345

EUROTHERM
CHESSELL

**Model 345
Chart recorder**

**Installation and
operation manual**

EUROTHERM
CHESSELL

Declaration of Conformity

Manufacturer's name:	Eurotherm Recorders Limited
Manufacturer's address	Dominion Way, Worthing, West Sussex, BN14 8QL, United Kingdom.
Product type:	Industrial chart recorder
Models:	344 (Status level A13 or higher) 345 (Status level A13 or higher) 346 (Status level A9 or higher)
Safety specification:	EN61010-1: 1993 / A2:1995
EMC emissions specification:	EN50081-2 (Group1; Class A)
EMC immunity specification:	EN50082-2

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

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

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

CE

IA249986U120 Issue 2 Dec 96

MODEL 345
INSTALLATION AND OPERATION MANUAL

LIST OF CONTENTS

Full contents lists appear at the beginning of each section, and a comprehensive index is to be found at the end of the manual.

LIST OF EFFECTIVE PAGES

This (issue 6) manual consists of the following pages at their specified issue numbers:

Safety Notes

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

WARNING!
ANY INTERRUPTION OF THE PROTECTIVE CONDUCTOR INSIDE OR OUTSIDE THE APPARA-
TUS, OR DISCONNECTION OF THE PROTECTIVE EARTH TERMINAL IS LIKELY TO MAKE THE
APPARATUS DANGEROUS UNDER SOME FAULT CONDITIONS. INTENTIONAL INTERRUPTION
IS PROHIBITED.

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2. Whenever it is likely that protection has been impaired, the unit shall be made inoperative and secured against unintended operation. The nearest manufacturer's service centre should be contacted for advice.

3. Any adjustment, maintenance and repair of the opened apparatus under voltage, should be avoided as far as possible and, if inevitable, shall be carries out only by a skilled person who is aware of the hazard in-volved.

4. Where conductive pollution (e.g. condensation, carbon dust) is likely, adequate air conditioning/filtering/ sealing etc. must be installed in the recorder enclosure.

5. Signal and supply voltage wiring should be kept separate from one another. Where this is impractical, shielded cables should be used for the signal wiring.

6. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.

7. For portable equipment, relays may be wired only to SELV-E

SYMBOLS USED ON THE RECORDER LABELLING

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

Symbol	Description
⚠	Refer to the Manual for instructions
⏚	Protective Earth
∿	This recorder for ac supply only
⎓	This recorder for dc supply only.
⚡	Risk of electric shock
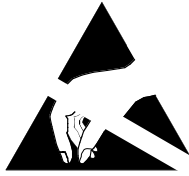
Static electricity

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

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

345 INSTALLATION AND OPERATION MANUAL
SECTION 1 OVERVIEW
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INSTALLATION CATEGORY AND POLLUTION DEGREE

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

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

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

1.1 INTRODUCTION

This manual is intended to familiarise the user with the installation, operation and maintenance of the Model 345 recorder. The manual is organised into sections, as follows:

Section 1 describes the manual and its organisation, and includes the recorder specification.

Section 2 contains mechanical and electrical installation procedures, including the placement of circuit board links as appropriate.

Section 3 describes the operation of the recorder. Mechanically, chart, pen and battery replacement are described. The recorder display/keyboard and the associated operator menu are also described

Section 4 covers the setting-up (configuration) of the basic recorder to user requirements.

Section 5 details the recorder configuration of options such as totalisers, derived channels (maths pack) etc.

Section 6 gives information on simple servicing, using the recorder self checking, calibration and Instrument alarm features. Also included is a list of spare parts.

Annex A is a quick reference guide to the recorder configuration, including a description of all the configurable parameters, and an 'access to configuration' diagram showing the complete configuration menu arrangement.

1.2 RECORDER DESCRIPTION

The Model 345 recorder is a user configurable 1 to 3 input, continuous-trace 100 mm. calibrated-width instrument using digital indication to display measured value. The use of modular construction and surface-mount circuit card technology ensures a compact design which is easy to maintain and upgrade.

Configuration is carried out using the recorder display and integral keyboard. The Configuration Menu is divided into sections for fast basic set-up, and for selection of only those functions needed for a particular application.

1.3 SPECIFICATION

HARDWARE RANGES

The specification which follows, contains references to 'Hardware Ranges'. When an input range is defined, the recorder chooses the lowest hardware range (i.e. the most accurate) that will cover the specified input range. (Table 1.3 gives details of the ranges.) The user can, if he wishes, force the recorder to use a specific hardware range, using the channel range calibration pages described in section 6 of this manual.

HARDWARE RANGE	I/P ACCURACY	PEN ACCURACY	MINIMUM SPAN
- 4.0 to +20mV	± 0.02 mV	± 0.04 mV	4 mV
-12.0 to +60 mV	± 0.06 mV	± 0.12 mV	15 mV
-16 to +80 mV	± 0.08 mV	± 0.16 mV	20 mV
- 40 to 200 mV	± 0.20 mV	± 0.40 mV	50 mV
- 80 to 400 mV	± 0.40 mV	± 0.80 mV	100 mV
- 0.34 to 1.7 V	± 1.7 mV	± 3.4 mV	425 mV
- 0.50 to + 2.5 V	± 2.5 mV	± 5 mV	625 mV
-1.00 to + 5.0 V	± 5 mV	± 10 mV	1.25 V

Table 1.3 Hardware ranges, minimum spans, input and pen accuracies.

1.3 SPECIFICATION (Cont.)

Number of measuring inputs		Up to three
Number of contact (event) inputs		Up to six
Input Types	TC:	B, C, E, J, K, L, N, R, S, T, Ni-Ni/Mo
	RTD:	Pt100, 10Cu, Ni100, Ni120
	Voltage:	-1V to + 5Vdc (100Vdc with attenuator) over 8 hardware ranges.
	Resolution:	0.01% of hardware range
	Minimum span:	4 mV
	Maximum span:	6 Volts
	Maximum low value:	80% of span
	Maximum negative input:	-25% of hardware range
	DC current:	250 Ohm Shunt
	Contact (event)	Contact Closure
Input accuracy		$\pm$ 0.10% of spans >4 mV.
Input impedance (contact input)		> 20 MΩ
Common mode rejection ratio		120 dB at 50 to 60 Hertz
Normal mode rejection ratio		60 dB at 50 to 60 Hertz
CJC rejection ratio		25:1 minimum
Input isolation		Installation category II; Pollution degree 2 (See page 1-1) 250 Volts ac
Maximum input voltage		24 Volts, without causing damage.
Linearisations:		TC, RTD, $\sqrt{}$, $^3/_2$ and $^5/_2$ powers, log and user-entered curve.
Derived variables option		+, -, x, $\div$, ave, & hi/lo select, hi/lo peak, 3rd order polynomial, log, power, formulæ for mass flow, humidity, F_0, RH, ZrO_2
Writing System		Blue, Red and Green disposable markers (1.8 km of line each).
Retransmission:		1, 2 or 3 isolated, scaled 4 to 20 mA outputs
Transducer Power Supply:		1 or 2 supplies both giving up to three 24 Vdc, 100 mA outputs
Memory		Configuration and data stored in EEPROM and battery-backed RAM.* See section 1.4 below
Communications		RS 422
Chart (100mm calibrated width)	Type:	Roll (32 metres) or Z-fold (16 metres)
	Speeds:	1 mm/hr up to 1cm/sec
	Drive method:	Stepper motor
	Drive accuracy	1 cm over 32 metres
Configuration method	at recorder:	by keyboard and associated 40-character fluorescent display
	remotely:	Any terminal with serial link.
Display type		40-character, 2-row, vacuum-fluorescent (blue).
Channel update		250 msec.
Writing speed		<500 msec. 10% to 90% of full scale.
Pen position resolution		0.2% of chart range
Pen accuracy		0.5% of chart range

* The back-up battery allows RAM data to be retained for approximately one month with power removed form the recorder. A 'Memory Retention' option is available, which stores all data, indefinitely, in an EEPROM.

1.3 TECHNICAL SPECIFICATION (Cont.)

Alarms	Per Channel:	Up to four
	Types:	High, Low , Dead band (deviation) and Rate-of-Change
Output relays option	Per Instrument:	Up to 16, individually assignable
	Contact rating:	30W or 60VA
	Maximum current:	3A within W/VA ratings above.
	Maximum voltage:	260V within W/VA ratings above
Annotation option	Header message:	One per instrument, includes Instrument ID, Date, Time, Chart speed, Batch Number.
	Scales:	One per channel (includes descriptor and trace ID)
	Alarms:	Number, time and date
	Alarm messages:	One per alarm
	Chart speed change message:	New speed, and time and date of change.
	Custom messages:	up to 10
	Log:	Channel and totalisers
Environmental	Operational temperature range:	0 to 50˚C
	humidity:	0 to 90% RH, non condensing.
	max. altitude:	< 2000 metres
Power Requirements	Nominal supply voltage:	110 Vac - 10% + 15% or 230 Vac,- 10% + 15%; 25 VA 24 Vdc, 25 W
Physical	Panel:	144x144mm (5.7 in)
	Cutout:	138x138mm (5.5 in)
	Depth:	345mm (13.6 in)
	Average Weight:	7kg (15 lbs)

1.4 MEMORY PROTECTION

There are three areas of memory in the recorder as follows:-
1. EEPROM internal to the microprocessor on the main board.
2. Separate EEPROM located on the main board.
3. Battery-backed RAM or auxiliary EEPROM located with the operating program.

The microprocessor EEPROM stores channel information, as follows:

1. Channel ranges	6 CJC source (internal or external)
2. Channel inputs	7 Units selection
3. Chart spans	8 Channel status (on or off)
4. Filter settings	9 Channel 1, 2, 3 alarm settings
5. Linearisations	

The separate EEPROM stores mainly 'instrument' information as follows:-

1. Chart speed and units	6 Alarm access status	11 ID number
2. Logged channels and totalisers	7 Pen calibration	12 External CJ temperature
3. Batch number	8 Magnification	13 Decimal point positions
4. Password	9 Magnified channel Ns	14 Annotator calibration
5 Channel descriptors	10 Print mode choice	15 Time format

The battery backed RAM (or auxiliary EEPROM) stores mainly option information, as follows:

1. Alarm messages	5. Communications	9. Totaliser values
2. Custom curve	6. Re-transmission	10. Soft key
3. DV calculations	7. Custom messages	11. Trace History
4. Timers	8. Relay configurations	

SECTION 2 INSTALLATION
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2.1 UNPACKING

The recorder is shipped in a special pack, designed to ensure adequate protection during transit. Should the outer box show signs of abnormal wear or damage, it should be opened immediately and the recorder examined. If there is evidence of damage, the instrument must not be operated, and the local representative should be contacted for instructions.

After removing the recorder from its packing, the packing should be examined before it is discarded to ensure that all accessories and documentation have been removed.

2.1.1 CHASSIS REMOVAL

Open the door of the recorder.

Depress the latch at the lower right corner of the chart cassette (figure 2.1.1a). Pull the cassette up and out until it disengages from the recorder chassis.
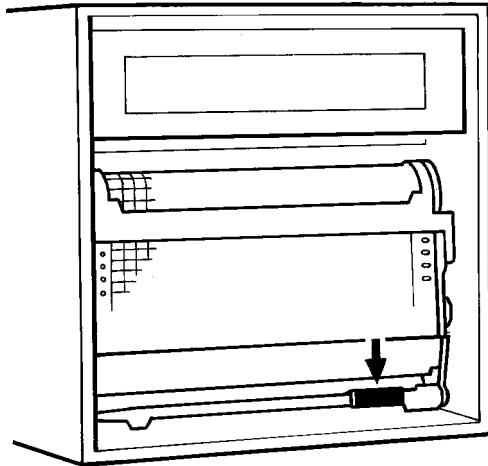
Figure 2.1.1a   Cassette removal

Locate the chassis jacking bolt shown in figure 2.1.1b and release the recorder chassis from the case by rotating the bolt anti-clockwise. This also has the effect of disconnecting all rear terminal board connections (including power) to the recorder chassis

Note...
If the recorder has been installed, it should be isolated from mains (line) power, before it is removed from the case.

Figure 2.1.1b Jacking bolt location

2.1.1 CHASSIS REMOVAL (Cont.)

Once removed from the case, the recorder should be inspected for mechanical integrity. If the recorder is to be stored before use, return it to the case, and replace it in the plastic bag in which it was received.

2.2 MECHANICAL INSTALLATION

The recorder is intended for installation in a 138 mm square cutout in a vertical or sloping (up to 45 degrees from vertical) panel.

Note...
  The annotator printing mechanism is somewhat position sensitive. If the recorder is to be mounted in a sloping panel refer to the 'Printing Adjustments' section (6.4) for dot intensity adjustment.

The instrument is inserted through the panel cutout, from the front. It is then secured by using two DIN type clamps as shown in Figure 2.2. These clamps can be fitted to the top, bottom or either side of the case, but opposite sides should be used whenever possible.

It is sometimes helpful to centre-punch the rear face of the panel at the contact points for the clamps. This will keep the clamps from "wandering" as they are tightened.

CAUTION
IT IS IMPORTANT NOT TO USE EXCESSIVE FORCE WHEN TIGHTENING THE CLAMPS. THE USE OF FORCE GREATER THAN THAT WHICH IS NECESSARY TO SECURE THE CASE, MAY DEFORM IT, AND PREVENT PROPER WITHDRAWAL OF THE RECORDER FROM ITS CASE.

To demount the recorder case, loosen the clamps and gently prise them from the case.

Front view

View on right hand side

Panel cutout details

View on underside
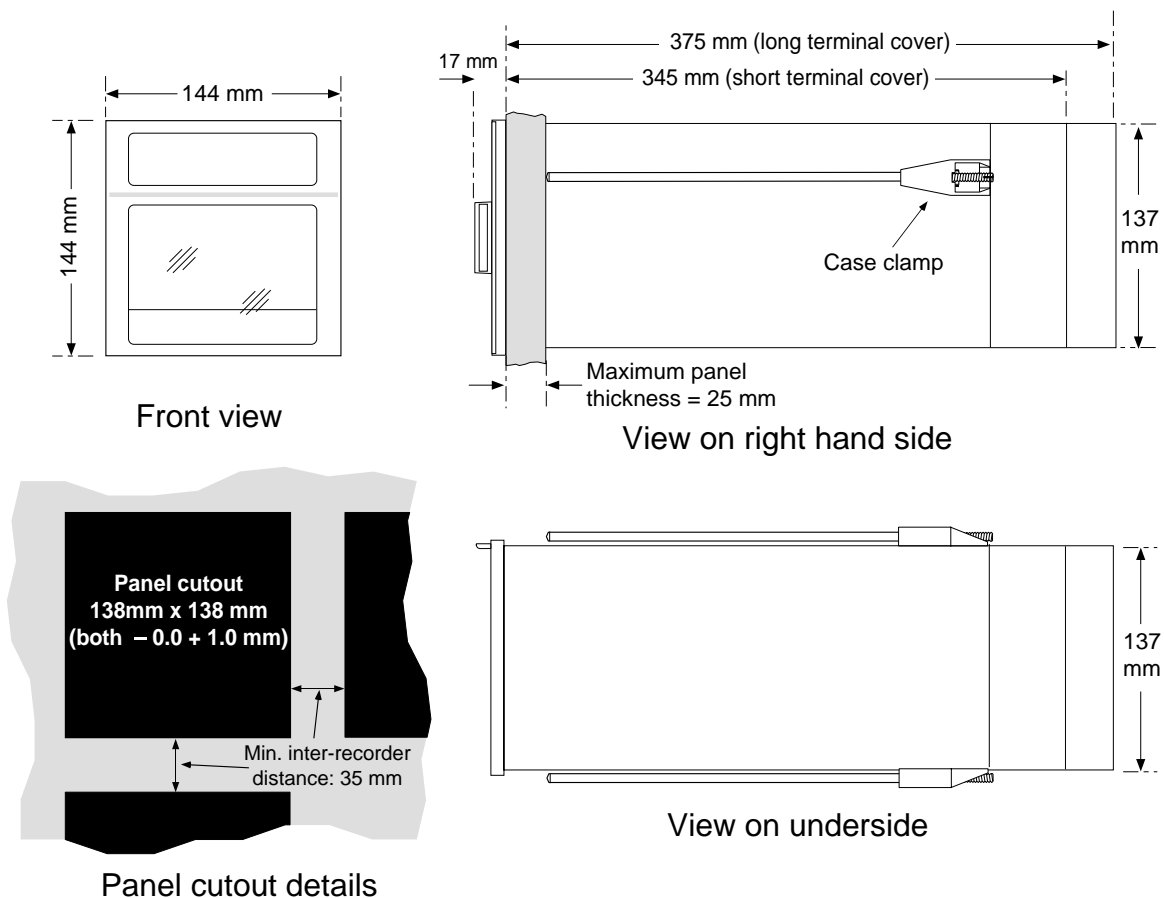
Figure 2.2 Case dimensions

2.3 ELECTRICAL INSTALLATION

All electrical connections are made at the rear of the recorder case. In order to gain access to the terminals, the rear terminal cover has to be removed by gently prising it off with a small screwdriver or similar blade.   With the cover removed, the rear terminal panel is revealed as depicted in figure 2.3, which shows the complete range of channel input and option terminations.

CAUTION
THE TERMINATION OF WIRING TO THE RECORDER DEPENDS ON THE NUMBER OF CHANNELS AND OPTIONS FITTED TO THE RECORDER.   THE DEFINITION OF 'AS-SHIPPED' CONNECTIONS IS GIVEN ON A LABEL LOCATED ON THE INSIDE OF THE REAR TERMINAL COVER OF THE RECORDER.

CAUTION
DAMAGE WILL BE CAUSED TO THE TERMINALS IF THE TERMINAL SCREWS ARE OVER-TIGHTENED. THE RECOMMENDED MAXIMUM TORQUE IS 0.4Nm.
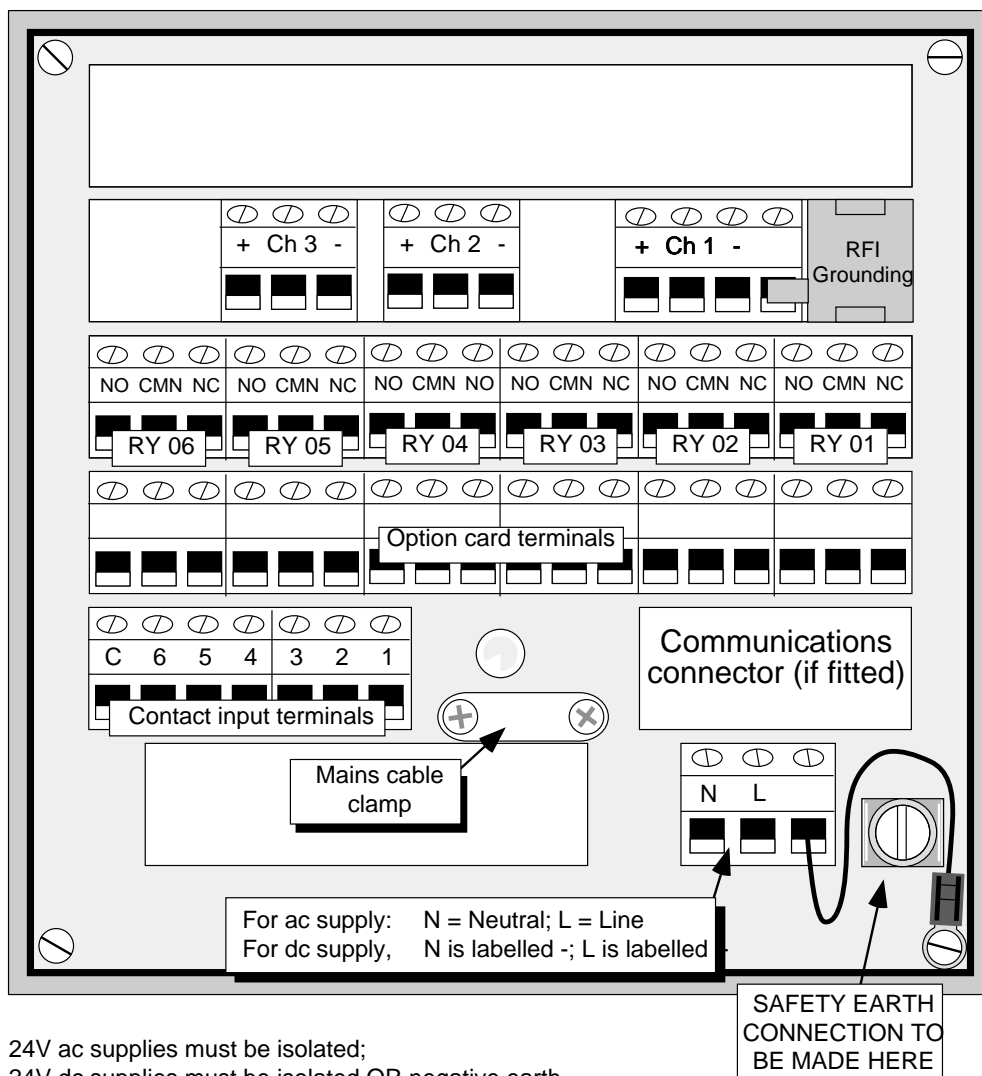
24V ac supplies must be isolated;
24V dc supplies must be isolated OR negative earth.
If not, the recorder fuse will rupture and any residual current device in the circuit will trip.

