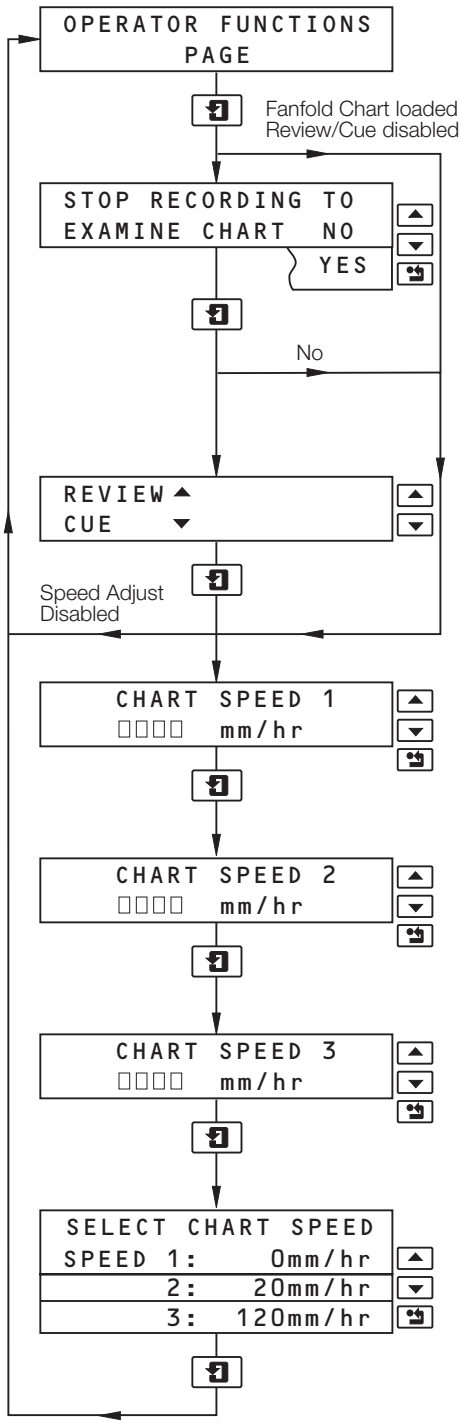
Press the ↻ key from the Counter Reset loop to enter the Counter Stop/ Go loop. The page remains in this loop until the Counter Reset loop is re–selected or the page is exited. Select **GO** to start the counter or **STOP** to stop it.

3. ***Counter Reset***

- The Counter Reset loop is the default loop.
- The batch flow total can be reset to the Preset Value if required. Select **YES** and press the ↻ key to reset the counter.

3.6 Operator Functions Page

This page allows the operator to review the roll chart and set/select chart speeds if enabled in the **Operator Setup Level** – see Section 6.3. The page is not displayed if **NO** is selected in the **Cue/Review Enable** and **Speed Adjust Enable** frames – see Section 6.3.1.



Stop Recording

Select **YES** to stop the chart and advance to **Review/Cue**. Select **NO** to omit **Review/Cue** and advance to **Set Chart Speed**. If fast printing of text is in progress the chart does not stop until printing is complete.

Press ↵ to store the selection.

Once recording is stopped, data is not buffered and therefore incoming data cannot be printed on the chart.

Review/Cue

Use review and cue to rewind or advance the roll chart to examine a specific occurrence.

Pressing the ⏎ key causes recording to be resumed automatically.

Set Chart Speeds

Set each of Chart Speeds 1, 2 and 3, between 0 and 1500mm/h. When the selected speed is reached, press the ↵ key to store the selection.

Select Chart Speed

Select one of three pre-defined chart speeds. The values shown are the company standard settings.

Press the ↵ key to store the selection.

3.7 Security Access

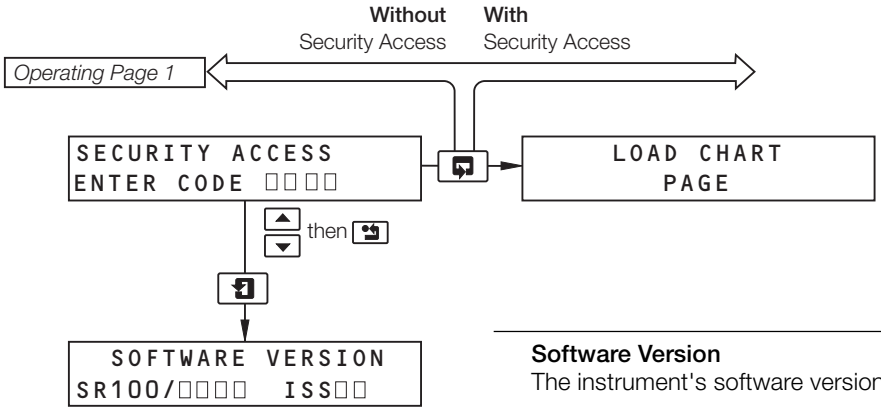
A security system prevents tampering with the secure parameters by utilizing three levels of access.

Security Level 1 – access to **Load Chart Page**.

Security Level 2 – access to **Process Review Page** and **Print Messages Page**.

Security Level 3 – access to the **Configuration Level Pages**.

If necessary, Security Access can be disabled to allow entry to all pages by setting the passwords to 0 – see Section 5.5.1. If access to security level 3 is not available contact the Customer Support Organization for further information.



Security Access
Enter password 1 or 3 to obtain access to load chart page and/or the configuration level. Press the key to enter password.

Software Version
The instrument's software version is displayed.

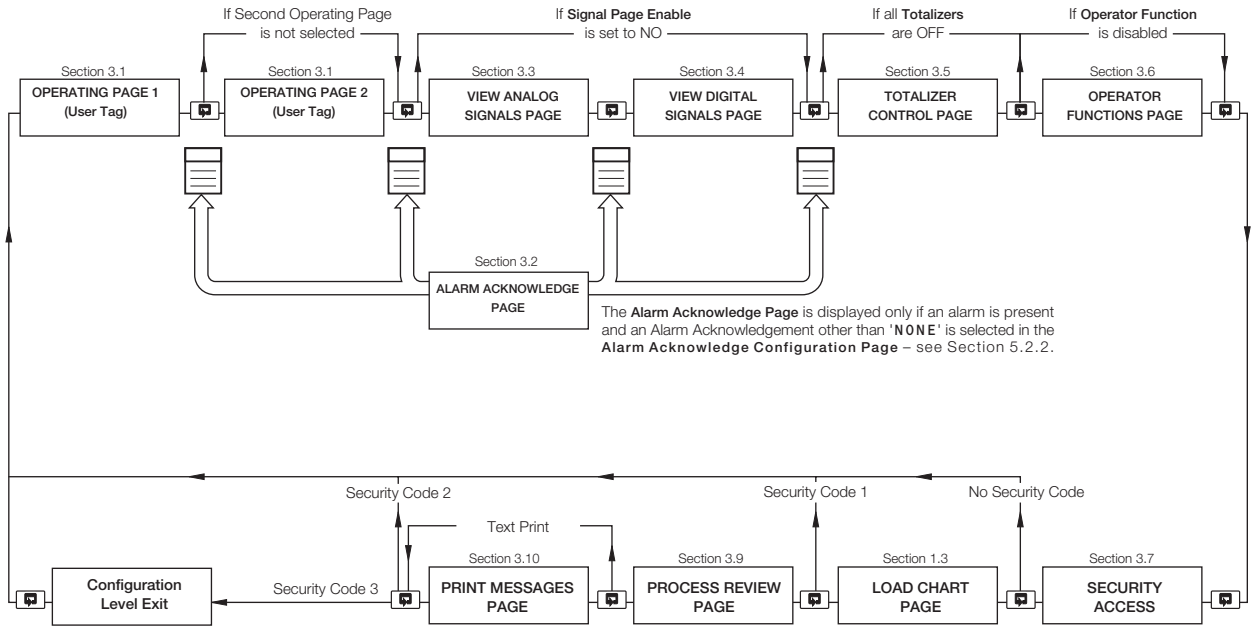


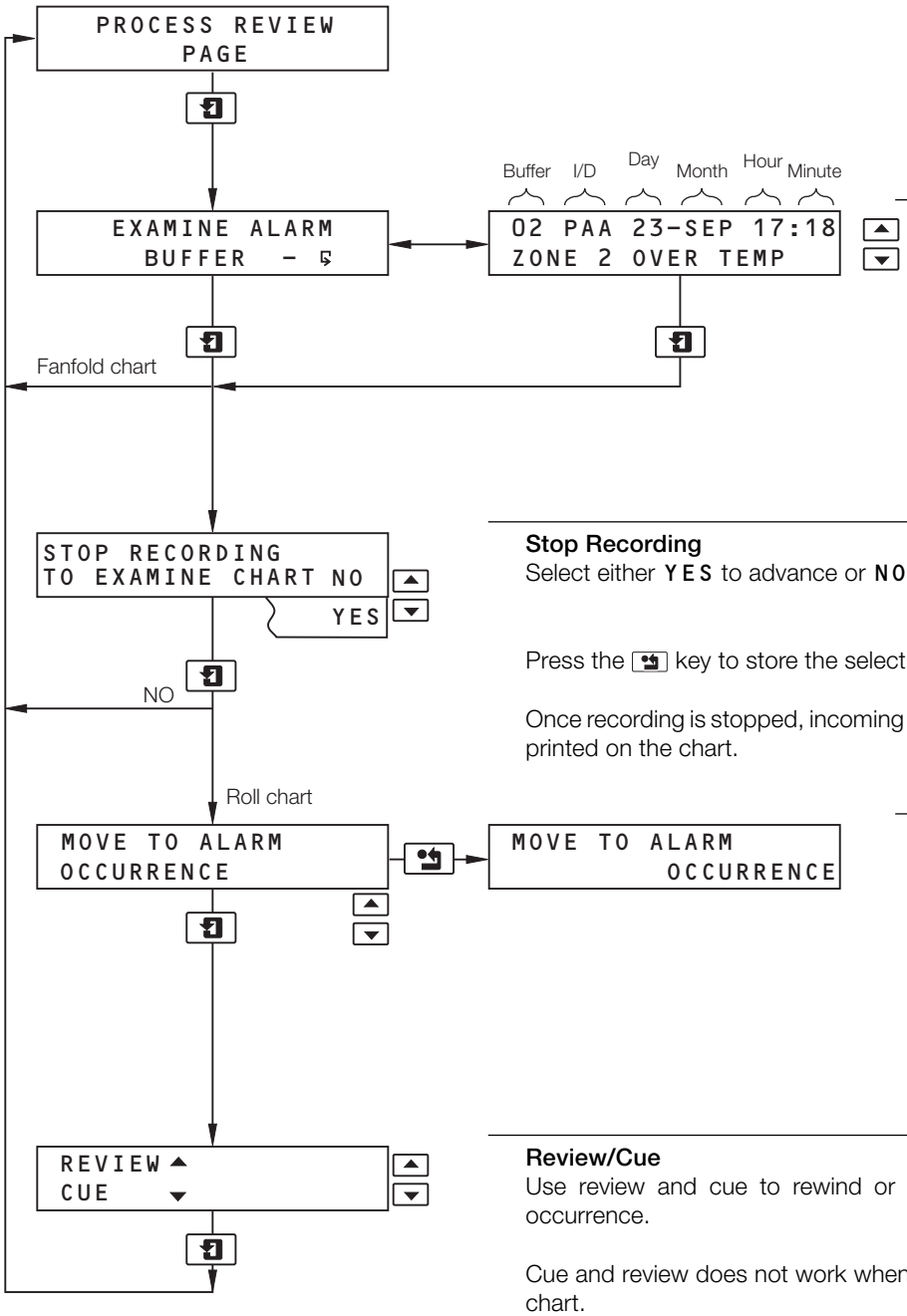
Fig. 3.2 Security Levels – Advanced Operation

3.8 Load Chart Pages

Load Chart Pages are detailed in section 1.3. Two pages are provided, one for loading a roll chart, the other for loading a fanfold chart.

3.9 Process Review Page

This page can be accessed only with Security Access Level 2 or 3 and is used to review the alarm buffer and chart.



Examine Alarm Buffers
The last 10 process or real time alarms can be viewed. A buffer number is assigned to each alarm. Buffer 1 contains the most recent alarm.

Select the buffer to be viewed.

Note. Reloading a new chart clears the buffer.

Stop Recording
Select either **YES** to advance or **NO** to return to top of page.

Press the ↵ key to store the selection.

Once recording is stopped, incoming data is not buffered and therefore cannot be printed on the chart.

Move To Alarm Occurrence
The chart can be automatically rewound to any one of the above alarm buffers. On entering the desired buffer identity number the lower chart display changes to **SEARCHING** and the chart rewinds to the selected alarm occurrence.

Select the required buffer identity number and press the ↵ key.

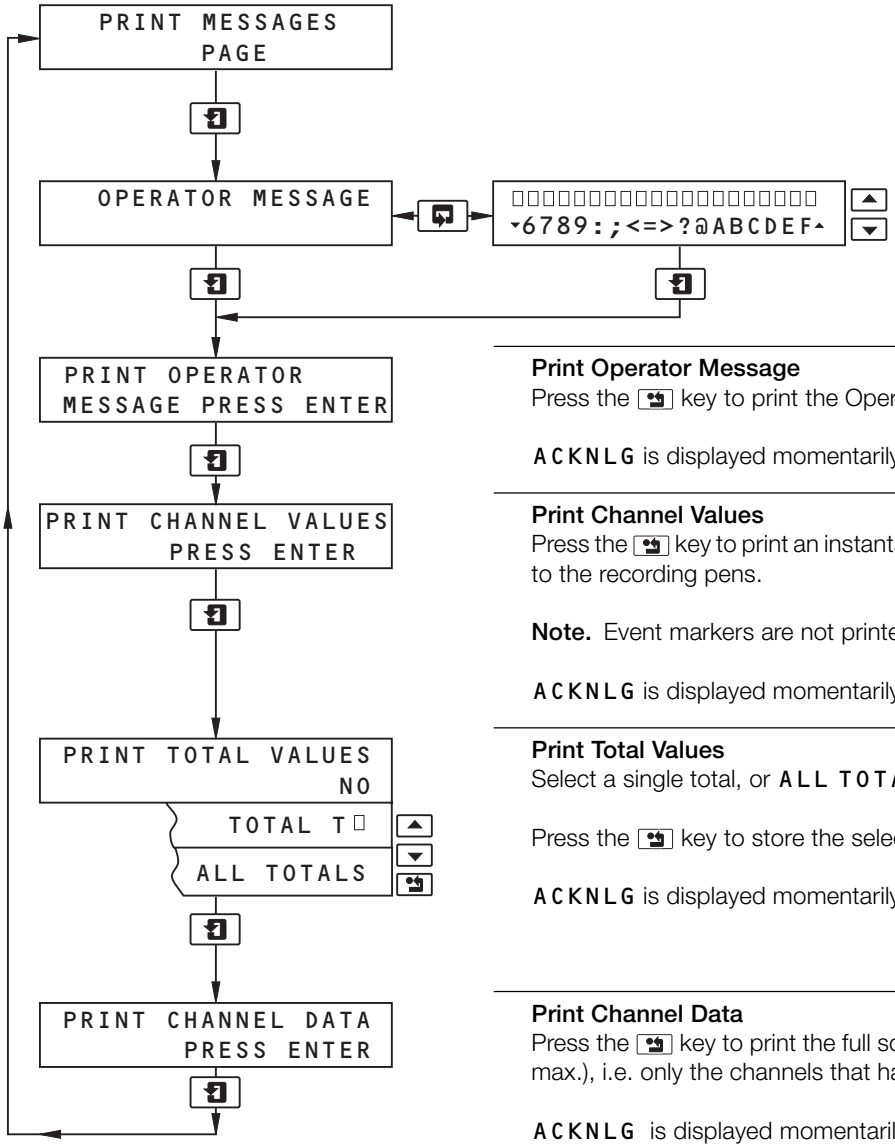
Review/Cue
Use review and cue to rewind or advance the chart to examine a specific occurrence.

Cue and review does not work when less than 20mm have been recorded on a chart.

Note. Recording resumes automatically when this page is exited.

3.10 Print Messages Page

In the **Print Messages Page** it is possible to enter an operator message in the upper display. The lower display shows a portion of the available character set – see Front Fold-out.



Operator Message
An operator message of up to twenty characters can be set on the upper display – see Front Fold-out.

Print Operator Message
Press the ↵ key to print the Operator Message on the chart.

ACKNLG is displayed momentarily.

Print Channel Values
Press the ↵ key to print an instantaneous value and units of any inputs assigned to the recording pens.

Note. Event markers are not printed.

ACKNLG is displayed momentarily.

Print Total Values
Select a single total, or **ALL TOTALS**, to be printed on the chart.

Press the ↵ key to store the selection and print the values.

ACKNLG is displayed momentarily.

Print Channel Data
Press the ↵ key to print the full scale and zero values of the recorded inputs (6 max.), i.e. only the channels that have trend pens assigned to them.

ACKNLG is displayed momentarily.

4 CONFIGURATION – GENERAL

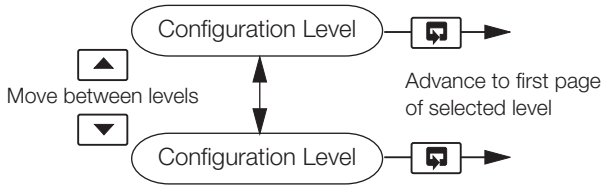
The configuration programming pages are separated into two major levels, BASIC and ADVANCED. An overview of the configuration programming pages is shown on the Back Fold-out. Associated pages are grouped into sub-levels within the major levels.

4.1 Controls – Fig. 4.1

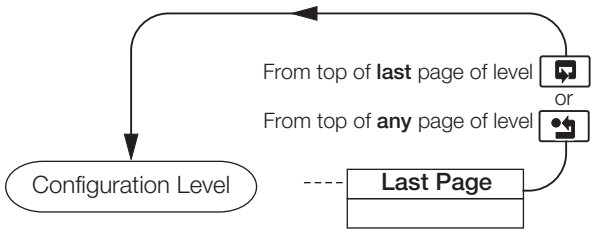
Movement between pages and parameters uses the same controls as the operating pages – see Front Fold-out.

The controls used to move between levels and from the page tops, back to the configuration levels, are shown in Fig. 4.1.

Tags and messages can be entered at set parameters within the configuration pages. The illustration on the Front Fold-out shows the controls and method required to enter text.



A – Moving between Configuration Levels



B – Returning to Configuration Level

Fig. 4.1 Configuration Level Controls

4.2 Input Options

Depending on the options selected the instrument can have up to 12 analog inputs – see Table 4.1. The pen option determines the number of inputs available on the standard analog input board (A1 to A6). The type of input module fitted in module position B determines the number of additional inputs available (B1 to B6); Type 3 (3 inputs), Type 6 (6 inputs) – see Table 4.1.

Pen Option		1 Pen		2 Pen		3 Pen		4 Pen		5 Pen		6 Pen	
Standard Inputs Available	A1	●		●		●		●		●		●	
	A2			●		●		●		●		●	
	A3					●		●		●		●	
	A4							●		●		●	
	A5									●		●	
	A6											●	
Module Type		3	6	3	6	3	6	3	6	3	6	3	6
Optional Inputs Available	B1	●	●	●	●	●	●	●	●	●	●	●	●
	B2	●	●	●	●	●	●	●	●	●	●	●	●
	B3	●	●	●	●	●	●	●	●	●	●	●	●
	B4		●		●		●		●		●		●
	B5		●		●		●		●		●		●
	B6		●		●		●		●		●		●
Max. No. of Inputs		4	7	5	8	6	9	7	10	8	1	9	12

Table 4.1 Input Options

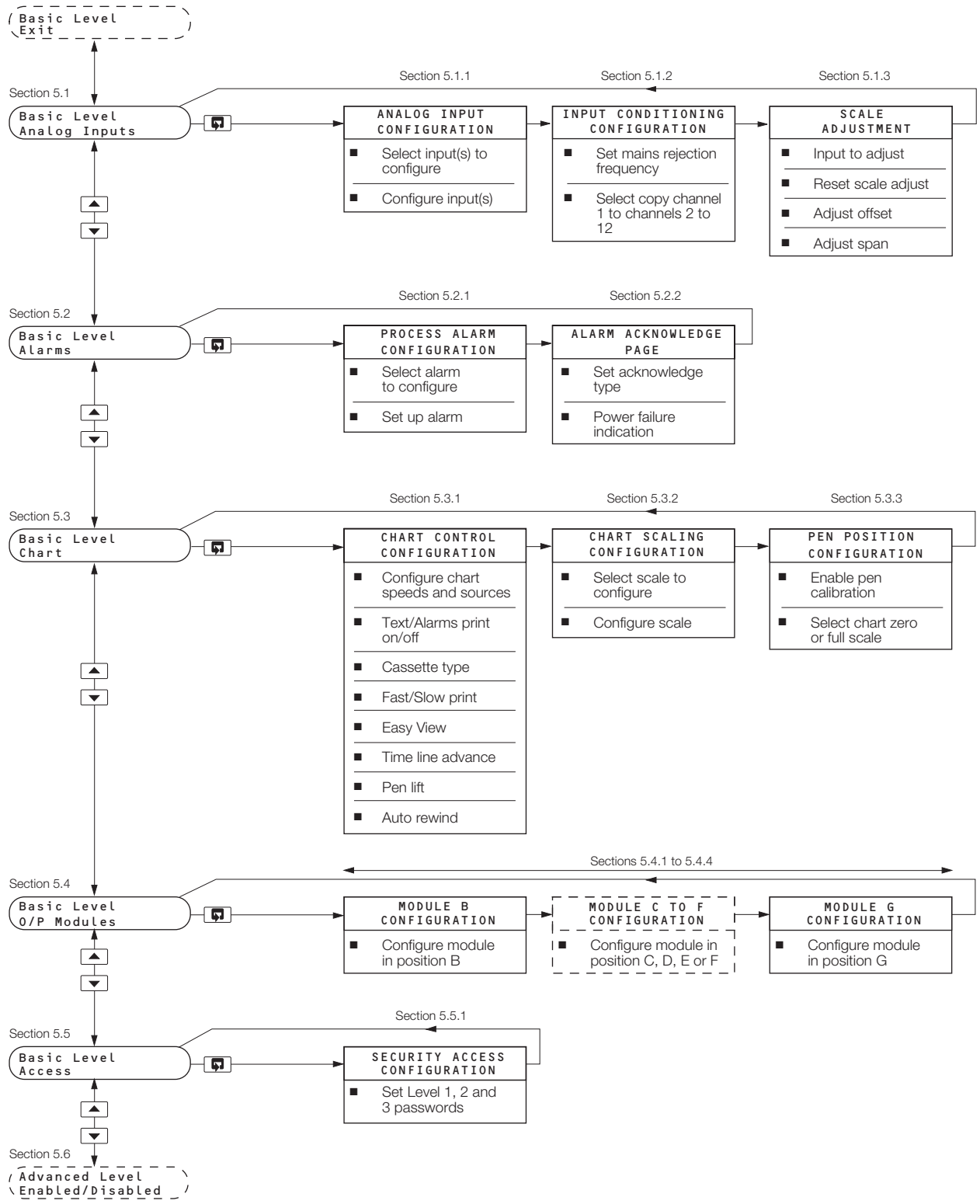


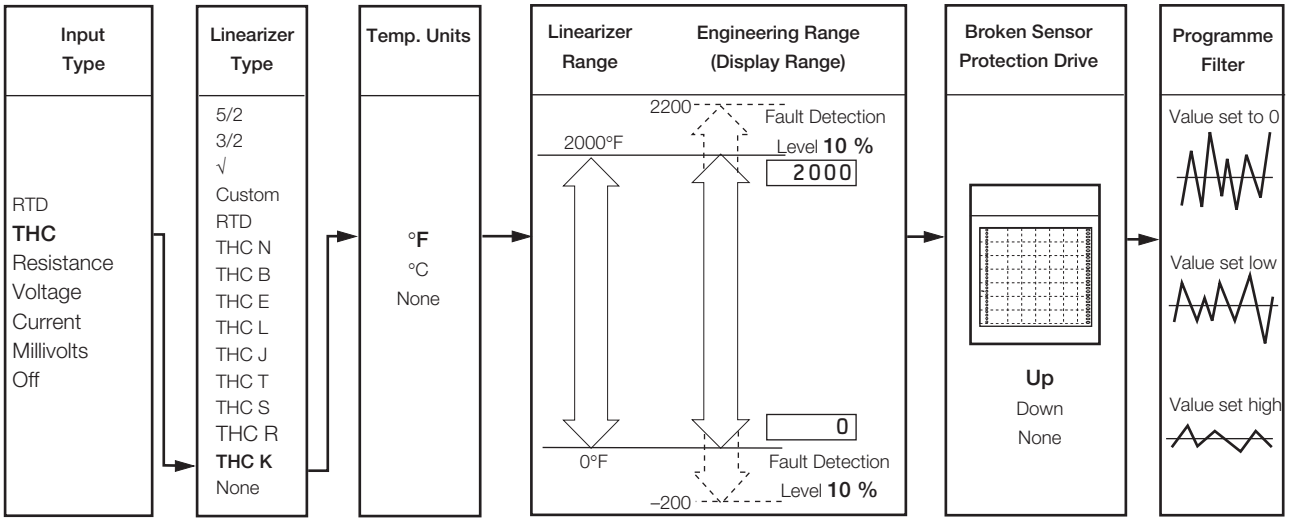
Fig. 5.1 Basic Level – Overview

5.1 Basic Level – Analog Inputs

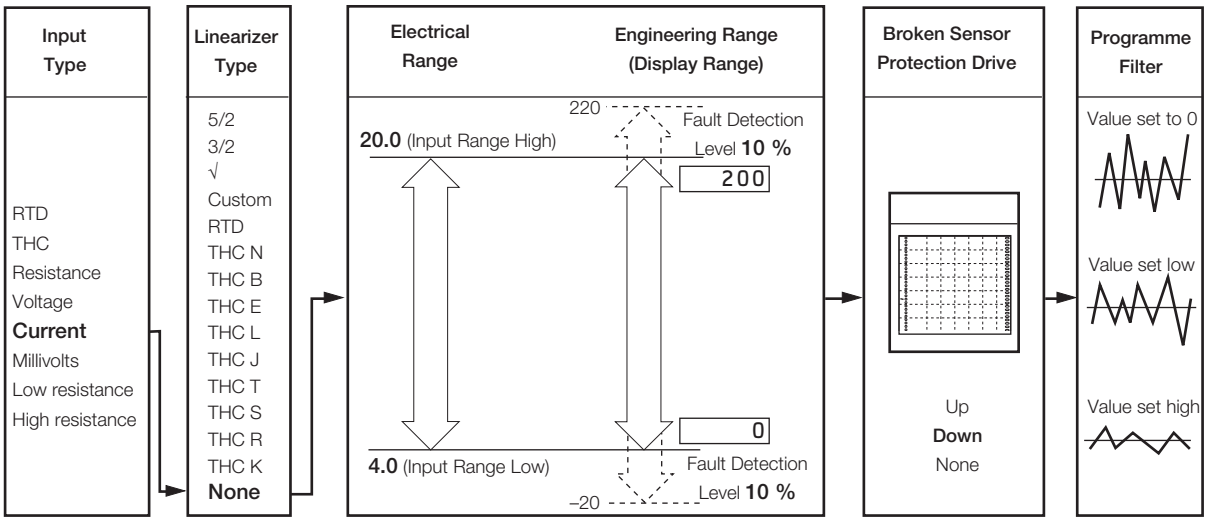
5.1.1 Analog Input Configuration Page

Information.
- Up to 12 analog inputs – on standard boards (inputs A1 to A6) and optional boards (inputs B1 to B3 or B1to B6).
- Universal inputs – mV, mA, V, THC, RTD and resistance.
- Internal cold junction compensation.
- Linearization – of temperature sensors or any electrical input to allow use of non-linearizing transmitters.
- Programmable fault levels and actions.
- Digital filter – to reduce the effect of noise on inputs.

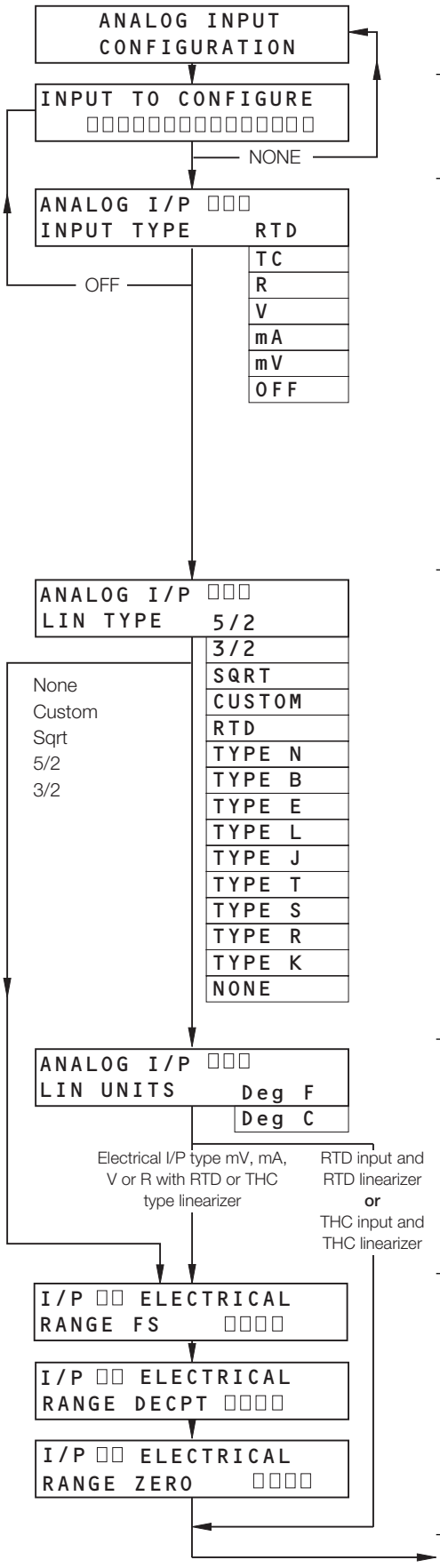
Example A – setting up:
- a Type K thermocouple
- measuring temperature in °F
- displaying a range of 0 to 2000°F (e.g. Linearizer range 0 to 2000°F)
- a fault detection level 10% above 2000°F (engineering/display range) and 10% below 0°F (engineering/display range)
- in the event of a fault being detected and/or the fault detection level being exceeded the process variable is driven upscale.



Example B – setting up:
- a current input of 4 to 20 mA
- displaying a range of 0 to 200psi
- a fault detection level 10% above 200psi (engineering/display range) and 10% below 0psi (engineering/display range)
- in the event of a fault being detected and/or the fault detection level being exceeded the process variable is driven downscale.



...5.1.1 Analog Input Configuration Page



Input to Configure
Select the analog input to configure (A1 to A6, B1 to B6, depending on the options fitted – see Section 4.2). On entry the default is NONE.

Input Type
Select the analog input type required:

RTD	–	Resistance Thermometer
TC	–	Thermocouple*
R	–	Resistance
V	–	Voltage
mA	–	Low current (set to at least one decimal point)
mV	–	Low voltage
OFF	–	Sets input to off (analog I/P A1 cannot be turned off)

* For thermocouple applications using an external fixed cold junction, select **mV** input type.