Figure 2.3 Rear terminal panel connections

Note... Use of 2.5mm^2 cable is recommended for supply (mains) voltage wiring

2.3.1 SUPPLY VOLTAGE WIRING

This product is designed for use with a filtered Mains supply. If a filtered supply is not available, a Mains Lead Filter Option is available from the manufacturer.

WARNING

MAINS (LINE) EARTH MUST BE MADE TO THE SAFETY EARTH CONNECTION AS SHOWN IN FIGURE 2.3, PREFERABLY USING AN M5 SOLDER OR CRIMP TAG.   UNDER NO CIRCUMSTANCES MAY THE SAFETY EARTH BE CONNECTED TO THE UNMARKED TERMINAL NEXT TO THE LINE TERMINAL.

CAUTION

24V AC SUPPLIES MUST BE ISOLATED FROM MAINS. 24V DC SUPPLIES MUST EITHER BE ISOLATED OR NEGATIVE EARTH. FAILURE TO ENSURE THIS WILL RESULT IN THE RUPTURING OF THE RECORDER INPUT FUSE OR THE TRIPPING OF ANY RESIDUAL CURRENT DEVICE IN THE CIRCUIT.

 Withdraw the recorder from the case. Note the Recorder ON / OFF switch on the panel just below the jacking bolt This switch must be in the OFF position when the chassis is returned to the case after Supply Voltage wiring.

Locate the supply voltage selector switch on the right-hand side of the chassis (figure 2.3.1).   Set this switch to agree with the voltage to be connected to the case terminals.   Locate the line fuse on the main board, adjacent to the line input terminal.   If necessary change the fuse to suit the supply voltage. (1A for 120V. supply, 500mA for 240V supply). See section 6 for appropriate fuse part numbers.
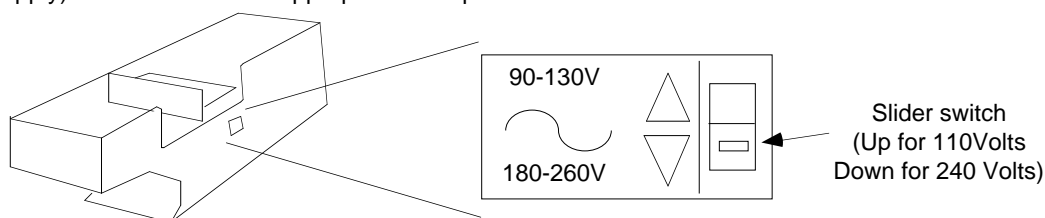
Figure 2.3.1 Voltage selector switch settings

2.3.2 SIGNAL WIRING

The recorder can be connected and configured to operate with a variety of signal sources such as: Thermocouples, RTDs, DC Current, DC Voltage and Contact (event) Inputs.   The configuration of the recorder for a specific type of input may require the moving of one or more links on the channel amplifier card and/or the use of input conditioning circuits such as shunts and voltage dividers.   The positions of the various connectors on the terminal panel are shown in figure 2.3.   Connection diagrams for various input sources are shown in figures 2.3.2a to 2.3.2e, and the positions of the circuit board linkss are described below in section 2.4.

THERMOCOUPLE INPUTS

Thermocouples are connected directly to the case terminal board using the + and - terminals for the designated channel, as shown in figure 2.3.2a below.

DIRECT VOLTAGE INPUTS UP TO 5 VOLTS DC

Voltage inputs to a maximum of 5 Vdc are connected directly to the recorder input connectors, see figure 2.3.2a.

CAUTION

VOLTAGES ABOVE $\pm$ 24 VOLTS WILL DAMAGE THE INPUT CIRCUITRY.
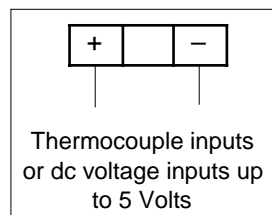
Figure 2.3.2a

Thermocouples and dc inputs up to 5 Volts

2.3.2 SIGNAL WIRING (Cont.)

ATTENUATED DC VOLTAGE INPUTS ABOVE 5 VOLTS

Inputs between 5 V and 100 V dc can be connected only if a 1 Megohm, 100:1 input attenuator is fitted as shown in figure 2.3.2b, below. This results in recorder input voltages of 50 mV with a 5 V signal and of 1 V with a 100 V signal.

Example
A linear voltage which can vary between 2 to 10 volts is to be applied to a recorder channel input. Because anything over 5 Volts exceeds the maximumm input voltage, an attenuator is used. A standard 100:1 qttenuator will reduce the voltage range to 20mV to 100mV.
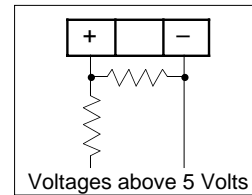
Figure 2.3.2b
Input connections for dc voltages above 5 Volts

RTD (RESISTANCE TEMPERATURE DETECTOR) INPUTS

The recorder supplies the actuation current and connections for 100Ω Platinum RTDs (Pt100s). Signal wire size and length must be chosen to ensure that lead lengths are equal and individual leads do not exceed 10Ω each between the recorder and the RTD.
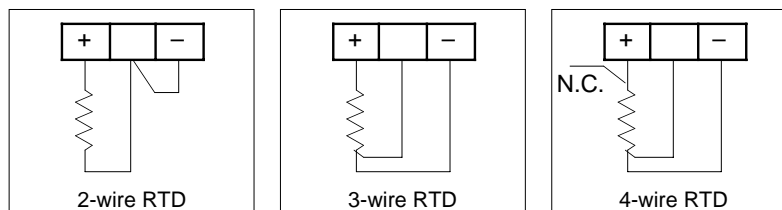
Figure 2.3.2c Input connections for Resistance Thermometers

CONTACT INPUT (EVENT) CONNECTIONS

These optional inputs (figure 2.3.) permit many recorder functions to be controlled by an external contact closure. Connections are made (via switches) between the 'COM' terminal and the relevant input terminals 1 to 6. Good quality, low resistance 'dry' (not powered) contacts should be used.

See Section 3.4 (Internal triggers and action equations) for a description of the use of Contact inputs.

2.3.2 SIGNAL WIRING (Cont.)

CURRENT INPUTS (RECORDER SUPPLY)

The 24 V dc to operate a transducer can be provided by a recorder-mounted supply which is connected at the terminal board to the shunt (normally 250Ω, converting the 4 to 20 mA signal to 1 to 5 V) (see figure 2.3.2d).
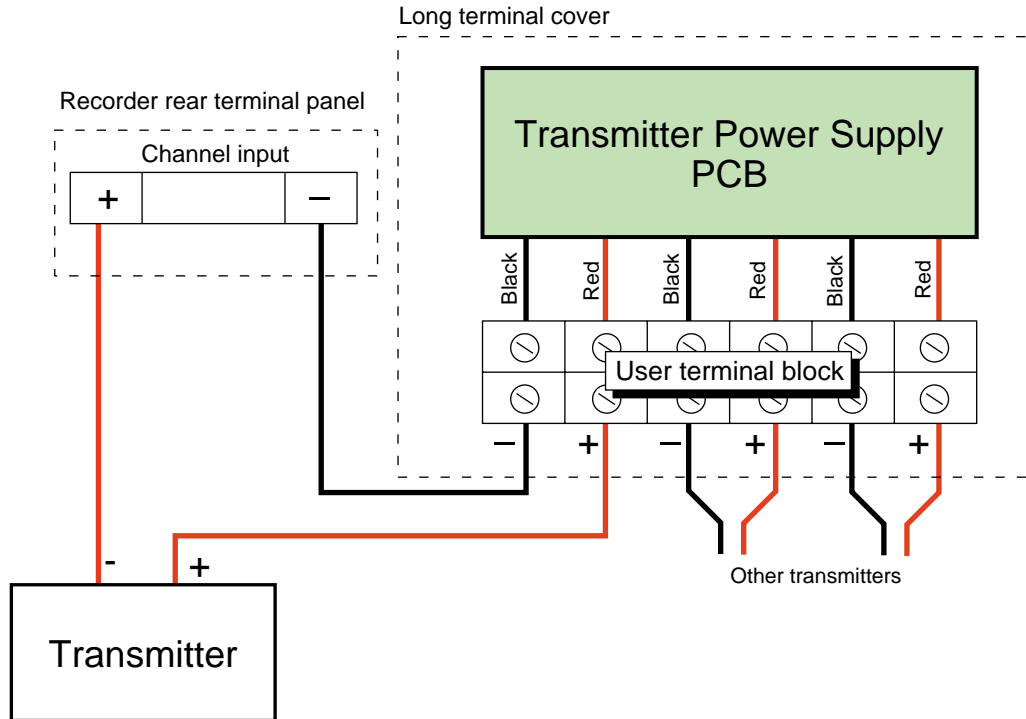
Figure 2.3.2d Current input connections (recorder supply)

CURRENT INPUTS (EXTERNAL SUPPLY)

The connection of a 4 to 20 mA device with a separate, external power supply requires only the use of a shunt resistor to convert the current signal into a voltage input (1 to 5 V with a 250Ω shunt).
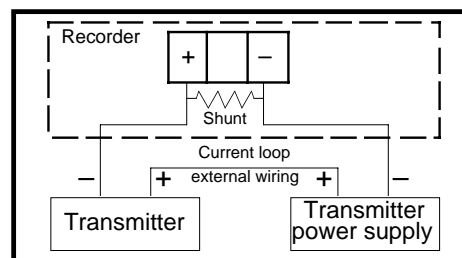
Figure 2.3.2e Current input connections (external supply)

2.4 CIRCUIT BOARD LINKS

There are several configuration links along the rear edge of each Input amplifier circuit board.   Each channel Amplifier has two links (identifed as TC/RTD & UP/DOWN on the board printing). In addition, each board has one common Link (CJC/RTD).   **ALL** of these links must be checked and/or set before the recorder is placed into service.   Each Link is a set of three pins with a removable shorting block between two of them.   Figure 2.4 shows the locations of the links.
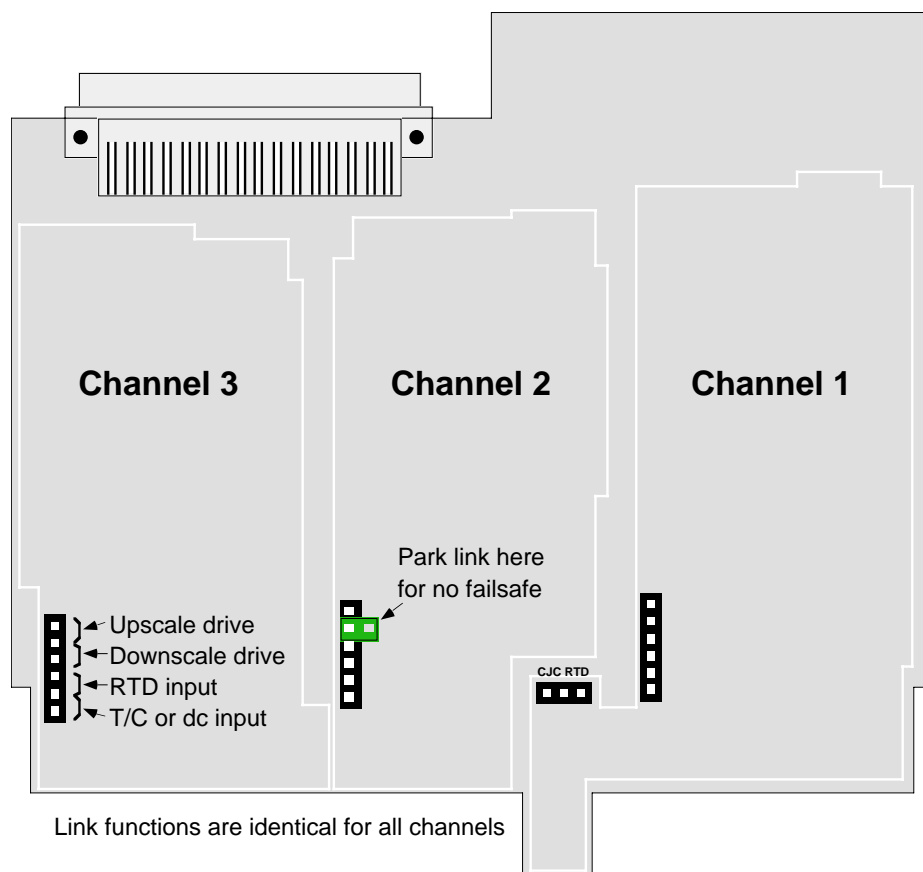
Figure 2.4 Input amplifier configuration link locations.

2.4 CIRCUIT BOARD LINKS (Cont.)

2.4.1 INPUT CHANNEL CONFIGURATION RULES

1. If only one channel on a 3-channel card is to measure a direct thermocouple input, it must be Channel 1.
2. If more than one channel is to be connected for direct thermocouple, channel 1 MUST be one of those channels.
3. If the channel 1 Link is set for 'RTD', no channel on the same board can be used for direct thermocouple input.

Note...
   The thermocouple cold junction compensation (CJC) for all three channels on an input amplifier card is measured by the channel 1 circuitry.

2.4.2 CHANNEL THERMOCOUPLE / RTD LINK

The TC/RTD Link within each input amplifier's circuitry must be set to 'TC' (Thermocouples, Millivolt and Voltage or Current inputs) or 'RTD' (Resistance Temperature Detector).

If the centre and 'TC' pins are connected, the channel is set up for thermocouples and other dc inputs.   If the centre and 'RTD' pins are connected, the channel is set up for RTDs.

2.4.3 THERMOCOUPLE FAILSAFE (UP - DOWN) LINKS

The UP/DOWN Link for each channel amplifier determines the open input (TC Break or Failsafe) direction for that channel.   This function does not operate if the other link for the channel is in the 'RTD' position. Should the input go open circuit,   the recorded and displayed values are driven beyond the established range limits in the chosen direction, triggering any appropriate alarms as they go.

If the fail safe feature is not required, the link can be conveniently 'parked' on pin 2 at right angles to the rest of the row of pins.

Note...
   The fitting of up- or down-scale links causes a slight reduction in measurement accuracy.   Thus to gain the maximum from the measurement system, the fail-safe links should not be fitted.

2.4.4 CJC LINK

There is a link just behind the CJC sensor 'finger' on the rear edge of each input amplifier board.

If channel 1 is set up to be connected to an RTD, the CJC link must be in the 'RTD' position. Channel 1 may then be connected only to a resistance thermometer.   Channels 2 or 3 can be used either with resistance thermometers or dc inputs, but NOT thermocouples.

If channel 1 is set up to be connected to a thermocouple, then channel 1 may be used to measure a thermocouple or dc input but NOT an RTD input.   Channels 2 and 3 can be used for thermocouples, dc inputs or resistance thermometers.

2.4.5 CIRCUIT BOARD LOCATION

There are seven circuit board locations on the recorder chassis: five rear chassis plug-in slots, one main board (containing the microprocessor and chart drive circuitry) located across the chassis bottom and the annotator drive (with battery) board located as shown in figure 2.4.5 The boards located in the five rear slots are as shown in table 2.4.5a, below.   The slots are numbered from top (slot 1) to bottom (slot 5).
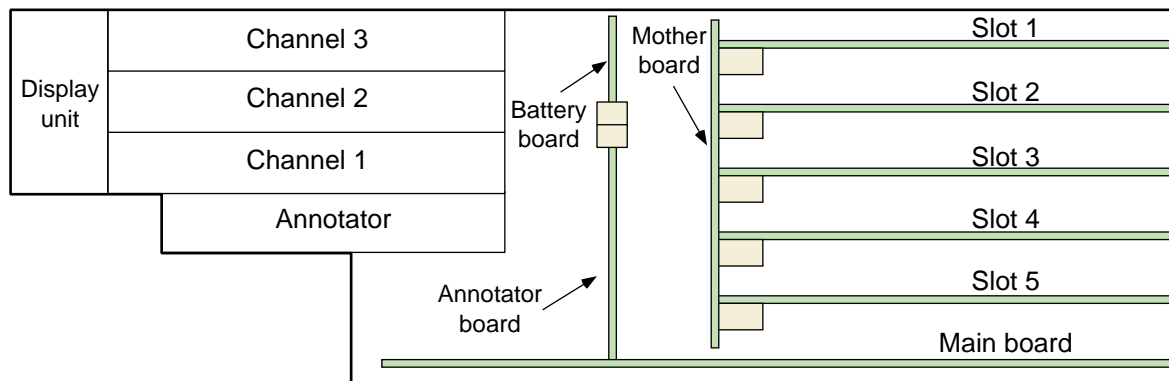
Figure 2.4.5 Circuit board location diagram

Slot	Board type
1	Servo motor (pen drive) board
2	Input amplifier board (channels 1, 2 and 3)
3	Option board
4	Option board
5	Option board

Table 2.4.5a Circuit board locations

OPTION BOARD TYPES

There are 13 types of option board that can be used in the option slots as shown in table 2.4.5b, below.   With the exception of Slot 5, any Option board can go into any Option slot.   Because of the chassis jacking bolt, the 2, 4 and 6 relay boards and the retransmission boards cannot go into Slot 5.   Separate 2 and 4 relay or Triac boards are available for Slot 5.   This limits the maximum number of relays to two boards of 12 (Slots 3 & 4) and one board of 4 (Slot 5) giving a maximum of 16 relays in all.

Board type	Board description	Possible board locations		
		Slot 3	Slot 4	Slot 5
1	Two relay board	Yes	Yes	No
2	Four relay board	Yes	Yes	No
3	Six relay board	Yes	Yes	No
4	Two relay board	Yes	Yes	Yes
5	Four relay board	Yes	Yes	Yes
6	Two triac board	Yes	Yes	Yes
7	Four triac board	Yes	Yes	Yes
8	One re-transmission board	Yes	Yes	No
9	Two re-transmission board	Yes	Yes	No
10	three re-transmission board	Yes	Yes	No
11	Six event input board	Yes	Yes	Yes
12	RS422 comms board	Yes	Yes	Yes
13	Six event and RS422 comms board	Yes	Yes	Yes

Table 2.4.5b Option board types and permitted locations

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SECTION 3 OPERATION

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CHANGING CHART CASSETTE TYPE

When changing from roll to z-fold or from z-fold to roll type cassette, it may be necessary to adjust the latch position to ensure correct gear meshing with the chart drive motor.

In order to carry out this adjustment, remove the recorder from the case and rest it on its left side (as shown in the figure).   Release the latch securing screw and adjust the position of the latch such that the gear train on the cassette meshes correctly with the motor gear.   (For the sake of clarity, the figure shows the cassette re-moved.)

When correctly meshed, there should be a few degrees of backlash throughout the gear train
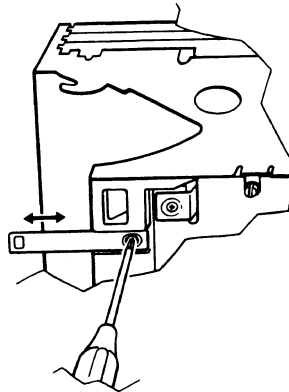
Latch adjustment

SECTION 3 OPERATION

3.1 INTRODUCTION

Section 3 is divided into two main parts.   The first part describes mechanical day-to-day operations, such as changing charts and pens.   The second part describes the operation of the display / keypanel, the interpretation of the displays and the 'Operator menu' used for chart control, entry of batch numbers, and other items which do not require the entry of a password in order to access them.   Password protected configuration items are described in section 4 (Configuration).

3.2 MECHANICAL OPERATION

3.2.1 ROLL CHART REPLACEMENT (MANUAL CASSETTE)

Open the door of the recorder and remove the cassette by operating the catch-release, swinging the bottom of the cassette upwards, and carefully pulling it forwards out of the chassis.
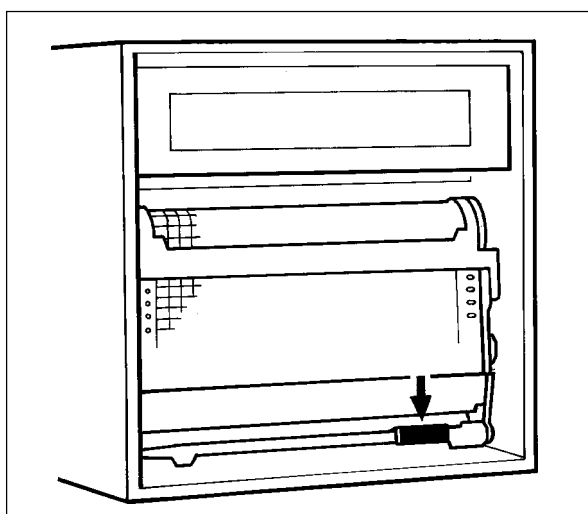
Figure 3.2.1a Cassette Removal

Remove the used chart by opening the paper tray as shown in figure 3.2.1b. and lifting the take-up spool out of the cassette.
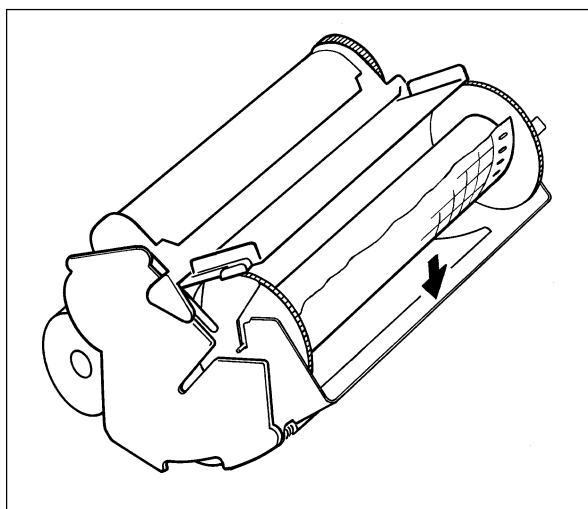
Figure 3.2.1b Take-up spool removal

3.2.1 ROLL CHART REPLACEMENT (MANUAL CASSETTE) (Cont.)
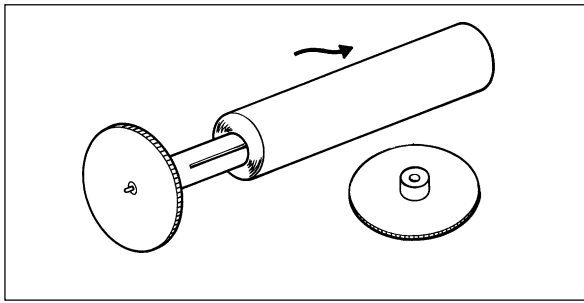
Figure 3.2.1 c Chart removal

Unscrew* the end section of the take-up spool and remove the used chart from the remaining 'stub', as shown in figure 3.2.1c.   A slight rotation of the chart, against the direction of winding may assist in the re-moval.

Re-assemble the take-up spool.

* For recorders manufactured between January 1993 and July 1994, the end section must be **pulled off**, not unscrewed. When re-assembling such cassettes, it must be ensured that the gearwheel keyway engages with the key on the inside of the stub, **and that the gearwheel is pushed fully home**. Failure to ensure this can result in faulty chart take-up action.

If necessary, remove the old chart's cardboard spool from the pay-off lugs

Mount a new roll of chart into the supply roll holders, as shown.

Cut or fold the the end of the new chart into a point
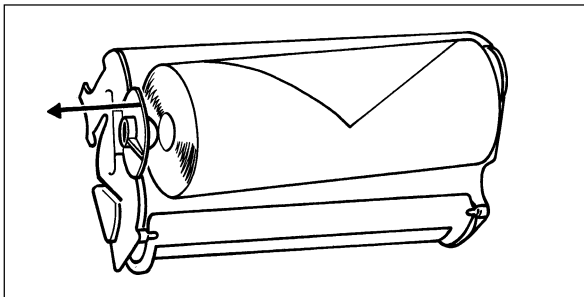
Figure 3.2.1d Chart installation
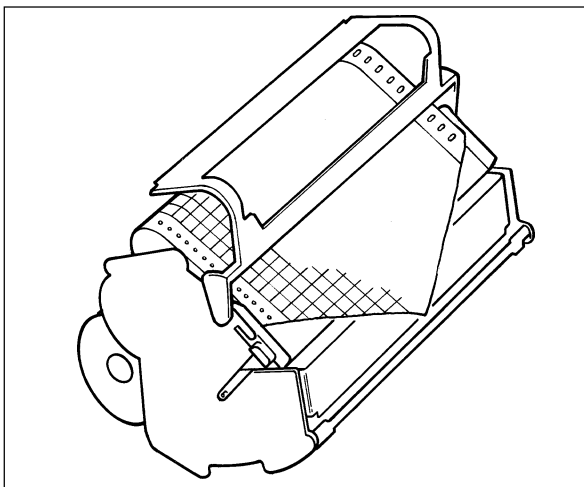
Figure 3.2.1e Chart feed (1)

Lift the plastic chart guide/paper tear-off and pass the end of the new chart under it (figure 3.2.1e).
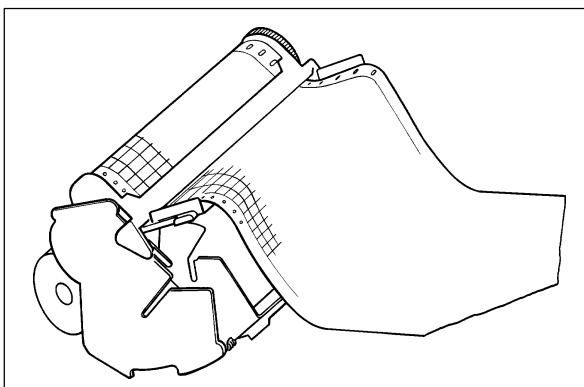
Figure 3.2.1f Chart feed (2)

Ensuring that the sprocket holes do not get damaged, pull out approximately 30 cm. of chart.   Close the chart tear-off guide, ensuring that the chart is located squarely on the sprockets.

3.2.1 ROLL CHART REPLACEMENT (MANUAL CASSETTE) (Cont.)
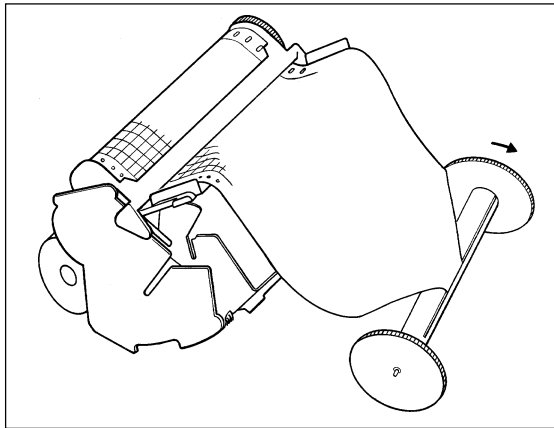
Figure 3.2.1g Chart feed (3)

Insert the chart into the slot in the take-up spool assembly, as shown.   Wind approximately two turns of chart onto the take-up spool
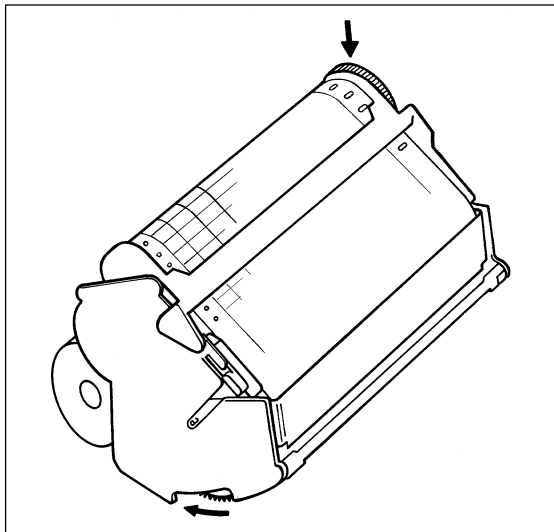
Figure 3.2.1h Chart tension adjustment

Whilst maintaining tension on the chart (by rotating the take-up spool), re-insert the spool into the paper tray. Apply light pressure to the sides of the tray and return it to the closed position.   Ensure that the platen is 'clicked' into place.

Tension the chart by holding the drive roller and turning the left-hand exposed take-up flange, as shown.
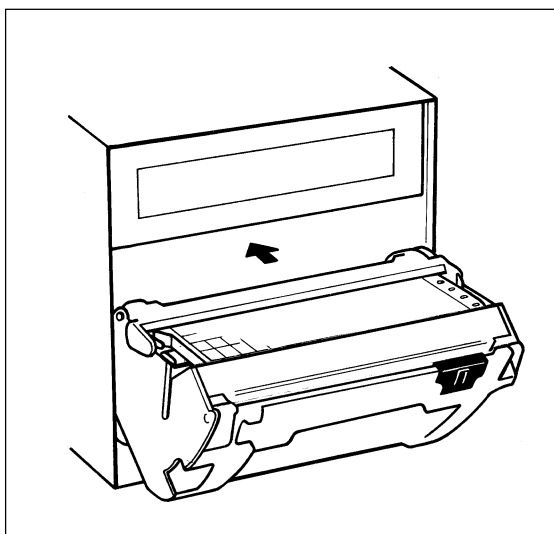
Figure 3.2.1i
Return of the cassette to the chassis

The cassette can now be returned to the recorder chassis, as shown, and then swung down and pushed inwards **until it latches into position**.

Ensure that the cassette drive train meshes with the drive gear.

It is recommended that the servo pen alignment procedure (section 6.3.1) is carried out to ensure that the pen zero and span positions match the new chart.

3.2.2 ROLL CHART REPLACEMENT (AUTO TAKE-UP CASSETTE)

Remove the cassette and eject the take-up spool as described in figures 3.2.1a and 3.2.1b above.
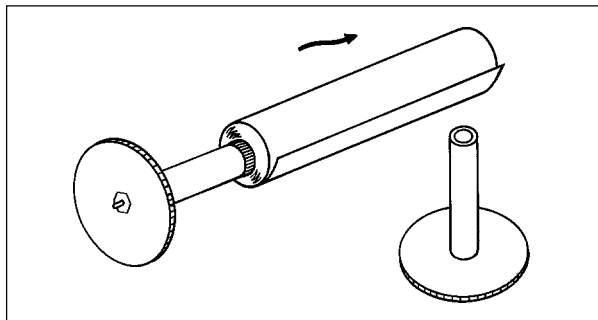
Figure 3.2.2a Chart removal

Unscrew one end of the take-up spool, and remove the used chart from the remaining 'stub', as shown in figure 3.2.2a. A slight rotation against the direction of winding may assist in the removal.

Re-assemble the take-up spool and refit it in the cassette. Apply light pressure to the sides of the paper tray and return it to the closed position.   Close platen, ensuring that it 'clicks' into place
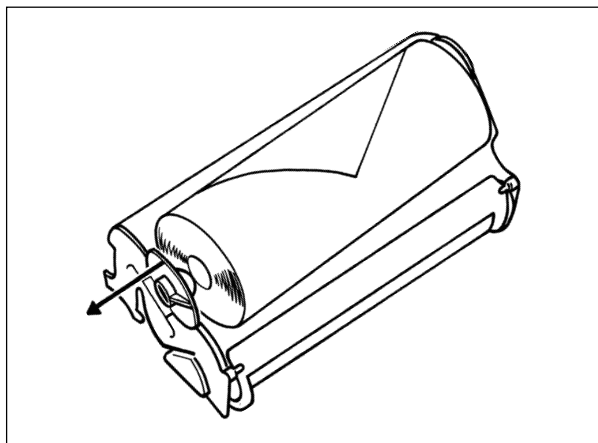
Figure 3.2.2b Chart installation

If necessary, remove the old chart's cardboard spool from the pay-off lugs.

Mount a new roll of chart into the supply roll holders as shown.
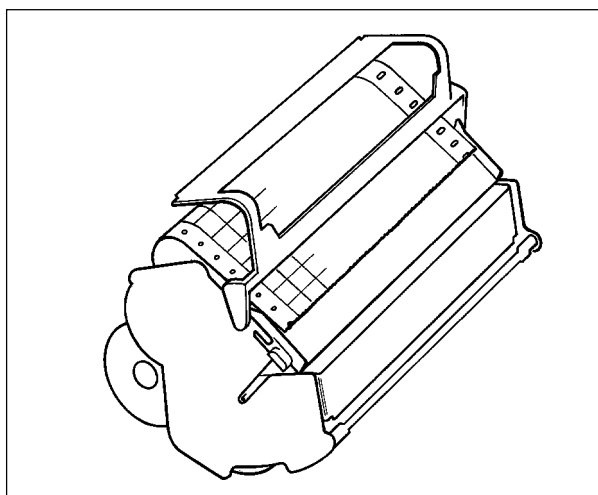
Figure 3.2.2c Chart feed (1)

Lift the plastic chart guide / paper tear-off and pass the end of the new chart under it as shown.

3.2.2 ROLL CHART REPLACEMENT (AUTO TAKE-UP CASSETTE) (Cont.)
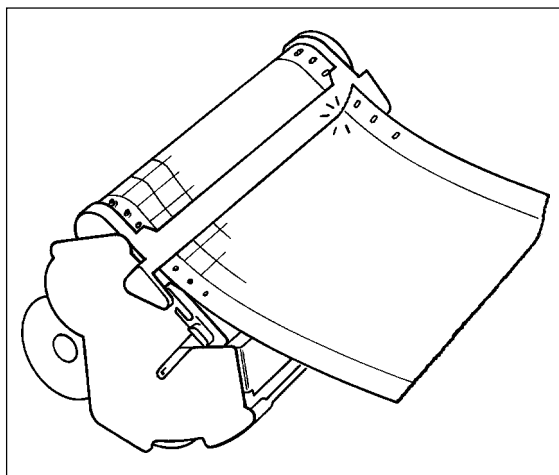
Figure 3.2.2d Chart feed (2)

Ensuring that the sprocket holes do not get damaged, close the chart tear-off guide, 'clicking' it into position. Ensure that the chart is located squarely such that the horizontal grid lines are parallel with the chart tear-off guide.

Remove excess chart by lifting the free end of the chart upwards and pulling it against the serrations on the tear-off guide.
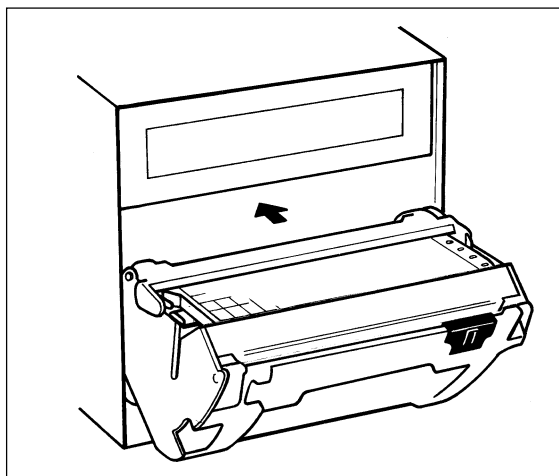
Figure 3.2.2e Return of the cassette to the chassis

Return the cassette to the recorder, and swing it down until it latches into position.

Use the 'Chart Advance' feature in the Operator menu (section 3.3.3) to feed the chart into the take-up mechanism. Ensure that the chart flows freely during this take-up process.

It is recommended that the servo pen alignment procedure (section 6.3.1) is carried out to ensure that the pen zero and span positions match the new chart.

3.2.3 Z-FOLD CHART REPLACEMENT

PREPARING THE CHART

Remove the cassette from the recorder, as described in section 3.2.1 above

Remove the chart from its box and fan it (figure 3.2.3a) from both ends. Once this has been done, the chart should be tapped gently on a table or bench. This process removes dust from the chart perforations, which might otherwise build up and eventually clog the cassette mechanism.
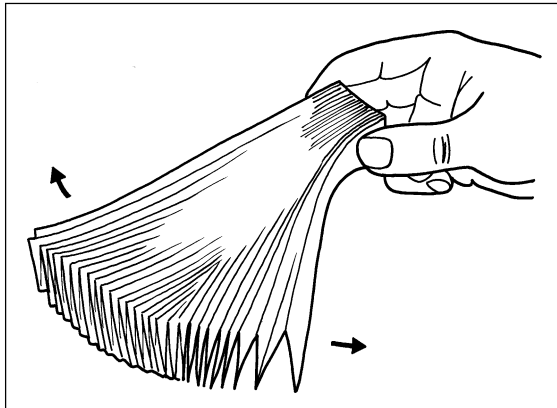
Figure 3.2.3a Preparing the chart

OPENING THE CASSETTE

As shown in figures 3.2.3 b and c, access to the chart loading area is by opening the Door Moulding (figure 3.3.2b) then pulling the plastic Paper Guide Assembly away from the roller, allowing the metal Cover Assembly to be hinged out (figure 3.2.3c).
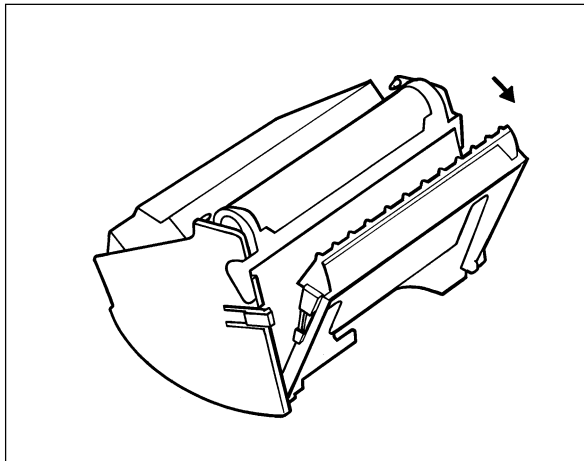
Figure 3.2.3b Opening the cassette
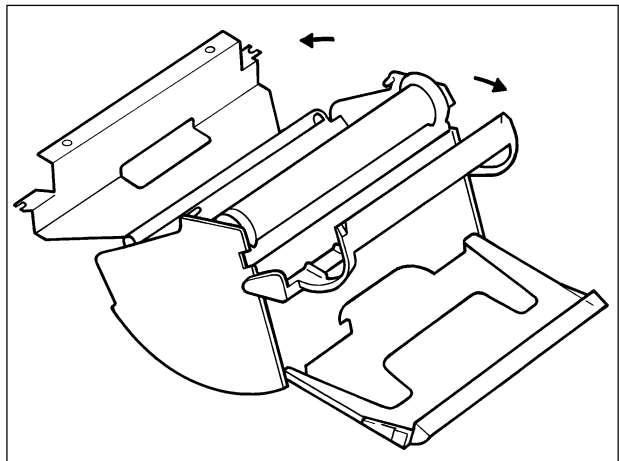
Figure 3.2.3c
Opening the paper guide and cover assembly

3.2.3 Z-FOLD CHART REPLACEMENT (Cont.)

LOADING THE CHART
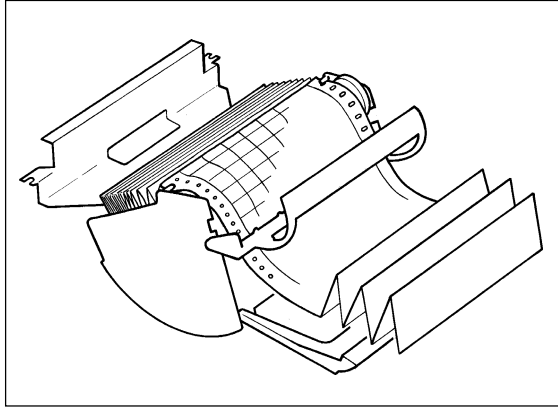
Figure 3.2.3d Chart loading (1)

Orient the chart such that the end with the red stripe is at the bottom of the pack.

Lift the top leaf of the chart and if necessary turn the chart to ensure a) that the calibrated face of the chart will be facing out when the chart is loaded, and b) that the slots in the chart are at the right-hand side of the cassette **as viewed from the front of the cassette as installed in the recorder.**

Insert the chart into the cassette, and pull approximately 30 cm (1 ft.) of chart between the open paper guide and the roller, as shown in figure 3.2.3d
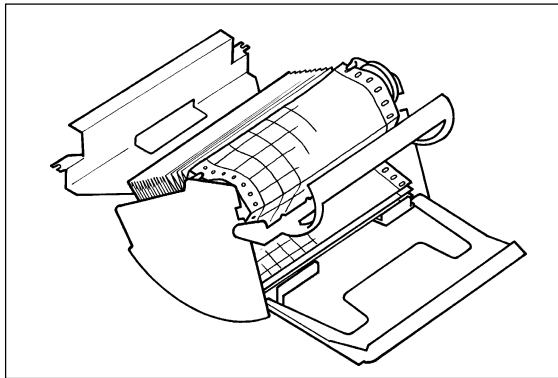
Figure 3.2.3e Chart loading (2)

Fold the free end of the chart, so that it folds naturally, and place the folded end into the take-up tray as shown in figure 3.2.3e

IF THE DIRECTION OF FOLDING IS REVERSED, THE CHART WILL NOT TRANSPORT CORRECTLY, AND WILL FAIL IN OPERATION.
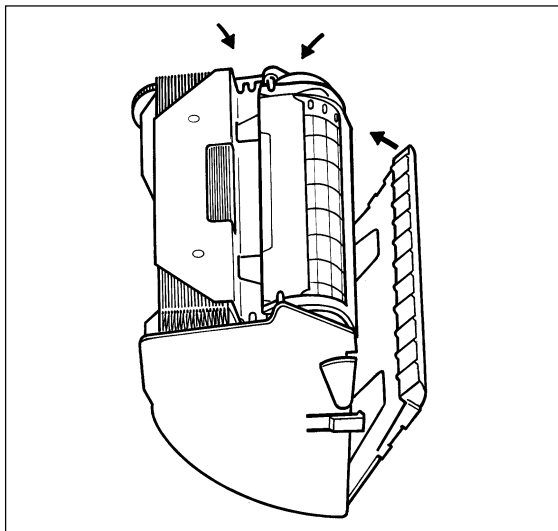
Figure 3.2.3f Chart loading (3)

Ensuring that the chart is square with the cassette sides, and that the chart holes are correctly located on the sprockets, carefully push the metal cover assembly to its closed position, and latch it by closing the paper guide moulding over it (figure 3.2.3f)   Ensure that it clicks into position.