Note. Before selecting input types other than **TC** and **mV**, ensure links are set correctly – see Section 7.5.1.

Linearizer Type
Select the linearizer type required:

5/2	–	$x^{5/2}$
3/2	–	$x^{3/2}$
SQRT	–	Square root
CUSTOM	–	As set in **Math Functions Configuration Level**
RTD	–	Resistance Thermometer
TYPE N	–	Type N thermocouple
TYPE B	–	Type B thermocouple
TYPE E	–	Type E thermocouple
TYPE L	–	Type L thermocouple
TYPE J	–	Type J thermocouple
TYPE T	–	Type T thermocouple
TYPE S	–	Type S thermocouple
TYPE R	–	Type R thermocouple
TYPE K	–	Type K thermocouple
NONE	–	No Linearizer

Linearizer Units
Select the temperature units required, degrees Fahrenheit or degrees Celsius.

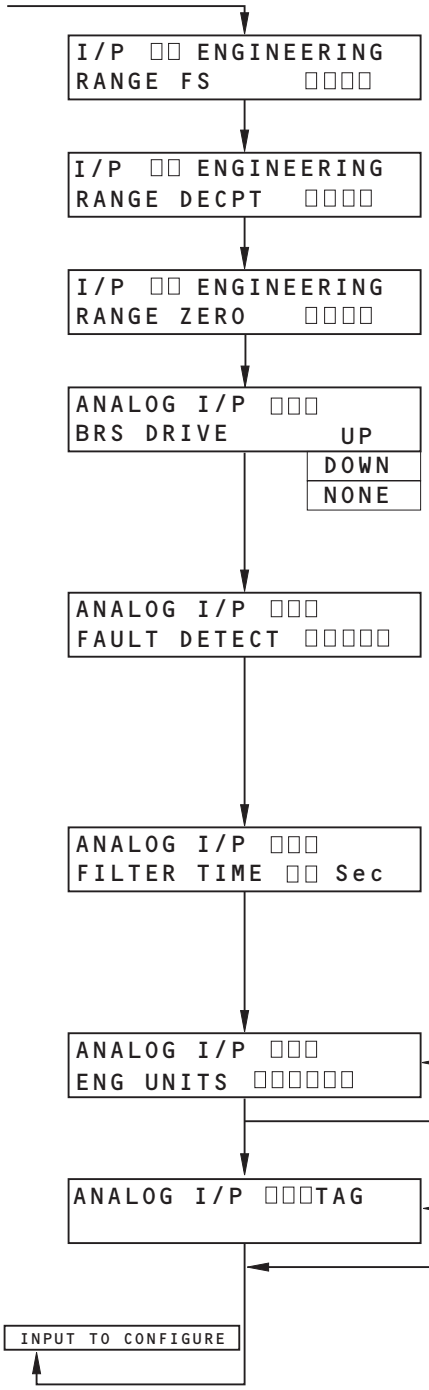
Input Electrical Range
Defines the electrical range (mA, mV, V or Ω) over which the input operates.

The limits are as specified in Table 5.1 on page 33.

The values and the decimal point position should be set such that the input is calculated to the maximum number of decimal places.

Continued on next page.

…5.1.1 Analog Input Configuration Page



Input Engineering Range

For inputs with RTD and thermocouple linearizers:

Defines both the display range of the instrument and the operating range of the input linearizer. The limits are as specified in table 5.2, according to linearizer type.

For other input linearizer types (or NONE):

Defines the engineering range (i.e. what is displayed) over the elecrical range entered previously. The limits are –999 to +9999 for both range full scale and zero.

Broken Sensor Drive

In the event of a fault being detected on the input, the analog input is driven according to the Broken Sensor Drive. Select the broken sensor drive required:

- **UP** – Upscale drive
- **DOWN** – Downscale drive
- **NONE** – No drive

Fault Detection

A fault level percentage can be set to detect a deviation above or below the input span. Set the value required, between 0.0 and 100.0% of the display range in 0.1% increments.

Example – for a 10% setting on an input range of 100 to 200mV, a fault is detected at 90mV and 210mV.

Filter Time

This setting can be used to smooth the transition between input steps or to 'average out' a noisy input. It sets the time period (between 0 and 60 seconds in 1 second increments) in which the process variable input is sampled. The analog input is then calculated from the average of the samples taken.

Engineering Units

Input units of up to six characters can be set on the upper display – see Front Fold-out.

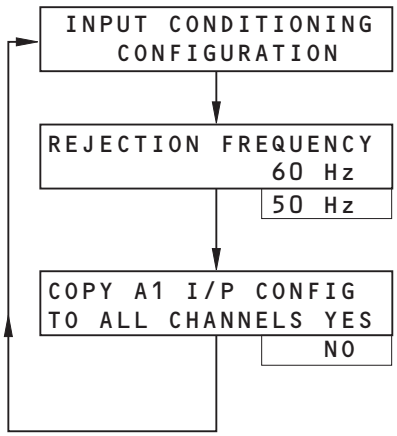
Analog Input Tag

An input description of up to twenty characters can be set on the upper display – see Front Fold-out.

Return to **Input to Configure** frame.

5.1.2 Input Conditioning Configuration Page

Information.
- Mains filter – selectable for maximum noise rejection.
- Quick input configuration feature (copies channel A1 settings to all other inputs) – for applications where all the inputs are the same.



Rejection Frequency
Select the mains rejection frequency required; 50Hz or 60Hz.

Copy A1 Input Configuration
Allows the configuration set for channel A1 to be copied to all other analog input channels. The tag set for A1 is also copied to all the channels

Return to top of **Input Conditioning Configuration** frame.

Input Type	Min. Value	Max. Value	Min. Span
Millivolts	–2000	2000	2.5
Volts	–20	20	0.25
Milliamps	–100	100	0.25
Resistance	0	8000	10

Table 5.1 Electrical Limits

THC /RTD Type	°C			°F		
	Min.	Max.	Min. Span	Min.	Max.	Min. Span
Type B	–18	1800	710	0	3272	1278
Type E	–100	900	45	–148	1652	81
Type J	–100	900	50	–148	1652	90
Type K	–100	1300	65	–148	2372	117
Type L	–100	900	50	–148	1652	90
Type N	–200	1300	90	–328	2372	162
Type R & S	–18	1700	320	0	3092	576
Type T	–250	300	60	–418	572	108
RTD	–200	600	25	–328	1112	45

Table 5.2 Temperature Limits

Note. Performance accuracy is not guaranteed below 400°C (725°F) for types B, R and S thermocouples.

Min. span below zero:	Type T	70°C/126°F
	Type N	105°C/189°F
THC standards	DIN 43710	IEC 584
RTD standard	DIN 43760	IEC 751

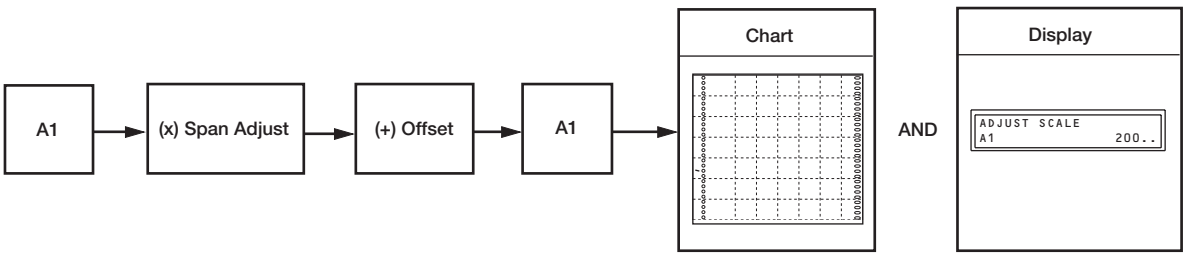
5.1.3 Scale Adjustment Page

Information.
- Analog inputs – do not require re-calibrating when the input or range is changed.
- Scale Adjustment Reset – removes any previously programmed offset or scale adjustment settings.
- System Offset Errors – can be removed using Offset Adjustment.
- System Scale Errors – can be removed using Span Adjustment.
- Offset/span Adjustment – can be used to perform spot calibration.

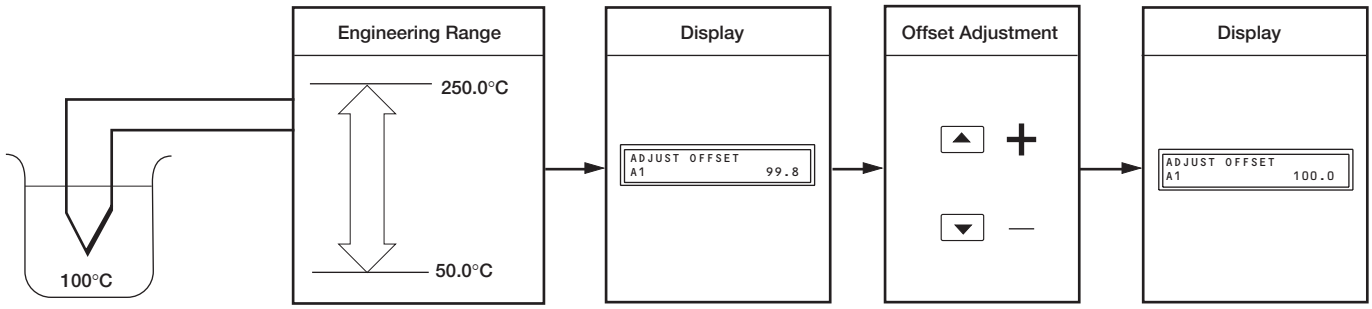
Switch off the power supply to the instrument. Connect accurate signal sources, suitable for simulation over the entire input range, in place of each analog input connection A1 to A6 (terminals TB1–1 to 18) and B1 to B6 (terminals TB2–1 to 18), if fitted. For thermocouple inputs, connect the millivolt source using appropriate compensating cable – see Table 5.3. For 2–lead resistance thermometers, connect the resistance box at the sensor end of the leads or the lead resistance must be added to the calibration values.

As a general rule spot calibration should be:
< 50% of range span value when using Offset Adjustment parameters
> 50% of range span value when using Span Adjustment parameters

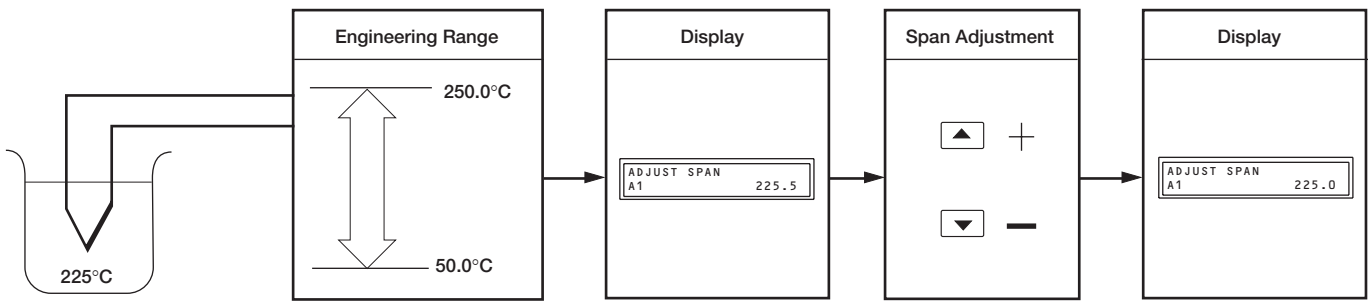
Scale Adjustment



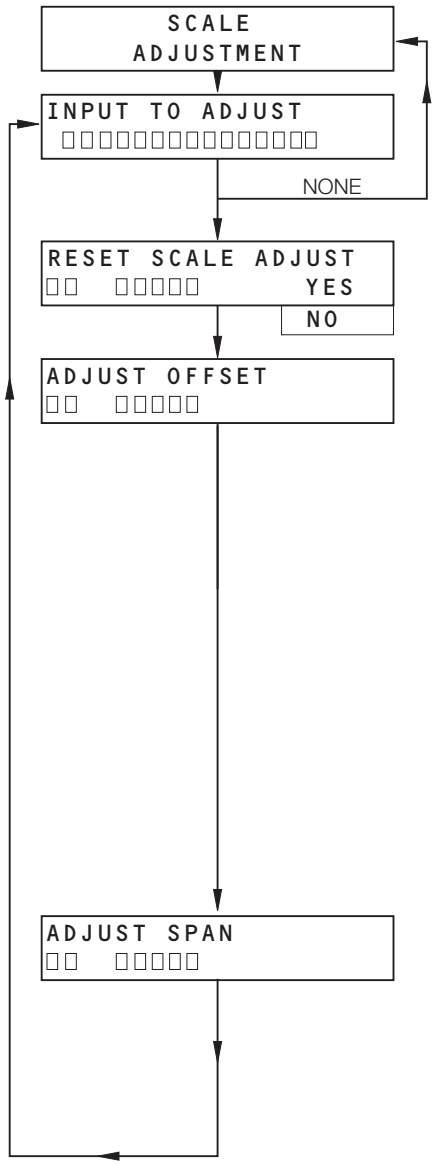
Offset Adjustment



Span Adjustment



...5.1.3 Scale Adjustment Page



Input to Adjust
Select the analog input to adjust (A1 to A6, B1 to B6, depending on the options fitted – see Section 4.2). On entry the default is **NONE**.

Scale Adjustment Reset
Select **YES** to reset the analog input offset and span values to their nominal values.

Offset Adjustment
Electrical and resistance thermometer inputs:
apply the correct input for the spot calibration required.
For RTD inputs, use resistance values obtained from standard tables.

Thermocouple inputs:
measure the ambient temperature at the output terminals of the signal source (calibrator). From thermocouple tables obtain the millivolt equivalent of this temperature (a) and that for the spot calibration temperature (b). Subtract (a) from (b) and set the signal source to the resultant value. (The voltage is negative if the spot calibration temperature is below the measured ambient temperature).

Note. The displayed units are engineering units.

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

Example – if the display range is 50.0 to 250.0 and a spot calibration is required at 100.0 and 225, inject a signal equivalent to 100.0 and set the display to 100.0.

Span Adjustment
Proceed as for **Offset Adjustment** above and apply the correct input for the spot calibration required. The displayed units are engineering units. Set the value required. The decimal point is set automatically.
For the example above inject a signal equivalent to 225.0 and set the display to 225.0.

Return to **Input to Adjust** parameter.

Type of Thermocouple	Compensating Cable											
	BS1843			ANSI MC 96.1			DIN 43714			BS4937 Part No.30		
	+	–	Case	+	–	Case	+	–	Case	+	–	Case
Ni-Cr/Ni-Al (K)	Brown	Blue	Red	Yellow	Red	Yellow	Red	Green	Green	Green	White	Green *
Ni-Cr/Cu-Ni (E)	—			—			—			Violet	White	Violet *
Nicrisil/Nisil (N)	Orange	Blue	Orange	Orange	Red	Orange	—			Pink	White	Pink *
Pt/Pt-Rh (R and S)	White	Blue	Green	Black	Red	Green	Red	White	White	Orange	White	Orange *
Pt-Rh/Pt-Rh (B)	—			—			—			Grey	White	Grey *
Cu/Cu-Ni (T)	White	Blue	Blue	Blue	Red	Blue	Red	Brown	Brown	Brown	White	Brown *
Fe/Con (J)	Yellow	Blue	Black	White	Red	Black	Red	Blue	Blue	Black	White	Black *
* Case Blue for intrinsically safe circuits												
Fe/Con (DIN 43710)	—			—			DIN 43710			—		
							Blue/red	Blue	Blue			

Table 5.3 Thermocouple Compensating Cables

5.2 Basic Level – Alarms

5.2.1 Process Alarm Configuration Page – Figs. 5.2 and 5.3

Information.
- 12 Process alarms – identified A to M (excluding I).
- High/low process alarms.
- Alarms assignable to any analog input or math result.
- Adjustable hysteresis value – to prevent oscillation of alarm state.
- Alarms can trigger printing of messages – see Sections 6.1.2 and 6.1.3.

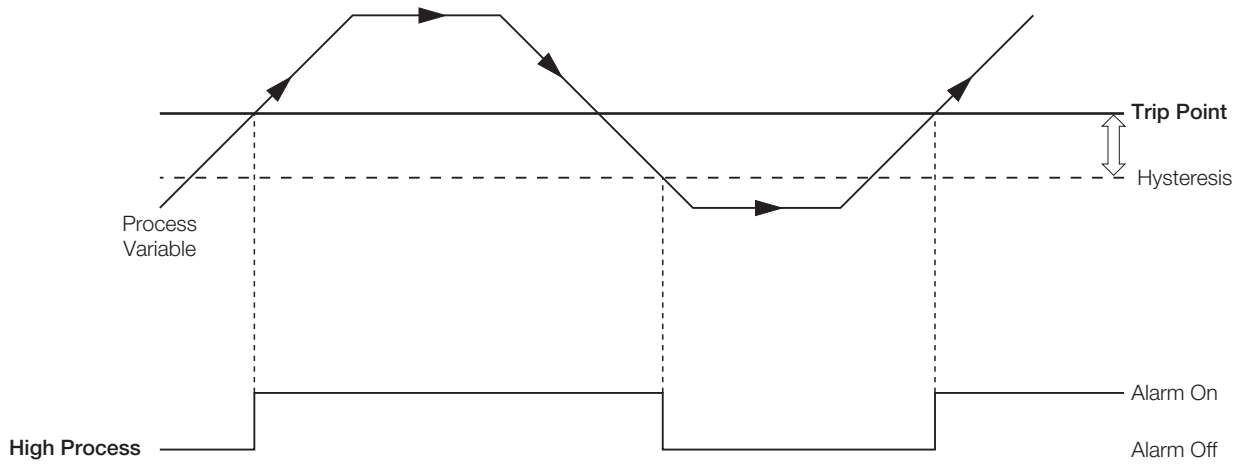


Fig. 5.2 High Process with Hysterisis

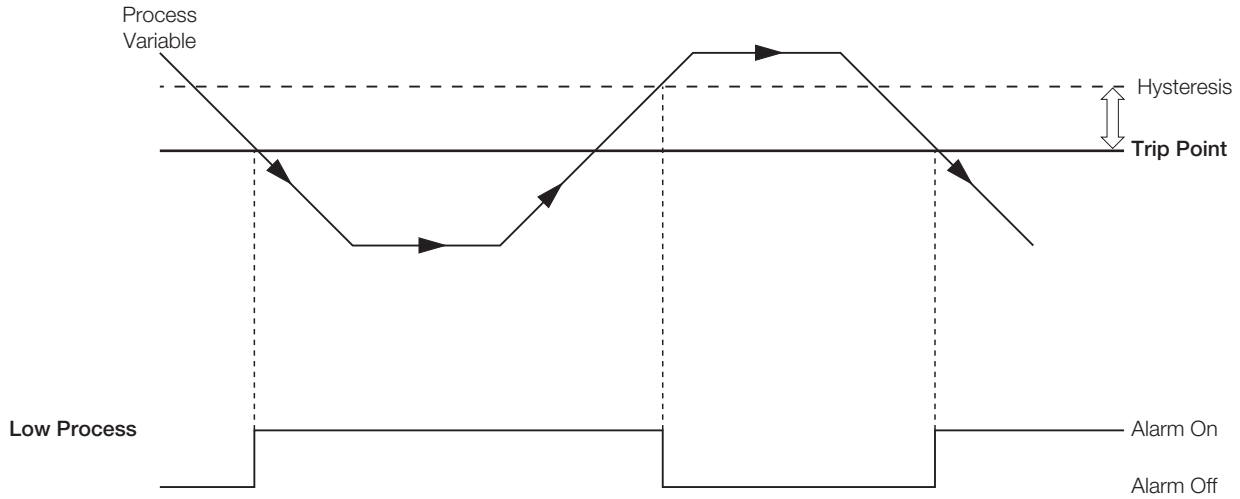
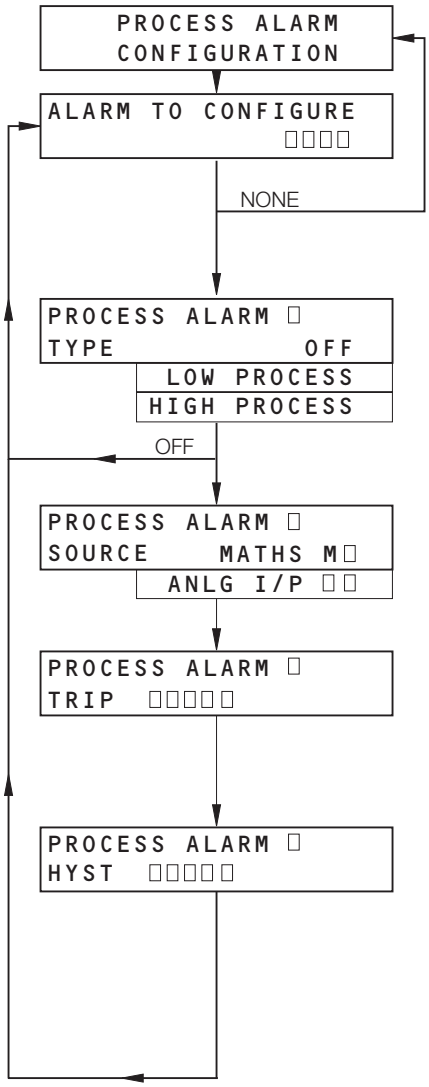


Fig. 5.3 Low Process with Hysterisis

...5.2.1 Process Alarm Configuration Page



Alarm to Configure
Select the process alarm to configure. Up to twelve alarms (A to M, excluding I) can be programmed. Each alarm can be assigned an Alarm Type, a Trip Level and a Hysteresis setting. Alarm A is the highest priority and M the lowest.

On entry the default is **NONE**.

Alarm Type
An alarm type can be assigned to the alarm identity selected above.
Select the alarm type required:

OFF	–	Sets alarm selected above to **OFF**
LOW PROCESS	–	Alarm activated when process falls below trip level
HIGH PROCESS	–	Alarm activated when process rises above trip level.

Alarm Source
An alarm source is assigned to the alarm identity selected above.
Select the alarm source required from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.2) and math functions M1 to M4.

Trip Level
Set the trip level for the alarm selected above (the trip level set should not exceed the display range limits by more than 10%).

Trip levels are displayed in engineering units.

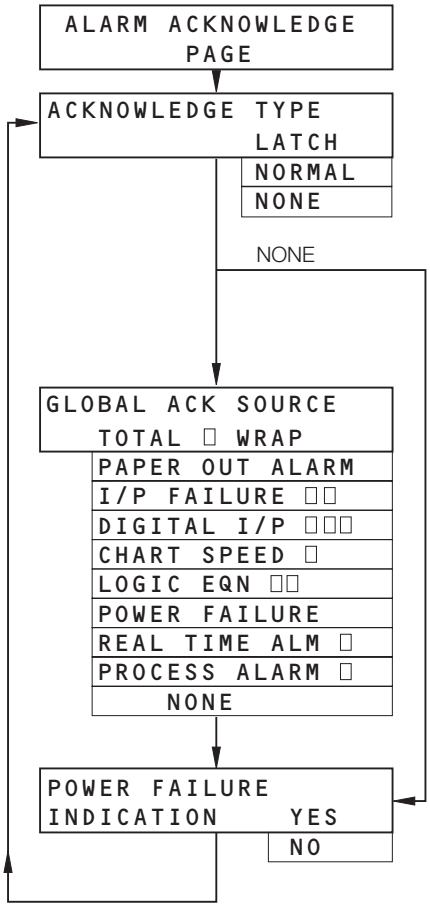
Hysteresis
The hysteresis is operational when the alarm is active.
Set the hysteresis value required (in engineering units) between display full scale and zero.

The alarm is activated at the trip level but turns off only after the alarm variable has moved into the safe region by an amount exceeding the hysteresis value.

Return to **Alarm to Configure** frame.

5.2.2 Alarm Acknowledge Configuration Page

Information.
- Three operator acknowledge options.
- Global alarm acknowledgement – from internal or external digital source.
- Indication of power failure – can be enabled/disabled.



Acknowledge Type
Select the type of alarm acknowledge facility required:

`LATCH` – Alarm state remains active until acknowledged in the **Alarm Acknowledge Page** in the **Operator Level** (see Section 2.3) and the condition is removed.

`NORMAL` – Alarm state remains active until the condition is removed. Acknowledge facility available.

`NONE` – Alarm state remains active until the condition is removed. Acknowledge facility not available.

Global Acknowledge Source
Select the source required to acknowledge all alarms:

`TOTAL WRAP` – Wrap-around of a totalizer (T1 to T6)
`PAPER OUT ALARM` – End of chart reached
`I/P FAILURE` – Failure of analog input (A1 to A6, B1 to B6)
`DIGITAL I/P` – Active digital input (DA1 to DG3)
`CHART SPEED` – Selection of chart speed (1 to 3)
`LOGIC EQN` – Logic equation true (1 to 10)
`POWER FAILURE` – After power failure
`REAL TIME ALM` – Real time alarm on (1 or 2)
`PROCESS ALARM` – Pre-defined process alarm (A to M, excluding I)
`NONE` – No automatic acknowledge required.

Power Failure Indication Enable
Select `YES` to enable the display of the Power Failure alarm in the **Alarm Acknowledge Page** in the **Operator Level** (see Section 2.3) and the `POWER FAILED` message in the **Operating Pages**.

Return to **Acknowledge Type** frame.

Acknowledge Type	Alarm Condition	Alarm Acknowledged	Alarm Acknowledge Page Display	***Operating Page Display
`LATCH`	Alarm Present	No	`ACTIVE`	Flashing 🔔
		Yes	`ACKNLG`	**Steady 🔔
	Alarm Cleared	No	`LATCH`	Flashing 🔔
		Yes	*`CLEAR` (or none)	None
`NORMAL`	Alarm Present	No	`ACTIVE`	Flashing 🔔
		Yes	`ACKNLG`	**Steady 🔔
	Alarm Cleared	No	`UN-ACK`	Flashing 🔔
		Yes	*`CLEAR` (or none)	None
`NONE`	Alarm Present	N/A	`N/A`	Flashing 🔔
	Alarm Cleared	N/A	`N/A`	None

* An alarm status of `CLEAR` is displayed only if the **Alarm Acknowledge Page** in the **Operator Level** (see Section 2.3) is being viewed at the time the alarm becomes inactive.

** A steady 🔔 appears only when ALL active alarms are acknowledged.

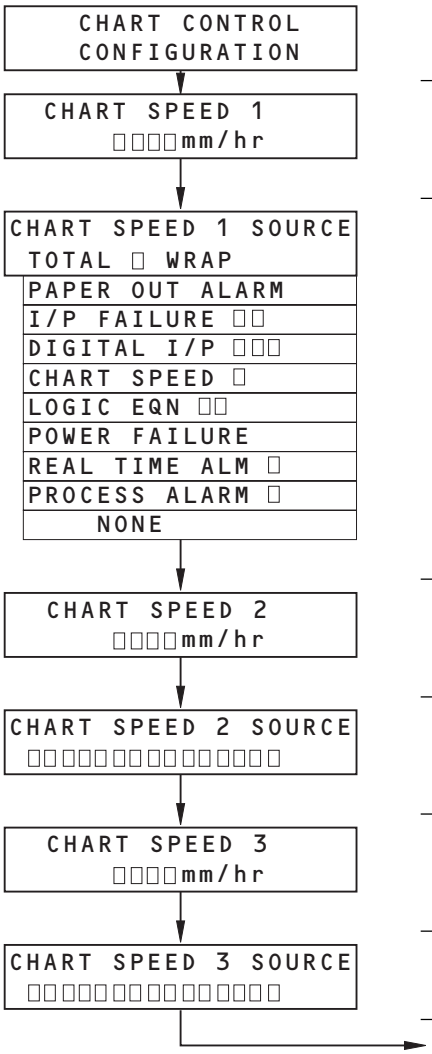
*** The flashing or steady 🔔 appears on the Operating Page Display only if alarm print is set to `ON`.

Table 5.4 Alarm Acknowledge Facilities and Displays

5.3 Basic Level – Chart

5.3.1 Chart Control Configuration Page

Information.
- Set up to 3 independent chart speeds – selectable from operating level or by digital signal.
- Enable/disable printing of text (except alarms).
- **NO AUTO PRINT** facility – allows an unbroken trace at higher chart speeds (> 120mm/h) with printing of time, scales, etc. at the start and end of a batch.
- Enable/disable alarm printing.
- Text can be selected to be printed fast or slow.
- Auto pen-drop – automatically returns the pen capsule to an operating state after a 5 minute delay to ensure recording is not inadvertently left disabled.
- Easy View feature – allows quick access of latest printed Information.
- Time Line Advance – allows the chart to be advanced to the required time line before commencing recording.



Set Chart Speed 1
Select a chart speed between 0 and 1500mm/hr.

Chart Speed 1 Source
Select the source required to initiate a change to chart speed 1:

TOTAL WRAP	–	Wrap-around of a totalizer (T1 to T6)
PAPER OUT ALARM	–	End of chart reached
I/P FAILURE	–	Failure of analog input (A1 to A6, B1 to B6)
DIGITAL I/P	–	Active digital input (DA1 to DG3)
CHART SPEED	–	Selection of chart speed (1 to 3)
LOGIC EQN	–	Logic equation true (1 to 10)
POWER FAILURE	–	After power failure
REAL TIME ALM	–	Real time alarm on (1 or 2)
PROCESS ALARM	–	Pre-defined process alarm (A to M, excluding I)
NONE	–	No automatic action

Set Chart Speed 2
Select a chart speed between 0 and 1500mm/hr.

Chart Speed 2 Source
Select a chart speed source as for chart speed 1 above.

Set Chart Speed 2
Select a chart speed between 0 and 1500mm/hr.

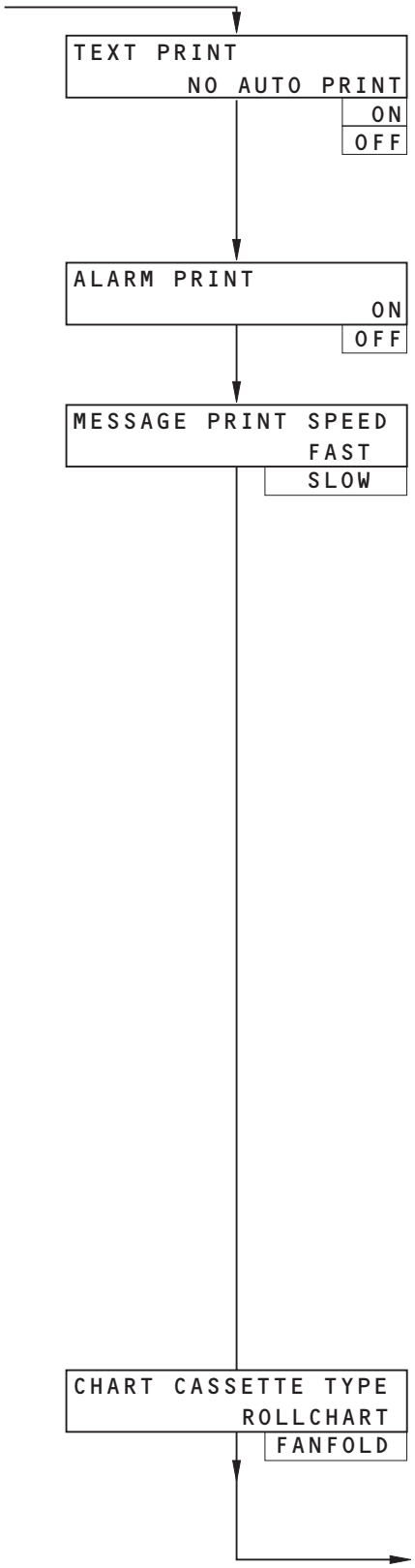
Chart Speed 3 Source
Select a chart speed source as for chart speed 1 above.

Continued on next page.

Information. A chart speed of 120mm/hr is required when digital input DA1 is active. At all other times set chart speed to 20mm/hr.
- Set chart speed 1 to 20mm/hr
- Set chart speed 2 to 120mm/hr
- Set chart speed 1 source to **CHARTSPEED 2**
- Set chart speed 2 source to DA1

Select chart speed 1 and start recording. When DA1 becomes active the chart speed changes to 120mm/hr. When DA1 becomes inactive the chart speed returns to 20mm/hr.

…5.3.1 Chart Control Configuration Page



Text Print Enable
Select the text printing required:

- `NO AUTO PRINT` – disable printing all text that is printed automatically, i.e. Time, Date, Channel Tags and Trace Identifiers
- `ON` – enable printing of all text except alarm messages
- `OFF` – no text printing.

Alarm Print Enable
Select `ON` to enable the printing of alarm messages.

Message Print Speed
With chart speeds ≤120mm/hr the selections have the following effect:

- `FAST` – Interrupts chart traces to print alarms or operator message.
- `SLOW` – Prints alarms or operator message during chart traces.

Above 120mm/hr chart traces are automatically interrupted for fast printing.

Parameter to Print	Chart Speed ≤ 120 mm/h	
	Print Speed Slow	Print Speed Fast
Process Alarms	Slow	Fast
Real Time Alarms	Slow	Fast
Time	Slow	Slow
Chart Speed Change	Slow	Slow
Time/Date Chart Speed (240 mm)	Slow	Slow
Scales (Scale Internal)	Slow	Slow
Scales (Digital Signal)	Slow	Slow
20 Character Channel Tag	Slow	Slow
Channel Values	Fast	Fast
Operator Message	Slow	Fast
20 Character Message Block	Slow	Fast
Channel Data	Fast	Fast
Trace Identifiers	Slow	Slow
Totalized Values	Fast	Fast
Scales (Test Print)	Fast	Fast

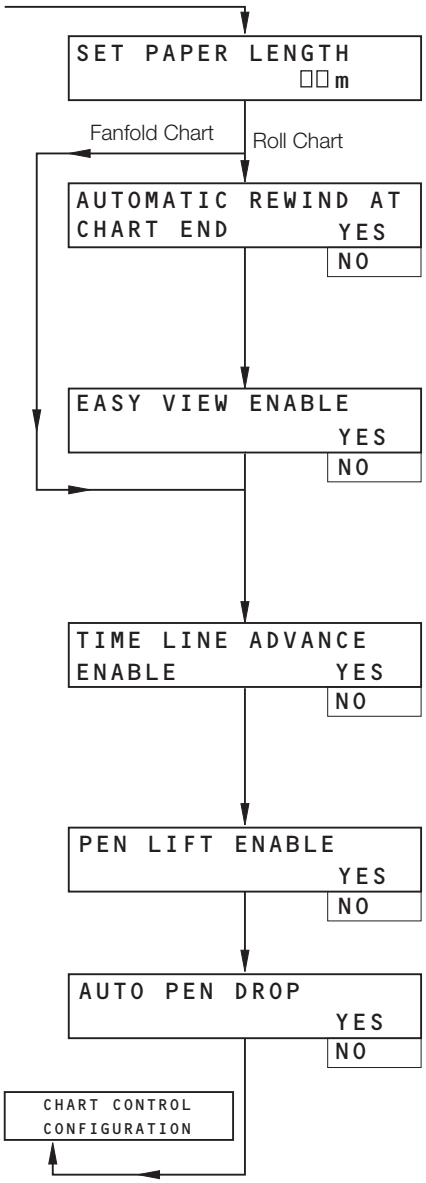
Note. The parameters in the above table are listed in order of the priority in which they are printed.

Chart Cassette Type
Select the type of chart cassette to be used.

Caution. Ensure the correct type of cassette is set. Damage to the instrument may occur if the type is set incorrectly.

Continued on next page.

...5.3.1 Chart Control Configuration Page



Set Paper Length
Set the required paper length in 1m increments. For roll chart cassette type, maximum paper length is 25m. for fanfold cassette type, maximum paper length is 12m.

Automatic Chart Rewind
When this feature is enabled, chart recording will stop and the chart will automatically rewind when the chart remaining value reaches zero.

Note. Automatic rewind will operate only if the instrument is in **Operating Page 1 or 2** or either of the **View Signals Pages** when the chart end state is set.

Easy View Enable (roll chart only)
Easy view allows the operator to view the latest printed information on the chart by winding the chart forward a small distance for a few seconds. The chart is automatically returned to the recording position where it prints any buffered data, ensuring no loss of data.

Select **YES** to enable Easy View function in **Operating Pages 1 and 2**.

Time Line Advance
The time line function enables the chart to be advanced to the required time line before commencing recording.

Select **YES** to display Time Line advance function in the **Load Chart Page**.

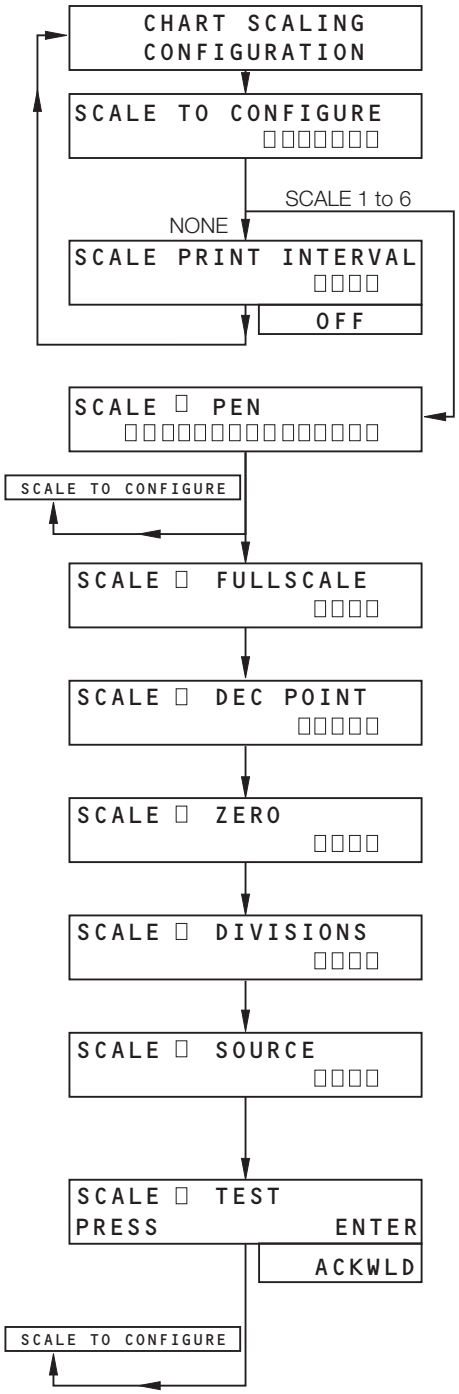
Pen Lift Enable
Select **YES** to enable the front panel Pen Raise/Lower key (⇆).

Auto Drop Enable
Select **YES** to enable the auto drop facility. This returns the pen capsule to an operating state approximately 5 minutes after the pen lift is activated.

Return to top of **Chart Control Configuration Page**.

5.3.2 Chart Scaling Configuration Page

Information.
- Up to six independent scales can be printed on the chart.
- Programmable full scale and zero values.
- Test print facility to enable instant checking of entered scale.
- Selectable interval between scales on charts.



Scale to Configure
Six separate scales can be programmed with full scale and zero values, the decimal point position and the division separation of the selected chart.
Select the scale to configure. On entry the default is **NONE**.

Set Print Interval
Set the interval required between scales on chart between 10mm and 240mm in 1mm intervals (this interval is the length of channel traces and not the actual chart length). If automatic scale printing is not required, select **OFF**.

Scale Pen
Select the pen color to be used to print the selected scale (refer to Table 5.5 on page 43 for pen options).

Set Full Scale
Select the full scale value for the scale, between –999 and +9999.

Set Decimal Point
Select the number of decimal places for the scale (0, 1 or 2).

Set Zero
Select the zero value for the scale, between –999 and +9999.

Set Divisions
Select the division separation of the chart for the scale (75, 70, 60, 50, 40 or 30).

Set Source
Select the digital source required to print the scale – refer to the **Chart Speed 1 Source** frame in the **Chart Control Configuration Page** (Section 5.3.1) for options.

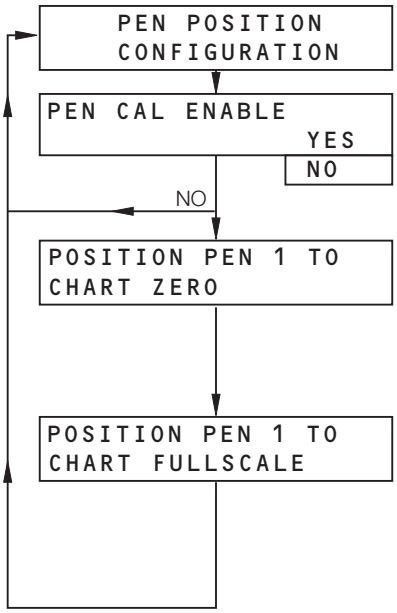
Scale Test
Pressing the ↵ key initiates a scale test print. The scale is always printed in the Fast Text mode.

Return to **Scale to Configure** parameter.

Note. Select the minimum number of digits for full scale value to ensure that the printed scale does not obscure the chart. If the sub-divisions of the scale for the major traces on the chart are not integers then set the correct number of decimal places to give the optimum accuracy.

5.3.3 Pen Position Configuration Page

Information.
- Allows accurate calibration of the pen positions on the chart.
- Can be used to remove effects of inconsistencies in the charts.



Pen Calibration Enable
Select **YES** to advance to the zero and full scale setting parameters.

Chart Zero Position
The chart advances at high speed and the pen moves to its zero position. With the door open set the chart zero position of pen 1 – Magenta/Red using the ▲ and ▼ keys. Press the ↵ key to store the pen 1 zero position.

Chart Full Scale Position
The chart continues to advance at high speed and the pen moves to its full scale setting. Set the chart full scale position of pen 1.

Press the ↵ key to store the pen 1 full scale position.

Return to **Pen Position Configuration** frame.

Instrument Type	Available Colors/Pen No.					
	Pen 1	Pen 2	Pen 3	Pen 4	Pen 5	Pen 6
Single Pen	Red	—	—	—	—	—
Two Pen	Red	Green	—	—	—	—
Three Pen	Red	Green	Blue	—	—	—
Four Pen	Magenta	Red	Black	Green	—	—
Five Pen	Magenta	Red	Black	Green	Blue	—
Six Pen	Magenta	Red	Black	Green	Blue	Brown

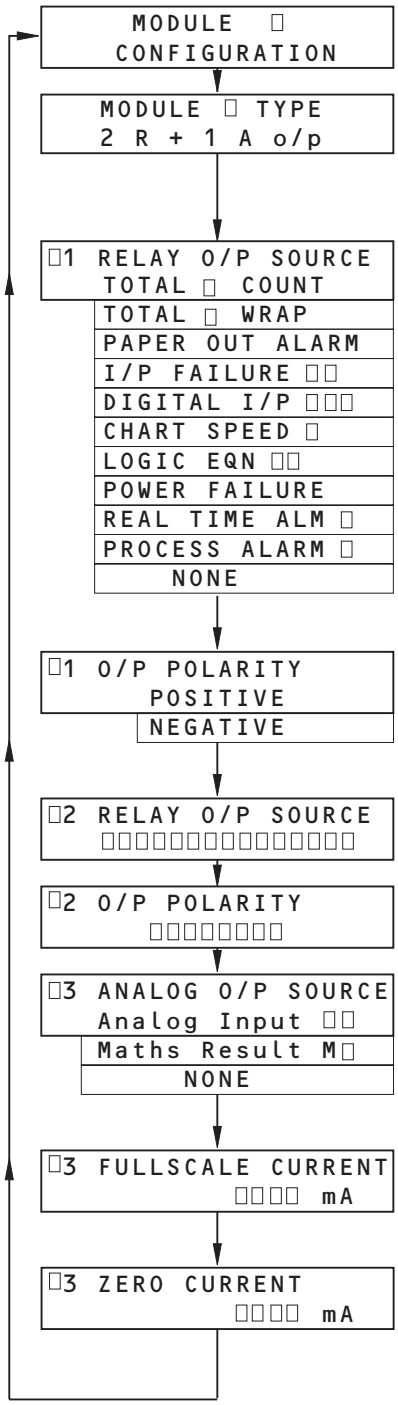
Table 5.5 Pen Options

5.4 Basic Level – Output Modules

Information.

- Selection of output module type – Hybrid, Relay, Analog output and Digital output.
- Modules can be fitted into module positions B to F (positions B and C are unavailable if a second analog input board is fitted).
- Automatic detection of type of modules fitted.
- Programmable sources for analog, relay and digital outputs.
- Programmable polarity for each relay and digital output.
- Programmable current range for each analog output.

5.4.1 Output Module Configuration Page – Hybrid Modules



Module Type
The type of module fitted is displayed. **NOT FITTED** is displayed where the module location is not used. The Hybrid module contains two relay output circuits and one analog output circuit.

Circuit 1 Relay Output Source
Select the source required to activate the relay output:

TOTAL COUNT	– Totalizer pulse output (T1 to T6)
TOTAL WRAP	– Wrap-around of a totalizer (T1 to T6)
PAPER OUT ALARM	– End of chart reached
I/P FAILURE	– Failure of analog input (A1 to A6, B1 to B6)
DIGITAL I/P	– Active digital input (DA1 to DG3)
CHART SPEED	– Selection of chart speed (1 to 3)
LOGIC EQN	– Logic equation true (1 to 10)
POWER FAILURE	– After power failure
REAL TIME ALM	– Real time alarm on (1 or 2)
PROCESS ALARM	– Pre-defined process alarm (A to M, excluding I)
NONE	– No output source required

Circuit 1 Output Polarity
Select the output polarity required:

POSITIVE	– relay energized when condition is true
NEGATIVE	– relay de-energized when condition is true

Circuit 2 Relay Output Source
Select the source required to activate the relay output as for circuit 1 above.

Circuit 2 Output Polarity
Select the output polarity required as for circuit 1 above.

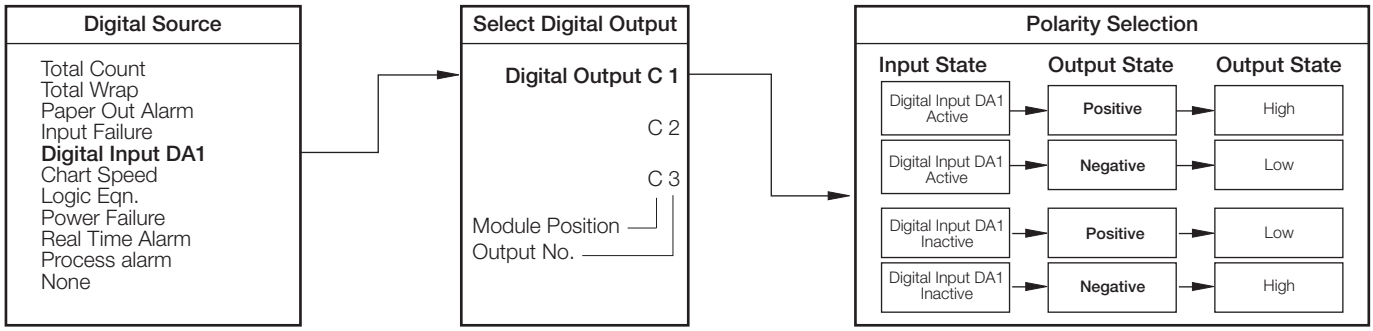
Circuit 3 Analog Output Source
Select the source required to activate the analog output. The source is selected from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.3) or math functions M1 to M4. If no output is required select **NONE**. Output is linearized if linearizer selected for input.

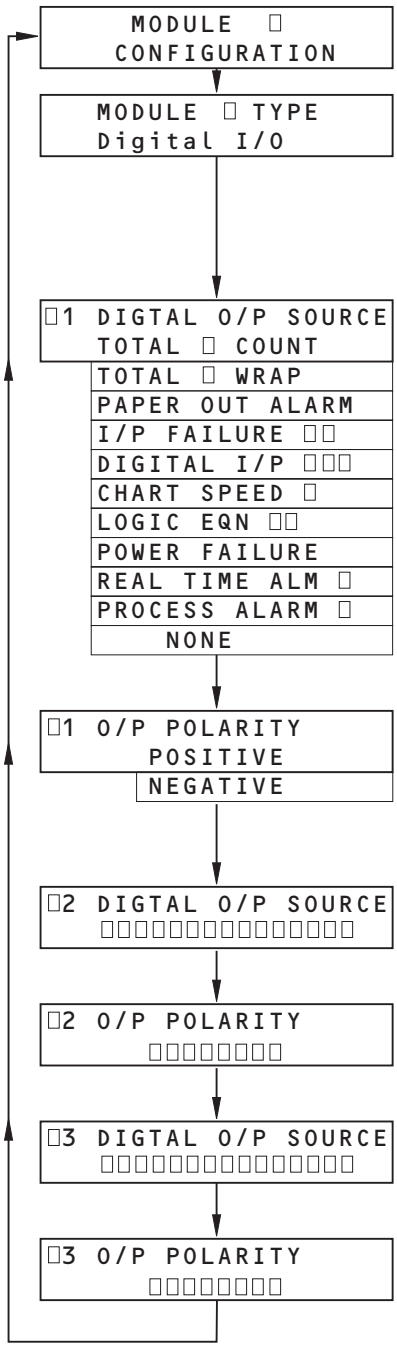
Circuit 3 Full Scale Current
Set the output current required to represent the full scale value of the output source selected above.

Circuit 3 Zero Current
Set the output current required to represent the zero value of the output source selected above.

Return to top of **Output Module Configuration Page**.

5.4.2 Output Module Configuration Page – Digital Modules





Module Type
The type of module fitted is displayed. **NOT FITTED** is displayed where the module location is not used.
The Digital Input/Output module contains three output circuits and three input circuits. The digital inputs are allocated according to the module location of the board (i.e. DB1 – 3 to DG1 – 3).

Circuit 1 Digital Output Source
Select the source required to activate the digital output:

TOTAL COUNT	–	Totalizer pulse output (T1 to T6)
TOTAL WRAP	–	Wrap-around of a totalizer (T1 to T6)
PAPER OUT ALARM	–	End of chart reached
I/P FAILURE	–	Failure of analog input (A1 to A6, B1 to B6)
DIGITAL I/P	–	Active digital input (DA1 to DG3)
CHART SPEED	–	Selection of chart speed (1 to 3)
LOGIC EQN	–	Logic equation true (1 to 10)
POWER FAILURE	–	After power failure
REAL TIME ALM	–	Real time alarm on (1 or 2)
PROCESS ALARM	–	Pre-defined process alarm (A to M, excluding I)
NONE	–	No output source required

Circuit 1 Output Polarity
Select the output polarity required:

POSITIVE	–	Relay energized when condition is true
NEGATIVE	–	Relay de-energized when condition is true

Circuit 2 Digital Output Source
Select the source required to activate the digital output as for circuit 1 above.

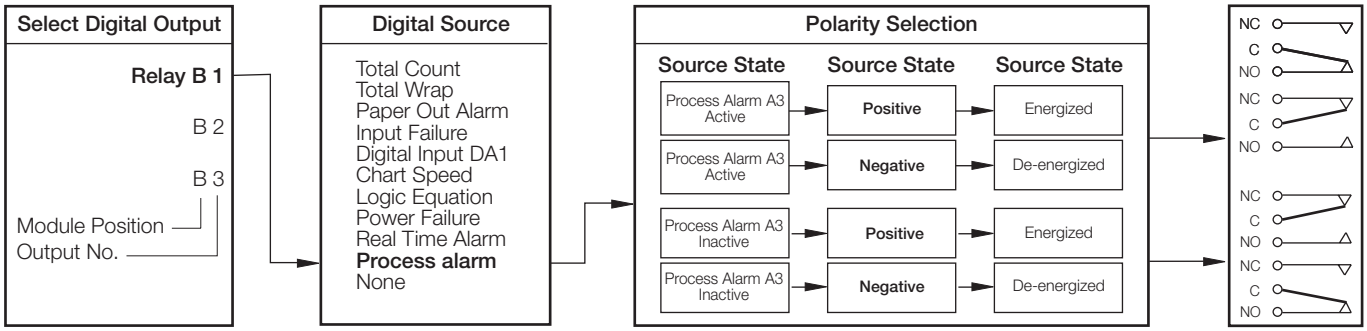
Circuit 2 Output Polarity
Select the output polarity required as for circuit 1 above.

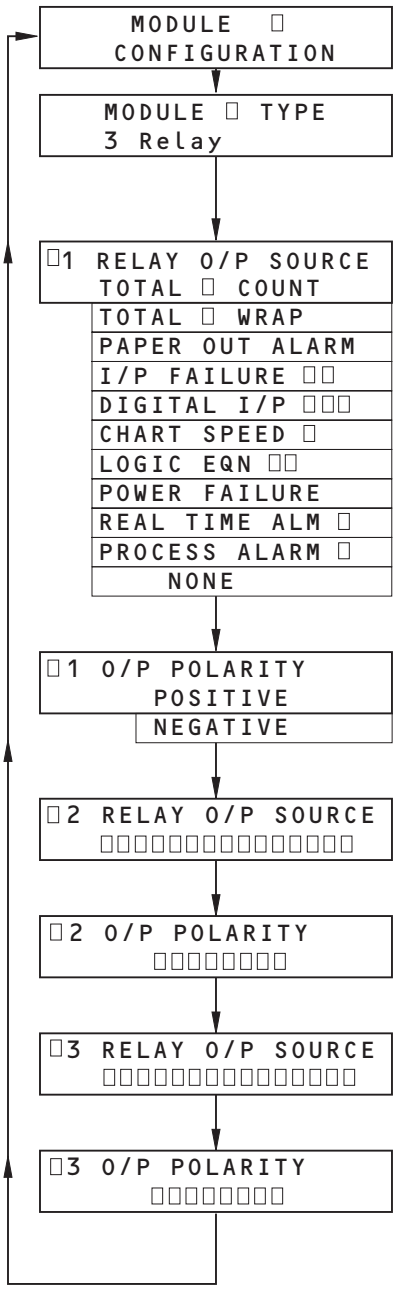
Circuit 3 Digital Output Source
Select the source required to activate the digital output as for circuit 1 above.

Circuit 3 Output Polarity
Select the output polarity required as for circuit 1 above.

Return to top of **Output Module Configuration Page**.

5.4.3 Output Module Configuration Page – Relay Modules





Module Type
The type of module fitted is displayed. **NOT FITTED** is displayed where the module location is not used.
The Relay Output module contains three relay output circuits.

Circuit 1 Relay Output Source
Select the source required to activate the relay output:

TOTAL COUNT	– Totalizer pulse output (T1 to T6)
TOTAL WRAP	– Wrap-around of a totalizer (T1 to T6)
PAPER OUT ALARM	– End of chart reached
I/P FAILURE	– Failure of analog input (A1 to A6, B1 to B6)
DIGITAL I/P	– Active digital input (DA1 to DG3)
CHART SPEED	– Selection of chart speed (1 to 3)
LOGIC EQN	– Logic equation true (1 to 10)
POWER FAILURE	– After power failure
REAL TIME ALM	– Real time alarm on (1 or 2)
PROCESS ALARM	– Pre-defined process alarm (A to M, excluding I)
NONE	– No output source required

Circuit 1 Output Polarity
Select the output polarity required:

POSITIVE	– relay energized when condition is true
NEGATIVE	– relay de-energized when condition is true

Circuit 2 Relay Output Source
Select the source required to activate the relay output as for circuit 1 above.

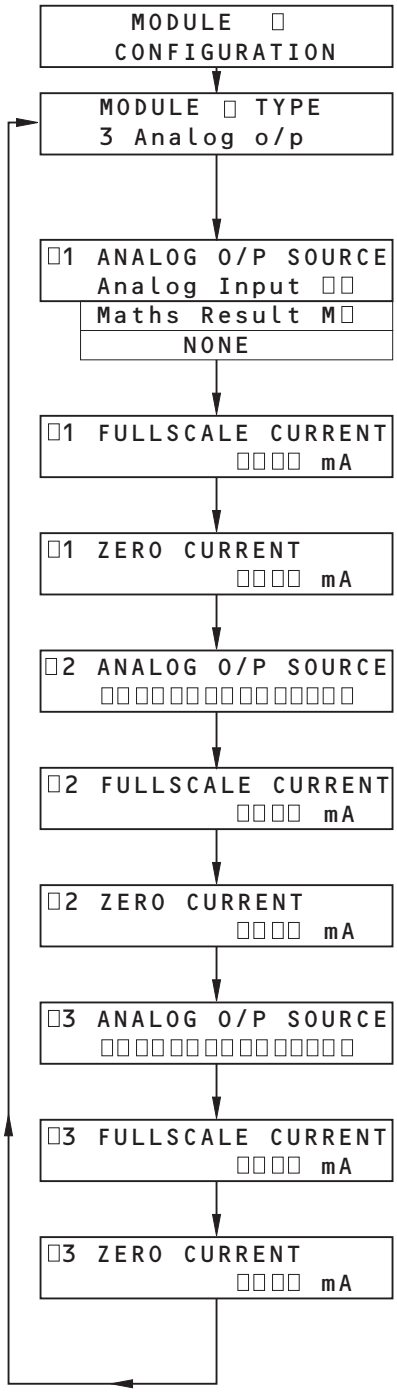
Circuit 2 Output Polarity
Select the output polarity required as for circuit 1 above.

Circuit 3 Relay Output Source
Select the source required to activate the relay output as for circuit 1 above.

Circuit 3 Output Polarity
Select the output polarity required as for circuit 1 above.

Return to top of **Output Module Configuration Page**.

5.4.4 Output Module Configuration Page – Analog Modules



Module Type
The type of module fitted is displayed. **NOT FITTED** is displayed where the module location is not used.
The Analog Output module contains three analog output circuits.

Circuit 1 Analog Output Source
Select the source required to activate the analog output. The source is selected from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.2) or math functions M1 to M4. If no output is required select **NONE**. Output is linearized if linearizer selected for input.

Circuit 1 Full Scale Current
Set the output current required to represent the full scale value of the output source selected above.

Circuit 1 Zero Current
Set the output current required to represent the zero value of the output source selected above.

Circuit 2 Analog Output Source
Select the source required to activate the analog output as for circuit 1 above.

Circuit 2 Full Scale Current
Set the output current required to represent the full scale value of the output source selected for circuit 2 above.

Circuit 2 Zero Current
Set the output current required to represent the zero value of the output source selected for circuit 2 above.

Circuit 3 Analog Output Source
Select the source required to activate the analog output as for circuit 1 above.

Circuit 3 Full Scale Current
Set the output current required to represent the full scale value of the output source selected for circuit 3 above.

Circuit 3 Zero Current
Set the output current required to represent the zero value of the output source selected for circuit 3 above.

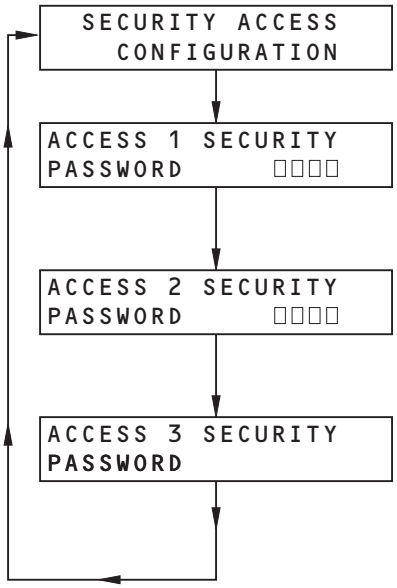
Return to top of **Output Module Configuration Page**.

5.5 Basic Level – Access

5.5.1 Security Access Configuration Page

Information.

- The 3 levels of security are:
  Level 1 – access to **Load Chart Page** and **Memory Card Data Logging Set-up Page** (if applicable)
  Level 2 – access to Level 1 pages + **Process Review Page** and **Print Messages Page**
  Level 3 – allows access to Level 1 and 2 pages + **Configuration Level**
- This page is used to set the passwords for the security levels.



Set Access Level 1 Password
The Level 1 password allows access to the **Load Chart Page** and the **Memory Card Data–Logging Setup** (if a Memory card is fitted).
Set the password to any number between 0 and 1999.

Set Access Level 2 Password
The Level 2 password allows access to Level 1 and the **Process Review** and Print **Messages Pages.**
Set the password to any number between 0 and 1999.

Set Access Level 3 Password
The Level 3 password allows access to Levels 1 and 2 and the **Configuration Level**. Set the password to any number between 0 and 1999.
Security Access can be disabled by setting 0 as the password for all 3 levels.

Return to top of **Security Access Configuration Page**.