Close the door moulding, ensuring that it also clicks into position. This sequence is shown in the diagram at the right- -hand end of the cassette

3.2.3 Z-FOLD CHART REPLACEMENT (Cont.)

Figure 3.2.3g Checking paper transport
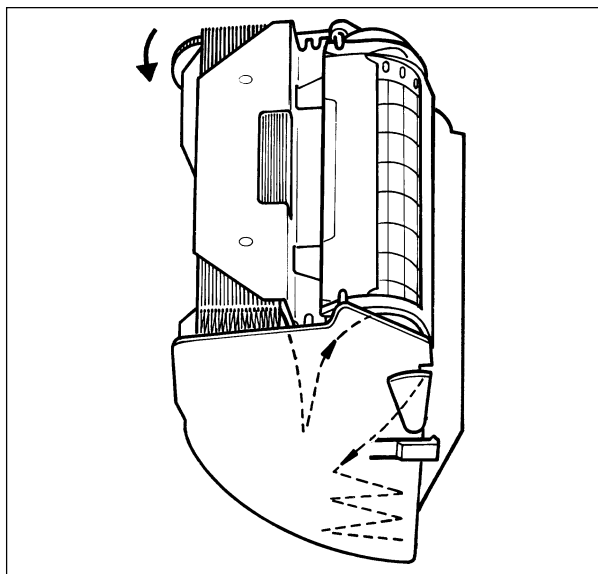
Check that the chart is passing correctly through the cassette by rotating the pinion as shown in figure 3.2.3g.

Return the cassette to the recorder, and swing it down until it latches into position.

It is recommended that the servo pen alignment procedure (section 6.3.1) is carried out to ensure that the pen zero and span positions match the new chart.

3.2.4 CHART REVIEW / TEAR-OFF

CHART REVIEW
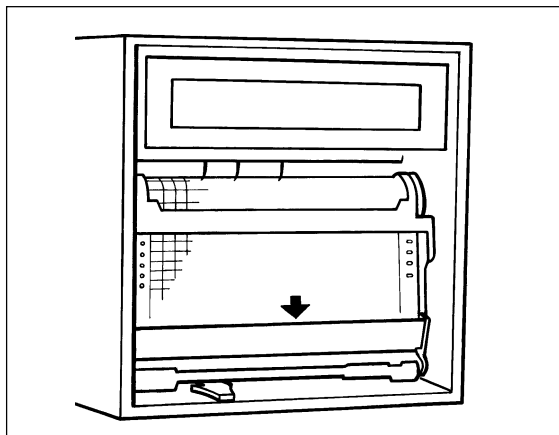
Figure 3.2.4a Chart release

Open the recorder door and open the paper tray as shown.
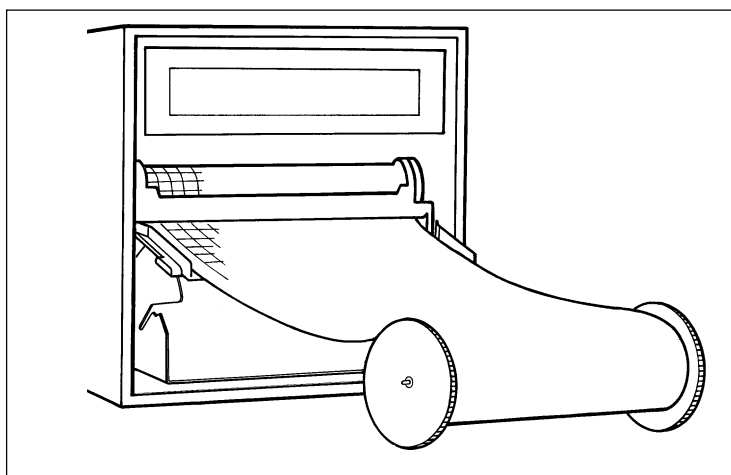
Figure 3.2.4b Chart review

The take-up spool can now be removed and pulled out, allowing past sections of the chart to be viewed.The take-up spool is returned to the cassette as previously described.

CHART TEAR-OFF
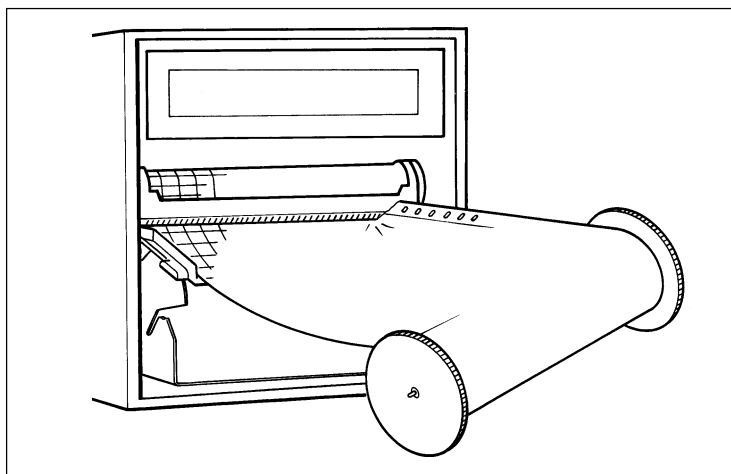
Figure 3.2.4c Chart tear-off

If a section of chart is to be detached, the take-up spool is removed as just described, and the chart is pulled up-wards and across, to tear the chart on the serrated edge of the chart tear-off / guide, as shown in the figure.

The relevant parts of the chart replace-ment procedure should be followed to release the required section of the chart from the take-up spool, and to re-fit the remaining chart to the cassette.

3.2.5 PEN INSTALLATION AND REPLACEMENT

CAUTION
PENS MAY BE CHANGED ONLY WHEN THEIR MOVEMENT IS DISABLED USING THE OPERATOR MENU DESCRIBED BELOW.   ANY ATTEMPT TO CHANGE A PEN WHILST IT IS 'LIVE' IS LIKELY TO LEAD TO DAMAGE TO THE RECORDER.

PEN PARK

The → key is operated to call the first page of the operator menu to the display.   The page scroll key is then operated repeatedly, until a 'Pen Park On(Off)' display page appears.   The <↑> or <↓ > is now used to select pen park ON, and the ENTER key is operated.   This causes the pens to fan out, allowing easy access (figure 3.2.5). Further movement of the pens is inhibited until pen park is selected OFF.

PEN REPLACEMENT

Once the pens are fanned, the exhausted pens can be removed by gently pulling on them.   The new pens can now be fitted by inserting them carefully into their retaining clips. Care must be taken to apply as little force sideways, as possible.

When the recorder is mounted in a sloping panel, the intensity of the annotator dots might be reduced as the rear of the case is lower than the front.   See Section 6 for dot intensity adjustment.
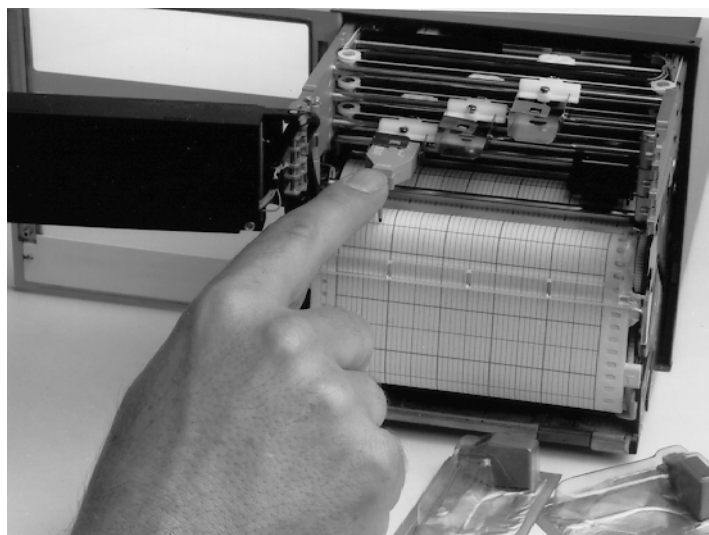
Figure 3.2.5 Pen replacement

3.2.6 BATTERY REPLACEMENT

To ensure the protection of accumulated data (Totaliser Values, Trace History, Averages, Maximums, etc.), the RAM Battery should be changed at yearly intervals.   For recorders with annotation, if the battery voltage falls below a 'safe' level, or if the battery is missing, a 'battery low' message is printed on the chart after each power-up.

The Clock and Supplementary Memory Protection Battery is mounted on a small circuit board which is plugged onto the top of the annotator board (see figure 2.4.5). When changing this battery this board is removed and discarded (note 2 below), and a replacement board fitted as follows:-

Remove the recorder from its case.   Rotate the 1/4 turn fastener and lift the cover between the pen tray and the servo drive board.   Using a gentle rocking motion, carefully unplug the battery board from the top of the annotator board, ensuring that the annotator board remains in place.

Fit the new battery board and close the cover, latching it shut using the 1/4 turn fastener. Return the recorder to its case.

Notes...
1. During battery changing, data is retained (on the main board) by means of a capacitor fitted on the annotator board.   If the annotator board is removed, or if the battery replacement is not carried out promptly, accumulated data will be lost.
2. Exhausted batteries must be disposed of according to the local environmental regulations covering the type of battery involved. They should not just be 'thrown away'.

Figure 3.2.6 Battery replacement

3.3 CONTROL PANEL AND OPERATING DISPLAYS

The operating displays appear both at the recorder display and at a hand-held terminal if fitted.   The hand-held terminal can display only 16 characters, resulting in the loss of the last 4 character positions from the 20-character recorder display.
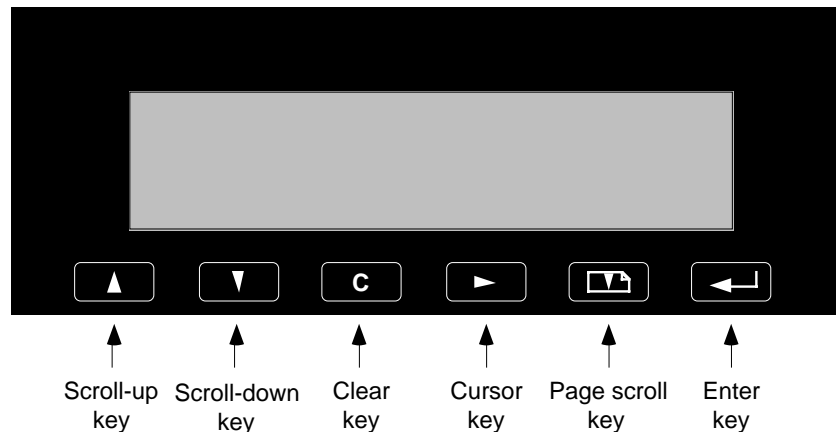
Figure 3.3 Control panel key-functions

3.3.1 MEASURED VALUE DISPLAYS

There are two types of operating display: Multi-channel and Single channel. After initialisation is complete, the multi-channel display is presented, showing Channels 1, 2 and 3 channel number, measured value and units-of-measure.

MULTI-CHANNEL DISPLAYS
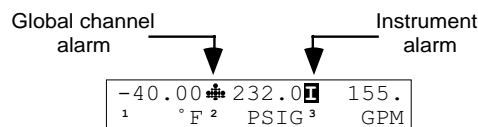
There will be two Multi-channel displays for 4, 5 or 6 (derived) channels.   If all three channels in a display are turned OFF (see section 4 - channel function), that display will not appear.

Multi-channel displays scroll to the next higher group every 12 seconds. Operation of the ENTER key causes the scroll to stop, holding that particular display until another key is operated.

The down arrow key can be used to step through all multi-channel displays; the up arrow key can be used to step through all the multi-channel displays, followed by all the single channel displays.

3.3 OPERATION (Cont.)

SINGLE CHANNEL DISPLAYS

```
Ch Descriptor  ↑∨∧↓
ChN  value units 🆘 ✚
```

Single channel displays show the channel descriptor, the channel number, the units-of-measure, the global alarm symbol and up to four individual alarm indication symbols.

Single-channel displays scroll to the next channel every 12 seconds.   Operation of the ENTER key causes this scrolling to stop holding that particular display until another key is operated.

There is a single-channel display for every input or derived variable (DV) channel (unless the Linearisation Function or Source DV choice is OFF).

The up or down arrow keys step through the single-channel displays.

Operation of the Clear key causes a return to the first multi-channel display.

3.3.2 ALARMS

An Instrument alarm (inverse video 'I') appears flashing after initialisation.   If this 'I' continues to flash for more than 90 seconds, section 6.2 of this document should be referred to for Instrument Alarm information.

The global alarm bell symbol appears flashing whenever any alarm on any channel becomes active.   The bell continues to flash until all alarms have cleared.

On multi-channel displays, the alarm channel number also flashes.   On single-channel displays, there are four alarm indicator positions in the upper right corner.   The symbols which appear there depend on the types of Alarm that are currently active on that channel.   The possible symbols and their interpretations are as follows:

∧   Absolute high
∨   Absolute low
↑   Rate-of-change rising
↓   Rate-of-change falling
|←   Deadband (deviation)

3.3.3 OPERATOR MENU

The Operator Menu is accessed by operating the side arrow key on the recorder display keypanel or the Handheld Terminal. No Password is needed for this menu.

SOFTKEY

Note...

This display appears only if the softkey has been defined as operator accessible in the instrument configuration (described in section 4.9).

A number of functions can be initiated by any one of a number of triggers, as set up in the relevant configuration page. For example, a specific alarm, a specific event input, or a totaliser reaching a preset value could all be configured to operate an alarm relay through what is called an Action Equation page, associated with the relay.   One of the triggers available is called the Softkey, and if the softkey is configured to be accessible to the operator, this will allow the operator to trigger any of the functions which has 'softkey' in its action equation.

If all the relevant options are installed, the action equation functions are:

1. Output relay.
2. Selection of alternative chart speed.
3. Initiation of log printing.
4. Printing of a user-entered message.
5. Reset totaliser

6. Replay trace history
7. Change range magnification
8. Reset derived variables
9. Start timer
10. Reset timer.

The ENTER key is operated to select the Soft Key for configuration (on or off).

```
   Soft Key ?


```

```
Soft key descriptor
   On / Off
```

The up/down arrow keys are used to turn the soft key function ON and OFF. Selection of ON sends one trigger to functions such as totaliser reset and trace history which require a single input to actuate, reset, etc. Functions such as alarm relays, alternative chart speed and range magnify which are a change of state, receive a continuous trigger for as long as the Soft Key is ON.   The descriptor which appears at the top line of the display, is defined as a part of the Instrument Configuration, desccribed in section 4.9.

VIEW TOTALISER

```
View Total.?
      N
```

The up/down arrow keys are used to select a totaliser for viewing.   Once selected an operation of the ENTER key causes the current value held in the totaliser to be displayed.   Operation of any key causes a return to the totaliser select display.

3.3.3 OPERATOR MENU (Cont.)

From background
display

Enable/disable
softkey*

Set softkey
on or off

Option
Enter totaliser
nº for viewing

View selected
totaliser value

Option
Enter totaliser
nº to be reset

Use to
initiate reset

Set primary
chart speed

To return to the background
(measured value) display, use
the key

Set chart
advance
on or off

Set chart hold
on or off

Set pen park
on or off

Configure
alarms? *

Use to
access alarm
configuration

Enter batch
number

Print log?

Use to
initiate log

Select timer
to view

Option
Set Range
Magnify on or off

Option
Replay history?

Use to
initiate replay

Set alternative
chart speed on
or off

Set alarm
message printing
on or off

Use to
cancel message
printing

Option
Enter DV Nº to
be viewed

Use to
initiate replay

Option
Enter DV Nº to
be reset

Use to
initiate reset

Option
Enter custom
message Nº for
printing

Use to
initiate reset

Set up time
and date

View
instrument
alarms

See section 6

* Alarm configuration and softkey enable/disable
appear only if they have been set up to be
operator accessible in the Instrument
Configuration, described in section 4.9

Figure 3.3.3 Operator menu organisation

3.3.3 OPERATOR MENU (Cont.)

TOTALISER RESET

```
┌─────────────────────────┐
│  Rset Total.?           │
│      N                  │
└─────────────────────────┘
```

The up/down arrow keys are used to select the totaliser which is to be reset. Refer to the section 5 (Options) for further details.   Once the required totaliser number has been selected by operation of the ENTER key, a further operation of the ENTER key is required to initiate the reset.

```
┌─────────────────────────┐
│   Rset Total.?          │
│ ENTER to confirm        │
└─────────────────────────┘
```

Notes..
1. The resetting of a totaliser causes an internal trigger, which may have been configured to affect other re-corder functions.
2. The totaliser must have been configured as 'Resettable' in the totaliser configuration.

PRIMARY CHART SPEED

```
┌─────────────────────────┐
│ Pri. Chart Spd          │
│    _XXXX MM/HR          │
└─────────────────────────┘
```

The up/down/side arrow keys are used to set the primary chart speed. The speed units ('in/hr' or 'mm/hr') are defined in the instrument configuration menu (section 4.9) and are not configurable from the above display.

CHART ADVANCE

```
┌─────────────────────────┐
│ Chart Advance           │
│      Off                │
└─────────────────────────┘
```

The up/down arrow keys are used to operate the chart advance. When selected ON, the chart will advance at maximum speed, until selected OFF again.

CHART HOLD

```
┌─────────────────────────┐
│  Chart Hold ?           │
│     Off                 │
└─────────────────────────┘
```

The up/down arrow keys are used to operate Chart Hold function.

With hold selected ON, chart motion and annotator printing are inhibited.   The tracing of measured values will however continue, and if chart hold is active for extended periods with rapidly changing input signals, damage may be caused to the chart.

PEN PARK

```
┌─────────────────────────┐
│  Pen Park               │
│      Off                │
└─────────────────────────┘
```

The up/down arrow keys are used to stop the chart and to position the pens for replacement. See section 3.2.5 for replacement instructions.

3.3.3 OPERATOR MENU (Cont.)

ALARM CONFIGURATION

Note...
   This display appears only if alarm access has been defined as operator accessible in the instrument configuration (section 4.9).

If the alarm configuration has been defined as operator accessible, then the user can carry out a full alarm configuration.   Refer to section 4.10 for full details

BATCH NUMBER

```
 Batch Number
123456
```

The up/down/side arrow keys are used to define up to six alpha-numeric characters (following the fixed letter 'B') that are to be printed with the Time Header.   The Time Header is printed on Power-up, as the first line of the Log and once in each sequence of Printed Scales.

LOG INITIATION

```
  Print Log ?
```

The ENTER key is operated to call the Log up for printing.

```
  Print Log ?
ENTER to confirm
```

The ENTER key is operated again to initiate the printing of the Log. Once started the Log will continue until it is complete.   If other actions (such as a chart speed change) occur during the printing of the Log, a line is drawn across the chart to mark the time. Any printing called for by those actions will be delayed until after the Log.

VIEW TIMER

```
  View Timer?
     N
```

The Up and Down arrow keys are used to select Timer 1 to 4 for access.   Operation of the Enter key calls the selected timer's configuration to the display.   The configuration can be viewed but not altered. See section 4.12 for details on timer functions.

```
Timer N
 13:00  31 JAN90
```

Operation of the Clear key returns the operator to the menu.

RANGE MAGNIFY

```
Range Magnify
     Off
```

The up/down arrow keys to turn the Range Magnify function ON or OFF.

3.3.3 OPERATOR MENU (Cont.)

REPLAY HISTORY

```
┌─────────────────────────────┐
│ Replay Hist.?               │
│                             │
│                             │
└─────────────────────────────┘
```

The ENTER key is operated to select the trace history function.

```
┌─────────────────────────────┐
│ Replay Hist.?               │
│ ENTER to confirm            │
└─────────────────────────────┘
```

The ENTER key is used to initiate operation of history replay.

ALTERNATIVE CHART SPEED ENABLE

```
┌─────────────────────────────┐
│ Alt. Chart Spd              │
│       Off                   │
└─────────────────────────────┘
```

The up/down arrow keys are used to change to the alternative chart speed selected in the instrument configuration. This choice overrides any action equation triggers (section 3.4) in the instrument configuration menu (section 4.9).

ALARM MESSAGE PRINT DISABLE

```
┌─────────────────────────────┐
│ Alarm Msg Cancl             │
│                             │
└─────────────────────────────┘
```

The ENTER key is operated to access all, as yet unprinted alarm messages. This feature is particularly useful when the input measurements are known to be in an abnormal state and many alarms have occurred, resulting in a possible backlog of alarm messages.

```
┌─────────────────────────────┐
│ Alrm Msg Cancl              │
│ ENTER to confirm            │
└─────────────────────────────┘
```

A further operation of the ENTER key causes all queued alarm messages to be cancelled.

VIEW DERIVED VARIABLE

```
┌─────────────────────────────┐
│ View DV Val?                │
│      N                      │
└─────────────────────────────┘
```

The up/down arrow keys are used to select a derived variable for viewing.   Once selected an operation of the ENTER key causes the current value of the variable to be displayed.   Operation of any key causes a return to the DV select display.

3.3.3 OPERATOR MENU (Cont.)

DERIVED VARIABLE RESET

```
┌─────────────────────────────┐
│    Reset DV?                │
│         N                   │
│                             │
└─────────────────────────────┘
```

The up/down arrow keys are used to select the variable which is to be reset. Refer to section 5 (Options) for further details.   Once the required variable number has been selected by operation of the ENTER key, a further operation of the ENTER key is required to initiate the reset.

```
┌─────────────────────────────┐
│    Reset DV?                │
│ ENTER to confirm            │
│                             │
└─────────────────────────────┘
```

Note...
   The resetting of a derived variable causes an internal trigger, which may have been configured to affect other recorder functions.

MESSAGE PRINTING

```
┌─────────────────────────────┐
│ Print Message               │
│         NN                  │
│                             │
└─────────────────────────────┘
```

The up/down arrow keys are used to select a message to be printed.   Once selected, a double operation of the ENTER key initiates printing.

Subsequent operation of any key causes a return to the message select display.

Note...
   If break-trace mode is selected, the printing of the message will interrupt the traces.