5.6 Advanced Level Access – Fig. 5.4

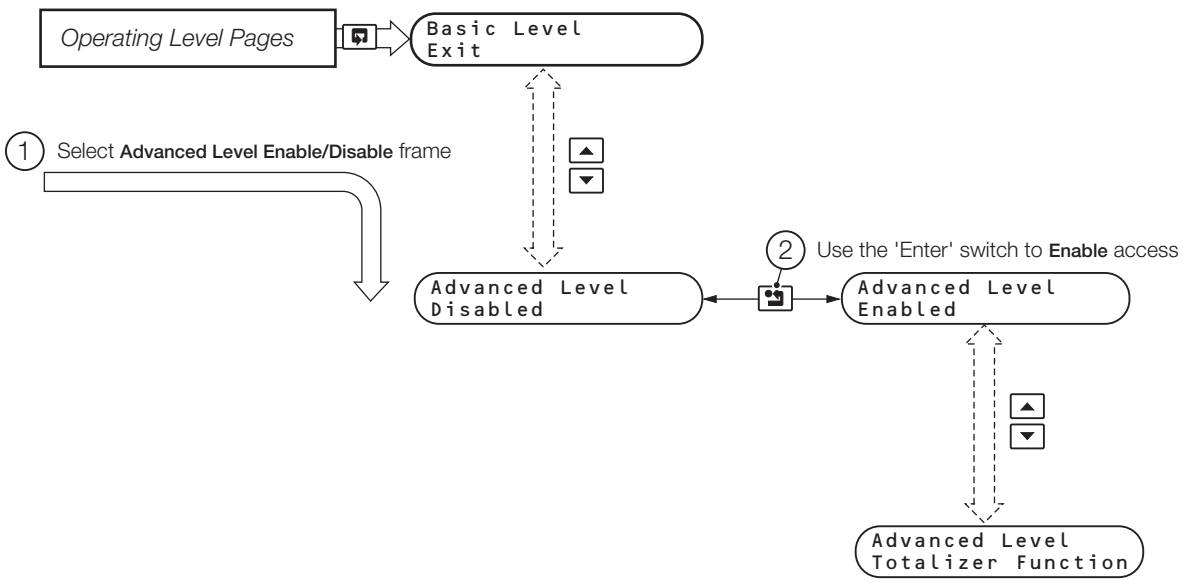


Fig. 5.4 Accessing to the Advanced Configuration Levels

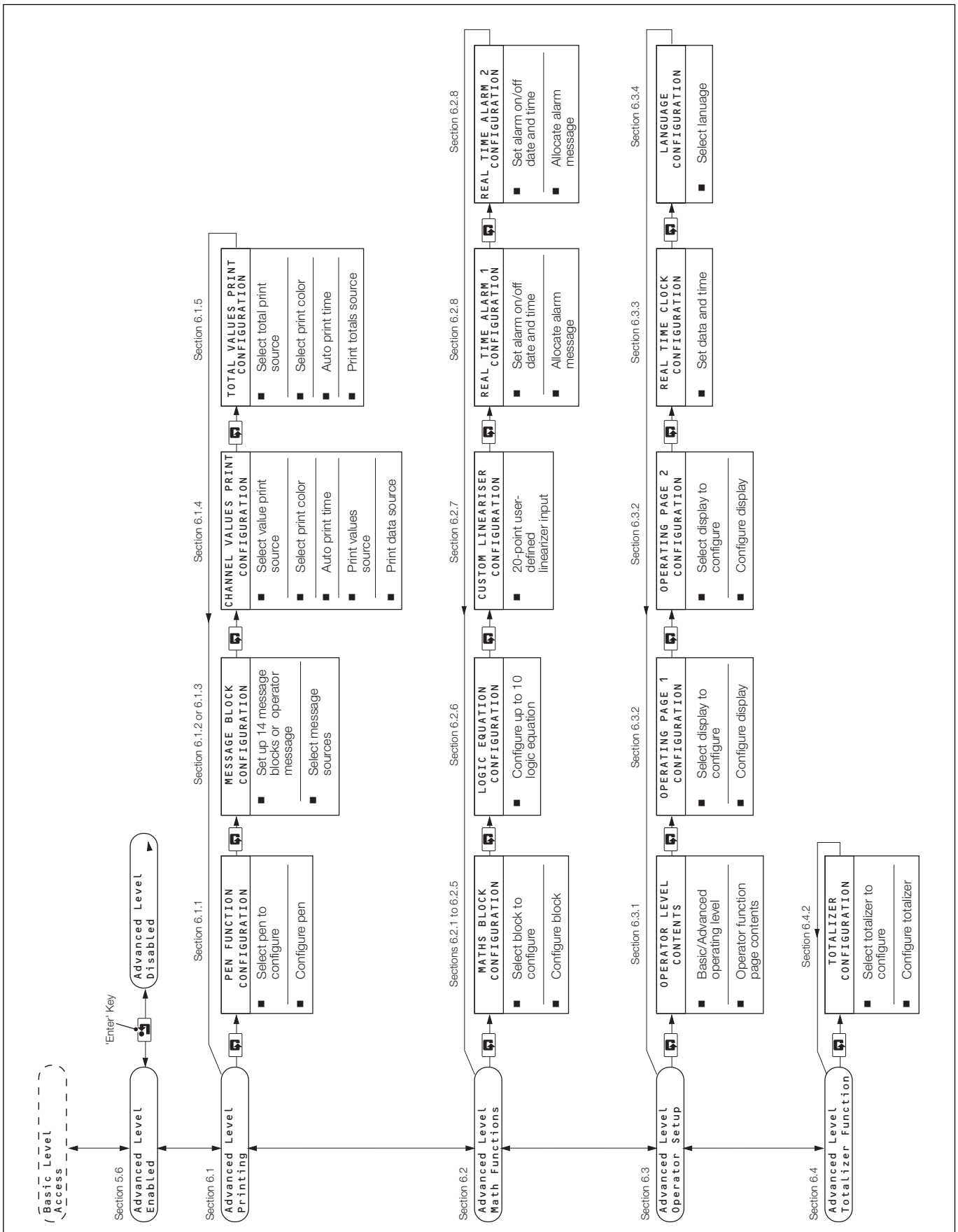
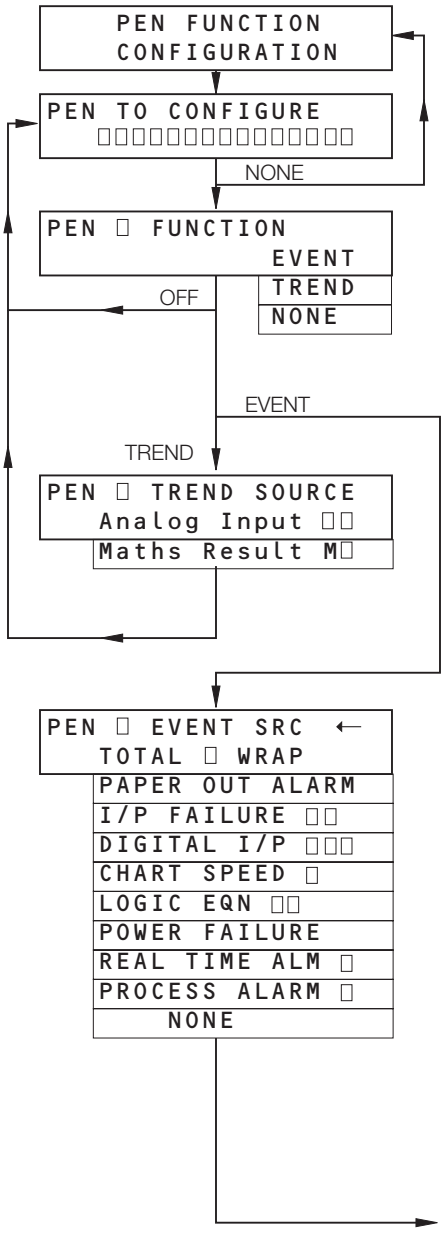


Fig. 6.1 Advanced Level – Overview

6.1 Advanced Level – Printing

6.1.1 Pen Function Configuration Page – Fig. 6.2

Information.
- Two pen option functions, **Trend** or **Event**:
  Trend – chart trace represents analog input or math result.
  Event – 3-position event marker (IN, OFF and OUT).
- Six programmable zones for event marking.



Pen to Configure
Select the pen to configure (refer to Table 5.5 on page 43 for pen options)

Pen Function
Select the pen function required:

EVENT	–	The pen provides indication of an event by moving from one preset position to another.
TREND	–	The pen provides a standard trace representing the input selected.
NONE	–	No function required for the selected pen. Pen 1 cannot be set to **NONE**.

Pen Trend Source
Select the input required for a standard trace. The input sources are selected from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.2) or math functions M1 to M4.

Return to **Pen to Configure** parameter.

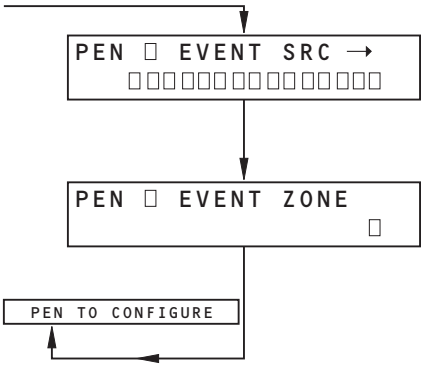
Pen Event Source (LEFT)
Select the event source required:

TOTAL WRAP	–	Wrap-around of a totalizer (T1 to T6)
PAPER OUT ALARM	–	End of chart reached
I/P FAILURE	–	Failure of analog input (A1 to A6, B1 to B6)
DIGITAL I/P	–	Active digital input (DA1 to DG3)
CHART SPEED	–	Selection of chart speed (1 to 3)
LOGIC EQN	–	Logic equation true (1 to 10)
POWER FAILURE	–	After power failure
REAL TIME ALM	–	Real time alarm on (1 or 2)
PROCESS ALARM	–	Pre-defined process alarm (A to M, excluding I)
NONE	–	No output source required

With an event occurrence the pen moves approximately 3mm to the left of the central position within the zone set below. LEFT has priority over RIGHT (i.e. if both are active then the event pen moves to the left of the central position).

Continued on next page.

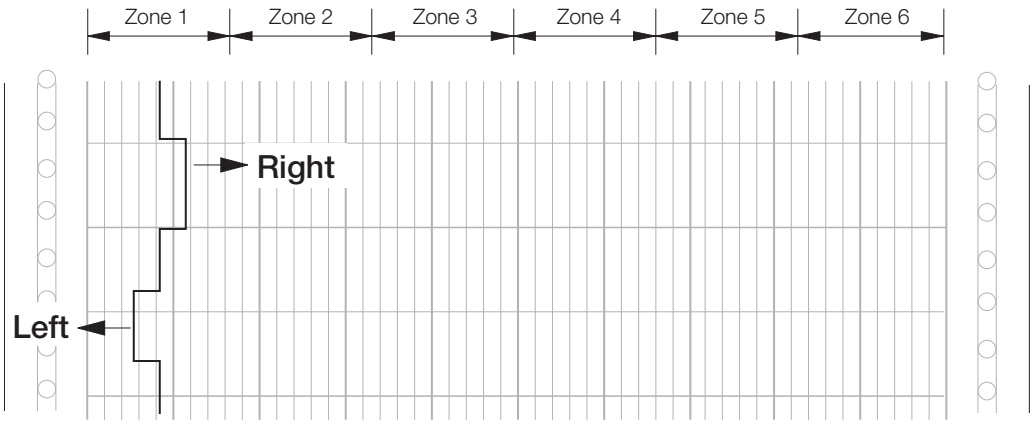
...6.1.1 Pen Function Configuration Page – Fig. 6.2



Pen Event Source (RIGHT)
Select the event source as for LEFT (previous page). With an event occurrence the pen moves approximately 3mm to the right of the central position within the zone set below.

Pen Event Zone
Select the event zone required. Zones 1 to 6 are positioned equidistant across the chart from zero to full scale – see Fig. 6.2.

Return to **Pen to Configure** frame.



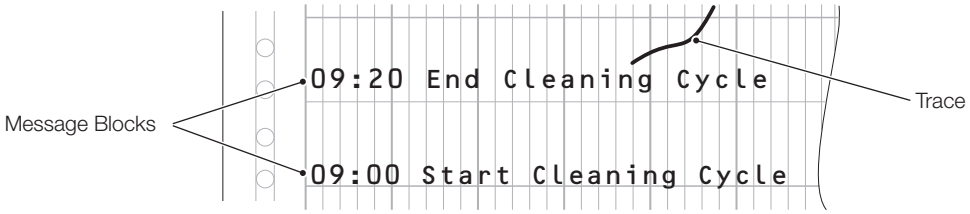
Zones 1 to 6 each 16.6mm wide.

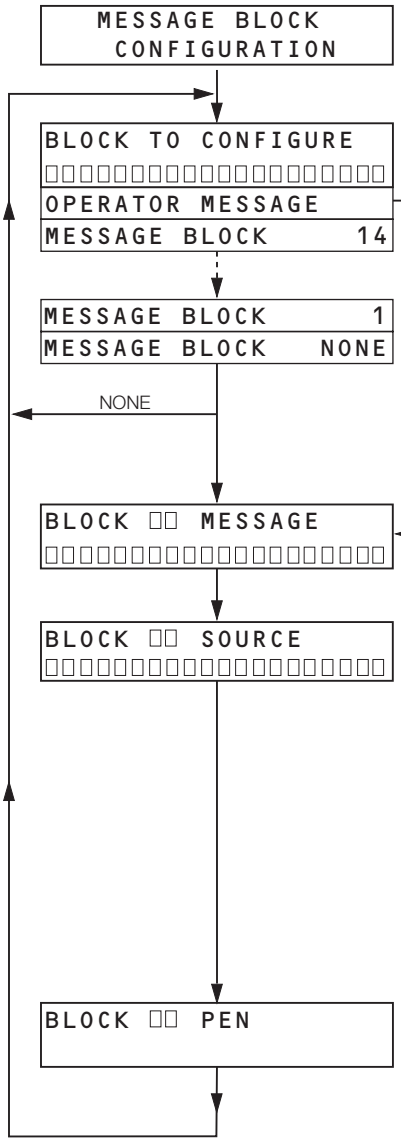
LEFT and RIGHT are represented by a 3mm shift from the centre line.

Fig. 6.2 Chart Event Zones

6.1.2 Message Block Configuration Page (Message Blocks)

Information.
- Fourteen 20-character message blocks.
- Message printing can be triggered by internal or external digital signals.
- Programmable color of message.
- Time stamping of all messages.





Block to Configure (Operator Message or Message Block)
Select the message block to be configured.

Refer to Section 6.1.3 for Operator Message configuration.

Block Message
Set the required message required on the upper display – see Front Fold-out.

Block Source
Select the required source to activate the printing of the message block.

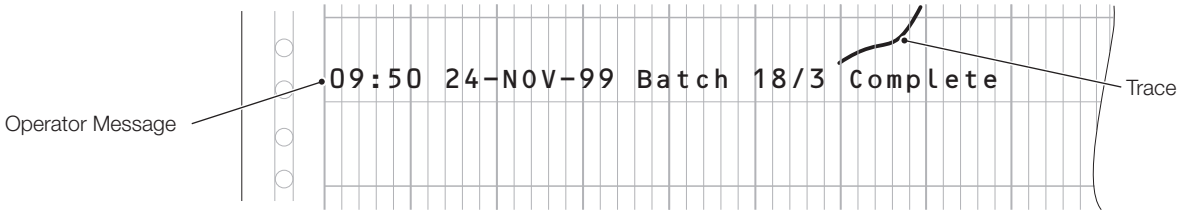
TOTAL WRAP	– Wrap-around of a totalizer (T1 to T6)
PAPER OUT ALARM	– End of chart reached
I/P FAILURE	– Failure of analog input (A1 to A6, B1 to B6)
DIGITAL I/P	– Active digital input (DA1 to DG3)
CHART SPEED	– Selection of chart speed (1 to 3)
LOGIC EQN	– Logic equation true (1 to 10)
POWER FAILURE	– After power failure
REAL TIME ALM	– Real time alarm on (1 or 2)
PROCESS ALARM	– Pre-defined process alarm (A to M, excluding I)
NONE	– No output source required

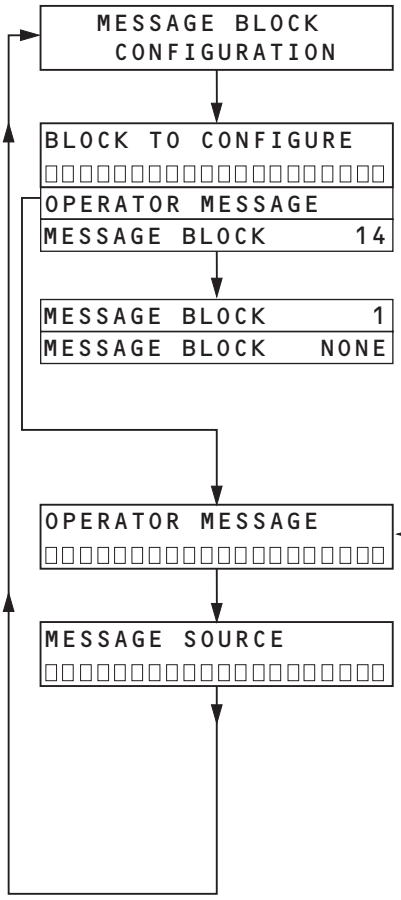
Block Pen
Select the pen required to print the message block (refer to Table 5.5 on page 43 for pen options).

Return to **Block to Configure** frame.

6.1.3 Message Block Configuration Page (Operator Message)

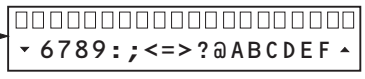
Information.
- 20-character operator message.
- Message printing can be triggered by internal or external digital signals.
- Programmable color of message.
- Time stamping for message.





Block to Configure (Operator Message or Message Block)
Select the **OPERATOR MESSAGE** option.

Refer to Section 6.1.2 for Message Block configuration.



Operator Message
Set the required message required on the upper display – see Front Fold-out.

Message Source
Select the required source to activate the printing of the operator message.

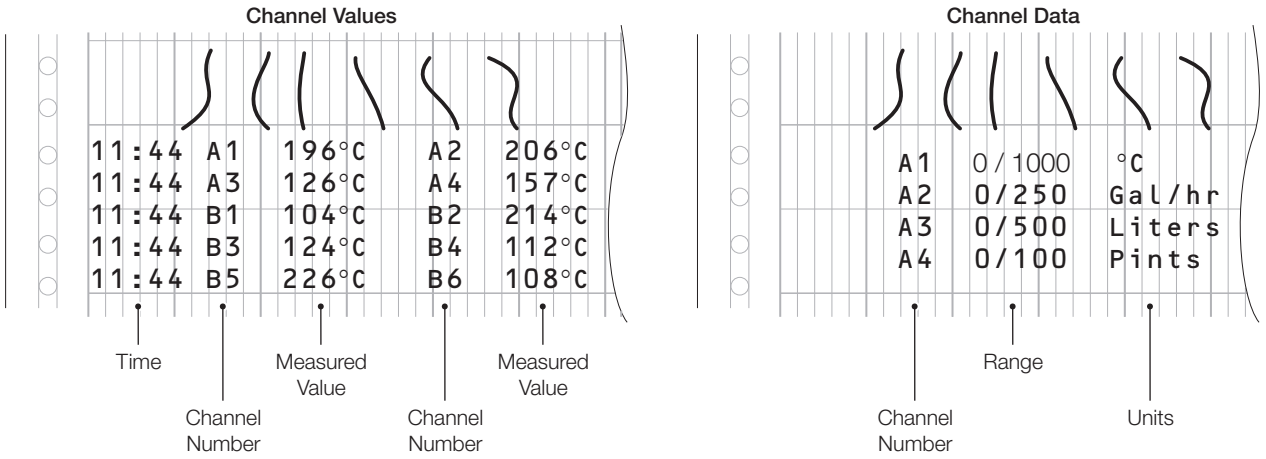
TOTAL WRAP	– Wrap-around of a totalizer (T1 to T6)
PAPER OUT ALARM	– End of chart reached
I/P FAILURE	– Failure of analog input (A1 to A6, B1 to B6)
DIGITAL I/P	– Active digital input (DA1 to DG3)
CHART SPEED	– Selection of chart speed (1 to 3)
LOGIC EQN	– Logic equation true (1 to 10)
POWER FAILURE	– After power failure
REAL TIME ALM	– Real time alarm on (1 or 2)
PROCESS ALARM	– Pre-defined process alarm (A to M, excluding I)
NONE	– No source selected – printing initiated by user in **Print Messages Page** – see Section 3.10.

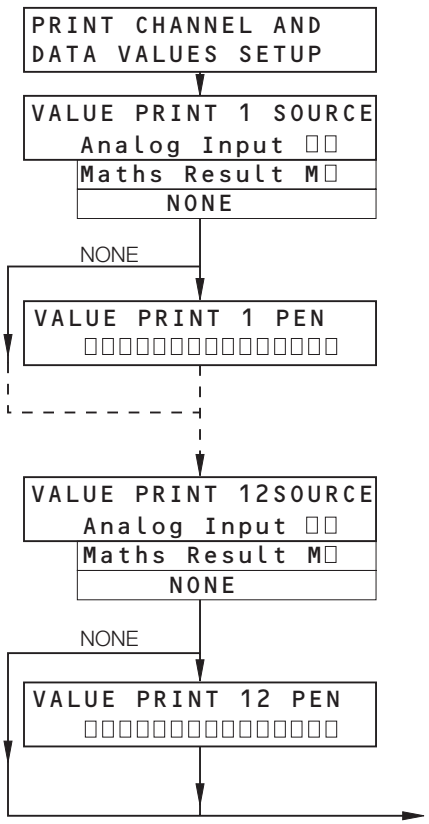
Return to **Block to Configure** frame.

6.1.4 Print Channel and Data Values Setup Page

Information.
- Printing of up to 12 channel values.
- Channel identity, value and engineering units printed for each channel.
- Printing can be triggered from internal or external digital signal or at pre-configured time intervals.

Note. Channel values are always ‘fast’ printed.

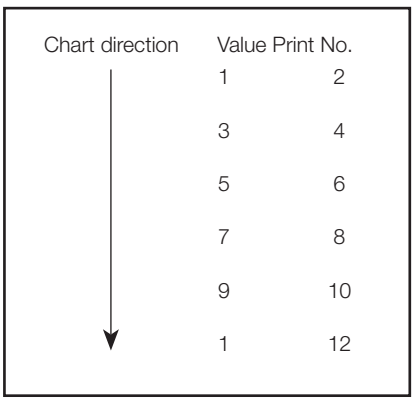




Value Print Source and Pen
Select an input source for each of the 12 channel values to be printed. The input sources are selected from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.2) or math functions M1 to M4. Select the pen required for each channel. Refer to Table 5.5 on page 43 for pen options.

Select source and pen for all 12 values.

The print output pattern is as follows:



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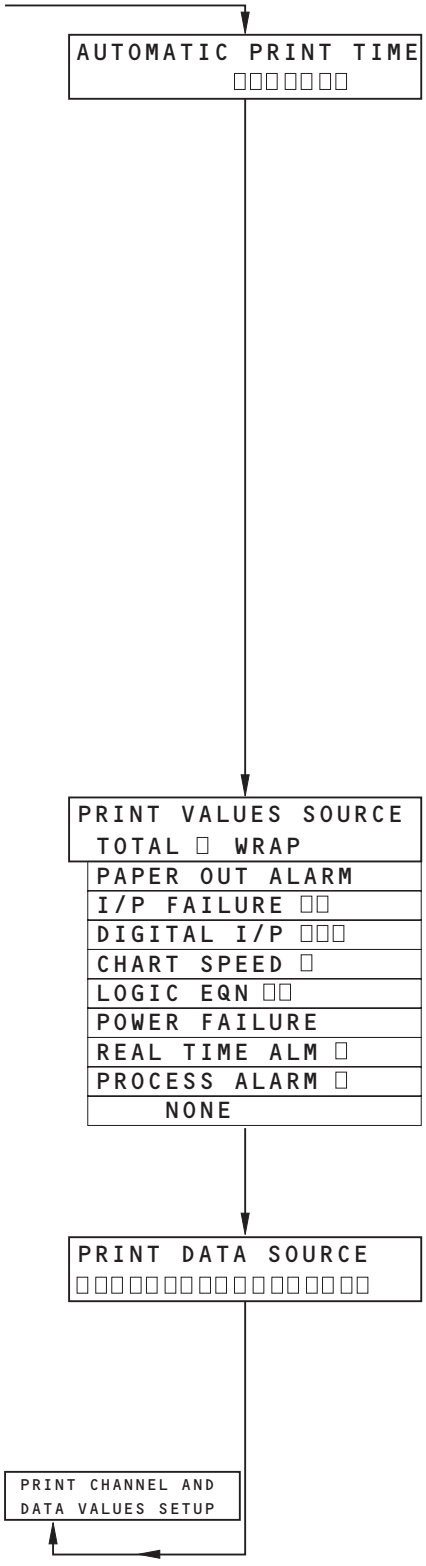
...6.1.4 Print Channel and Data Values Setup Page



Automatic Print Time
Select the time interval required between each set of printed values. The time interval is selectable in 5, 10, 15, 20, 30 min. and 1, 2, 4, 6, 8, 12, 24 hr. intervals. Automatic printing can be set to **OFF** if not required.

Automatic Print Time (Internal)	Time Intervals Between Automatic Prints
Off	Automatic Print Time Disabled
5 Minutes	On the Hour and Every 5 Minutes Thereafter
10 Minutes	On the Hour and Every 10 Minutes Thereafter
15 Minutes	On the Hour and Every 15 Minutes Thereafter
20 Minutes	On the Hour and Every 20 Minutes Thereafter
30 Minutes	On the Hour and Every 30 Minutes Thereafter
1 Hour	Every Hour, On the Hour
2 Hours	Midnight and Every 2 Hours Thereafter
3 Hours	Midnight and Every 3 Hours Thereafter
4 Hours	Midnight and Every 4 Hours Thereafter
6 Hours	Midnight and Every 6 Hours Thereafter
8 Hours	Midnight and Every 8 Hours Thereafter
12 Hours	Midnight and Midday
24 Hours	Midnight

Print Values Source
Select the source required to initiate printing of the channel values:

- **TOTAL WRAP** – Wrap-around of a totalizer (T1 to T6)
- **PAPER OUT ALARM** – End of chart reached
- **I/P FAILURE** – Failure of analog input (A1 to A6, B1 to B6)
- **DIGITAL I/P** – Active digital input (DA1 to DG3)
- **CHART SPEED** – Selection of chart speed (1 to 3)
- **LOGIC EQN** – Logic equation true (1 to 10)
- **POWER FAILURE** – After power failure
- **REAL TIME ALM** – Real time alarm on (1 or 2)
- **PROCESS ALARM** – Pre-defined process alarm (A to M, excluding I)
- **NONE** – No source selected – printing initiated at automatic print time set above or by user in **Print Messages Page** – see Section 3.10.

Print Channel Data Source
Select the source required to initiate printing of channel data (sources are as for previous frame).

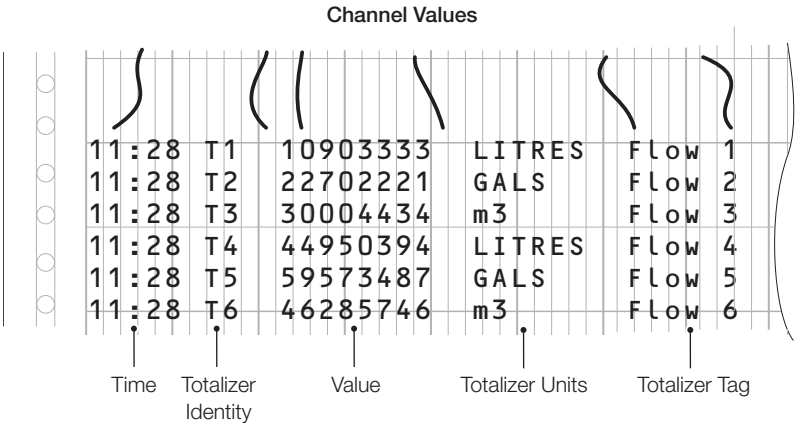
Note. Channel data is printed only for channels that have trend pens assigned to them.

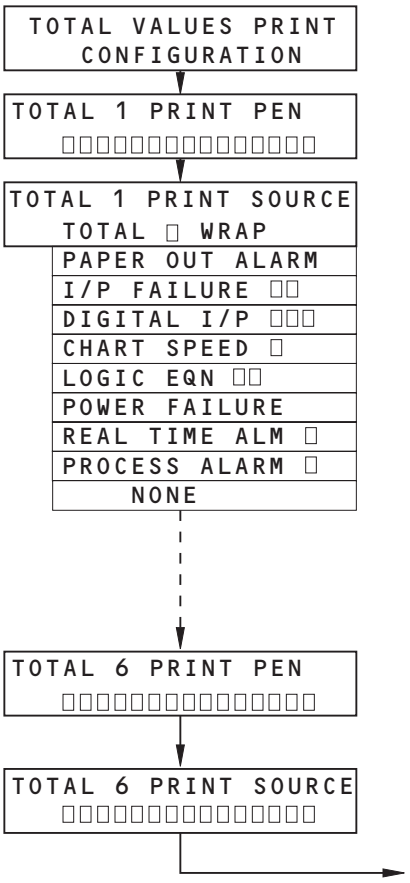
Return to top of **Output Module Configuration Page**.

6.1.5 Total Values Print Configuration Page

Information.
- Printing of totalizer identity, value and tag.
- Printing of individual values triggered from internal or external digital signal.
- Values can be printed via digital signal or at pre-configured time intervals.

Note. Totalizer values are always 'fast' printed.





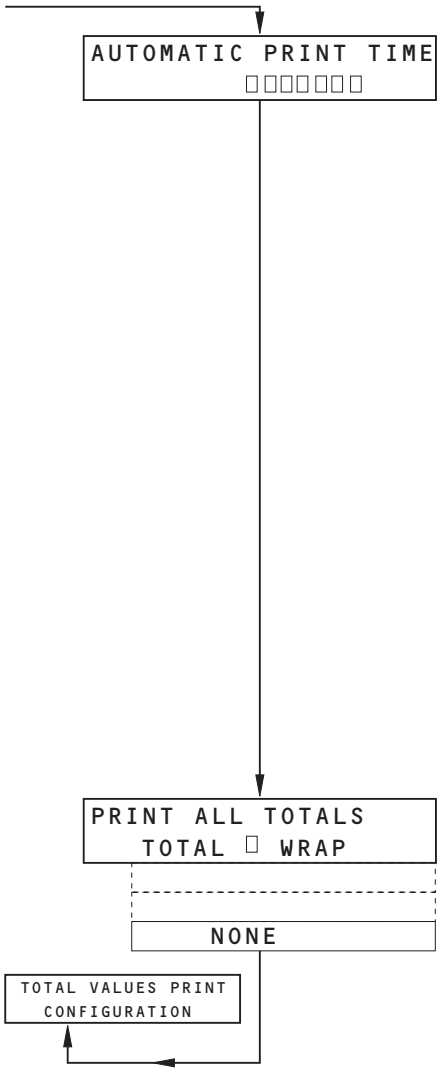
Totalizer Print Source and Pen
Select the source required to initiate printing of each of the six totalizers. The totalizers can be printed in any of the available colors. Refer to Table 5.5 on page 43 for pen options.

TOTAL WRAP	– Wrap-around of a totalizer (T1 to T6)
PAPER OUT ALARM	– End of chart reached
I/P FAILURE	– Failure of analog input (A1 to A6, B1 to B6)
DIGITAL I/P	– Active digital input (DA1 to DG3)
CHART SPEED	– Selection of chart speed (1 to 3)
LOGIC EQN	– Logic equation true (1 to 10)
POWER FAILURE	– After power failure
REAL TIME ALM	– Real time alarm on (1 or 2)
PROCESS ALARM	– Pre-defined process alarm (A to M, excluding I)
NONE	– No source selected – printing initiated at automatic print time set above or by user in **Print Messages Page** – see Section 3.10.

Select pen and source for all 6 totalizers.

Continued on next page.

...6.1.5 Total Values Print Configuration Page



Automatic Print Time
Select the time interval required between each set of printed values. The time interval is selectable in 5, 10, 15, 20, 30 min. and 1, 2, 4, 6, 8, 12, 24 hr. intervals. Automatic printing can be set to **OFF** if not required.

Automatic Print Time (Internal)	Time Intervals Between Automatic Prints
Off	Automatic Print Time Disabled
5 Minutes	On the Hour and Every 5 Minutes Thereafter
10 Minutes	On the Hour and Every 10 Minutes Thereafter
15 Minutes	On the Hour and Every 15 Minutes Thereafter
20 Minutes	On the Hour and Every 20 Minutes Thereafter
30 Minutes	On the Hour and Every 30 Minutes Thereafter
1 Hour	Every Hour, On the Hour
2 Hours	Midnight and Every 2 Hours Thereafter
3 Hours	Midnight and Every 3 Hours Thereafter
4 Hours	Midnight and Every 4 Hours Thereafter
6 Hours	Midnight and Every 6 Hours Thereafter
8 Hours	Midnight and Every 8 Hours Thereafter
12 Hours	Midnight and Midday
24 Hours	Midnight

Print All Totalizers
Select the source required to initiate printing of all of the six totalizers. The sources are as above.

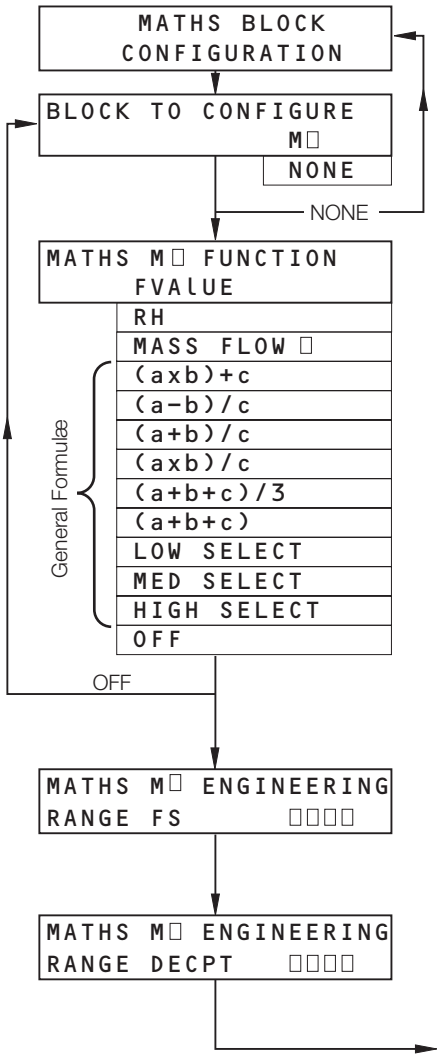
Return to top of **Total Values Print Configuration Page**.

6.2 Advanced Level – Math Functions

6.2.1 Math Block Configuration Page

Information.
- 4 programmable math blocks.
- Each math block can be configured for any of the 13 math functions, i.e. Fvalue, relative humidity, mass flow (2) arithmetic (6) or signal select (3).
- Programmable engineering units and result tag for each block.

Note. The **Math Block Configuration Page** is separated into three types of configuration depending on the function selected. In each case, after selecting the function required, the display parameters, engineering units and result tag are set.



Block to Configure
Select the math block to configure (M1 to M4) On entry the default is **NONE**.

Math Function
Select the math function required:

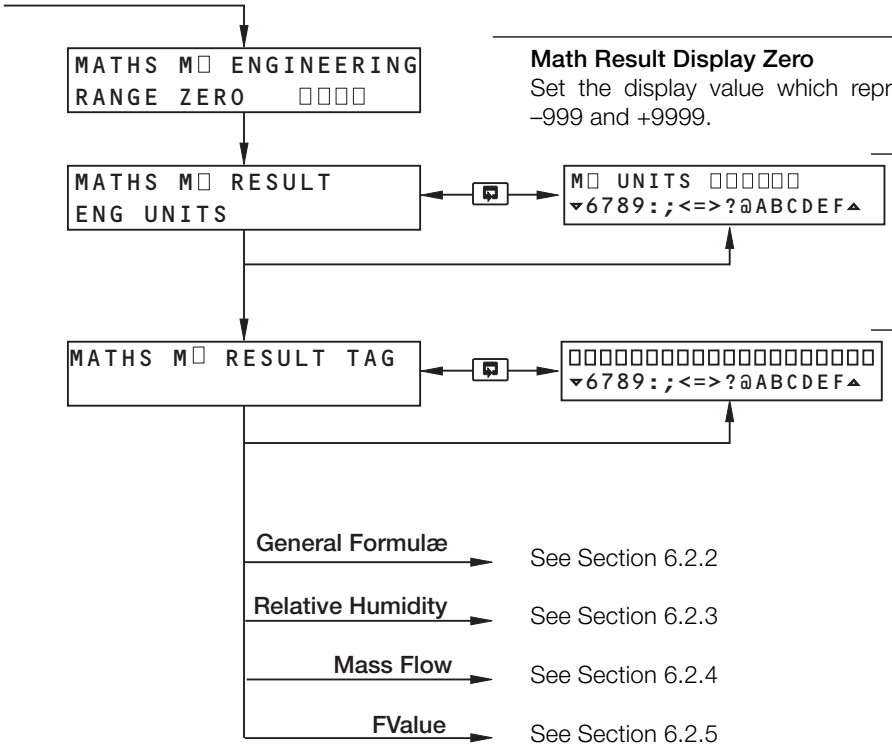
FVALUE	–	Fvalue calculation
RH	–	Relative Humidity calculation
MASS FLOW 2	–	Calculation of mass flow from differential pressure
MASS FLOW 1	–	Calculation of mass flow from volume flow
(axb)+c	–	Equivalent to straight line equation y=mx+c
(a–b)/c	–	} Simple arithmetic
(a+b)/c	–	
(axb)/c	–	
(a+b+c)/3	–	Averaging
(a+b+c)	–	Addition
LOW SELECT	–	Output follows lowest of three inputs
MED SELECT	–	Output follows median of three inputs
HIGH SELECT	–	Output follows highest of three inputs
OFF	–	Sets math function to **OFF**.

Math Result Engineering Range Full Scale
Set the display value which represents the maximum result value, between –999 and +9999.

Math Result Engineering Range Decimal Point
Set the number of decimal places required for both the display full scale and display zero values.

Continued on next page.

...6.2.1 Math Block Configuration Page



Math Result Display Zero
Set the display value which represents the minimum result value, between –999 and +9999.

Engineering Units
Engineering units of up to six characters can be set on the upper display – see Front Fold-out.

Math Result Tag
A result description of up to twenty characters can be set on the upper display – see Front Fold-out.

General Formulæ → See Section 6.2.2
Relative Humidity → See Section 6.2.3
Mass Flow → See Section 6.2.4
FValue → See Section 6.2.5

6.2.2 General Formulæ

These functions referred to as general formulæ are as follows:

(a x b) + c

$\frac{(a - b)}{c}$

$\frac{(a + b)}{c}$

$\frac{(a \times b)}{c}$

$\frac{(a + b + c)}{3}$

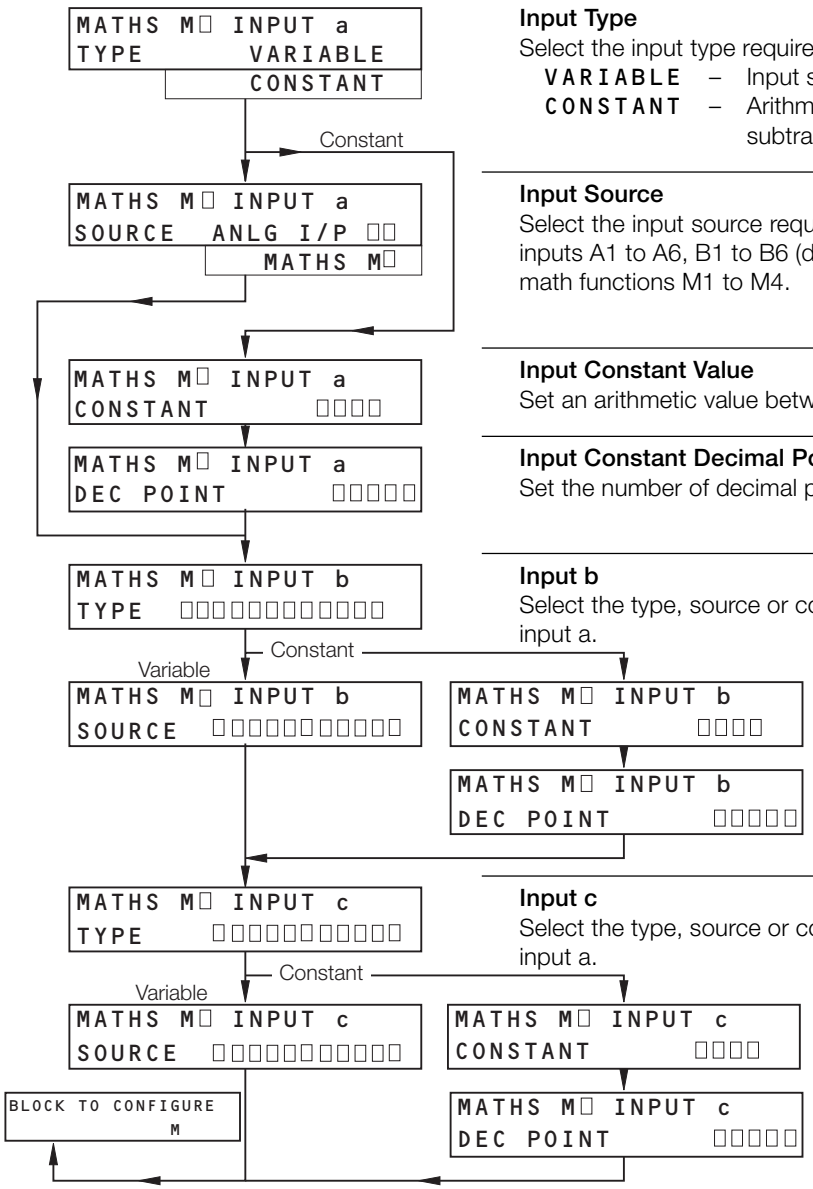
(a + b + c)

LOW SELECT

MED SELECT

HIGH SELECT

In each of these functions the three inputs can be configured as variables or constants. A variable uses an input source, either analog or another math function.



Input Type
Select the input type required for input a:

- **VARIABLE** – Input signal (analog input or math block)
- **CONSTANT** – Arithmetic value used as multiplier, divisor or for addition or subtraction

Input Source
Select the input source required for input a. The source is selected from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.2) or math functions M1 to M4.

Input Constant Value
Set an arithmetic value between the values –999 and +9999.

Input Constant Decimal Point
Set the number of decimal places for the input (0 to 3 places).

Input b
Select the type, source or constant as required for input b. The method is as for input a.

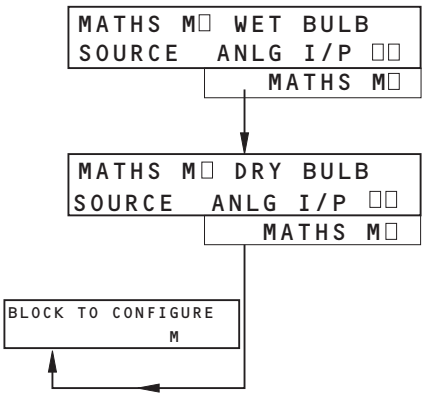
Input c
Select the type, source or constant as required for input c. The method is as for input a.

Return to **Block to Configure** frame.

6.2.3 Relative Humidity (RH)

The relative humidity calculation requires two inputs, one from a wet bulb sensor and one from a dry bulb sensor. Both of these inputs are configured as variables. RH tables are based on the use of an aspirated pyrochrometer having an air velocity of at least 11.5 feet per second or 3.5 meters per second across the bulb sensors.

Inputs used for wet and dry bulb measurement must be in the ranges 0 to 100°C or 32 to 212°F. The result must be set to 0 to 100.0% RH.



Input Source
Select the input source required for the wet bulb input. The source is selected from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.2) or math functions M1 to M4.

Input Source
Select the input source required for the dry bulb input. The source is selected from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.2) or math functions M1 to M4.

Return to **Block to Configure** frame.

6.2.4 Mass Flow 1 and 2

The two types of mass flow calculations available are as follows:

Mass Flow 1 – uses a volume flow input as the basis for the calculation

Mass Flow 2 – uses a differential pressure input as the basis for the calculation.

The standard formula for mass flow 1 is as follows:

$$M = k\,V\,\frac{P}{Pr}\,\frac{Tr}{T}$$

where:

k = Scaling constant
V = Input a (input from volume flow source)
P = Absolute Pressure (pressure input source)
T = Temperature (temperature input source)
Tr = Reference temperature (set as a constant)
Pr = Absolute reference pressure (set as a constant).

The temperature units used by the input source must be specified as all calculations use absolute temperatures and conversion is made if the input uses °C or °F.

The formula used for mass flow 2 is as follows:

(i) $$M = k\sqrt{h}\sqrt{\frac{P}{T}\,\frac{Tr}{Pr}}$$

where:

h = differential pressure head

Some differential pressure sensors incorporate a square root linearizer and therefore produce an output linear to flow. In these instances no additional linearization within the advanced process recorder is required. Where the input from the differential pressure sensor is linear to differential pressure head the square root linearizer within the advanced process recorder's **Analogue Input Configuration Page** must be used.

The formula used internally is:

(ii) $$M = k\;a\;\sqrt{\frac{P}{T}\,\frac{Tr}{Pr}}$$

where:

input a = linearized flow signal.

The linearized flow signal is produced by the transmitter or derived from the signal linearized within the advanced process recorder.

When using mass flow, care must be taken in sizing the differential transmitter. Variations in pressure and temperature affect the differential pressure developed across the flow device. In its basic form:

$$M = \sqrt{h\,\frac{P}{T}}$$

Note. As pressure P decreases, the dp(h) increases. Likewise, as temperature T increases this also causes an increase in dp(h). If the variation in temperature pressure is sufficient to cause the dp to exceed the range of the dp transmitter, then errors occur in calculating the mass flow. It is therefore generally recommended to size the flow system on minimum pressure and maximum temperature conditions to ensure the dp transmitter remains within its calibrated range.

…6.2.4 Mass Flow 1 and 2

Example A – calculating the mass flow of water from the volume flow.

At a temperature of 60°F (520°R) and an absolute pressure of 14.696 psia, 1 gallon (US) of water has a mass of 8.334 lbs.

To calculate the mass flow of water from the volume flow the following settings are used:

A1 – volume flow of water (gal/min)
A2 – temperature of water (°F)
A3 – absolute pressure of water (psia)
M2 – result of math block 2 (lb/min)

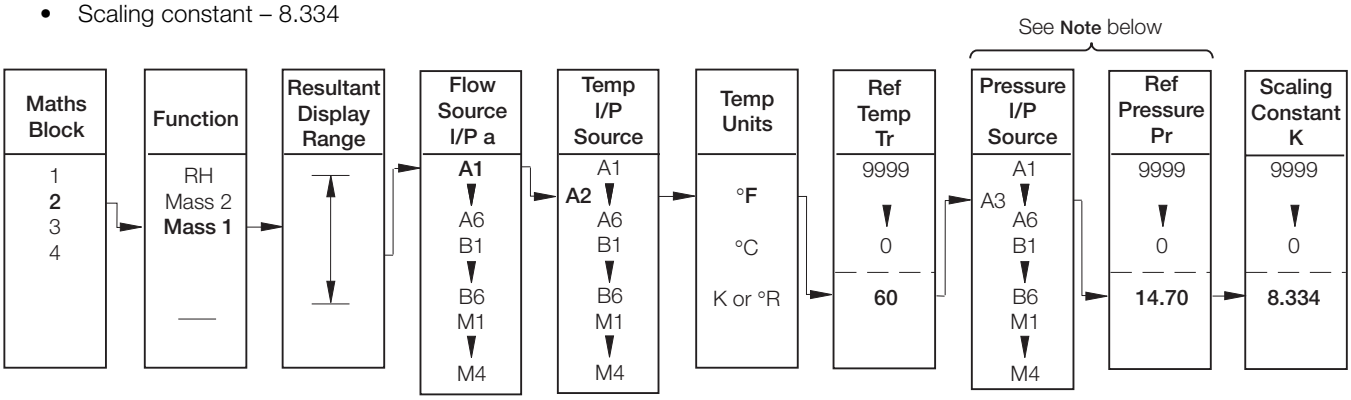
$$\text{Mass Flow 1} = k \; V \; \frac{P}{Pr} \; \frac{Tr}{T}$$

therefore the equation is:

$$\text{M (lb/min)} = 8.334 \times \text{Volume (gal/min)} \times \frac{\text{measured absolute pressure (PSIA)}}{14.696 \text{ psia}} \times \frac{520°R}{\text{measured temperature °R}}$$

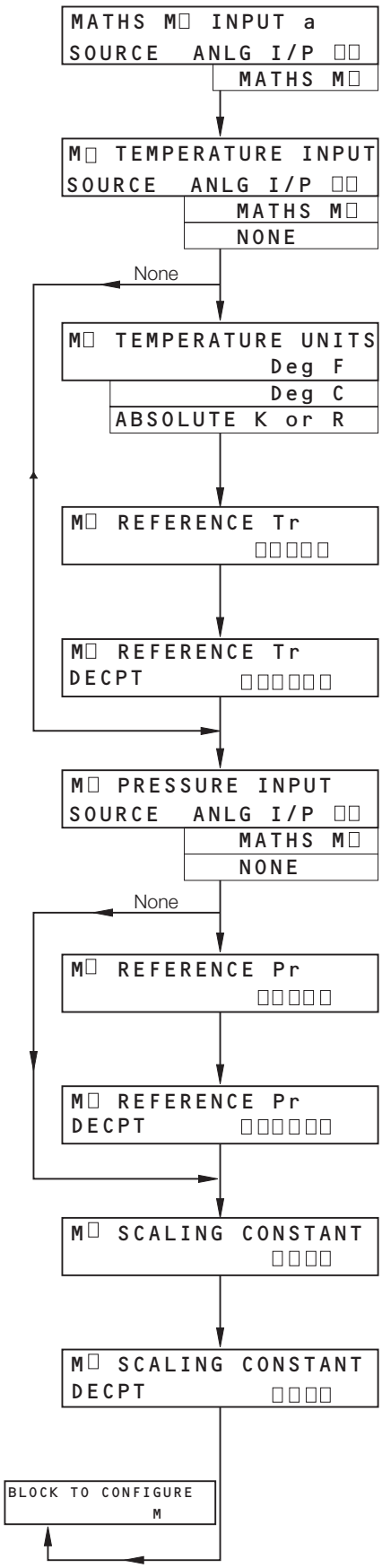
The example below shows the construction of Math block 2 with the following selected:

- Math block function – Mass Flow 1
- Display range
- Flow source – A1
- Temp source – A2
- Temp units – °F
- Temp ref – 60 (60°F = 520°R)
- Pressure source – A3
- Ref pressure – 14.70
- Scaling constant – 8.334



Note. All pressure readings must be in **absolute**, not gauge terms.

…6.2.4 Mass Flow 1 and 2



Input Source
Select the input source required for input a. The source is selected from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.2) or math functions M1 to M4.

Temperature Input Source
Select the input source required for the temperature input. The source is selected from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.2) or math functions M1 to M4.

Temperature Units
Select the input source temperature units:

Deg F	–	Input source measured in °F
Deg C	–	Input source measured in °C
ABSOLUTE K or R	–	Input source measured in degrees absolute

Reference Temperature
Set the value which represents the reference temperature, between 0 and +9999. The decimal point is set in the next parameter.

Reference Temperature Decimal Point
Set the number of decimal places required for the reference temperature (0 to 3 places).

Pressure Input Source
Select the input source required for the absolute pressure input. The source is selected from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.2) or math functions M1 to M4.

Reference Pressure
Set the value which represents the absolute reference pressure to between 0 and +9999. The decimal point is set in the next parameter.

Reference Pressure Decimal Point
Set the number of decimal places required for the absolute reference pressure (0 to 3 places).

Scaling Constant
Set the value which represents the scaling constant (k), between 0 and +9999. The decimal point is set in the next parameter.

Scaling Constant Decimal Point
Set the number of decimal places required for the scaling constant (k) (0 to 3 places).

Return to **Block to Configure** frame.

6.2.5 Fvalue

Application

The application of Fvalue measurement enables sterilizing cycles to be shortened, relative to the traditional time versus temperature cycles commonly adopted.

This in turn leads to greater throughput, reduced energy consumption and minimization of product degradation due to over exposure to high temperatures.

The most widely used method of sterilization is to heat the product after it has been sealed into its final container, using saturated steam maintained at a high temperature in a pressurized autoclave oven. Steam is used because of superior heat transfer characteristics, compared to dry air.

Heat's ability to kill micro-organisms varies with the type of organism and increases exponentially with increasing temperature. By definition the steam sterilization (Fo) has a target sterilization of 121.1°C and dry heat sterilization (Fh) a target sterilization temperature of 170°C.

Example – an increase of 10°C from 121.1 to 131.1°C in the steam sterilizing temperature of the *Bacillus Stearo-thermphilus* organism increases the death rate by a factor of ten.

The change in sterilization temperature which causes a factor-of-10 change in the death rate is unique to each organism and is called the Z value.

Although 121.1°C is universally accepted as a reference for steam sterilization processes, the actual sterilizing temperature varies, depending on the products involved and on each sterilization process.

Calculation – Fig. 6.3

The advanced process recorder's advanced Fvalue implementation takes the Fvalue into account and allows the process engineer to compute both steam (Fo) and dry heat (Fh) results, with user defined target sterilization temperatures and Z values.

The function implemented within the instrument can be used to calculate any Fvalue with the general formula:

$$\text{Fvalue}(t) = \text{Fvalue}(t-1) + \frac{\left(10^{\frac{(T_o - T_t)}{Z}}\right)}{\left(\frac{60}{\text{sample rate}}\right)}$$

Where:

Fvalue(t)	–	current Fvalue sum
Fvalue(t – 1)	–	Fvalue sum at last sample
T_o	–	measured temperature
T_t	–	target sterilizing temperature
Z	–	temperature interval representing a factor of 10 reduction in killing efficiency (Z factor)
Sample Rate	–	0.48 seconds

The Fvalue sum (in minutes) gives an equivalent time at the target sterilization temperature taking into account the time taken to approach and the time exceeding the target sterilization temperature.

Example – A typical steam sterilizing cycle – see Fig. 6.3.

The period AB is the chamber evacuation part of the cycle, when the chamber is alternatively evacuated and purged with steam to remove air. The ramp up to final sterilizing temperature starts at B. The thermal conductivity of the load determines the time taken to achieve point D, but is typically 30% of the total cycle time. It is in the area, C D, and E F, that Fvalues make their contribution to shortening sterilization time, by accumulating credit for the time spent approaching and receding from the sterilizing temperature.

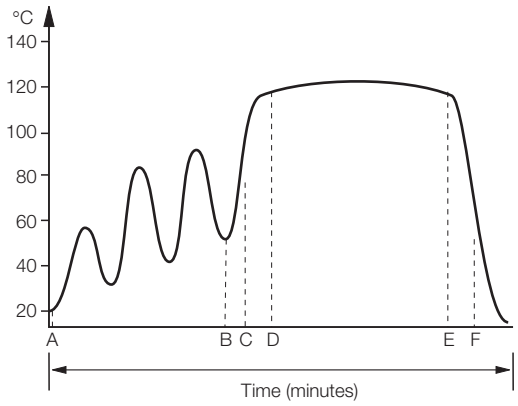


Fig. 6.3 Typical Steam Sterilization Cycle

…6.2.5 Fvalue

It is important to note the large change in equivalent sterilizing time which results from a small increase in the sterilizing temperature. Going from 121 °C to 122 °C, an increase of only 1 °C, reduces the time needed to kill an equal number of organisms by a factor of 26%. Likewise, a measurement error which results in the set point being 1 °C too low could result in a product not being sterilized properly.

Using the advanced process recorder with its highly accurate temperature measurement and exceptional reliability can pay large dividends in increased productivity. Normally the sterilizing time must be increased to compensate for the uncertainty of the temperature measurements. The instrument reduces this uncertainty and allows the process engineer to reduce sterilization cycle times.

Accuracy

As the Fvalue calculation is essentially a logarithmic function**,** the effect of measurement errors is significant on the resultant Fvalue.

The table below shows the resultant error in the Fvalue resulting from various measurement errors with a Z value of 10 °C:

Temperature Error (°C)	Fvalue Error (Fo)
0.1	2.3%
–0.1	–2.3%
0.5	12.0%
–0.5	–11.0%
1.0	26.0%

The instrument can measure TC and RTD inputs with an accuracy of better than 0.1%. This results in superior Fvalue calculation accuracy.

To improve the accuracy even further the Scale Adjust facility can be used to adjust the individual channel readings to be correct at the sterilizing temperature.

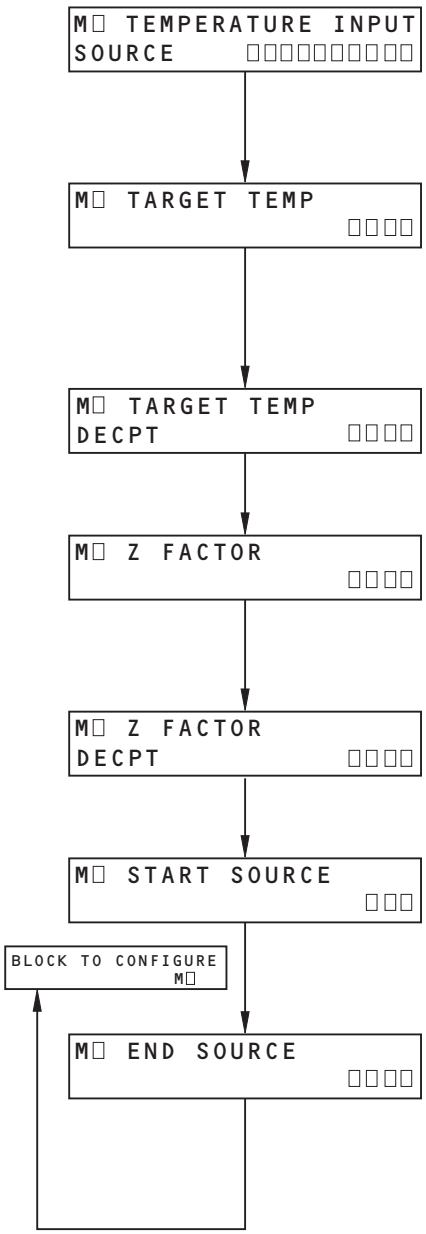
As Fvalue calculation is an integrating function, the sample rate has a direct effect on the accuracy when the temperature is changing. With a steady state signal the sample rate does not affect accuracy.

...6.2.5 Fvalue

An Fvalue calculation has to be calculated for each measuring thermocouple or RTD. The instrument can perform up to four independent Fvalue calculations.

The input channels should be configured with a zero based range and have a sufficiently large span reading so that they do not go over range during the purging cycle. Over-range inputs can cause a math block error and result in the Fvalue calculation being invalid.

If the sensors being used are inaccurate, the individual channels can be adjusted using the instrument's Scale Adjust Facility – see Section 5.1.3.



Temperature Input Source
Select the input source (A1 to A6, B1 to B6 or Math Block M1 to M4) to perform Fvalue calculation on.

The input sources available depend on the input options fitted – see Section 4.2.

Target Temperature
Enter the target sterilization temperature in °C.

Universally accepted standards:
Steam (Fo) – 121.1°C
Dry Heat (Fh) – 170°C

Target Temperature Decimal Point
Set the number of decimal places for the target temperature (0 to 3 places).

Z Factor
Enter the Z factor in °C.

The change in sterilization temperature which causes factor-of-10 change in the death rate is unique to each organism and is called the Z Factor.

Z Factor Decimal Point
Set the number of decimal places for the Z Factor (0 to 3 places).

Start Source
Select the digital source to start or reset the Fvalue calculation.

Example – Set the high process alarm to start the Fvalue calculation when the measured temperature reaches 100°C.

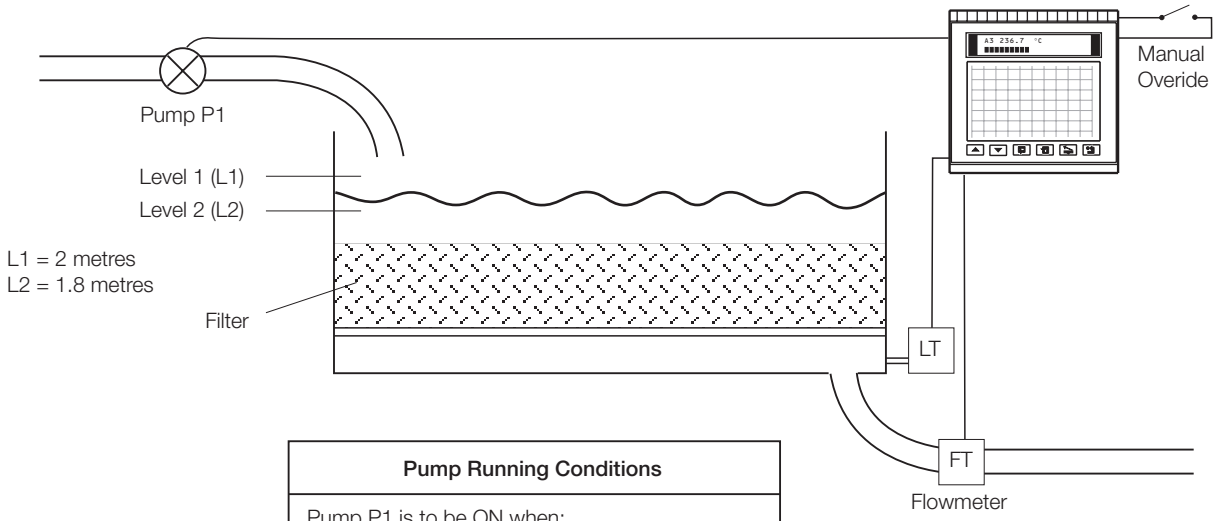
End Source
Select the digital source to end the Fvalue calculation.

Example – Set the high process alarm to end the Fvalue calculation when the math result reaches 10 Fvalue units.

Return to **Block to Configure** frame.

6.2.6 Logic Equation Configuration Page – Fig. 6.4

Example – Liquid in a filter has to be maintained between levels 1 and 2 by switching on and off pump P1. Pump P1 is off during the night. For filter cleaning, manual override of the pump is required.



Pump Running Conditions

Pump P1 is to be ON when:

- Level falls below L2

  and

  the time is between 8:00 a.m. and 5:00 p.m.

- **and**

  there is no manual overide.

Input Elements

- Alarm A set as a low process alarm with a trip of 1.8m. Hysteresis for Alarm A set to 0.2m.

  Real Time Alarm 1 set ON at 8:00 a.m. and OFF at 5:00 p.m.

- Digital Input DA1 set for positive logic so that an:

  open contact = normal operation (logic input active)
  closed contact = manual overide (logic input non-active).

Logic Equation – See Below

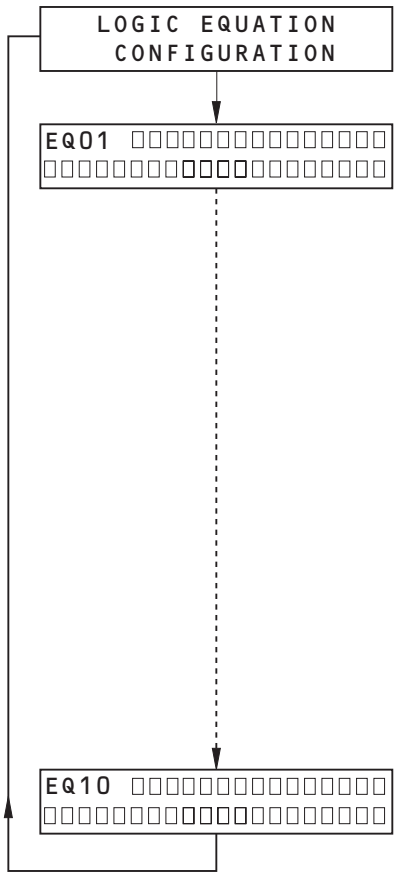
EQ01 = PAA & RT1 & DA1

Information. The logic equation can be assigned to a relay to switch the pump on and off. To ensure safe operation of the system, the output polarity of the relay should be set to POSITIVE, then in the event of a power failure to the recorder alone, the pump is stopped, leaving the filter in a safe condition.