TIME AND DATE SETTING

```
┌─────────────────────────────┐
│  Time & Date                │
│ HH:MM  DD MMMYY             │
│                             │
└─────────────────────────────┘
```

The up/down/side arrow keys are used to enter a time and date.   The printing format of the time can be selected as either 12-hour or 24-hour in the instrument menu.   The format when setting the time is always 24-hour.   This display appears only if the annotator driver board is fitted.

INSTRUMENT ALARM REVIEW

```
┌─────────────────────────────┐
│ Inst. Alarms ?              │
│                             │
│                             │
└─────────────────────────────┘
```

The ENTER key is used to call the instrument alarms for review.   Refer to section 6 for details.

3.4 INTERNAL TRIGGERS AND ACTION EQUATIONS

Many of the standard and optional features of the recorder can be reset, started, stopped etc. in response to internal triggers or to external events.   The most common example is a relay responding to an alarm.

The nine types of internal trigger that can modify the recorder operating features are as follows:-
Contact (event) input (external contact closure) (CI1 - CI6)
An active Alarm (A11 - A64) (A11 = Channel 1, Alarm 1; A64 = Channel 6, Alarm 4).
The global alarm (bell symbol) becoming active (GLA)
The instrument alarm ('I' symbol) indicating a problem in the self- check diagnostics (INA)
A timer reaching its preset time/date (TM1, TM2).
A totaliser reaching its preset value (TT1 - TT6).
A totaliser automatically resetting at 999,999,999 (TR1 - TR6).
The Log Start command (LOG)
Use of the designated 'Soft Key' in the Operator Menu (KEY). See Section 3.3.3

If the relevant option(s) is (are) fitted, the features that can be activated by one or more of these triggers are:-
Operate alarm relay
Select alternative chart speed
Initiate printing of a log
Print custom message
Reset totaliser
Replay trace history
Initiate range magnification
Reset derived variables
Start/reset timers

The specific effects that a trigger can have are described with each individual feature.   However, the means of selecting the internal triggers is the same for all functions. An action equation is a 'Logic OR' statement which defines the trigger (or triggers) that will modify a particular feature. It is entered as a series of trigger codes separated by commas (see examples below).   Each action equations page is used to enter up to four triggers. Action equations can be several pages long; 3 pages would be needed for 10 alarms to operate one relay, for example.

EXAMPLES:

1. An action equation for output relay 01 responding to Alarm 1 on Channel 1 (A11) would be:-

```
RY01  Act Eq  P1
A11,____,____,____,
```

2. An action equation for printing custom message 07 in response to alarm 3 on channel 2 OR alarm 1 on channel 3 OR Event Input 3 would be:-

```
CM07  Act Eq  P1
A23,A31,CI3,____,
```

3.5 CHART PRINTING (ANNOTATION OPTION REQUIRED)

3.5.1 INTRODUCTION

Three chart printing modes (noprint, over-print and breaktrace) are available and are fully discussed in the instrument configuration description (section 4.9).   Briefly,

NOPRINT   Turns off all character string printing.

OVERPRINT   Prints all character strings without changing the chart speed.   Faster chart speeds cause the printing to become taller (see 'High Speed printing', below)   The printing appears on top of the channel traces.

BREAKTRACE   Interrupts the chart timing to optimise print speed with legibility. The chart speed change, log, alarm and custom messages are printed as quickly as possible by advancing the chart between each line of dots, as soon as each line is finished.   Scales are printed at normal chart speed.

Note...
   If any change which affects the character of the record (Chart Speed, Trace History, Range Magnify, etc.) takes place whilst other information is being printed, a red line is drawn on the chart when each change occurs.   The normal printing for each change is delayed until the current printing job is complete.

Alarm and Custom Messages interrupt all other printing jobs except the Log.   An interrupt occurs only after a line of text is completed.

Channel scale/descriptor and Time messages are printed alternately every 5 cm of chart (see figure below).

The channel scale and descriptor message is printed for a particular channel, only if the channel linearisation is not selected OFF in the channel configuration.

The ID/Batch No./Chart Speed/Date/Time line is printed at the next 5 cm. interval after the highest number channel scale.

The channel number is printed in the appropriate colour next to the channel trace, immediately above the descriptor print line.

HIGH SPEED PRINTING

With high chart speeds, text characters become vertically elongated to the extent that they can become difficult to read.   For this reason, the following should be noted:

1. Time and channel descriptors are not printed at chart speeds greater than 400 mm/hr.
2. In overprint mode, alarm messages, custom messages and logging do not occur at chart speeds greater than 400 mm/hr.
3. In break-trace mode, all printing except time and channel descriptors operate at all speeds.

3.5 CHART PRINTING (Cont.)
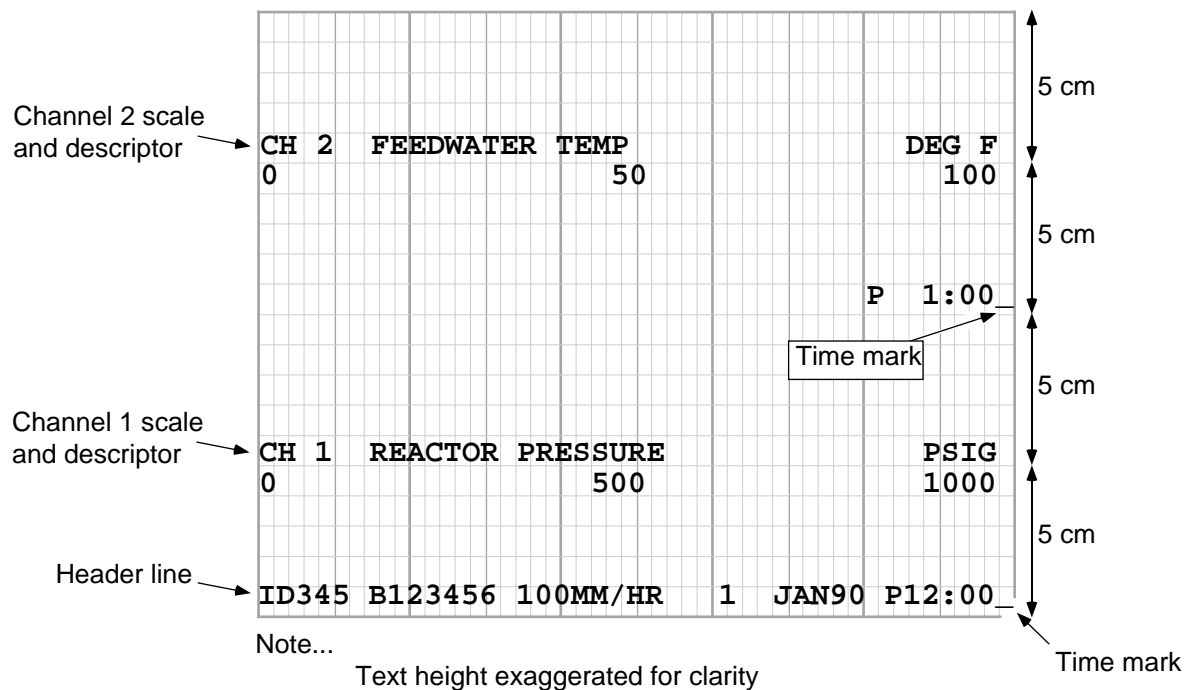
Figure 3.5.1
Channel scale, channel descriptor and time-of-day print example (channels 1 and 2 only)

3.5.2 ALARM MESSAGE PRINTING

Alarm messages are printed once when the relevant alarm becomes active (ON) and again when the alarm condition is no longer present (OFF). The symbol printed before the words "On" and "Off" indicates the alarm type.   Examples of alarm messages are:

```
P 4:45 13 JAN 89 A11 FEED TEMP HIGH  ^Off
P 4:40 13 JAN 89 A11 FEED TEMP HIGH  ^On
```

indicating that alarm1 (absolute high) of channel 1 became active at 4:40 in the afternoon of the 13th January 1989 and remained in alarm for five minutes.

Alarm messages will not print during a log.   If alarms occur so frequently that they cannot be printed, the Messages are saved and printed as quickly as is permitted by the current print mode.   Unprinted Alarm Messages may be cancelled by using the Alarm Message Cancel item in the operator menu.

Note...

   If a particular alarm toggles on and off so rapidly that the message printing cannot keep up, then at least the first 'alarm on' and the last 'alarm off' message will be printed;   Messages in between may be lost.

3.5.3 INSTRUMENT LOG

Input channels, derived channels and totalisers can be selected for printing. A Log printout is preceded by the ID/Batch/Chart Speed/Date/Time header, and is followed (except in break-trace mode) by a time mark.

Channels are printed as:

```
                                    A10:15_
        CH2 FEEDWATER TEMP              102.3    °F
        CH1 REACTOR PRESSURE            340.0  PSIG
         ID35 B123456  200MM/HR 23 OCT89 A10:00_
```

Totalisers are printed as:

```
                                     P2:05_
        TT2 TOTAL DISCHARGE        343344345 GAL
        TT1 TOTAL FEED FLOW        344345346 GAL
         ID34 B123456  200MM/HR 29 OCT89 P 2:00_
```

3.5.4 CUSTOM MESSAGES

A custom message can have up to 16 characters, and it is printed whenever one or more internal triggers in its action equation become active. Time is printed with each Message.

Custom Messages are printed as:

```
        BATCH CYCLE DONE               A10:27_
        BATCH SOAK START               A 9:57_
        BATCH START                    A 9:27_
```

CUSTOM MESSAGE Nº10

When custom message N 10 is printed, it is followed by the printing of all active channels' scales (providing the chart speed is less than 400 mm/hr.) and descriptors. This can be used to print scales at the end of a batch, shift or other period.

3.5.5 RANGE MAGNIFICATION

When Range Magnification (see section 5) is actuated by action equation or through the operator menu, all selected traces immediately change range. A line is drawn across the chart and new ranges are calculated by the recorder based on the Magnification Factor.

The measured value at time of initiation is located at the centre, unless a 'Magnification Centre' value has previously been entered as a part of the relevant channel's configuration. See section 5.6 for a full description.

Scale printing during magnification uses the new ranges.   When magnification is turned off, all scales are printed before the traces return to their originally configured ranges. Magnified ranges are printed as:

```
      RANGE MAGNIFIED
      CH 2 DISCHARGE FLOW                      MGD
      20                    45                  70
      CH 1 REACTOR PRESSURE                   PSIG
      740                  840                 940


      _____


                                        *
      CH 2 DISCHARGE FLOW               *    MGD
      0                    100          *    200
                                        *
                                        *
      CH1 REACTOR PRESSURE              *   PSIG
      0                    500          *   1000
```

3.5.6 TRACE HISTORY

When Trace History is activated, a line is drawn across the chart.   Above the line the history chart speed and 'history start' are printed. After the printing of the Pre-event History, a further line is drawn and identified as 'history trigger', with the trigger time printed at the right edge of the chart.

Because Trace History can have its own magnification, all history scales are printed before the recorder returns to its original status.   Trace History is printed as:

```
      HISTORY RANGES
      CH 2 DISCHARGE FLOW               *     MGD
      0                    100          *     200
      CH 1 REACTOR PRESSURE             *    PSIG
      0                    500          *    1000




      _____HISTORY TRIGGER_____P13:46




       200 MM/HR            HISTORY            START
```

SECTION 4: CONFIGURATION

LIST OF CONTENTS

(Continued)

LIST OF CONTENTS (Cont.)

SECTION 4 CONFIGURATION

4.1 OVERVIEW

The Main Configuration Menu is divided into sub-menus, some of which appear only if the associated option is fitted.   It is recommended that initial configuration follow the Main Menu sequence.

Each sub-menu covers a separate function or area of recorder operation (e.g. ranges, alarms, etc.) and is presented in a logical sequence of choices and value entries.   Each sub-menu is discussed separately in the basic configuration order.   For a "quick start" to measure and record an input, only the channel and instrument menus need be used.

The recorder display/keyboard can be used for all configuration. The basic format for the display presents the item to configure on the top line, and the choice to be made on the bottom line.

4.2 RECORDER KEYBOARD

In addition to a vacuum fluorescent display with two lines of 20 characters, the display assembly has 6 touch keys:

Up arrow   Used to increase a number/letter or to move forward through a selection list.

Down arrow   Used to decrease a number/letter or to move backward through a selection list.

\C (Clear)   Resets any number/word/selection not entered.   Also, backs up one menu level when "E" symbol not lighted.   Selections must be "Cleared" up to the Main Menu to take effect.

Side arrow   Used to enter Operator Mode and to move the cursor when entering numbers/letters.

Page   Used to Enter Configuration Mode and to move forward through a menu level.

Enter   Enter or Clear must be used to leave any display after a change has been made and the "E" symbol is lighted in the upper right corner. Changes made will not take effect until Entered.
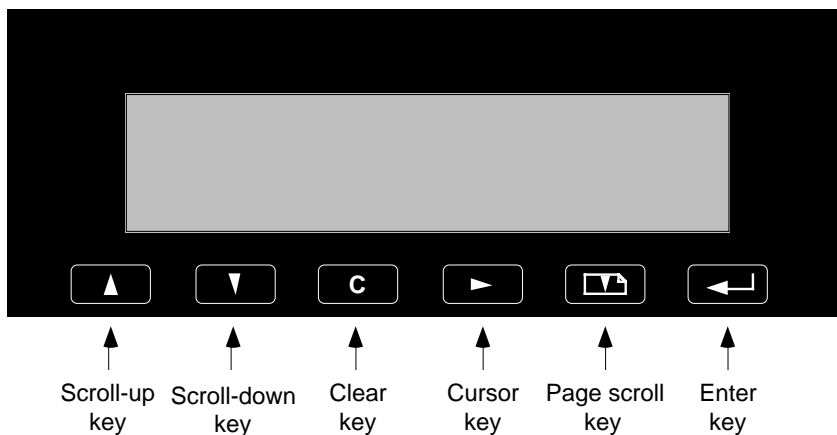
Figure 4.2 Recorder keyboard

4.3 RECORDER COMMUNICATIONS PORT

Computer entry of numbers, descriptors and units is possible via the configuration port (1/8in jack socket located as shown in figure 4.3a below).

When wiring the mating 1/8" stereo plug, the tip contact is terminal Tx, the centre is Rx and the shaft is common, as shown below:
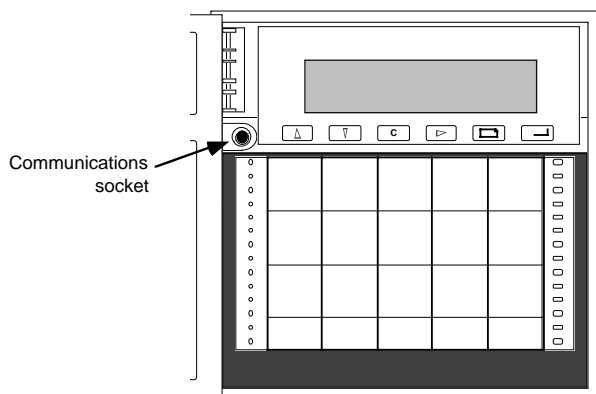
Figure 4.3a Communications socket location
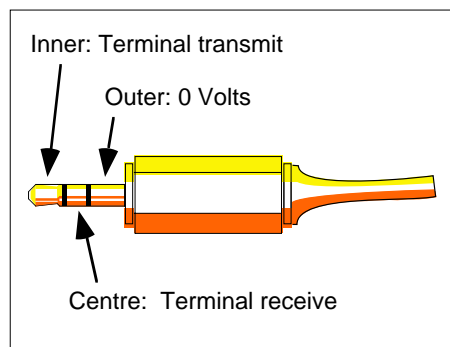
Jack plug wiring for transfer with host computer/dumb terminal

Figure 4.3b Jack plug connections

A terminal emulation program, such as Procomm, must be used to emulate a VT100 terminal, allowing the VT100 keys listed in table 4.3 below to be used.   For text entry, the typing-in of the two letters 'o''n' from any configuration page which is normally used to enter text using the up/down/side arrows (e.g. the programmable units page) will allow the VT100 alpha-numeric keys to be used instead.   In order to disable this feature, 'o''f''f' is typed-in.

The screen display is similar to the normal recorder display, but characters between ~ and √ (Section 4.4) are not displayed at the terminal screen. If one of these characters is required, it is necessary to read the recorder display.

Recorder key	Any terminal	VT100
Page back	ESC,O,Q	PF2
Page forward	ESC,O,R	PF3
Clear	ESC,O,S	PF4
Up arrow	ESC,[,A	↑
Down arrow	ESC,[,B	↓
Right arrow	ESC,[,C	→

Table 4.3 Terminal keys

The following information is provided as a guide only. It is the user's responsibility to determine if a particular terminal or computer can be used with the recorder port.   The port communications parameters are:

Baud Rate	4800
Parity	None
Data Bits	8
Stop Bits	1
Handshake	None

4.4 ENTRY OF ALPHANUMERIC DATA

The recorder uses a Scroll-and-Select method of alphanumeric data entry. When a word or number entry is required on a configuration display, a cursor will appear at the left end of the second line. The side arrow is used to move the cursor. The up and down arrow keys are used to scroll through a library of numbers (for entry of purely numeric alues) or a library of numbers, letters and characters (to enter a tag name or printed message).

Numbers entered with spaces between will "pack" (i.e. slide to the right) on entry.   For example, a number entered as:

```
Range High

15           0 ˚F
```
will pack to:

```
Range High
        150 ˚F
```
when entered

When scrolling through the listing, the speed of the scroll will increase after the first six characters and again after the next six characters.   Refer to the following Character Library to determine whether to scroll Up or Down to the next desired character.

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\ ] ^ _ ' { | } ~ ▮ank Å Æ ß É Ñ ö û ü § ç ¿ ¢ ∂ ε θ φ π μ Ω ∫ Σ ≠ Å ⁰¹²³⁴⁵⁶⁷⁸⁹ √ ± ˚ × ÷ ˚ ⊢⊣| £ ≤ ≥ ⌣ ▰ ← → ↓ ↑ ≪ ≫ ⩽ ⩾ ₀₁₂₃₄₅₆₇₈₉ blank ! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @

4.5 GETTING STARTED

The first configuration step is to enter the configuration mode.   This is done by pressing the page key while the recorder is on any display showing a measured value.   If unsure of the type of the current display, press CLEAR (C) several times until the display format stops changing. Then press the Page key.

4.6 PASSWORD

In order to access the Main Menu and change the recorder configuration it is necessary to enter the proper 1, 2 or 3-digit Password.

All instruments have a password of "10" when shipped, requiring only the entry of the digit "1" at the left end cursor to gain initial access. The up arrow key should be operated twice , followed by ENTER.

The entry of a user-selected Password is described in the Instrument configuration section below. (section 4.9).

Note...After a configuration choice has been made on a display, the operation of the ENTER key confirms the choice only for that display.   It is usually necessary to press CLEAR one or more times and return to the Main Menu before the choice becomes effective.

4.7 MAIN MENU

If all available options are present, the following items appear in the top level or 'Main' menu:

Channel	Used to enter the type and ranging of the measured input or derived variable along with Filtering, Tagging and Scale Printing information.
Instrument	Used to select chart speed units, alternative chart speed, printing mode, password, ID number, operator alarm, access and definition of the optional user-entered Custom Curve.
Alarm	Used for selecting the type and action of all alarms. Also used to define associated alarm messages.
Relays	Used to assign the optional relay and/or triac contact outputs to alarms, internal triggers and totalisers.
Totalisers (optional)	Used to set scaling factors, cut-off limits, reset conditions and tag name of each Totaliser (integrator).Log setup (optional)Used to define the circumstances that can automatically initiate an Instrument Log.
Custom messages (Optional)	Used to define up to ten user-defined messages of up to 16 alphanumeric characters each.TimersFour Clock or Calendar Timers that can be used to initiate logs, print mode changes, chart speed changes, various resets, etc. within the recorder.
Event Replay (optional)	Used to for define the operating parameters associated with: 1. The Trace History Function that stores up to 15 minutes of record history, for replay when a specified action occurs. 2. The Range Magnify Function that increases the resolution of a record by expanding (on command or automatically), a defined segment of a channel record to full scale. Ranges can also be condensed to cover a wider range of input value changes.
Derived variable (optional)	Used for the selection and combination of maths (+, -, x, $\pm$, ave, etc.) and predefined function operators (mass flow, F_o, RH, etc.) and constants for up to three calculated-value channels.
Communications (optional)	Allows communications with a host computer for reading and writing values.
Retransmission (optional)	Provides a linearised version of the relevant input signal, scaled 0 to 10 Volts.
Instrument Alarms	Used for the indication of the results of the instrument self check features. RAM battery status, operating ROM condition and the integrity of stored configuration data are checked.
Change Calibration	Used for instrument calibration (using high precision voltage, resistance and temperature inputs) and for re-entry of the factory calibration stored at manufacture.