Fig. 6.4 Pump/Filter Example

...6.2.6 Logic Equation Configuration Page

Information.
- 10 programmable logic (Boolean) equations.
- Up to 16 elements per equation.
- Equations can combine internal and external digital signals, e.g. alarms, digital inputs, other logic equation results, real time alarms etc.
- Equations can be used to activate many instrument functions, e.g. alarm acknowledgements, pen events, changes of chart speeds, value printing and relay outputs, etc.



Logic Equation 01
Using the following terms construct the required Boolean expression to be used as an activation event.

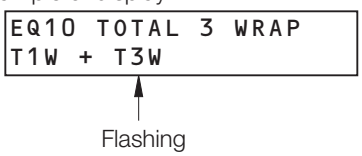
*	–	Terminator, used to complete the expression
)	–	Close bracket
(	–	Open Bracket
&	–	Logical AND
+	–	Logical OR
T1W – T6W	–	Wrap-around of totalizer (T1 to T6)
P_O	–	Paper Out alarm
FA1 – FB6	–	Input failure (A1 to A6, B1 to B6)
DA1 – DG3	–	Digital input active
CS1 – CS3	–	Chart speeds
L1 – L10	–	Logic equation true
PWR	–	Power failure
RT1 – RT2	–	Real time alarm on (1 or 2)
PAA – PAM	–	Predefined process alarm (A to M. excluding I)

The terms are selected by using the ▲ and ▼ keys, and the selection is stored by pressing the ↵ key. A maximum of 16 terms including the terminator can be used in the expression.

Up to ten logic equations can be configured.

Return to top of **Logic Equation Configuration Page**.

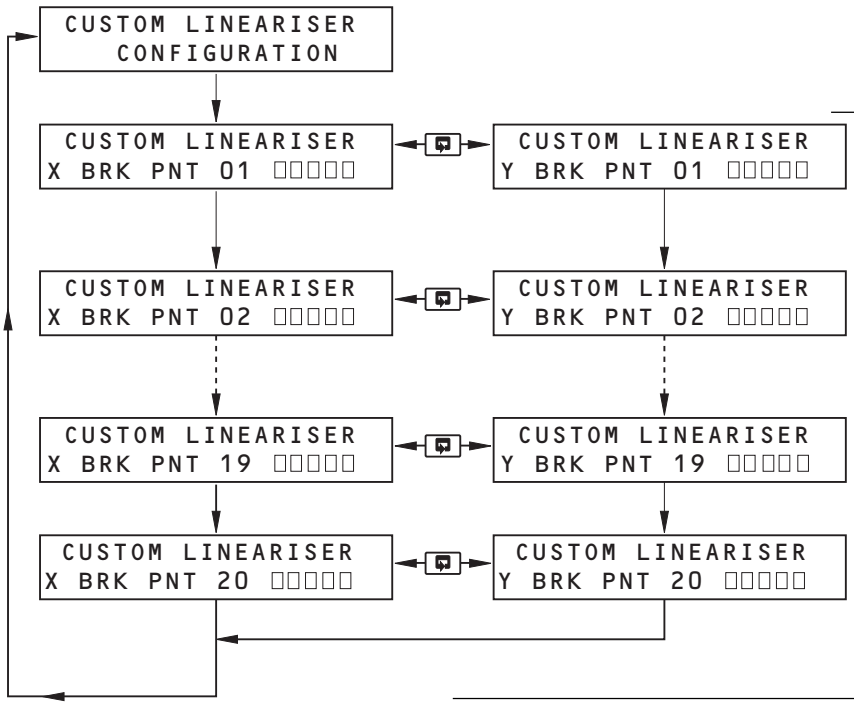
Example of display:



The example shows three terms of an equation (Total 1 wrap OR Total 3 wrap). Each term flashes until the ↵ key is pressed. The complete equation must end with the terminator (*).

6.2.7 Custom Linearizer Configuration Page – Fig. 6.5

Information.
- Single 20-point custom linearizer.
- Variable spacing on x and y axis to allow optimization of breakpoints.



Set custom linearizer X and Y breakpoints. Up to twenty X and Y points are set to create the linearizer function required. Set each value between 0.0 and 100.0%.

Note. The process variable input readings and equivalent display readings must be converted to percent of span values.

An example of a custom linearizer is shown in Fig. 6.5.

Return to top of **Custom Linearizer Configuration Page**.

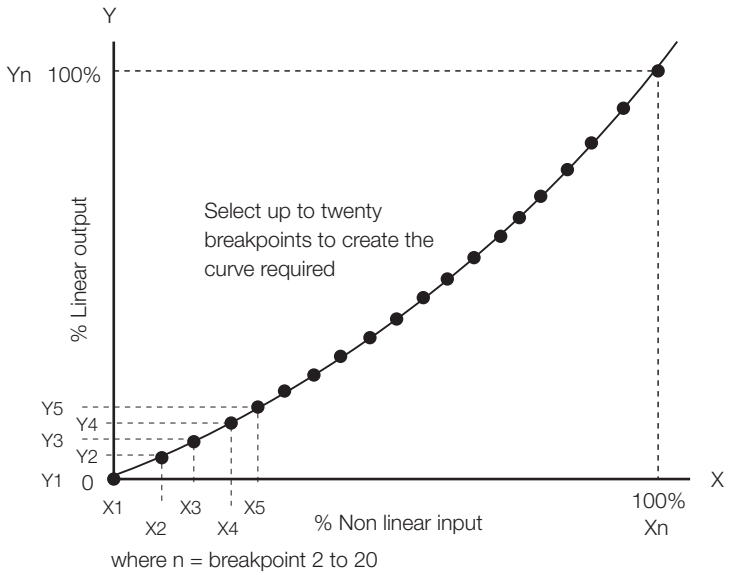
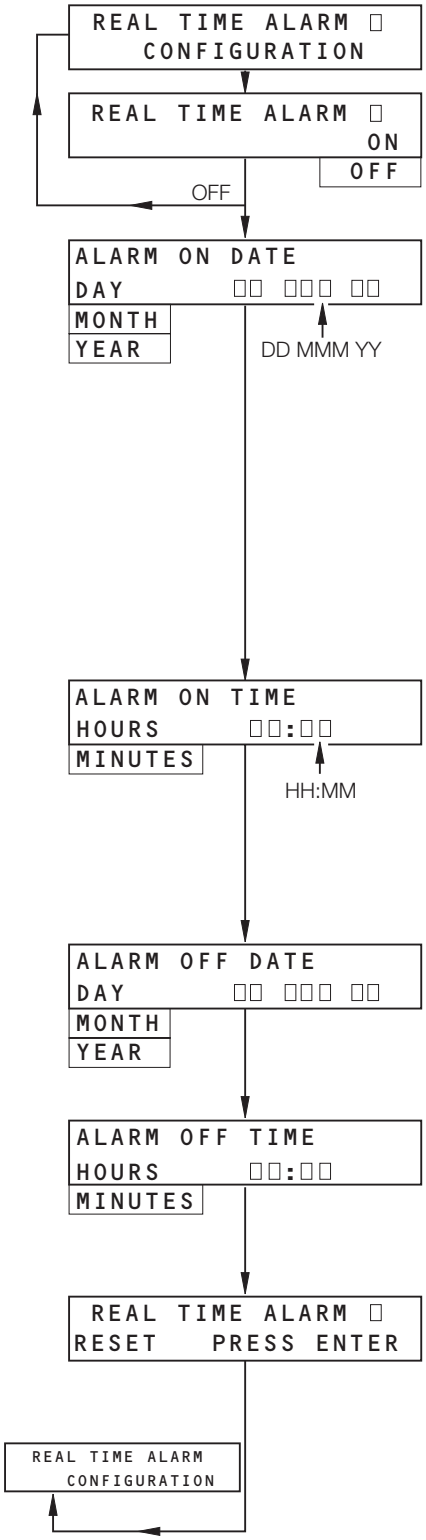


Fig. 6.5 Example of Custom Linearizer

6.2.8 Real Time Alarms 1 and 2 Configuration Page – Fig. 6.6

Information.
- 2 programmable real time events.
- Programmable start and end dates/times.
- Times can be specific to the hour, day, month, year or a combination of these parameters.



Alarm Enable
Select **ON** to enable real time alarm activation. Select **OFF** to de-activate the alarm and return to the top of the **Real Time Alarm Configuration Page**.

Alarm On Date
Set the alarm on date. Pressing the ↵ key advances the selection between **Day**, **Month** and **Year**.
The day, month and year can be set to ** allowing the alarm to be activated every day, month or year.

Examples – to activate the alarm on the 3rd day of each month set **Alarm On Date** to 03 *** **. To activate the alarm on a daily basis set ** *** **.

Note. The ** settings have to be entered sequentially, starting with every year and working down to every hour. If a specific date is set and subsequently the on time is, e.g. set to **:15, the date would automatically be changed to ** *** **.

Alarm On Time
Set the alarm on time. Pressing the ↵ key advances the selection between **Hours** and **Minutes**.
Hours can be set to ** allowing the alarm to be activated at a specific minute each hour (see note above).

Example – to activate the alarm at 15 minutes past each hour set **Alarm On Time** to **:15

Alarm Off Date
Set the alarm off date as above. Ensure the alarm off date is the same as or later than **Alarm On Date**. Only the parameters not set to ** in **Alarm On Date** can be adjusted.

Alarm Off Time
Set the alarm off time as above. If setting alarm off for the same day as alarm on, ensure that the time set is later than **Alarm On Time**. Only the minutes can be adjusted if the hours in **Alarm On Time** are set to **.

Alarm Reset
Pressing the ↵ key resets the real time alarm and the display changes to **ACKNLG**. Reset must be implemented after any changes to the real time alarm settings to ensure correct operation.

Return to the top of the **Real Time Alarm Configuration Page**.

…6.2.8 Real Time Alarms 1 and 2 Configuration Page – Fig. 6.6

Example 1 – to print out a daily total then reset.

Set Real Time Alarm 1 (RTA1) as follows:

ON time		OFF time
**	Year	**
***	Month	***
**	Day	**
00	Hour	00
00	Minutes	01

Assign Total 1 Print Source and Total 1 Reset Source to RTA1.

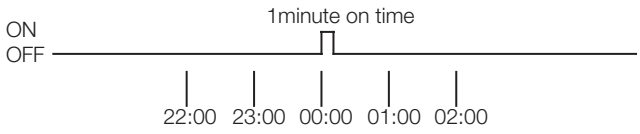


Fig. 6.6 Daily Total Printout using Real Time Alarm 1

Example 2 – to use two totalizers to log day and night flows.

Set RTA1 as follows:

ON time		OFF time
**	Year	**
***	Month	***
**	Day	**
06	Hour	18
00	Minutes	00

Assign Total 1 Stop/Go Source to RTA1 for total daytime flow and Total 1 Print Source to RTA2.

Set RTA2 as follows:

ON time		OFF time
**	Year	**
***	Month	***
**	Day	**
18	Hour	06
00	Minutes	00

Assign Total 2 Stop/Go Source to RTA2 for total night time flow and Total 2 Print Source to RTA1.

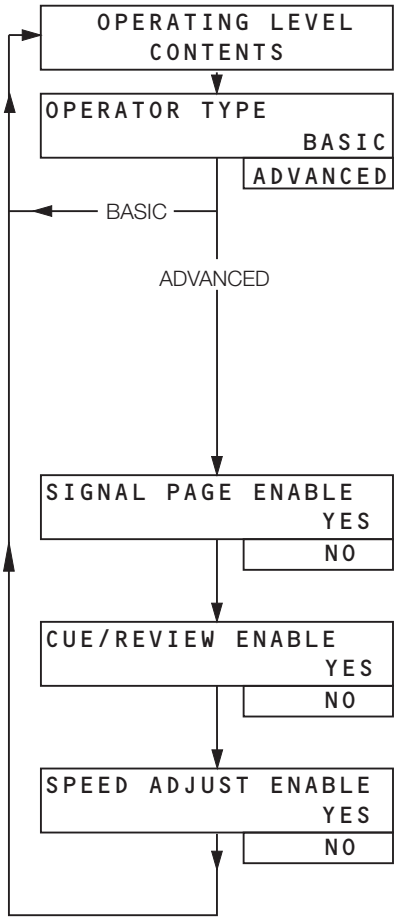
RTA1 ON is used to print the night flow total and RTA2 ON the day flow total.

6.3 Advanced Level – Operator Setup

6.3.1 Operating Level Contents Configuration Page

Information.

- 2 operating level complexities – Basic or Advanced.
- Page enable/disable facility for display of the following pages in the Operating Level:
  View Analog Signals and View Digital Signals Pages
  Cue/Review Page
  Speed Adjust Page



Level Complexity
Select the required operating level complexity.
If **BASIC** is selected the following pages are **not** included in the Operating Level.
Operating Page 2
View Analog Signals Page
View Digital Signals Page
Totalizer Control Page
Operator Function Page
Print Messages Page
Processes Review Page
Memory Card Data Logging Set-up

Signal Page Enable
Select **YES** to enable the **View Analog Signals Page** and the **View Digital Signals Page** in the operating level – see Sections 3.3 and 3.4 respectively.

Cue/Review Enable
Select **YES** to enable the cue/review feature in the **Operator Functions Page** – see Section 3.6.

Speed Adjust Enable
Select **YES** to enable the speed adjust frame in the **Operator Functions Page** – see Section 3.6.

Return to top of **Operating Level Contents Configuration Page**.

6.3.2 Operating Pages 1 and 2 Configuration Page – Fig. 6.7

Information.
- 2 Operating Pages.
- 8 programmable frames for each page.
- 4 frame types – Standard, Totalizer, Digital Signal or Pen Values.
- Programmable Operating Page tag.
- Operating Page 1 tag enable/disable option.

Note. The configuration procedures for **Operating Pages 1** and **2** are functionally similar. Frame 1 of page 1 cannot be set to **OFF**. This ensures that **Operating Page 1** is displayed on start-up.

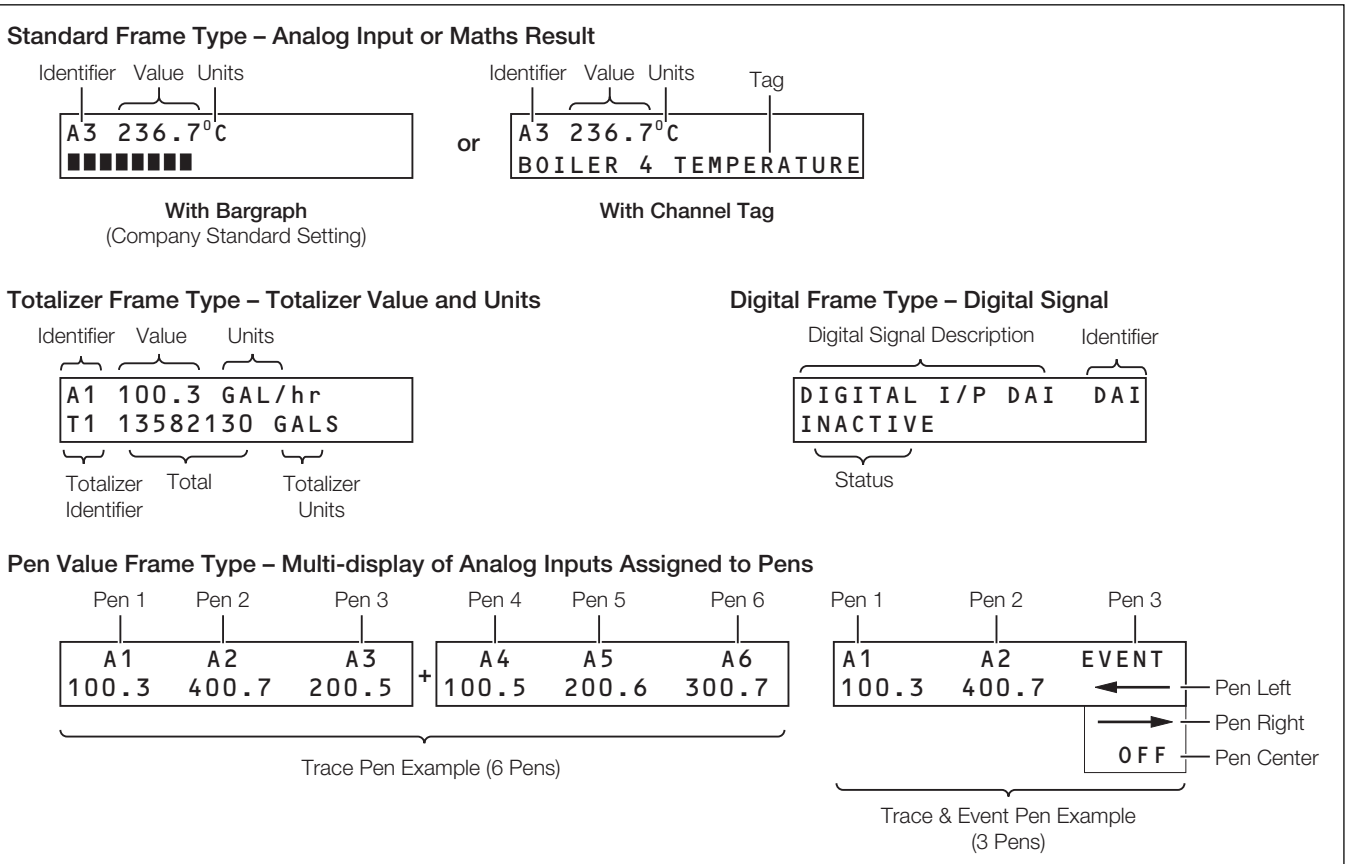
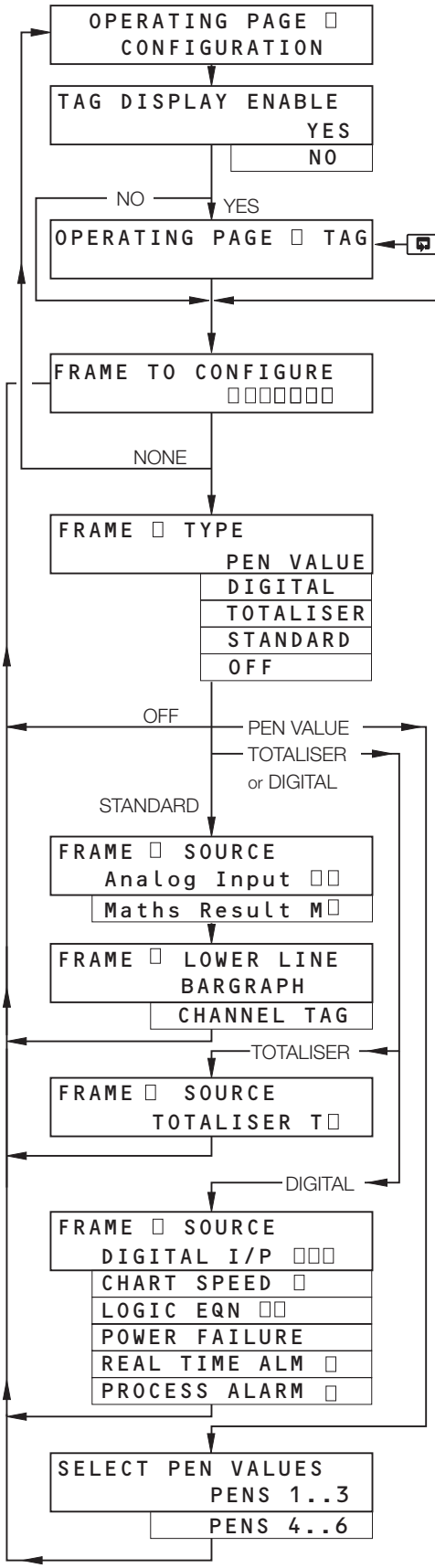


Fig. 6.7 Frame Type Options

...6.3.2 Operating Pages 1 and 2 Configuration Page



Tag Display Enable
Select **YES** to enable the **Operating Page 1** tag (not available for **Operating Page 2**.

Page Tag
A page name of up to twenty characters can be set on the upper display – see Front Fold-out.

Frame to Configure
Eight separate frames can be programmed for each page to display analog, digital or totalizer sources. These are displayed in sequence in **Operating Page 1 or 2.** On entry the default is **NONE**.
Select the frame to configure.

Frame Type
Select the frame required from the five frame types available (see Fig. 6.6, page 72):

PEN VALUE	–	Displays the inputs assigned to the pens Up to 3 inputs can be displayed in one frame
DIGITAL	–	Any one of up to 47 sources from digital inputs, alarms, logic equations or chart speeds
TOTALISER	–	Any one of six totalizers
STANDARD	–	Any one of up to 12 analog inputs (see Section 4.2) or four math functions
OFF	–	All but frame 1 of **Operating Page 1** can be set to **OFF**

Frame Source (Standard)
Select any one of up to 12 analog inputs (A1 to A6, B1 to B6, depending on the options fitted – see Section 4.2) or four math functions.

Frame Lower Line
Select one of the following:

BARGRAPH	–	Displays a 100 segment bar graph.
CHANNEL TAG	–	Displays the tag allocated to the selected input source

Frame Source (Totalizer)
Select any one of up to six totalizers (T1 to T6).

Frame Source (Digital)
Select the frame source from the six different digital input sources available:

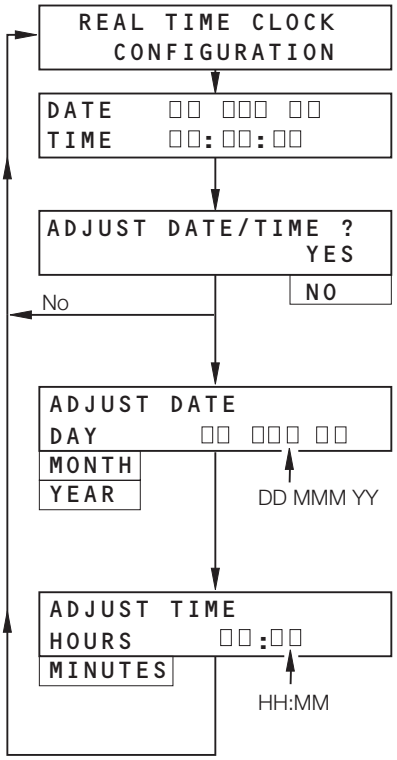
DIGITAL I/P	–	Any one of up to 19 digital inputs
CHART SPEED	–	Any one of three pre-defined chart speeds
LOGIC EQN	–	Any one of up to 10 logic equations
POWER FAILURE	–	The power failure alarm
REAL TIME ALM	–	Either of the two real time alarms
PROCESS ALARM	–	Any one of 12 process alarms

Select Pen Values
Select required pen value (1, 2 and 3) or (4, 5 and 6).

Return to **Frame to Configure** frame.

6.3.3 Real Time Clock Configuration Page

Information.
- Time and date set-up for the instrument's internal real time clock.



Date/Time
The current date/time set on the instrument is displayed.

Adjust Date/Time
Select **YES** to advance to adjust parameters. Select **NO** to return to top of **Real Time Clock Configuration Page**.

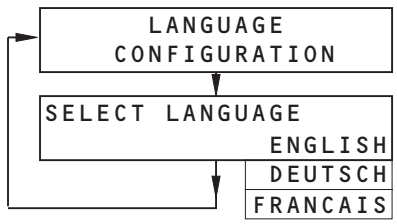
Adjust Date
Set the day, month and year. Pressing the ↵ key stores the parameter and selects the next parameter in the **Day**, **Month** and **Year** loop.

Adjust Time
Set the current time. Pressing the ↵ key stores the parameter and selects the next parameter in the **Hours** and **Minutes** loop.

Press the ↵ key to save the new date/time settings.

6.3.4 Language Configuration Page

Information.
- 3 languages are available for Operator and Programming frames:
  English
  German
  French



Select Language
Select the language to be displayed, English, German or French.

6.4 Advanced Level – Totalizer Function

6.4.1 Introduction to Totalization

Information.

- Six 8-digit totalizers which can be assigned to any channel or math result.
- Count up or count down.
- Count rates – from 0.001 to 10.0 counts/second.
- External counter pulse – can be used to energize relays or digital outputs (a maximum of 4 pulses per second are generated).
- Wrap function – with external wrap pulse used to energize relays or digital outputs.
- Programmable preset and predetermined count values – for (batch) flow total.
- Adjustable cut-off values.
- Operator level reset and stop/go.
- Digital signal reset and stop/go.

The totalizer option provides indication and recording of flow rates from input signals with linear, square law or power law characteristics. More than one totalizer can be allocated to a channel and these may be switched on or off as required.

The flow total for any channel can be viewed on the digital display and reset using the front panel keys and/or a digital signal. An additional internal 'Secure' total is also provided which can be reset only after gaining access to the **Advanced Configuration Level**.

External counters with their own power supplies can be driven using relay and digital output module options.

Converting the Engineering Flow Rate – Example A and B

To calculate the count rate high the engineering flow rate high must first be converted into units per second. The engineering range (display range) value is limited to 9999. In some circumstances the engineering flow rate high value may be greater than 9999 and the engineering range must therefore be scaled. In the calculation of units/second the actual engineering flow rate high value must be used.

$$\text{Max. flow rate in Units/Second} = \frac{\text{Actual Engineering Flow Rate High}}{\text{Engineering Range Units (in seconds)}}$$

Calculating the Count Rate High – Example A and B

The totalized decimal point allows the totals to be scaled between 10^{-8} and 10^{0} ie. .00000000 and 00000000 with multiplication factors of x 10 and x 100 giving 0000000**0** and 000000000; the latter two increase in increments of tens or hundreds respectively.

$$\text{Count Rate High} = \left.\frac{\text{units/second}}{\text{counter factor}}\right\} \text{Must be within the limits of 10.0 to 0.001 pulse per second}$$

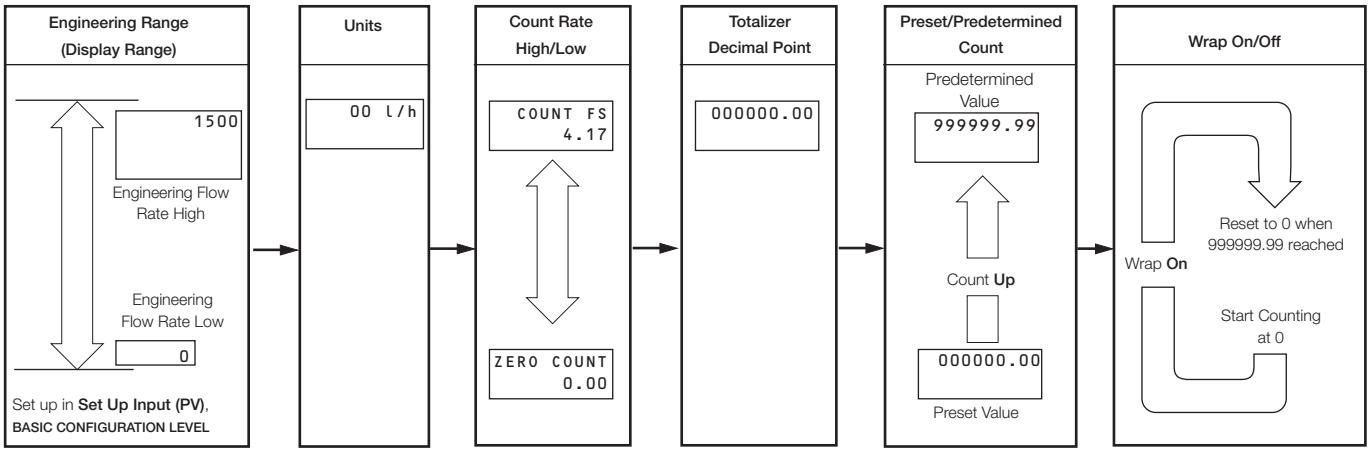
…6.4.1 Introduction to Totalization

Example A – setting up:

- engineering range of 0 to 1500 representing a range of 0 to 150,000 liters per hour
- measuring effluent discharge
- count every 0.01m^3
- wrap function ON, front panel total automatically reset to 0 and continues counting when predetermined value is reached.

Range = 150,000 l/h = 150m^3/h Units/second = $\frac{150}{3{,}600}$ = 0.0417m^3/s

Totalizer count full scale = $\frac{0.0417}{0.01}$ = 4.17 pulses/s (OK, maximum is 10)



Example B – setting up:

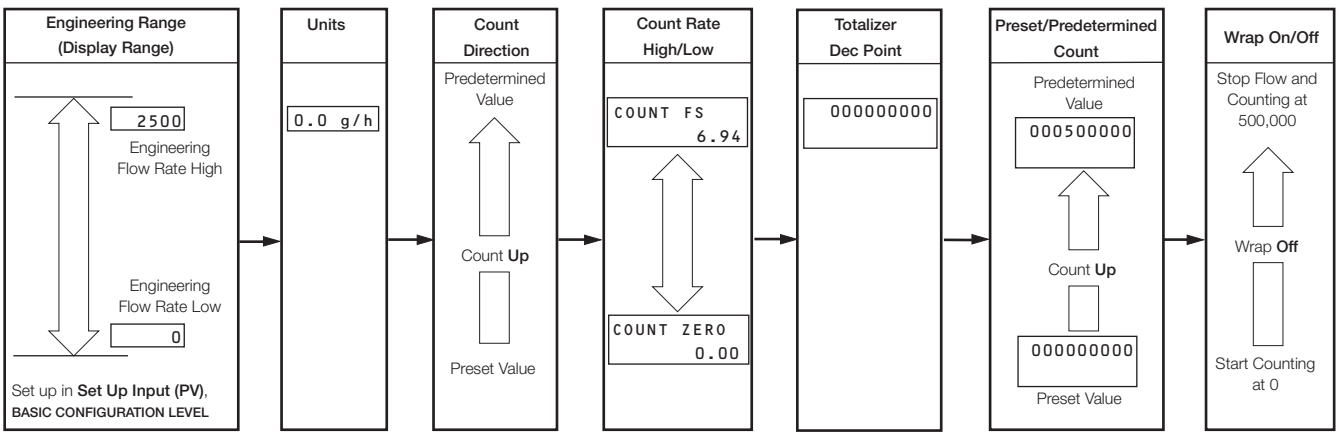
- engineering range of 0 to 2500 representing a range of 0 to 250,000 gallons per hour
- filling a storage tank with a capacity of 500,000 gallons
- least significant digit of 1 gallon shown on totalizer display (viewed in **Totals Page**, **Operator Level**)
- wrap function off, 1 second wrap pulse generated at predetermined value and combined in a logic equation to stop flow.