Note... The items marked 'optional' above are described in the Options section of this document (section 5)

MAIN MENU (Cont.)
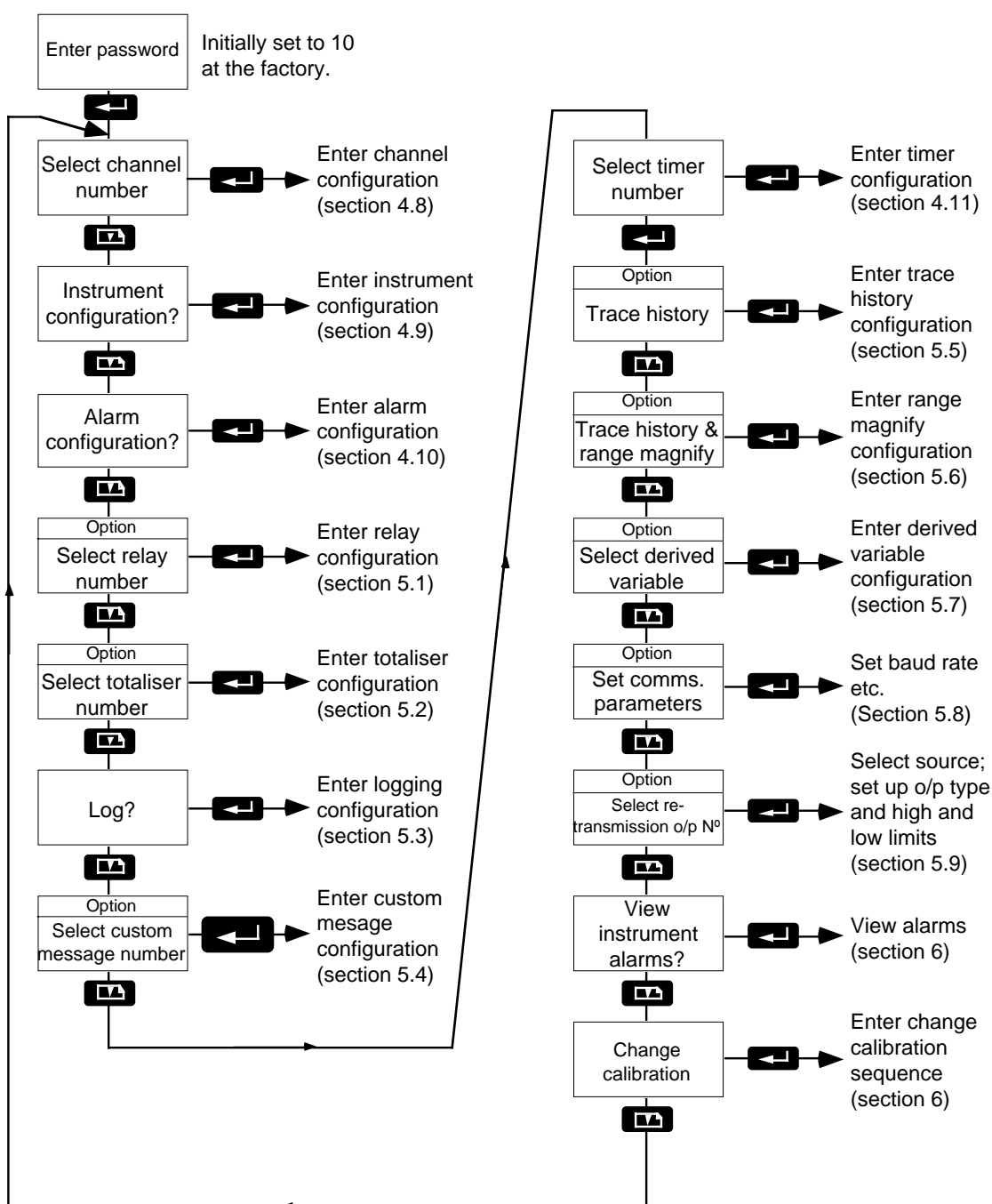
Figure 4.7 Main menu organisation

4.8 INPUT CHANNEL CONFIGURATION

4.8.1 LINEARISATION FUNCTION

```
C1 Lin. Func.
    Linear
```

This page selects the relationship between the input signal and the recorded / displayed value.   The up and down arrows are used to scroll through the following possible choices:

OFF   The channel value is displayed as OFF, and the trace is printed at the left edge of the chart (unless the trace is turned OFF).

Linear   No linearisation is applied to the input signal.

Square root   The recorder applies a square root function to the input (eg input =4, output =2).

3/2 power   The recorder takes the square root of the input, and raises the result to the power of 3 (e.g. input = 4; output = 8).

5/2 power   The recorder takes the square root of the input, and raises the result to the power of 5 (e.g. input = 4; output = 32).

Log-Base 10   Applies anti-log function to input signal (eg input = 4, output = 10,000).

Custom curve   Applies a user-entered linearisation table to the input signal.

Thermocouple   Applies Type B, C, E, J, K, L, N, Ni/NiMo, R, S or T linearisation to the input signal.

RTD   Applies 10 ohm copper, 100 ohm Pt (ANSI), 100 ohm PT (DIN), 100 ohm Nickel or 120 ohm Nickel resistance thermometer linearisation to the input signal.

Comms   'Comms' must be selected if values are to be written to process variables from a host computer.

Note...
Refer to Section 2.4 for information relating to the input amplifier board links which have to be set according to the type of input.

4.8.2 CHANNEL UNITS

```
C1 Units
    ˚C
```

This page allows the up and down arrows to be used to select ˚C, ˚F or user-entered units for the channel input signal.   These units appear in any display page which includes the relevant channel's units.

4.8.3 DECIMAL POINT POSITION

```
C1 Dec. Point
    X.XXXX
```

 The display shows the current position of the decimal point in the channel's displayed variable. The up and down arrow keys can be used to scroll through the choices: X.XXXX, XX.XXX, XXX.XX, XXX.X and XXXXX.It should be ensured that the number of decimal places chosen is not beyond the resolution capability of the input transducer, and that the least significant digit(s) do not change so rapidly as to make the display difficult to read.

4.8.4 PROGRAMMABLE UNITS

```
C1 Prog. Units

```

This page appears only when programmable units have been selected in the units display page previously described.   The up, down and side arrow keys are used to enter the units string required by the user.

4.8 CHANNEL CONFIGURATION (Cont.)

Select channel number for configuration

Operation of the **C** key causes a return to the previous (higher) menu level

Select linearisation function

Select temperature units ˚C, ˚F or 'Prog'

Select decimal point position

Enter programmable units string

Only if 'Prog' selected as temperature units

Select input type

Set low range

Set high range

Set low input

Set high input

Not for thermocouple inputs

Set low chart

Set high chart

Set value for magnification centre

Set filter time (seconds)

Set CJC internal or external

Only for thermocouple input type

Enter channel descriptor

Select annotator trace on/off

Set interpolation on/off

Make channel adjustments

Figure 4.8 Channel configuration menu organisation

4.8 CHANNEL CONFIGURATION (Cont.)

4.8.5 INPUT TYPE

```
C1 Input type
     Volts
```

This page is used to define the type of input which is connected to the channel.   The up and down arrows are used to select Volts, millivolts, Ohms or thermocouple as input type.

For direct connection of thermocouples, 'Thermocouple' should be selected both here and in the linearisation page previously described.   For indirect connection, Volts or millivolts as appropriate, should be chosen here, and the relevant thermocouple type in the 'linearisation' page described above.

Input low/high defines the actual electrical input.   This must lie within the range of the chosen thermocouple.

4.8.6 RANGES, INPUTS & CHART SPANS

Range, Input and Chart span entries combine to define how the measurement is presented on the Display and/or Chart.

Range: This is set to include the highest and lowest values to be measured in the Engineering Units to be used.

Range Low and High Values must be entered for all inputs. This is true even for direct TCs and RTDs to permit automatic setting of the recorder internal operating span (gain) for these inputs.

Input: This selection defines the Type of Input to be measured.

Example:
A transmitter ranged for 0 to 1000 litres per minute produces a 4 to 20 mA signal.   This is converted to 1 to 5 volts at the recorder by a 250   shunt.   The recorder Input is: lo = 1.00 V.; hi = 5.00 V.   The recorder Range is: lo = 0 litres per minute hi = 1000 litres per minute

The defined Range is used by the recorder to select one of the hardware ranges shown in table 4.8.6 below:

Hardware Range	Input accuracy	Pen accuracy	Minimum span
- 4.0 to + 20 mV	± 0.02 mV	± 0.04 mV	4 mV
- 12.0 to + 60 mV	± 0.06 mV	± 0.12 mV	15 mV
- 16.0 to + 80 mV	± 0.08 mV	± 0.16 mV	20 mV
- 40 to + 200 mV	± 0.20 mV	± 0.40 mV	50 mV
- 80.0 to + 400 mV	± 0.40 mV	± 0.80 mV	100 mV
- 0.34 V to + 1.7 V	± 1.7 mV	± 3.4 mV	425 mV
- 0.50 to + 2.5 V	± 2.5 mV	± 5.0 mV	625 mV
- 1.00 to + 5.0V	± 5.0 mV	± 10.0 mV	1.25 V

Table 4.8.6 Ranges, accuracies and spans

In order to measure negative going input signals, it is sometimes necessary to make the recorder select a higher than normal internal span (with a larger 20 % negative capability) as described in the channel range calibration description in section 6 of this manual.

Example:
To measure -1.0 V. to 1.0 V., the recorder must select the -1.0 to 5.0 V. internal span. A -100 to 100 foot range with an input of -1.0 to 1.0 V must be configured as a range of -100 to 500 with an input of 1.0 to 5.0 V.

4.8 CHANNEL CONFIGURATION (Cont.)

4.8.6 RANGES, INPUTS & CHART SPANS (Cont.)

Chart: In the above example, only the -100 to 100 foot portion of the range is needed on the chart. The
                    chart low/high settings permit the setting of a chart range that is not the same as the channel low/
                    high range.

HIGH AND LOW RANGE

```
C1 Range Low/High
  X.XXXX  units
```

X.XXXX   This is the Low / High end (in Engineering Units) of the Displayed and/or Recorded range. The
                    values are entered using the Up/Down/Side Arrows.

Although the recorder may function beyond the entered TC/RTD range endpoints, performance will be affected
once the selected span is exceeded.   Stated recorder TC/RTD accuracy is valid only within the entered Range
limits.

Example:
A Type J thermocouple range of 0 to 500 degrees F represents a span of 14.993 mV.   This Range causes the
recorder to choose an operating span of -4.0 to 20.0 mV.   Above 663 degrees F (20 mV) the recorded and/or
displayed temperature values will not necessarily be within stated accuracy.

Note that the previously selected unit-of-measure will appear on these range displays.

INPUT HIGH AND LOW VALUES

```
C1 Input Low/High
   X.XXXX Ω,V,mV
```

This display is present only when the Input Type chosen is 'Volts', 'Millivolts' or 'Ohms'. The Up/Down/Side arrow
keys are used to define the low and high end electrical input values.

For these Inputs, the internal operating span (gain) will be calculated from the entered Input values. The recorder
may function outside these Input settings (up to the maximum Input values permitted), but stated accuracy is valid
only within the Input settings.

If' 'Ohms' is chosen as the input type and any RTD type chosen as the linearisation function, no input low or high
value need to be entered. The internal operating span (gain) will be calculated from the range low/high.

If 'Ohms' is chosen as the input type and 'linear' or 'custom curve' is chosen as the linearisation function, both
Input Low and High values must be entered to define a specific resistance input and permit calculation of the
internal span.

CHART HIGH AND LOW VALUES

```
C1 Chart Low/High
    X.XXXX units
```

These are the low and high end values of the chart record   (not necessarily the same as the Range Low/High
values). A segment of the Range can be expanded for more detailed chart recording. Also, the chart span can be
greater than the Range, effectively limiting the record to a portion of the chart.

4.8 CHANNEL CONFIGURATION (Cont.)

4.8.7 MAG CENTRE

```
C1 Mag Center
   -D.DDDD units
```

This page allows entry of a value about which the trace will be centred when trace magnification is instigated.

4.8.8 INPUT FILTER

```
C1 Filter time
   XX seconds
```

The Input Filter slows the Full-range response of the complete instrument from its normal 0.5 seconds (None) to: 1, 2, 4, 8, 16 or 32 seconds.   All functions, including alarm sensing and response, are slowed by this feature. The Up/Down arrow keys are used to change the selection.

4.8.9 CJC TYPE

```
C1 CJC type
    Internal
```

The TC Cold (reference) Junction compensation site (where the signal lead changes from Thermocouple wire or compensated leadwire to copper) can be specified as either the recorder case input terminal board (Internal) or a remote terminal area (External).

The Up/Down Arrows are used to select the appropriate CJC Type. If 'external' is chosen, the temperature of the remote site must be entered in the Instrument Menu (see Section 4.9).

4.8.10 CHANNEL DESCRIPTOR

```
C1 Ch. Descr.
????????????????
```

The Channel Descriptor is a 16-character tag which appears above the current value on a single channel display and is printed on the chart when the channel range is printed or the channels logged.   The Descriptor is entered using the Up/Down/Side Arrow keys. See section 4.4 'Entry of Alphanumeric Data' for a list of available characters.

4.8.11 ANNOTATOR TRACE ON-OFF

```
C1 Anno. Trace
      Off
```

This feature allows the annotator to be used to trace the channel value as a series of dots, in addition to its normal printing tasks.   The up or down arrow keys are used to toggle the annotator trace for the channel being configured on or off.

4.8 CHANNEL CONFIGURATION (Cont.)

4.8.12 INTERPOLATION ON-OFF

```
C1 Interplt.
        On
```

The up or down arrow key can be used to toggle interpolation on or off for a channel being configured to use the annotator pen to draw its trace. Interpolation on causes a horizontal line to be drawn between consecutive dots as depicted in figure 4.8.12.
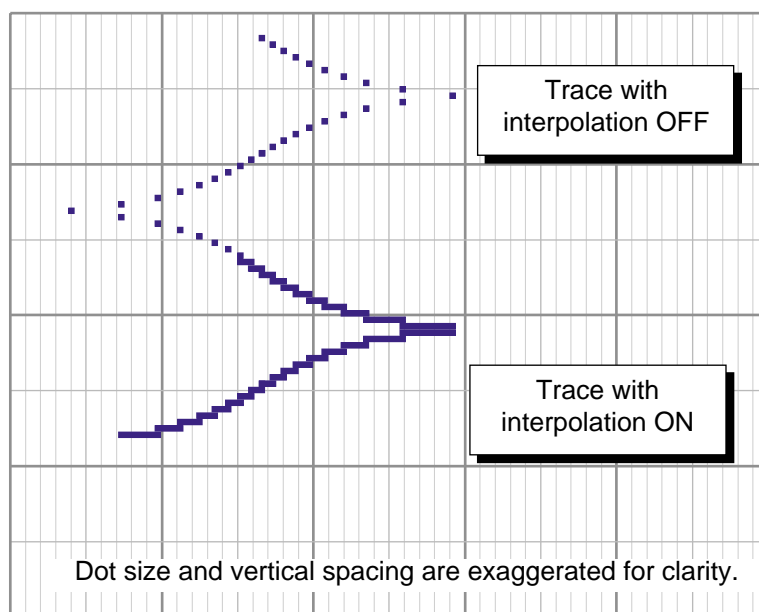
Figure 4.8.12 Interpolation example

4.8.13 CHANNEL ADJUST

```
C1 Ch. Adjust
   X.XXXX ?????
```

In some cases it is desirable to adjust the displayed and recorded Channel Value to agree with other measurements. The Adjust value is not limited. Positive values add to, and negative values subtract from the measured value.

The Channel Adjustment can also be used to 'zero' an input (such as a load cell) which has a unique input value for a zero output reading. The Up/Down/Side arrow keys are used to enter the amount of adjustment.

4.9 INSTRUMENT CONFIGURATION

4.9.1 ALTERNATIVE CHART SPEED

```
Alt.Chart Spd.
  XXX mm/hr
```

This display is used to establish an alternative (second) chart speed. Any speed between 1 mm/hr and 36,000 mm/hr (1 cm/sec) may be selected in 1 mm/hour increments. The up/down/side arrow keys are used to set the Chart Speed.

The alternative chart speed is selected on or off, manually from the operator menu (see section 3), or by means of the speed action equation display, below.

4.9.2 SPEED CHANGE EQUATION

```
Spd Act Eq ?
```

The recorder can be made to shift to the alternative chart speed using any of the internal triggers (such as an active Alarm) or an Event (contact) Input. See Section 3.4 for a discussion of Internal Triggers and Action Equations. Press Enter to review or change the action equation:-

```
Spd Act Eq P1
____,____,____,____,
```

This Action Equation defines the internal triggers that can be used to change to the alternative chart speed. The up/down/side arrow keys are used to enter the internal triggers.

4.9.3 CHART HOLD EQUATION

```
Cht Hold Eq ?
```

The chart hold function of the recorder can be initiated using any of the internal triggers (such as an active Alarm) or a Contact (event) Input. See Section 3.4 for a discussion of Internal Triggers and Action Equations. Press Enter to review or change the equation:-

```
Cht Hold Eq P 1
____,____,____,____,
```

The up/down/side arrow keys are used to enter the internal triggers to be used to initiate chart hold.

4.9 INSTRUMENT CONFIGURATION (Cont.)

4.9.4 PRINT MODE

```
┌─────────────────────────────────┐
│                                 │
│     Print Mode                  │
│                                 │
│                                 │
└─────────────────────────────────┘
```

There are three print modes available (if the annotator option is fitted), to allow the configuration of the chart record to meet different recording needs: The up/down arrow keys are used to select the required print mode. At chart speeds greater than 400 mm/hr. printing is disabled, as described in section 3.5.

NO PRINT MODE   No printing; channel traces only.Note...Features such as Trace History and Range Magnify require the printing of scale data to identify their data properly.

OVERPRINT MODE   Trace printing continues. All Annotation is printed over the channel records and at the selected chart speed.   Fast chart speeds cause printed characters to be taller.

BREAKTRACE MODE   Chart speed timing is interrupted for the Alarm, Log and Custom Messages.   Messages are printed at optimum speed for legibility with the chart advancing automatically between printing passes. Scale and Date/Time printing continues at the selected chart speed.

4.9.5 ID NUMBER

```
┌─────────────────────────────────┐
│       ID Number                 │
│         XX                      │
│                                 │
└─────────────────────────────────┘
```

This number (from 01 to 99) is contained in the ID Number/Chart Speed/Date/Time message which is printed on power-up and before each sequence of chart scales. It is entered using the up/down/side Arrow keys.

4.9.6 TIME FORMAT

```
┌─────────────────────────────────┐
│      Time Format                │
│          12                     │
│                                 │
└─────────────────────────────────┘
```

The time printed on the chart can be in 12 hour (AM/PM) format or in 24 hour format. The up/down arrow keys are used to select "12" or "24".

4.9.7 CHART SPEED UNITS

```
┌─────────────────────────────────┐
│    Chart Spd. Units             │
│        mm/hr                    │
│                                 │
└─────────────────────────────────┘
```

The Chart Speed can be defined in millimetres-per-hour (mm/hr) or inches-per-hour (in/hr). This choice is made to match the spacing of the time lines on the chart to be used. The up/down arrow keys are used for selection.

4.9 INSTRUMENT CONFIGURATION (Cont.)
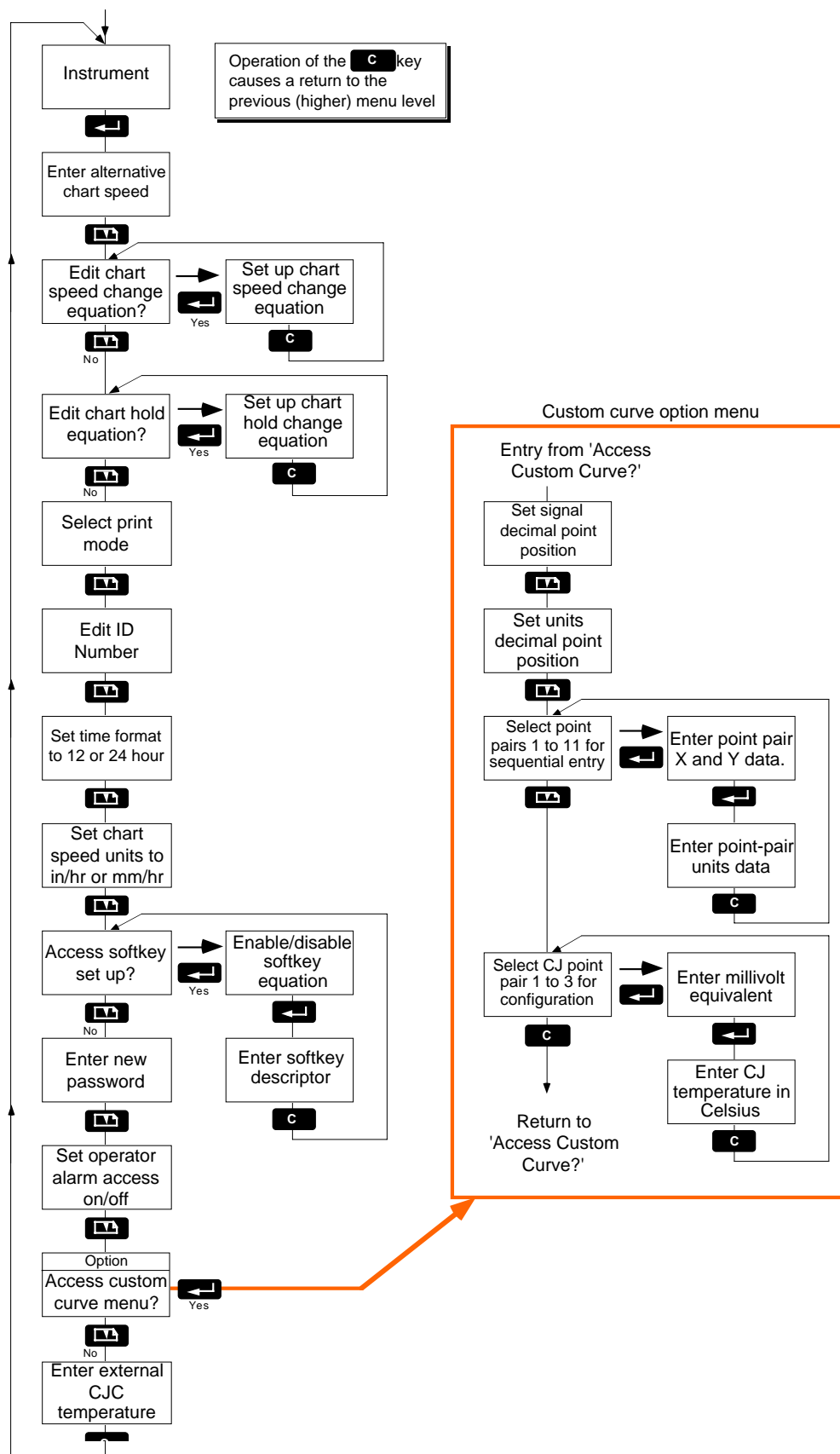
Figure 4.9 Instrument configuration menu arrangement

4.9 INSTRUMENT CONFIGURATION (Cont.)

4.9.8 SOFT KEY

```
┌─────────────────────────┐
│                         │
│      Soft key ?         │
│                         │
│                         │
└─────────────────────────┘
```

Press Enter to access the Soft Key Enable and Descriptor displays.   The Soft Key can be used to start, stop or res et any number of internal recorder features by operating any action equation (enter KEY into the equation).   It can also be given a unique 14-character name in the Operator Menu. See Action Equations in Section 3.4 for more details.

```
┌─────────────────────────┐
│    Soft Key En.         │
│         No              │
└─────────────────────────┘
```

The up/down arrow keys are used to enable or disable soft key operation from the Operator menu.

```
┌─────────────────────────┐
│    Soft key Desc.       │
│    DESCRIPTOR NO XX      │
└─────────────────────────┘
```

The up/down/side arrow keys are used to enter a tag name of up to 14-characters for the Soft Key. See Section 4.4 for entry of alphanumeric data.

4.9.9 PASSWORD

```
┌─────────────────────────┐
│    Password             │
│       XXX               │
└─────────────────────────┘
```

A new password of from one to three digits can be defined here. Unless the correct Password is entered, the Main Menu is not accessible for review or edit.   Permissible passwords are in the range from 1 to 999. The up/down/ side arrow keys are used to enter the new password.

Note...
    As shipped, the recorder password is: 10.

4.9.10 OPERATOR ALARM ACCESS ENABLE

```
┌─────────────────────────┐
│  Alarm Access           │
│    On / Off             │
└─────────────────────────┘
```

This display is used to determine whether an operator can access the recorder alarms from the Operator Menu. If the Access is 'ON' no password is needed to change alarm setpoints.   If the Access is 'OFF', alarm information does not appear on the Operator Menu.   The up/down arrow keys are used to change the selection.

4.9 INSTRUMENT CONFIGURATION (Cont.)

4.9.11 CUSTOMER LINEARISATION TABLE CONFIGURATION

```
Custom Curve
```

The Custom Curve is an 11-point, user-entered linearisation.   It is used as one of the linearisation functions (described in Section 4.8) to define the relationship between the input signal and the recorded/displayed value. When this option is present, 'Custom Curve ?' appears in the selection list for the channel Linearisation Function. The ENTER key is used to access the Custom Curve for review or edit.

CUSTOM CURVE DESCRIPTION

The Custom Curve combines the flexibility of a line/segment curve with the curve matching power of a polynomial equation.   The curve is defined in five segments, each segment consisting of three point-pairs which are used to calculate a second order polynomial equation for that segment.   Segment one is defined by point pairs 1, 2 and 3, segment 2 by point pairs: 3, 4 and 5, segment 3 by point pairs: 5, 6 and 7, and so on.   Adjacent segments share common end points to ensure continuity.

The curve is defined by entering unique point-pair values for all five segments.   For proper operation of the curve, all eleven point pairs must be entered.

The first step when using a Custom Curve is to determine the Input and Units values that define it.   If the curve is a series of straight lines (such as a tank profile), fewer than five segments may be adequate to define the area to be used.

For Custom Thermocouple curves, a three point Cold Junction Compensation curve must also be entered.

Note...
   If any of the 11 Point Pairs are not needed to define the Custom Curve, each pair's signal and unit values must be increasingly greater than the largest signal and unit values which are included in those unique point-pairs which are used (see point pairs eight to 11 in the example, below).

EXAMPLE

The volume of fluid in a tank is to be recorded by using a pressure transmitter mounted at the bottom of the tank. The pressure signal vs. volume is defined by a curve made up of two non-linear segments and one straight line segment, as shown below.

Note...
   Because the Custom Curve can be selected as the linearisation function for any channel the Point Pairs carry no range, units-of-measure or input units.   When the custom curve is configured, all values in the signal input and range low/high units have to be entered for the channel which is to use the curve.

CUSTOMER CURVE DECIMAL POINT POSITION: SIGNAL

```
Signal D P Pos.
   X.XXXX
```

This decimal position display is for the signal input values. Selection of the decimal position is by using the up/ down arrow keys (see section 4.8.3 for possible settings).

4.9.11 CUSTOMER LINEARISATION TABLE (Cont.)

Signal input		Units	Point
mA	mV	(%)	pair
4.0	1.000	0.00	1
4.5	1.125	2.22	2
5.0	1.250	6.67	3
5.5	1.375	11.11	4
6.0	1.500	20.00	5
13.0	3.25	60.00	6
20.0	5.000	100.0	7
	6.000	200.0	8
	7.000	300.0	9
	8.000	400.0	10
	9.000	500.0	11

Point pairs 8 to 11 must be entered even though they are not used.

Segment 1
Segment 2
Segment 3
Segment 4
Segment 5

Point pairs
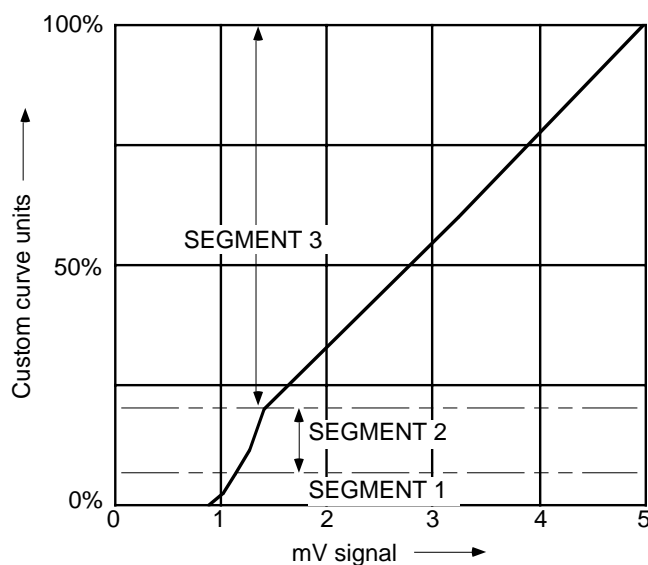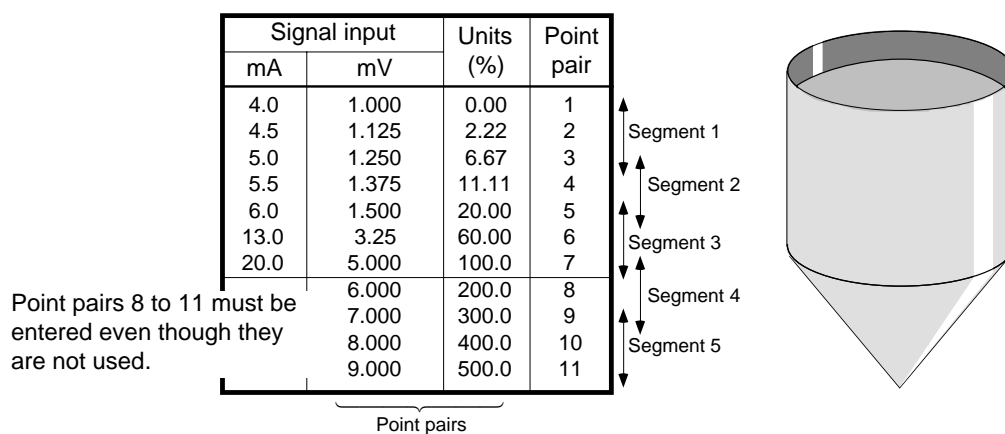
Figure 4.9.10 Customer linearisation curve example

CUSTOMER CURVE DECIMAL POINT POSITION: UNITS

```
Units D P Pos.
   X.XXXX
```

This decimal position display is for the range unit values. Selection of the decimal position is by using the up/down arrow keys (see Section 4.8.3 for possible settings).

4.9.11 CUSTOM CURVE LINEARISATION (Cont.)

POINT CONFIGURATION

```
┌─────────────────────────┐
│  Point Pair ?           │
│     XX                  │
└─────────────────────────┘
```

This display is used to select which of the 11 Point Pairs used to define the curve, is to be configured. The up/down arrow keys are used to define the relevant number, and the ENTER key is operated to call the next configuration page:-

Note...
    All eleven point pairs must be configured whether or not they are all used.

```
┌─────────────────────────┐
│  Pt. XX Signal          │
│     X.XXXX              │
└─────────────────────────┘
```

'Entry' of the point-pair number calls the above display for setting the pair input signal value. This value must be set in the same input values as the Channel which is to use the curve. The value is set using the up/down/side arrow keys. Once the value has been entered, the page-down key is operated to call the next configuration page.

```
┌─────────────────────────┐
│  Pt. XX Units           │
│     X.XXXX              │
└─────────────────────────┘
```

Operation of the page-down key after defining the signal value, calls the above display for setting the pair range units value. This value must be set in the same units of measure as the channel which is to use the curve. This value is entered using the up/down/side arrow keys. Operation of the clear key causes a return to the point-pair definition page, where the number of the next pair to be configured is entered.

COLD JUNCTION POINT PAIR CONFIGURATION

```
┌─────────────────────────┐
│  CJ Point Pair ?        │
│     N                   │
└─────────────────────────┘
```

The up/down/side arrow keys are used to select a CJ point-pair for configuration. The subsequent pages allow a three-point Cold Junction Compensation (CJC) curve for use with a thermocouple customer curve. The compensation curve is active only if input type 'Thermocouple' is selected for the channel which is to use the customer linearisation table. Operation of the ENTER key calls the first CJC configuration page.

```
┌─────────────────────────┐
│  CJ N mV.               │
│    XX.X mV              │
└─────────────────────────┘
```

The up/down/side arrow keys are used to enter the millivolt equivalents of the lowest (CJ1), midpoint (CJ2) and highest (CJ3) ambient temperatures that the recorder will encounter whilst using a customer-entered thermocouple linearisation table. The page-down key is operated to call the next configuration page.

```
┌─────────────────────────┐
│  CJ N Temp              │
│    XX.X C               │
└─────────────────────────┘
```

The up/down/side arrow keys are used to enter in degrees Celcius, the lowest (CJ1), midpoint (CJ2) and highest (CJ3) ambient temperatures that the recorder will encounter whilst using a customer-entered thermocouple linearisation table. The page-down key is operated to call the next configuration page.

4.9 INSTRUMENT CONFIGURATION (Cont.)

4.9.12 EXTERNAL CJC TEMPERATURE

```
Ext. CJC Temp.
  _0.0    ˚C
```

The up/down/side arrow keys are used to enter the a value in degrees Celsius, for the external CJC choice made during channel configuration.

4.10 ALARM CONFIGURATION
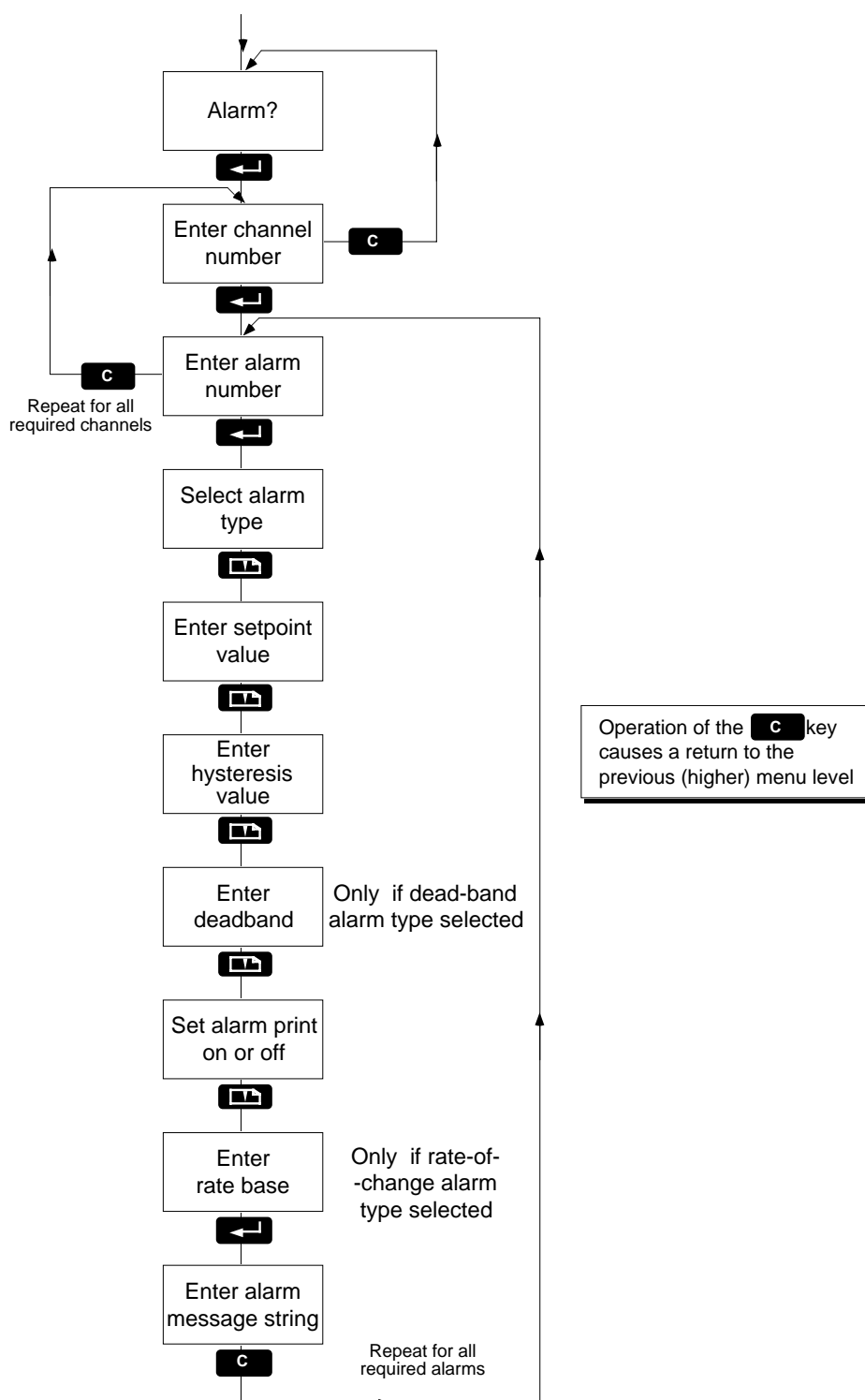
Figure 4.10 Alarm configuration menu arrangement

4.10 ALARM CONFIGURATION (Cont.)

Each channel (including the optional Derived Variable Channels) can have up to four Alarm setpoints. This means that the recorder can have up to 24 alarm setpoints.

4.10.1 ALARM CHANNEL SELECTION

```
┌─────────────────────────┐
│  Alarm channel ?        │
│         X               │
│                         │
└─────────────────────────┘
```

The up/down arrow keys are used to select the input channel or derived variable for which this alarm is to be configured.   Once the channel number has been selected, the ENTER key is used to call the next configuration page:-

4.10.2 ALARM NUMBER

```
┌─────────────────────────┐
│  Alarm Number ?         │
│         Y               │
│                         │
└─────────────────────────┘
```

Up to four alarms can be allocated to each channel or derived variable.   The up/down arrow keys are used to select which of these four is to be configured.   Once the selection has been made, operation of the ENTRY key calls the next configuration page.

4.10.3 ALARM TYPE

```
┌─────────────────────────┐
│  AXY Alarm Type         │
│      Type               │
│                         │
└─────────────────────────┘
```

This page allows the alarm type to be chosen, using the up/down arrow keys.   Available alarm types are as follows: Off, absolute high, absolute low, deadband and rate-of change (rising and falling).   Once the alarm type has been selected, the page-down key is used to access the SETPOINT display page

XY   Defines the channel number (X) and alarm number (Y) currently being configured. This identifier appears on each alarm configuration page.

Type   Off. This selection is used to disable an alarm even when it is fully configured.
            Absolute high.   This type of alarm is active when the measured value lies above the setpoint value. A hysteresis value can be entered later in the configuration, if required.
            Absolute low.   This type of alarm is active whenever the measured value lies below the setpoint value. A hysteresis value can be entered later in the configuration, if required.
            Deadband (deviation).   This type of alarm is active whenever the measured values lies outside a dead band to be specified later in the configuration.
            Rate of change rising.   This type of alarm is active if the measured value rises at a rate greater than that to be specified later in the configuration.
            Rate of change falling.   This type of alarm is active if the measured value falls at a rate greater than that to be specified later in the configuration.

Note...
    It is recommended that a filter setting of one second is used for rate of change alarms.   Longer time periods might slow rapid input changes to below the trigger point, whilst if no filter is used, an input step change might move too quickly for the recorder to measure a rate.

4.10 ALARM CONFIGURATION (Cont.)

4.10.3 ALARM TYPE (Cont.)

APPLICATIONS EXAMPLES

1. RATE-OF-CHANGE, RISING

When a large piece of rotating machinery is cold started, it is important to know if any of the bearings are overheating. An absolute alarm could be used but, during start-up, it would not give a warning until the bearing reached its normal operating temperature, which could be too late.If however, a rate-of-change type of alarm is used, it can be detected that the bearing is heating up more quickly than it should, thus giving advance warning of possible failure, allowing corrective action to be taken before any major damage is done.

2. ABSOLUTE HIGH, WITH HYSTERESIS

If a tank temperature absolute alarm is set to become active at say, 80 ˚C, then the alarm may become 'jittery' at 80 degrees, since a fall of only 0.1 degrees is sufficient to reset the alarm. Thus, any turbulence within the tank contents could cause the alarm to move continuously into and out of its active state, until the tank contents reached a temperature well above the set point. If the temperature of the tank is actually to be controlled at the setpoint temperature, the situation becomes even more unstable.

This problem is overcome using 'hysteresis', which effectively defines a deadband below the setpoint. In this example, a hysteresis of 5 degrees would still allow the alarm to become active at 80 degrees, but it would not reset until the temperature had fallen to 75 degrees.

4.10.4 ALARM SETPOINT

```
AXY Setpoint
  X.XXXX Units
```

An alarm setpoint is the value against which the measured value is compared. The up/down/side arrow keys are used to edit or enter a setpoint.

Notes...
1   Absolute High and Low setpoints are defined in terms of the measured value and represent levels beyond which an alarm becomes active.
2. A deadband (deviation) setpoint defines the centre of a band of measured values, within which the alarm is not active.
3. A rate-of-change setpoint represents a change in measured value which may not be exceeded (in the period to be configured in the RATE page described below) without the alarm becoming active

4.10.5 ALARM HYSTERESIS

```
AXY Hysteresis
 X.XXXX Units
```

If an absolute or deadband alarm resets exactly at the setpoint or edge of band, it can cycle in and out of Alarm frequently with a very slight change in measured value. Hysteresis prevents this by establishing the number of Units by which the Measured Value must pass the setpoint in the 'out-of-alarm' direction, before the Alarm resets. The up/down/side arrow keys are used to enter the value.

4.10 ALARM CONFIGURATION (Cont.)

4.10.6 DEADBAND

The following display appears only if 'deadband' alarm type, has been previously selected.

```
AXY Deadband
 X.XXXX ?????
```

The up/down/side arrow keys are used to enter a deadband value.   This value represents the size of the band (both above and below the setpoint), within which the alarm is not active.   For example if the setpoint is 80 units and the dead band is 5 units, then so long as the measured value lies between 75 and 85 units, the alarm will not be active.

4.10.7 ALARM MESSAGE PRINT ENABLE

```
AXY Alrm Print
   On / Off
```

The up/down/ arrow keys are used to select alarm print message on or off.   The printed message consists of the time and date of occurrence, the relevant channel and alarm number, the alarm on/off status and the user-entered alarm message (if any).

4.10.8 RATE BASE

The following display appears only if 'rate -of-change' alarm type, has been previously selected.

```
AXY Rate base
    /Hour
```

The up/down arrow keys are used to enter a period value of /Hour, /Min or /Sec.   The selection determines the period over which the rate-of-change 'setpoint' is to be measured.

4.10.9 ALARM MESSAGE

```
AXY Message
Valve overheat
```

The up/down/side arrow keys are used to enter an alarm message of up to 16 characters for printing when the alarm becomes active or resets. If alarm printing is enabled (see above), this message is printed on the chart along with the time and date of occurrence, the channel and alarm numbers, and the alarm on/off status.