Range = 250,000 gal/h Units/second = $\frac{250{,}000}{3600}$ = 69.4 gal/s

Totalizer count full scale = $\frac{69.4}{1}$ = 69.4 (too high, maximum is 10)

Increasing count to every 10 gallons = $\frac{69.4}{10}$ = 6.94 (OK)

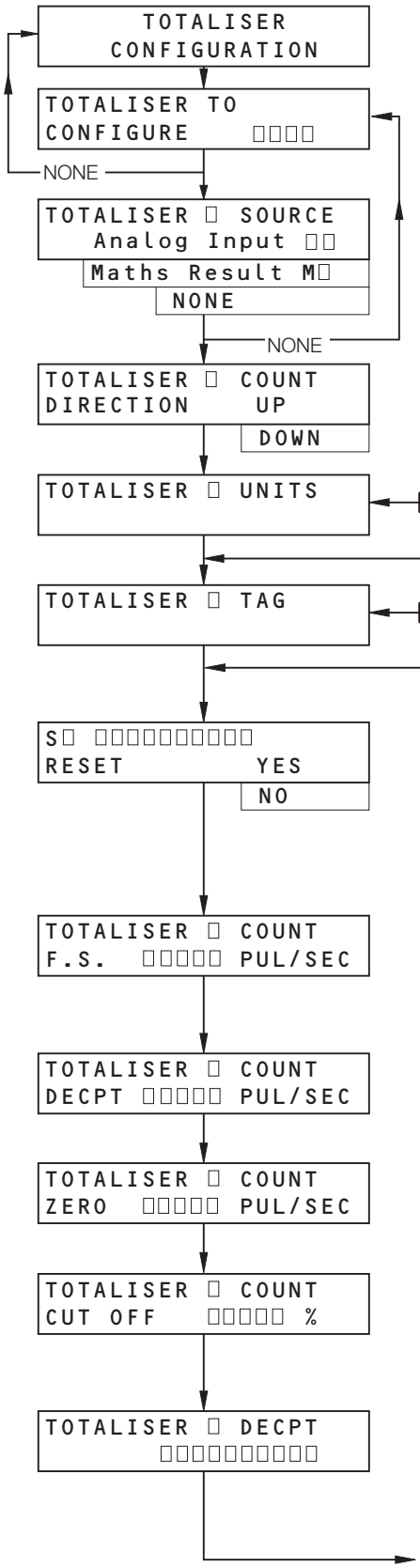
Set totalizer decimal point to x10 position to increment totalizer in 10 gallon steps.



Note. For the majority of applications the **Count Rate Low** is set to 0000. Only if the engineering **Flow Rate Low** is not zero is it necessary to calculate the **Count Rate Low** setting, e.g. when the resultant flow range of several flows added together always ensures a minimum flow is greater than zero.

6.4.2 Totalizer Configuration Page

This page is used to configure the totalizers T1 to T6.



Totalizer to Configure
Select the totalizer to configure (T1 to T6).
On entry the default is **NONE**.

Totalizer Source
An input source is assigned to the totalizer selected above. Select the source required from analog inputs A1 to A6, B1 to B6 (depending on the options fitted – see Section 4.2) or math functions M1 to M4.
Select **NONE** to set the totalizer off.

Totalizer Count Direction
Select either an incremental (**UP**) or decremental (**DOWN**) counter.

Totalizer Units
Units of up to six characters can be set on the upper display – see Front Fold-out.

Totalizer Tag
A totalizer name of up to eight characters can be set on the upper display – see Front Fold-out.

Secure Total
The secure total for the totalizer selected above is displayed. This value is independent of the displayed flow total and can comprise up to ten digits as set in the **Totalizer Decimal Point** parameter – see below.
Select **YES** and press enter to reset the secure total. The figure displayed depends on the type of counter selected (**UP** or **DOWN**)

Totalizer Count Full Scale
Set the required count (pulses/second) corresponding to the full scale input. This is programmable from 0.00 to 10.00 in 0.01 increments, or from 0.000 to 1.000 in 0.001 increments depending on the decimal point setting in the next parameter.

Totalizer Count Decimal Point
Set the required position of the decimal point for the count full scale set above. This can be set to give increments of 0.01 or 0.001.

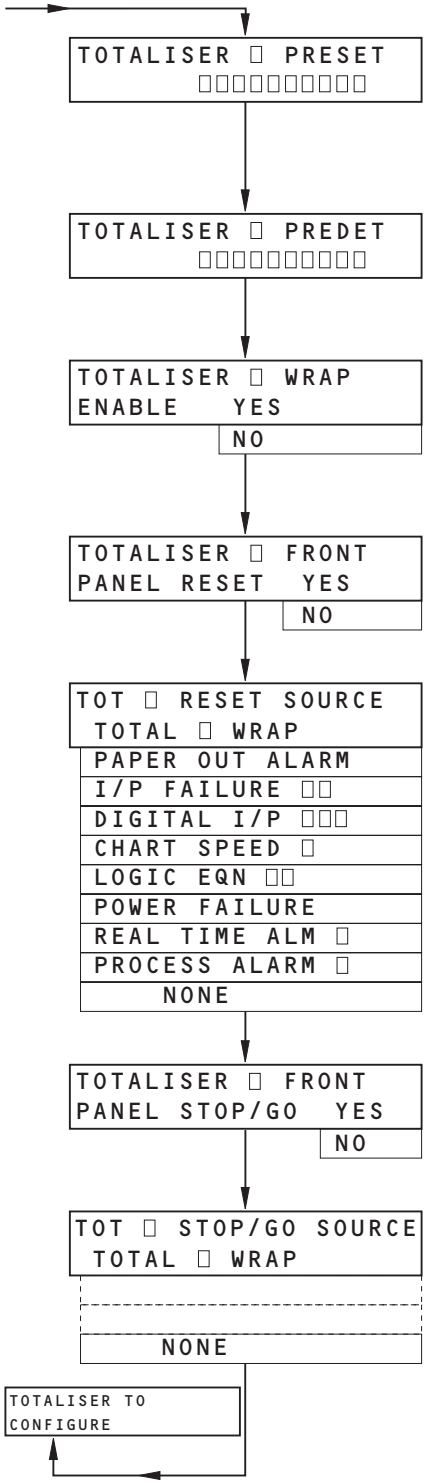
Totalizer Count Zero
Set the required count rate corresponding to zero input as for **Totalizer Count Full Scale** above.

Totalizer Count Cut Off
Set the lowest flow value (as a percentage of maximum flow rate) at which the totalizer is to stop counting. This is adjustable from 0.0 to 100.0% in 0.1% increments.

Totalizer Decimal Point
Set the decimal point for the displayed flow total and secure total. This is selectable between .00000000 and 00000000., with multiplication factors of x10 and x100 available, i.e. 000000000 and 0000000000.

Continued on next page.

…6.4.2 Totalizer Configuration Page



Totalizer Preset Value
Set the value to which the total reverts when it is reset. Begin with the first digit indicated by the cursor (_). Pressing the ↵ key stores the digit value and advances the cursor to the next digit.
Repeat for all digits to be set.

Totalizer Predetermined Value
Set the value required to cause a reset of the total if wrap is set on, or value at which the totalizer is to stop counting at. Setting is as for **Totalizer Preset Value** above.
Repeat for all digits to be set.

Totalizer Wrap–around Enable
When wrap-around is enabled, the total is automatically reset to the **Preset Value** once the Predetermined Value is reached.
When wrap-around is not enabled the total stops counting when the **Predetermined Value** is reached.

Totalizer Front Panel Reset Enable
When front panel reset is enabled the flow total can be reset to the preset value from the **Totalizer Page** – see Section 3.5.
Select **YES** to enable the reset.

Totalizer Reset Source
Select the source required to automatically activate the totalizer reset:

TOTAL WRAP	– Wrap-around of a totalizer (T1 to T6)
PAPER OUT ALARM	– End of chart reached
I/P FAILURE	– Failure of analog input (A1 to A6, B1 to B6)
DIGITAL I/P	– Active digital input (DA1 to DG3)
CHART SPEED	– Selection of chart speed (1 to 3)
LOGIC EQN	– Logic equation true (1 to 10)
POWER FAILURE	– After power failure
REAL TIME ALM	– Real time alarm on (1 or 2)
PROCESS ALARM	– Pre-defined process alarm (A to M, excluding I)
NONE	– No automatic reset required.

Totalizer Front Panel Stop/Go Enable
When front panel stop/go is enabled the flow total counter can be started and stopped from the **Totalizer Page** – see Section 3.5.
Select **YES** to enable stop/go.

Totalizer Stop/Go Source
Select the source required to automatically stop and start the totalizer:
source active – totalizer Go
source inactive – totalizer Stop.
The sources are as for **Totalizer Reset Source** above.

Return to the **Totalizer to Configure** parameter.

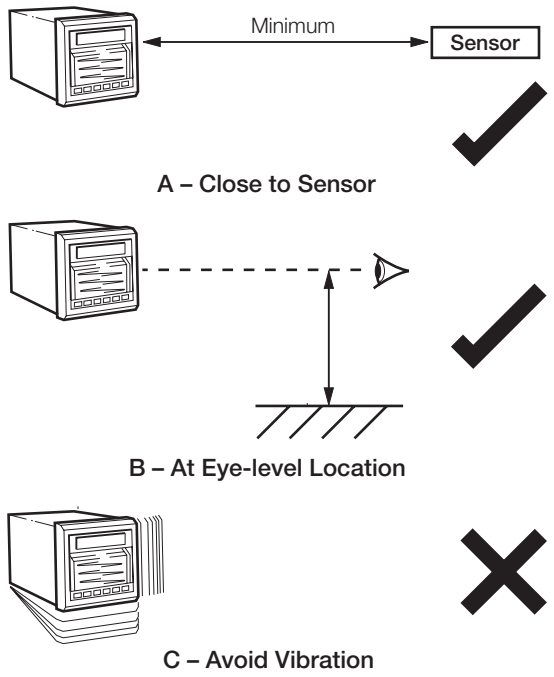
Note. For standard continuous counting set **Preset Value** to 00000000, **Predetermined Value** to 99999999 and wrap to **YES**.

7 INSTALLATION

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

End of Life Disposal
This instrument does not contain any substance that will cause undue harm to the environment. However, the unit contains a small lithium battery. This should be removed and disposed of responsibly in accordance with local environmental regulations. The remainder of the unit can be safely considered as normal waste and disposed of accordingly.

7.1 Siting – Figs. 7.1 and 7.2

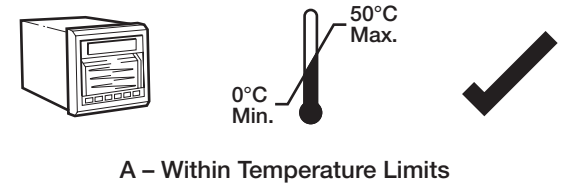


A – Close to Sensor

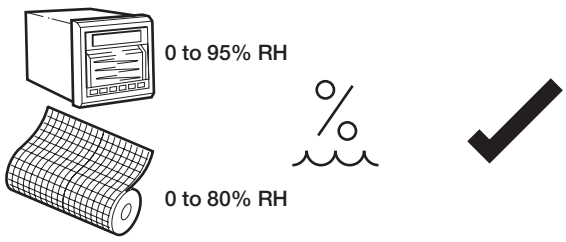
B – At Eye-level Location

C – Avoid Vibration

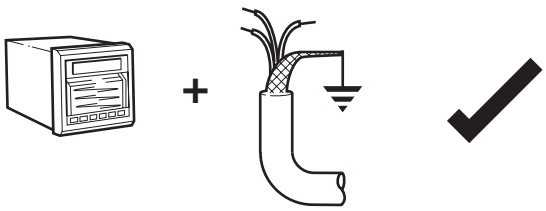
Fig. 7.1 General Requirements



A – Within Temperature Limits



B – Within Humidity Limits



Caution. Select a location away from strong electrical and magnetic fields. If these cannot be avoided, particularly in applications where walkie-talkies are expected to be used, screened cables within earthed metal conduit must be used.

C – Use Screened Cable

Fig. 7.2 Environmental Requirements

7.2 Mounting – Figs. 7.3 and 7.4

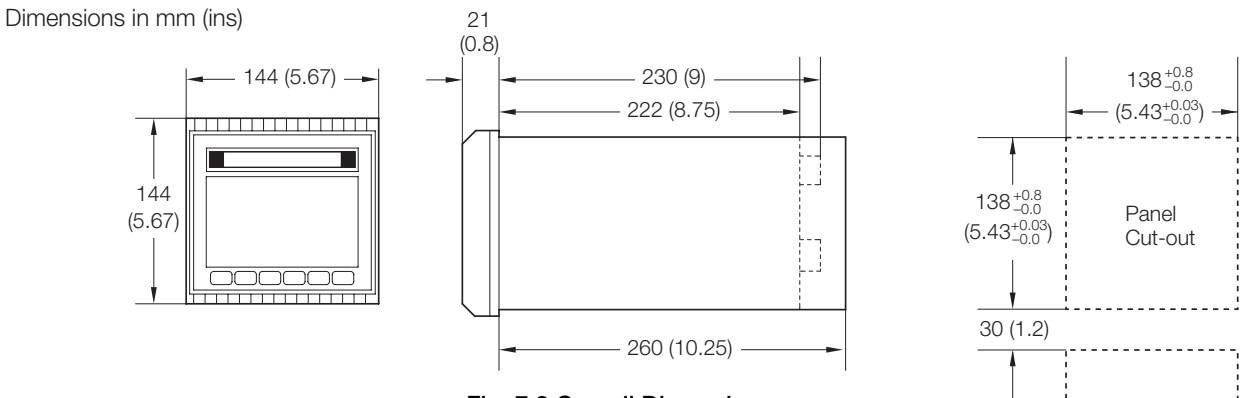
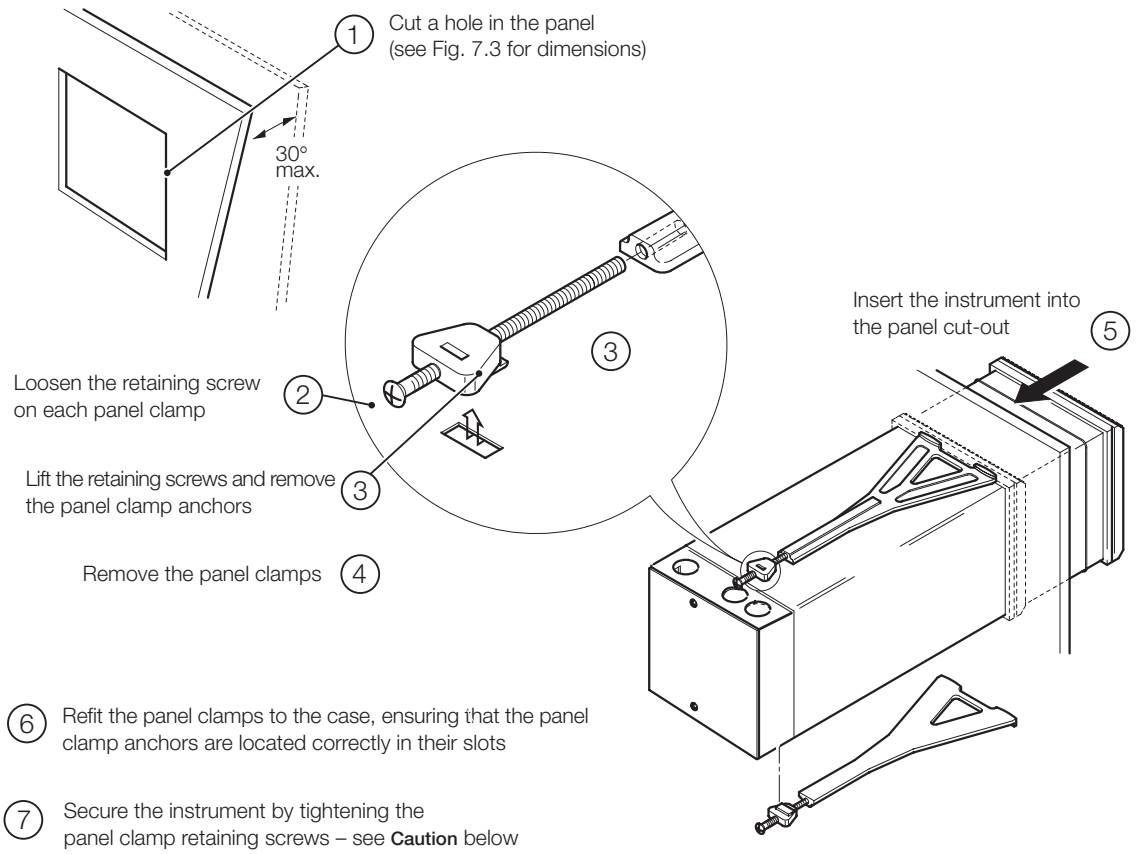


Fig. 7.3 Overall Dimensions

…7.2 Mounting – Figs. 7.3 and 7.4

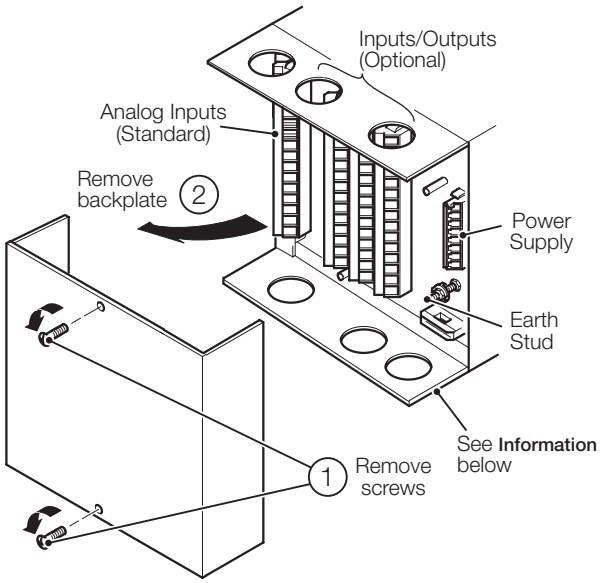


Caution. The clamp must fit flat against the instrument case. If the clamp is bowed, the securing screw is too tight and sealing problems may occur.

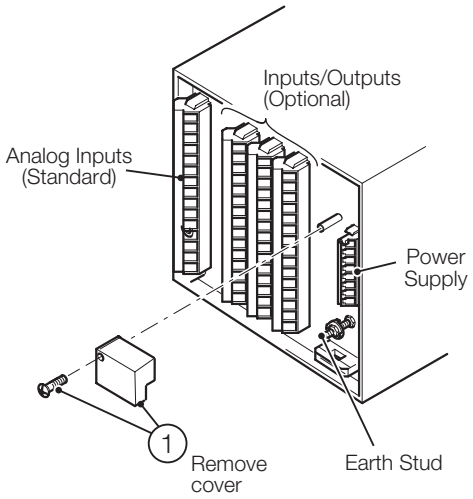
Fig. 7.4 Mounting

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

7.3 Access to Terminals – Fig. 7.5



A – Instruments with Terminal Compartment Extension



B – Instruments without Terminal Compartment Extension

Information. The terminal compartment extension used for anchoring cable conduits is an optional fitting.

Fig. 7.5 Access to Terminals

7.4 Connections General – Fig. 7.7

The terminals accept cables up to 2.5mm^2 cross section.

For the combination of this apparatus with other apparatus and/or for its connection to installations, the following notes apply:

Note.

- Always route signal leads and power cables separately, preferably in earthed metal conduit.
- It is strongly recommended that screened cable is used for signal inputs and relay connections, with the screen connected to the earth stud.

7.5 Analog Input Connections

(refer to Section 7.9 for 500V isolation option)

The chassis must be removed to gain access to the analog input modules when selecting the type of input required.

Open the instrument door and remove the chart unit – see Fig. 1.7 or 1.8. Remove the chassis as shown in Fig 7.6.

Note.

- For input connections of units with optional 500V isolation input boards refer to Section 7.9.
- There are no input type selector links for the 500V option.

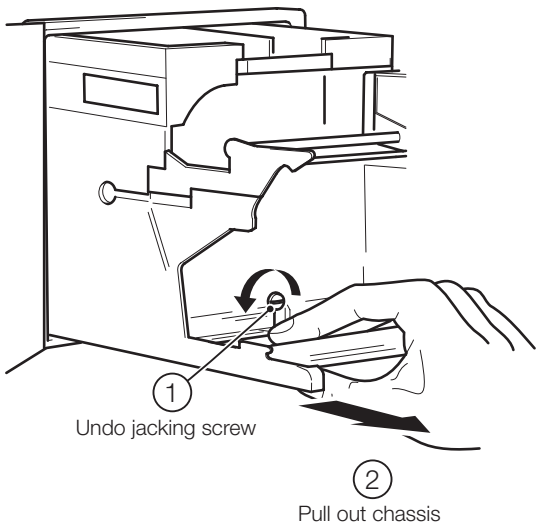


Fig. 7.6 Removing Chassis

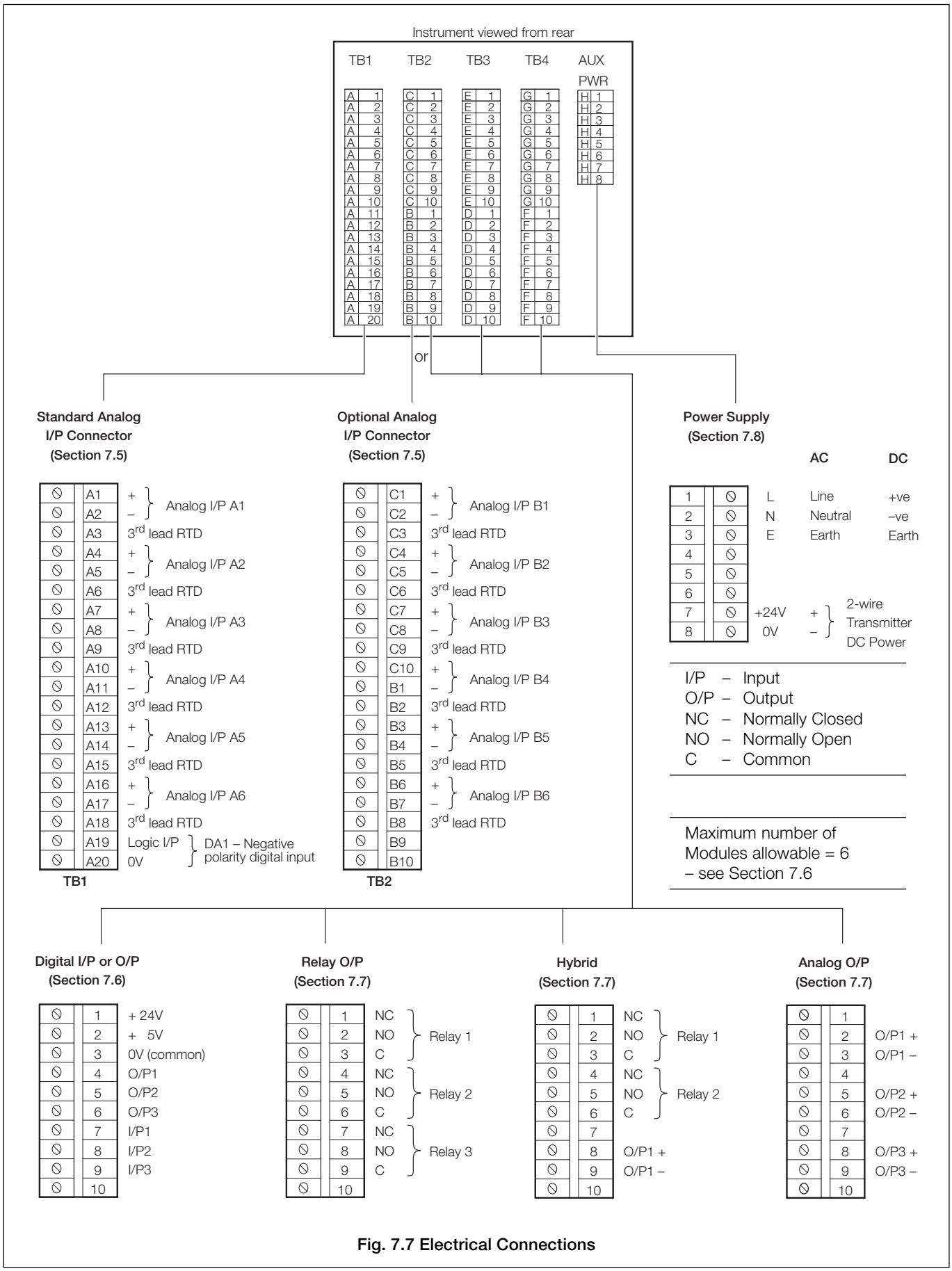


Fig. 7.7 Electrical Connections

…7.5 Analog Input Connections (refer to Section 7.9 for 500V isolation option)

7.5.1 Selecting Standard Analog Inputs – Fig. 7.8

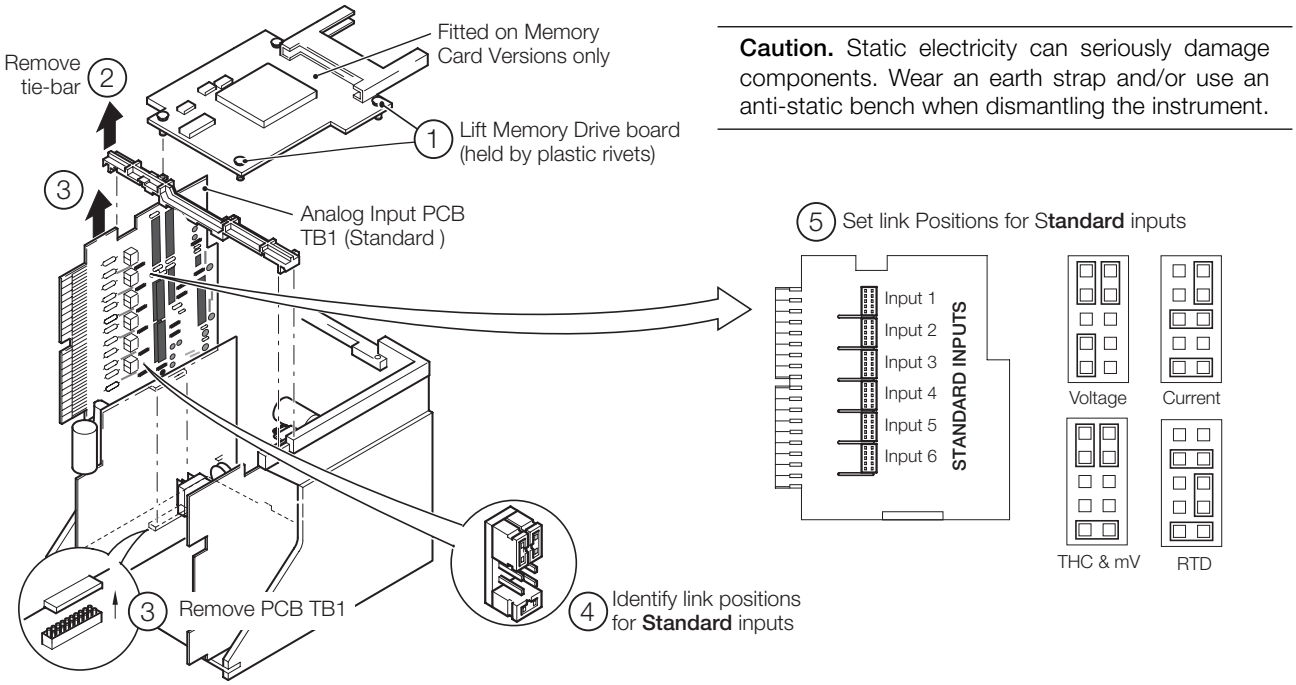


Fig. 7.8 Selecting Standard Analog Inputs

7.5.2 Selecting Optional Analog Inputs – Fig. 7.9

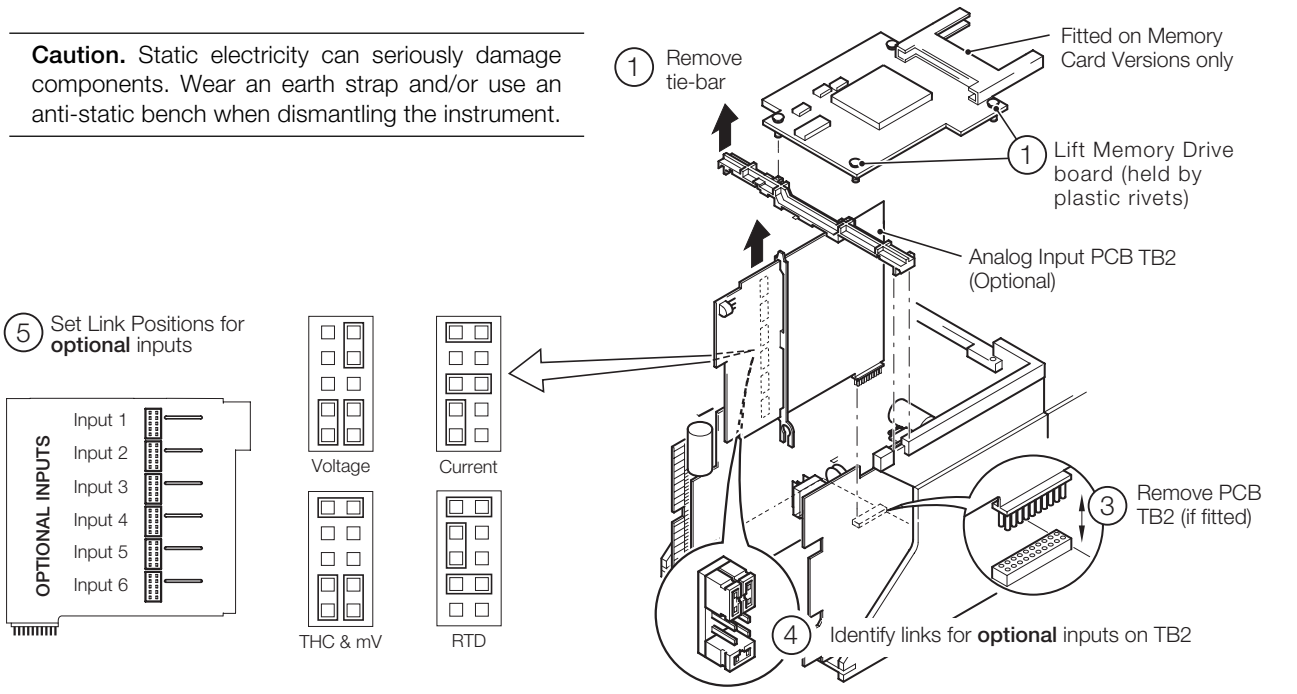
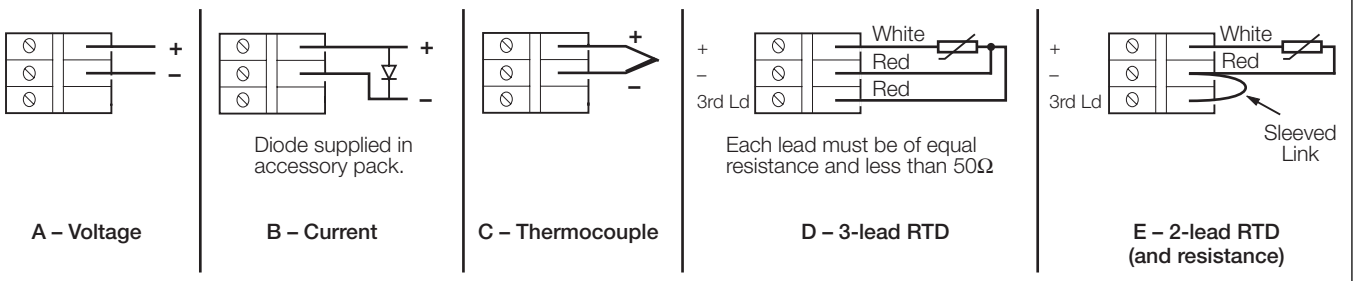


Fig. 7.9 Selecting Optional Analog Inputs

…7.5 Analog Input Connections (refer to Section 7.9 for 500V isolation option)

7.5.3 Current and Voltage – Fig. 7.10



Caution. Under no circumstances must the spare input terminal be linked to the negative.

Note. Refer also to Fig. 7.7 for terminal numbers.

Fig. 7.10 Analog Input Connections

Caution.

- To avoid damage to multi–channel instruments, high common mode voltages up to 250V r.m.s. max. must be present on all channels, or not at all.
- The maximum channel–to–channel voltage (between any two channels) must not exceed 12.5V or permanent damage to the instruments input circuitry may occur. To prevent such damage link the negative terminals on all inputs.
- For applications where the available 12.5V isolation is required, the link(s) between the relevant channel and the other channel(s) should not be fitted.

7.5.4 Thermocouple – Fig. 7.10

Use the correct compensating cable between the thermocouple and the terminals – see Table 7.1.

Automatic cold junction compensation (ACJC) is incorporated but an independent cold (reference) junction may be used.

7.5.5 Resistance Thermometer (RTD) – Fig. 7.10

If long leads are necessary it is preferable to use a 3-lead resistance thermometer.

If 2-lead resistance thermometers are used each input must be calibrated to take account of the lead resistance.

7.5.6 Transmitter Power Supply – Fig. 7.11

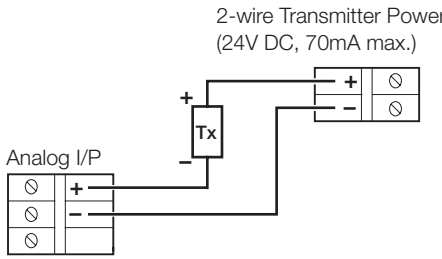


Fig. 7.11 Transmitter Power Supply

Type of Thermocouple	Compensating Cable											
	BS1843			ANSI MC 96.1			DIN 43714			BS4937 Part No.30		
	+	–	Case	+	–	Case	+	–	Case	+	–	Case
Ni-Cr/Ni-Al (K)	Brown	Blue	Red	Yellow	Red	Yellow	Red	Green	Green	Green	White	Green *
Ni-Cr/Cu-Ni (E)	—			—			—			Violet	White	Violet *
Nicrisil/Nisil (N)	Orange	Blue	Orange	Orange	Red	Orange	—			Pink	White	Pink *
Pt/Pt-Rh (R and S)	White	Blue	Green	Black	Red	Green	Red	White	White	Orange	White	Orange *
Pt-Rh/Pt-Rh (B)	—			—			—			Grey	White	Grey *
Cu/Cu-Ni (T)	White	Blue	Blue	Blue	Red	Blue	Red	Brown	Brown	Brown	White	Brown *
Fe/Con (J)	Yellow	Blue	Black	White	Red	Black	Red	Blue	Blue	Black	White	Black *
* Case Blue for intrinsically safe circuits												
Fe/Con (DIN 43710)	—			—			DIN 43710			—		
							Blue/red	Blue	Blue			

Table 7.1 Thermocouple Compensating Cable

7.6 Digital Inputs/Outputs Connections – Figs. 7.12 and 7.13

Digital input/output p.c.b.s may be fitted in any of the six module positions (B to G, maximum of 4 boards) – see Fig. 7.7. The boards must be removed from the instrument to gain access to input/output configuration links – see Figs. 7.12 and 7.13.

7.6.1 Selecting the Digital Input Type – Fig. 7.14

For **TTL inputs or zero switching** either positive or negative logic can be selected using the plug-in links LK5.

The digital input DA1 (terminals A19 and A20 – see Fig. 7.7) has fixed positive logic.

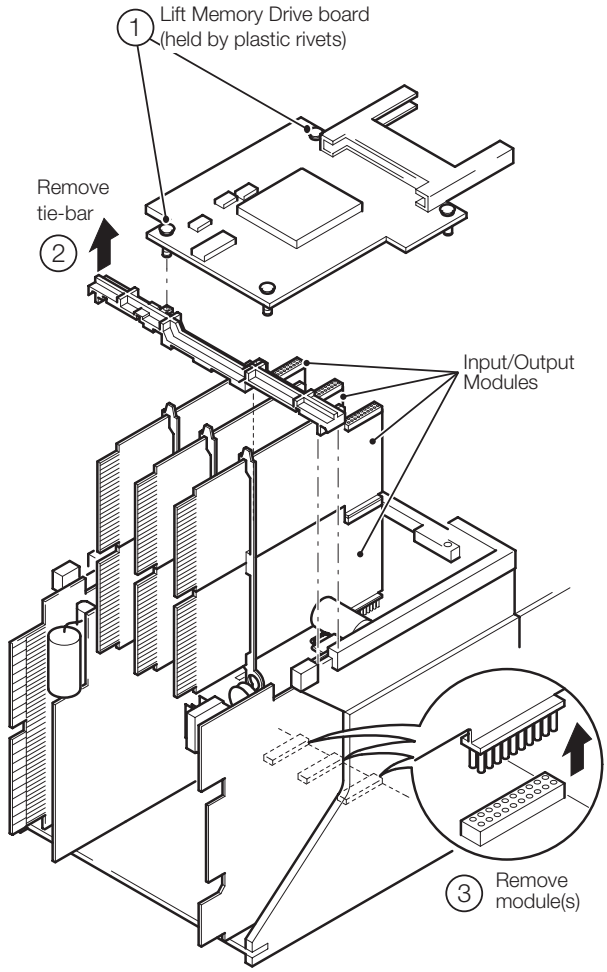


Fig. 7.12 Removing Modules

7.6.2 Selecting the Digital Output Configuration – Fig. 7.15

Each digital output can be selected to either TTL or open collector using the plug in links 2, 3 or 4. If an open collector type output is selected then a further selection can be made for either 5 or 24V output, with or without diode protection, using link 1.

Note. If diode protection is selected then only 5 or 24V can be assigned to any digital outputs configured as open collector. For mixed outputs of 5 and 24V link 1 must be removed resulting in loss of diode protection.

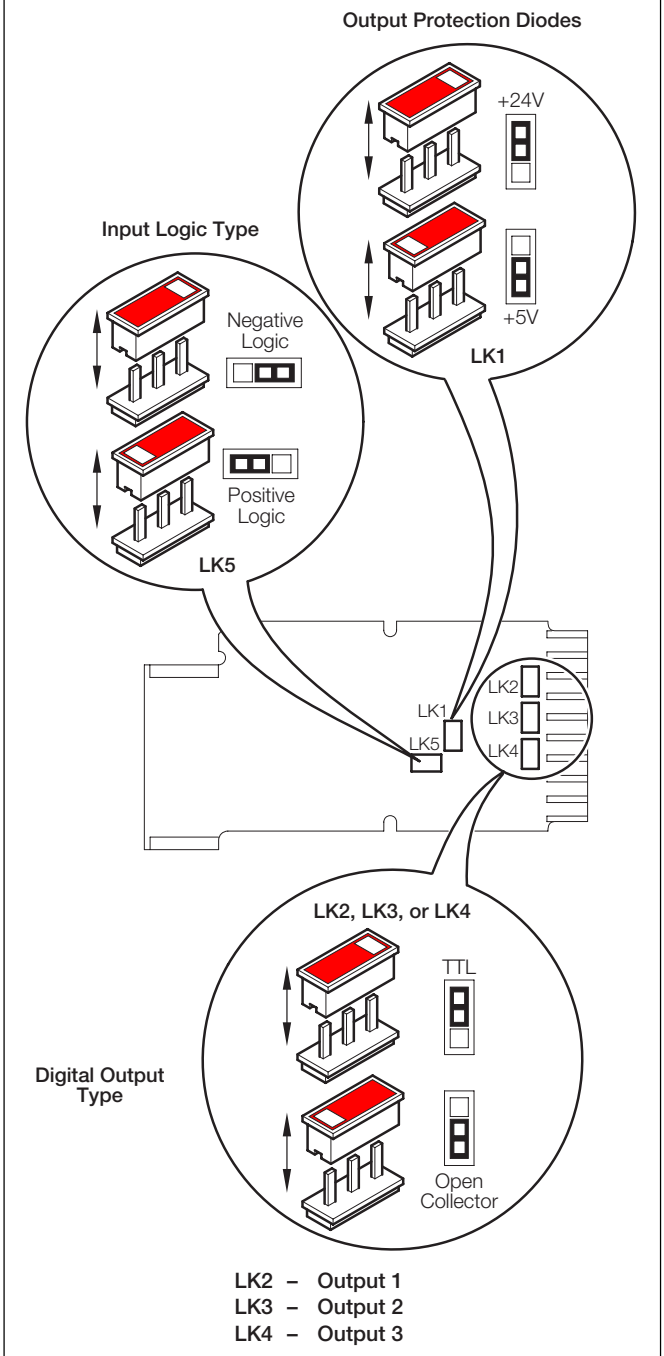


Fig. 7.13 Configuring the Digital Inputs/Outputs

7.6.3 Digital Input Connections – Fig. 7.14

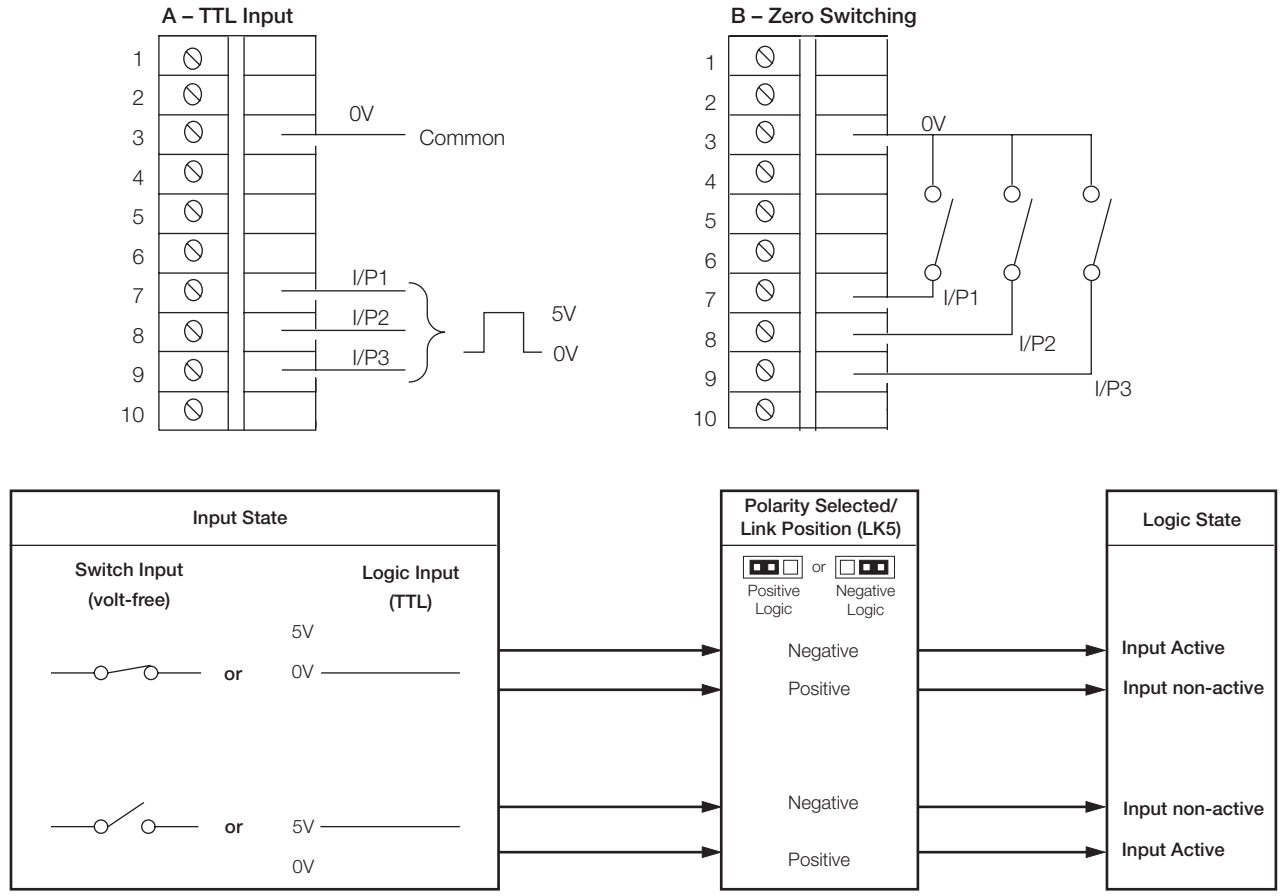
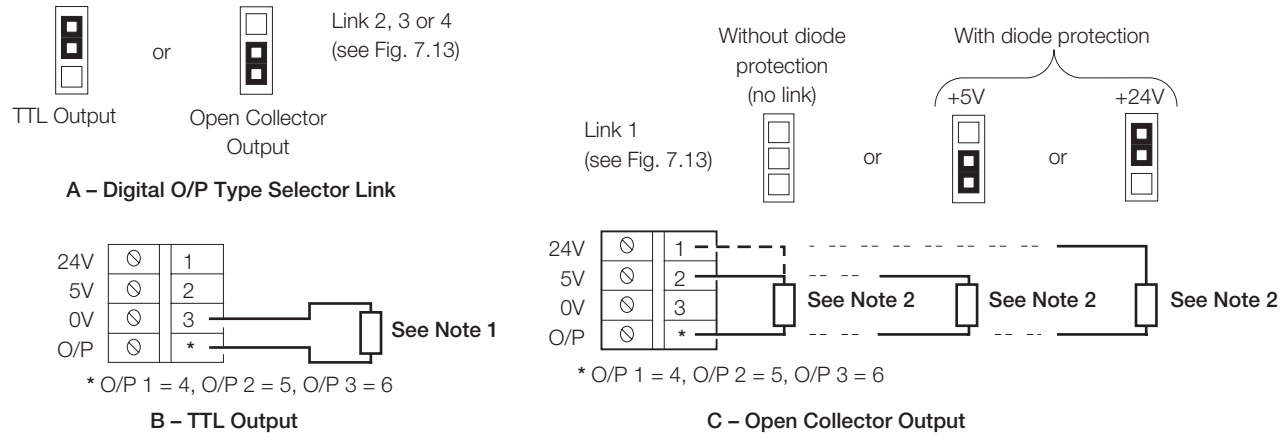


Fig. 7.14 Digital Inputs

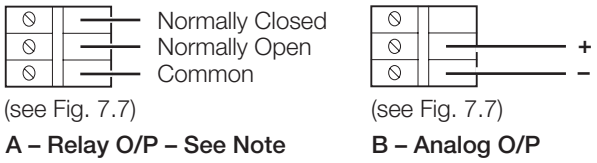
7.6.4 Digital Outputs – Fig. 7.15



Notes.
1. TTL Load greater than 15k
2. Open Collector Load drawing less than 20mA

Fig. 7.15 Digital Outputs

7.7 Relay and Analog Output Connections – Fig. 7.16



(see Fig. 7.7) (see Fig. 7.7)

A – Relay O/P – See Note **B – Analog O/P**

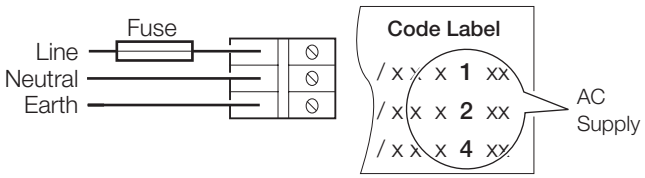
Notes. (Applicable to CSA certified units only)

- If 4 relay output modules are fitted then no additional option modules are allowed and module positions F and G (see Fig. 7.7) must remain vacant.
- The maximum total combined current flowing through the relays is 36A; the individual relay current of 5A remains unaltered.

Fig. 7.16 Output Connections

7.8 Power Supply Connections

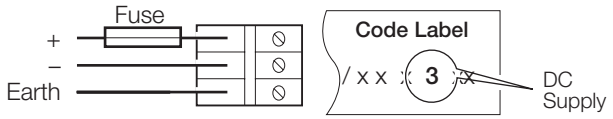
7.8.1 AC Mains – Fig. 7.17



Caution. Use fuse rating – 1A (max.) type T

Fig. 7.17 AC Mains

7.8.2 DC Supply – Fig. 7.18



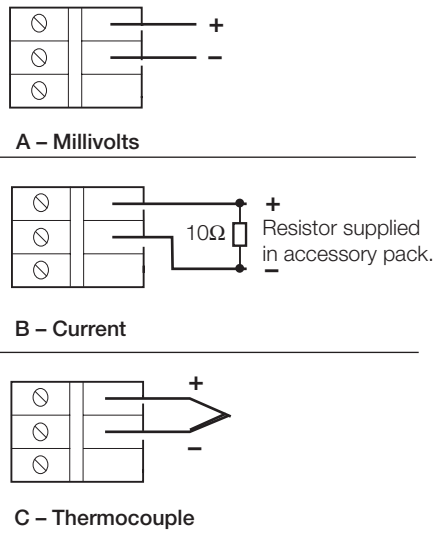
Caution. Use fuse rating – 3A (max.) type T

Fig. 7.18 DC Supply

7.9 500V Isolated Input Connections – Fig. 7.19

Information.

- Input type selection links are not fitted.
- No RTD or resistance measurements.
- Maximum millivolt range 2000mV.
- All standard current and thermocouple ranges apply.



Note. Refer to Fig. 7.7 for terminal numbers.

Fig. 7.19 500V Isolation Input Board Connections

8 SIMPLE FAULT FINDING

If the instrument does not appear to be working satisfactorily carry out the following checks before contacting the Service Organization.

Information.

- Are all the connections made correctly?
- Is there power to the instrument?
- Is there a signal at the input terminals?
- Does an external relay fail to de-energize? If so refer to Table 8.1.

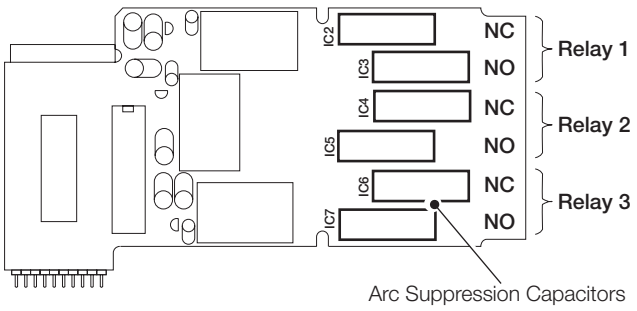
Symptom	Possible Cause	Action
Does not record (pens and chart do not move).	a) Paper remaining = 0.0m (displayed in operating pages). b) Chart speed = 0mm/hr.	a) Load a new chart – see Section 1.3 b) Select another chart speed – see Section 3.6.
Does not record (pens do not print but chart moves).	a) Cassette is not fitted correctly. b) Pen capsule is not fitted correctly. c) Pen lift is activated. d) Pen capsule has run out of ink.	a) Ensure cassette is correctly fitted – see Section 1.3. b) Remove and refit – see Section 1.4. c) Press pen lift switch to de-activate lift. d) Replace pen capsule – see Section 1.4.
Pen lift does not appear to work.	a) Recorder is completing the fast printing of a text message. b) Pen lift function is disabled in Chart Control Configuration.	a) Wait for these messages to be completed. b) Set Pen Lift Enable to YES – see Section 5.3.1.
Trace(s) have gaps in them.	a) Fast printing of text – due to high chart speed or b) Fast printing of operator messages and alarm messages.	a) Select a chart speed of 120mm/hr or slower (see Section 3.6), or turn text printing OFF (see Section 5.3.1). b) Set message print speed to SLOW – see Section 5.3.1.
Does not print date, time or trace identifiers.	Text printing is turned OFF in Chart Control Configuration.	Set Text Print to ON – see Section 5.3.1.
Does not print alarm messages.	Alarm printing is turned OFF in Chart Control Configuration.	Set Alarm Print to ON – see Section 5.3.1.
Paper cannot be re-wound to load a new roll.	Paper has come off end, due to incorrect paper length being entered.	Reload paper onto feed roller and use rewind. Ensure correct paper length is entered for new roll – see Section 5.3.1.
Does not return to correct position on chart after Cue/Review.	Cue and Review performed with cassette incorrectly fitted.	Ensure cassette is correctly fitted in place – see Section 1.3. To return to correct place remove casette and set chart position manually.
Poor print quality.	Use of incompatible paper type.	Use the recommended Company paper for best results. See Section 9 for further information.
Instrument will not move chart during Cue/Review.	Chart has not moved sufficient distance since being loaded.	Allow time for chart recording.
'Input Failed' message.	a) Input not configured correctly. b) Input links not set correctly. c) Input out of range.	a) Check configuration of failed input – see Section 7.5. b) Check configuration of input links – see Section 7.5. c) Bring input within input range.
Input exhibits a slow response to process input.	Programmable filter set for long response time.	Reduce programmable filter response time – see Section 5.1.1.
External relay(s) holding on when de-energized.	Arc suppression capacitor leakage current preventing the external relay(s) from de-energizing.	Remove capacitor – see Section 8.1.

Table 8.1 Simple Fault Location

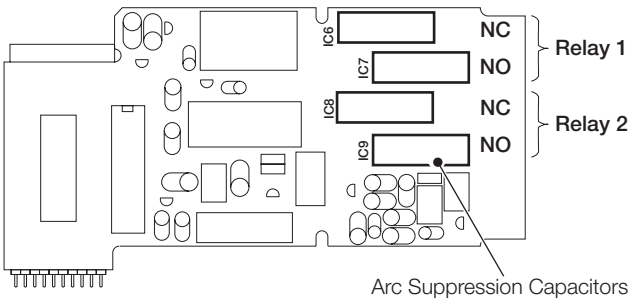
8.1 Arc Suppression Capacitors – Fig. 8.1

Arc suppression capacitors are fitted across the contacts of the alarm/control relays. If these contacts are used to operate external relays, the capacitor leakage current may be sufficient to prevent the external relay from de-energizing. If so, switch off the power supply and external alarm circuits. Identify the appropriate relay module and remove it – see Fig. 8.1.

Unsolder and remove the appropriate capacitors, shown in Fig. 8.1 and refit the module.



A – Relay Output Module Type R



B – Hybrid Module Type C

Fig. 8.1 Location of Arc Suppression Capacitors

9 SPARES LIST

9.1 Consumables

Item	Part No.
Roll Chart – 25m	
30 division	PR100–9000R
40 divisions	PR100–9001R
50 divisions	PR100–9002R
60 divisions	PR100–9003R
70 divisions	PR100–9004R
75 divisions	PR100–9005R
Fanfold Chart – 12m	
30 division	PR100–9000F
40 divisions	PR100–9001F
50 divisions	PR100–9002F
60 divisions	PR100–9003F
70 divisions	PR100–9004F
75 divisions	PR100–9005F
Pen capsule	
Up to three traces	PR100–0210
Up to three traces (high temperature – see **Note** below)	PR100–0229
Four to six traces	PR100–0211
Four to six traces (high temperature – see **Note** below)	PR100–0230
Memory card	
64kbyte	B10798
1Mbyte	B10865

Note. The high temperature cartridge is designed for use by recorders operating at ambient temperatures consistently above 30°C.

9.2 Replacement Parts

Item	Part No.
Roll chart cassette	SR100–0054
Fanfold chart cassette	SR100–0055
Memory drive board	PR100–0585
Analog Input module	
Standard:	
1 input pack	SR100–0519
2 input pack	SR100–0518
3 input pack	SR100–0517
4 input pack	SR100–0516
5 input pack	SR100–0515
6 input pack	SR100–0514
Optional:	
2 input pack	PR100–0477
3 input pack	PR100–0476
6 input pack	PR100–0475
Digital input/output module	PR100–0565
Relay output module	PR100–0545
Analog output module	PR100–0535
Hybrid module	PR100–0555
Serial communication module	PR100–0575
Processor board	SR100–0505
Motherboard	SR100–0195
Power Supply:	
115 to 230V AC	PR100–0445
10 to 30V DC	PR100–0495
10 to 30V AC	PR100–0496

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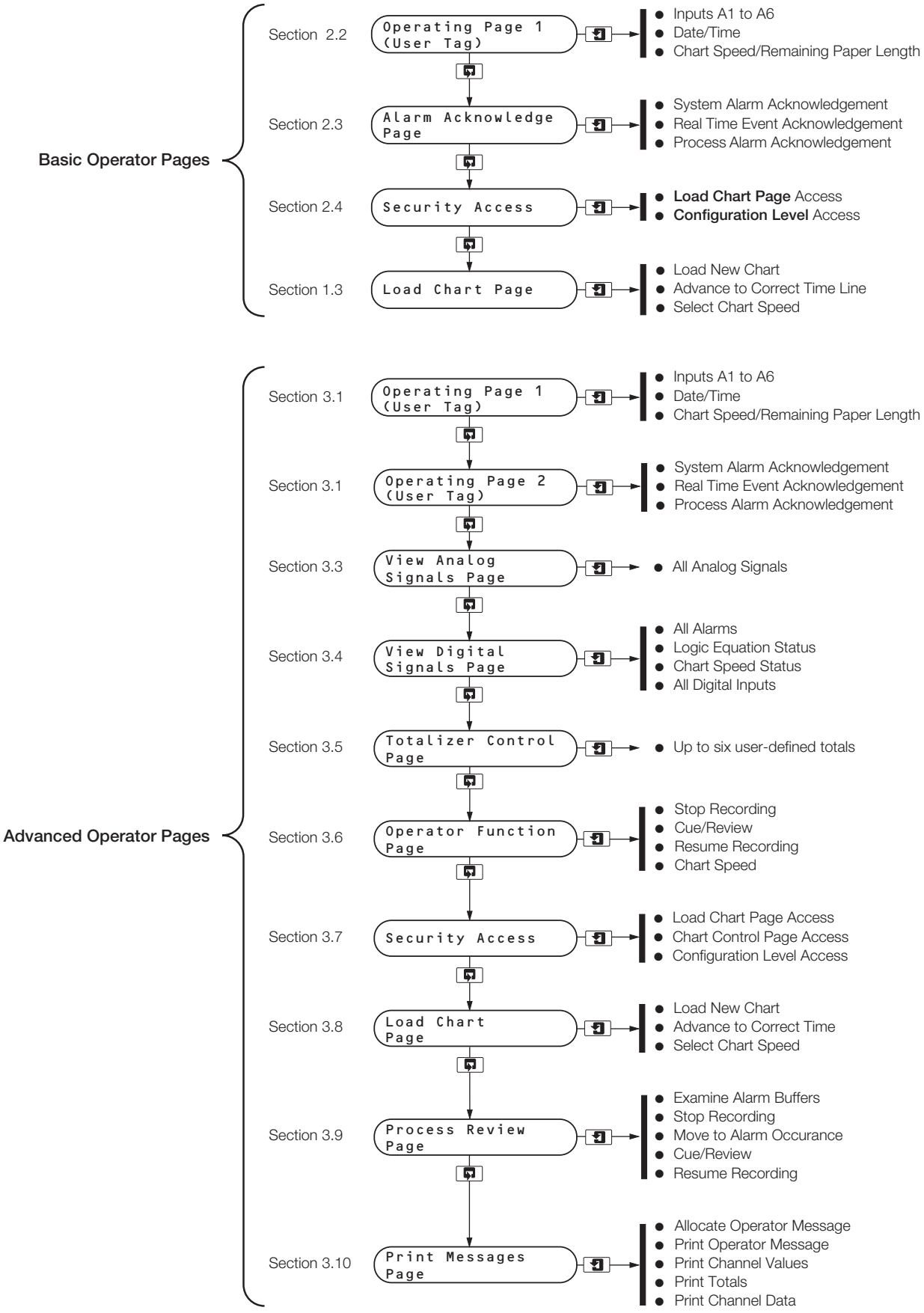
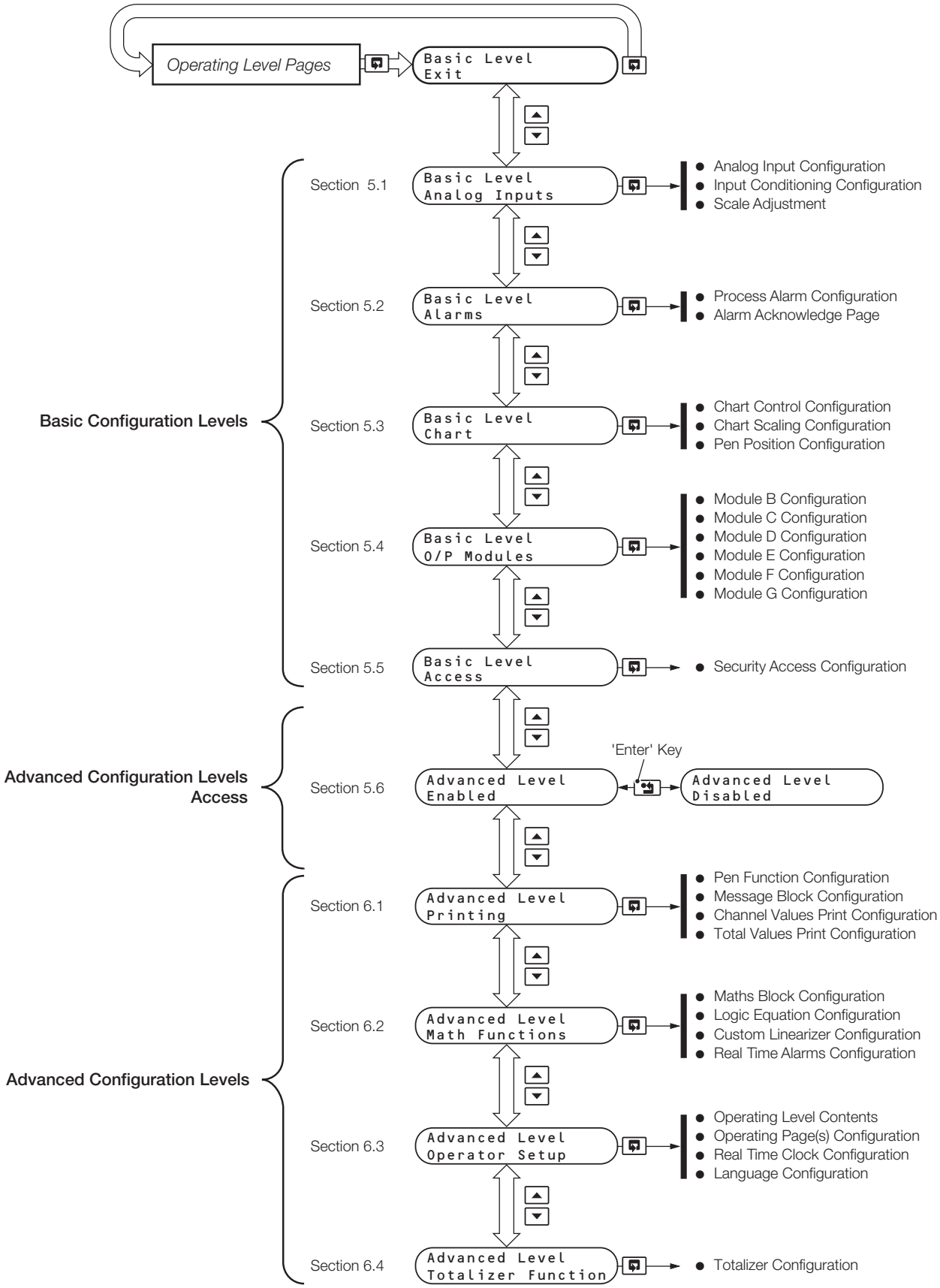
OPERATOR LEVEL OVERVIEW



CONFIGURATION LEVELS OVERVIEW



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Fax: +1 215 674 7183

Client Warranty

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

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

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

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