Refer to section 4.4 for text entry details

4.11 TIMER CONFIGURATION

4.11.1 INTRODUCTION

Four timers are available for controlling recorder tasks. Each of these may be configured to be a periodic timer (which outputs an internal trigger when it reaches its preset duration), or a clock timer (which outputs an internal trigger when it reaches its preset date and time.)   See section 3.4 for the listing of internal trigger controlled functions.

CLOCK TIMERS

A clock timer follows the recorder clock time and date.   An internal trigger output (TM1 to TM4) occurs when the timer's preset time and date occur. If the year is not entered (blank) the clock timer becomes a yearly repeat timer at the time, day and month set.   If the month is also blank, the clock operates as a repeat timer at the same time and day every month.

If the day is also blank, the clock timer operates as a repeat timer at the same time every day.   If the hour is also blank, it becomes an hourly repeat timer at the same time every hour.

EXAMPLE

If the clock timer is set for 13:30 17, it will output an internal trigger at 1:30 PM on the 17th of every month.

If the clock timer is set for 13:30, it will output its internal trigger every day at 1:30 PM.

For a weekly timer, set a Clock timer with the complete time and date, for the first reset of a Period timer set to 10,080 minutes

PERIODIC TIMERS

A Periodic Timer starts when entered or when it is reset on command from an internal trigger. It outputs its own internal trigger (TM1 to TM4) after reaching the preset duration. This trigger can be used to reset a periodic timer making it a repeating interval timer.

Note...
    The Clock Timer internal trigger can be used to reset the periodic timer at a specific time and date.

POWER LOSS EFFECTS

Upon power loss, the clock timer will continue toward its time/date. If the preset time passes while power is off, no action can occur.

The period timer will re-synchronise to the next period-end after power is returned, if the power loss is for less than 2 hours.   For example, if the period timer were configured, using its own internal trigger, and started to repeat every hour on the hour, and if power were returned at 10:35; the timer would run for 25 minutes and then reset at 11:00.

If the loss of power is for more than two hours, the period timer will start again whenever power is restored.

4.11 TIMER CONFIGURATION (Cont.)
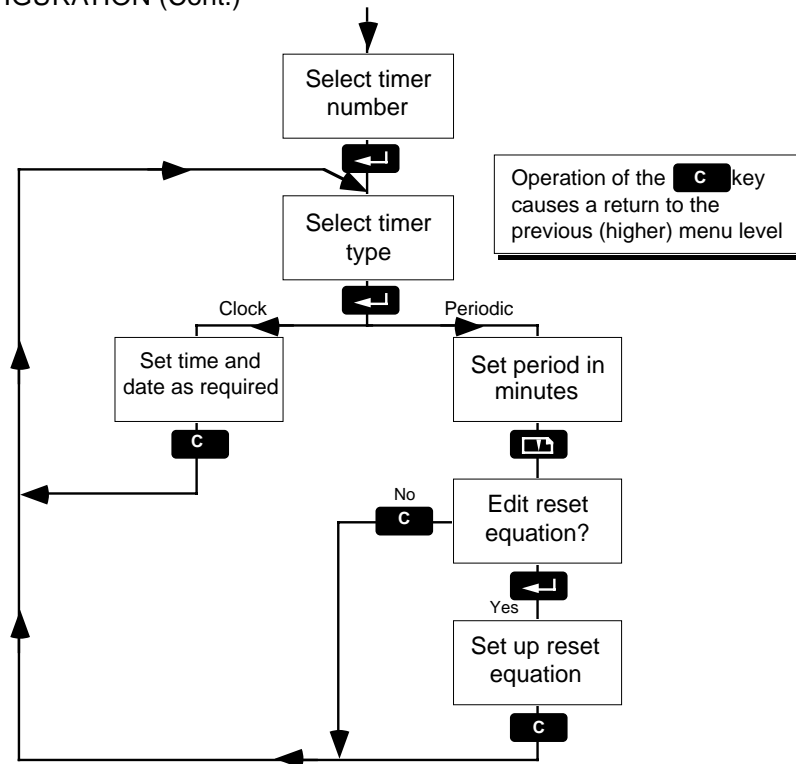
Figure 4.11 Timer configuration menu arrangement

4.11.2 TIMER CONFIGURATION PAGES

```
          Timer ?
             X
```

Use the Up/Down arrow keys to select timer 1, 2, 3 or 4.

TIMER TYPE SELECTION

```
      TM1 Type
             Off
```

The up/down arrow keys to select one of the following:

Off   Timer is turned OFF.
Clock   Timer will output its Internal Trigger when the preset Time/Date occurs.
Periodic   Timer will output its Internal Trigger when the preset Duration occurs.

TIMER OUTPUT

```
     TM1 Clock Out
       HH:MM DDMonYY
```

The up/down/side arrow keys are used to set the time and date for the output of the internal trigger. The format is:
HOUR:MIN DAY MONTH YEAR   Hours are set using a 24-hour clock (1 PM = 13 hours). If any of the param-
eters are left blank, the clock will output its trigger each time the remaining parameters occur, as described above.

PERIOD

```
     TM1 Period
     123456789 min
```

Use the up/down/side arrow keys to set the duration of the timed period in minutes.   The maximum duration is
999,999,999 minutes.

TIMER RESET

Press Enter to review or change the action equation which will reset a period timer.   This action Equation defines
those internal triggers which are to be used to reset a period timer.   See section 3.4 for a discussion of internal
triggers and action equations.   The up/down/side arrow keys are used to enter action equation internal triggers.

SECTION 5 OPTIONS
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(Continued)

List of contents (Cont.)

SECTION 5 OPTIONS

5.1 RELAY OUTPUTS

Relay outputs are added to the recorder as option cards. See Section 2.4 for option-slot usage choices. All output relays can be configured to operate in response to any internal trigger or external event input (see Section 3.4). Relays can also used for totaliser counter outputs (see Section 5.2).

```
    Relay ?
      XX
```

The up/down arrow keys are used to select a relay for configuration.   Relays in slots 3 & 4 are numbers one to 12. Relays in slot 5 are numbers 13 to 16.   Operation of the ENTER key calls the next configuration page:

```
RYNN Type
      Type
```

The up/down/side arrow keys are used to choose action equation, totaliser or OFF as relay type
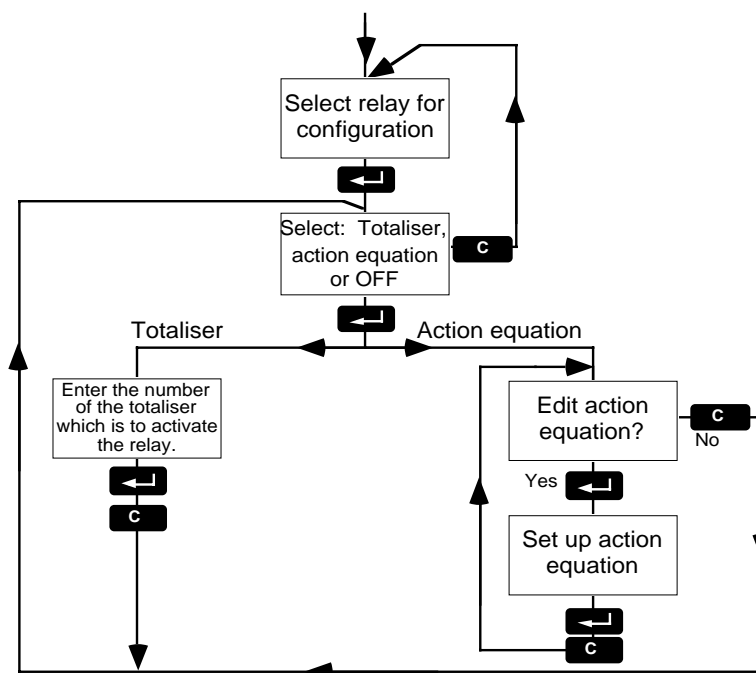
Figure 5.1 Relay configuration menu arrangement

5.2 TOTALISER OPTION

5.2.1 INTRODUCTION

A totaliser is an electronic integrator, primarily used to record the numeric total over time of a measured value that is expressed as a rate - (e.g., the number of gallons (since reset), based on a flow rate in gallons per minute). The totaliser reads the ranged numeric value of its input source once each second. Each reading is divided by the totaliser factor (usually the number of seconds in the Measured Value rate -/sec, /min, /hr, /day), and added to the total.

EXAMPLE

A totaliser is reading a gas flow range of 0 to 1200 cubic feet per minute (CFM). At half flow (600 CFM) the flow rate is 600/60 or 10.0 cubic feet per second. 10 counts will be added to the totaliser each second. A flow rate of 4320 cubic feet per day will give a totaliser input of 4,320/86,400 = 0.05 per second.   (86,400 = the number of seconds is a day ie 60 x 60 x 24).

Counts are added in whole units resulting in one count being added every 20 seconds (20 x 0.05 = 1).

A Totaliser can also be configured to be a Counter responding to contact closures measured by the optional Contact (event) Inputs (see Section 3.4). Count rates can be up to 50 pulses per second. Count rate scaling is described with the totaliser factor.

To begin configuration of a totaliser, the up/down arrow keys are used to select a totaliser number between 1 and 6, and the ENTER key is operated.

TOTALISER COUNTER OUTPUT OPTION

This feature permits the use of a separately specified output relay to 're-transmit' the totaliser count for use by an external counter or sampling system. Output counts can either be on a 'one-for-one' basis, with the totaliser counts (up to 50/second) or a scaled number (e.g. one output count for every 1000 totaliser counts.)

5.2.2 CONFIGURATION PAGES

TOTALISER TYPE

```
TTN Type
   Type
```

The up/down/ arrow keys are used to choose totaliser type, from OFF, continuous, preset up or preset down.

Note...
   A change to any part of the totaliser configuration will cause that totaliser to re-set.

Off	The integrating function is disabled.
Continuous	The input is summed until the totaliser is reset manually, automatically (at a count of 999,999,999) or by an internal trigger as set up in the appropriate action equation.
Preset down	The totaliser will count down from a pre-set number. When zero is reached, the totaliser activates an internal trigger which can be used for , amongst other things, re-setting the count to the preset number, and re-starting the count.
Preset up	The totaliser counts from zero up to a pre-set number. When this number is reached, the totaliser activates an internal trigger which can be used for, amongst other things, re-setting the counter to zero, and restarting the count.

Once the type has been selected, operation of the ENTER key calls the next totaliser configuration page.

5.2 TOTALISER CONFIGURATION (Cont.)

TOTALISER SOURCE

```
┌─────────────────────────┐
│  TTN Source             │
│       Source            │
└─────────────────────────┘
```

The up/down/ arrow keys are used to choose the source for the totaliser from measuring channel, derived channel or event input. Once the source has been selected, operation of the ENTER key will call the next configuration page.

TOTALISER FACTOR

```
┌─────────────────────────┐
│  TTN Factor             │
│      Factor             │
└─────────────────────────┘
```

The up/down/side arrow keys are used to enter a factor, according to the type of input specified in the previous page. The factor is entered as a single digit, followed by a power of ten. (See examples below).Channel sourceThe totaliser factor defines the time rate of the source channel in seconds. The page can also be used to define a ratio of measured counts per second to totalised counts.Event input sourceThe totaliser factor defines the scaling (ratio) of input counts to totalised counts.

EXAMPLES

1. To enter in seconds (as required), a time rate measured in hours, the factor is the number of seconds in an hour = 60 x 60 = 3,600, which can be written as 3.6 x 1000, or alternatively, 3.6×10^3

   When written in such a way, the value '3.6' is called the mantissa, and the '3' in '103' is called the exponent. The factor is entered in two pages, 3.6 being entered in the 'Mantissa' page, and '3' in the 'Exponent' page:

```
┌─────────────────────────┐
│  TT1 Fact Man           │
│   3.6000 Mant.          │
└─────────────────────────┘
┌─────────────────────────┐
│  TT1 Fact Exp           │
│        3 Exp.           │
└─────────────────────────┘
```

2. To enter in seconds, a time rate measured in days, the factor is the number of seconds in a day (86,400). This can be written as 8.64 x 10,000 or 8.64×10^4. Thus, in order to enter the factor, '8.64' is entered in the Mantissa page, and '4' in the exp. page.

```
┌─────────────────────────┐
│  TT1 Fact Man           │
│   8.6400 Mant.          │
└─────────────────────────┘
┌─────────────────────────┐
│  TT1 Fact Exp           │
│        4 Exp.           │
└─────────────────────────┘
```

5.2 TOTALISER CONFIGURATION (Cont.)
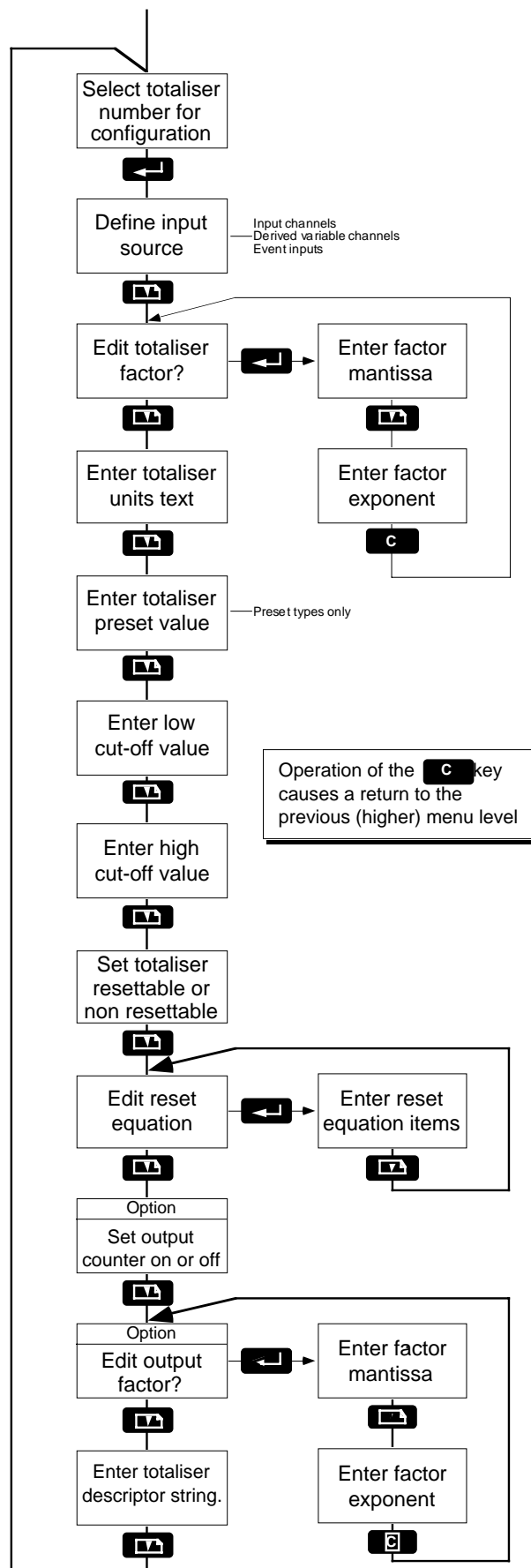
Figure 5.2 Totaliser configuration menu arrangement

5.2 TOTALISER FACTOR (Cont.)

Commonly used Totalisation Factors are:

	Seconds	Mantissa	Exponent (10^n)
Per second	1	1.0000	0
Per minute	60	6.0000	1
Per hour	3,600	3.6000	3
Per day	86,400	8.6400	4

It is important to remember that the Totaliser reads the Channel Value.   When configuring a channel, measured values that would normally be expressed in more than five digits (e.g. 0 to 3,000,000 Gallons per Day), must be ranged as a ratio of that number (e.g. 0 to 3,000 with a description of 'Gal./ Day X 1000'.   The totaliser would also be counting in thousands of gallons. 3,000,000 Gallons would add 3,000 Counts to the Totaliser.

It is also possible to make the totaliser count faster than the rate from the source.   To do this reduce the Factor Exponent value by the scaling multiple.   To scale the counting up by 1000, subtract 3 (10^3) from the Factor Exponent.

Note...
>   If the source is ranged 0 to 3.0 and the totaliser is scaled up by 1000, each 0.1 change in the source affects 100 counts; with a potentially large rounding error.   Source ranging in this case should be 0 to 3.000 where each 0.001 would represent 1 count.

To make a totaliser count more slowly, the factor is increased.   Directly totalising 30,000 gallons per minute (a factor of 6.0000 E 1) would add 43,200,000 counts per day and overflow the totaliser counter in 23 days.   If the Factor were scaled to count in thousands rather than units by changing the factor from 6.0000 E 1 (60) to 6.0000 E 4 (60,000); 43,200 Counts would be added per day - with each count representing 1000 gallons. The counter would then take over 60 years to reach 999,999,999.

FACTOR CONFIGURATION

Operation of the ENTER key calls the following display:

```
TT1 Fact Man
 X.XXXX Mant.
```

The mantissa part of the totaliser factor (calculated as described above) is entered using the up/down/side arrow keys, followed by an operation of the ENTER key, which calls the next display:

```
TT1 Fact Exp
     XX. Exp.
```

The exponent part of the totaliser factor is entered using the up/down/side arrow keys, followed by ENTER. Exponents from -30 to +30 may be used.   Operation of the CLEAR key calls the next page (totaliser units).

TOTALISER UNITS

```
 TT1 Units
UNITS
```

The up/down/side arrow keys are used to enter a five character unit-of-measure for the totaliser number.   Operation of the ENTER key calls the next display page.

5.2 TOTALISER CONFIGURATION (Cont.)

PRESET

```
   TT1 Preset
   XXXXXXXXX
```

This display is present only if 'Preset Up' or 'Preset Down' is the chosen type. A preset-up type counts up to this value, outputs its internal trigger and then stops until reset.   A preset-down type counts down from this number until it reaches zero.   It then outputs its internal trigger and stops until reset.

LOW CUTOFF

```
   TT1 Low Cutoff
      _0.000 Units
```

Some Measured Values are not meaningful near the low end of their range and some become negative when their input is turned off.   To avoid totalising these inaccurate signals, a low cutoff value (in measured value units) can be entered.   Totalisation stops below this value.   The up/down/side arrow keys are used to enter the low cutoff value.

HIGH CUTOFF

```
   TT1 Hi Cutoff
    _^^^^^^. Units
```

 The high cutoff stops totalisation above the entered cutoff Value.   The default setting is the over range value (^^^^). The high cutoff is set using the up/down/side arrow keys .

TOTALISER RESET

```
   TT1 Resettable
           No
```

This choice determines whether a totaliser can be reset. As long as this password-protected choice is NO, the totaliser cannot be reset.   Action equation and operator menu choices have no effect. The up/down arrow keys are used to change this choice.

TOTALISER RESET ACTION EQUATION

```
   TT1 Rset Eq ?
```

The ENTER key is used to review or change the action equation that controls the totaliser reset.   This action equation defines which internal triggers are to be used to reset the totaliser.   See Section 3.4 for a discussion of internal triggers and action equations.

A totaliser can be reset by its own trigger, making it possible for a preset totaliser to re-start automatically after it has reached its preset value.   The same internal trigger that starts a log can reset a totaliser each week, day, shift, etc. The up/down/side arrow keys are used to enter internal triggers.

5.2 TOTALISER CONFIGURATION (Cont.)

OUTPUT COUNTER ENABLE

```
┌─────────────────────┐
│  TT1 Cntr. Out      │
│          On         │
└─────────────────────┘
```

The up/down arrow keys to turn the optional totaliser counter output ON or OFF.

OUTPUT SCALING

```
┌─────────────────────┐
│  TT1 Out. Fact      │
│                     │
└─────────────────────┘
```

The ENTER key is operated to gain access the output factor mantissa and exponent editing pages The output can be scaled by the output factor to count at a different rate from that at which the totaliser counts.   The maximum rate for this trigger is 8 pulses per second, and each trigger pulse is "ON" for 50 milliseconds.Refer to the totalisation factor (above) for a description of this type of 'powers of 10' factor.

As with the normal totalisation factor previously described, the mantissa and exponent portions of the factor are entered on separate pages, by means of the up/down/side arrow keys.

DESCRIPTOR

```
┌─────────────────────┐
│  TT1 Tot. Desc.     │
│    DESCRIPTOR        │
└─────────────────────┘
```

The totaliser descriptor is a 16-character (max.) string which appears above the counter value in background totaliser displays and is also printed on the chart along with the totaliser count.   The descriptor is entered using the up/down/side arrow keys.

5.3 INSTRUMENT LOG

5.3.1 INTRODUCTION

The Instrument log can be configured to print out all active channels (including Derived Channels) and all active Totalisers. Alarm scanning and relay actions continue, but recording of Measured Values and Derived Variable is suspended while the Log is printing.

 The Log can be started from the operator menu or by one or more triggers in the log action equation. Once started, the log will continue to completion.

5.3.2 CONFIGURATION PAGES

LOGGING CHANNELS

The ENTER key is used to access the channel log display.   The up/down/side arrow keys are used to select those channels which are to appear in the Log.

LOGGING TOTALISERS

The ENTER key is used to access the totaliser log display.   The up/down/side arrow keys are used to select the totalisers whose values are to appear in the Log.

LOG INITIATION

Operation of the ENTER key allows editing of the logging action equation.   This action equation defines the internal triggers which are to cause the log to print.   See Section 3.4 for a discussion of internal triggers and action equations.

5.3 INSTRUMENT LOG (Cont.)
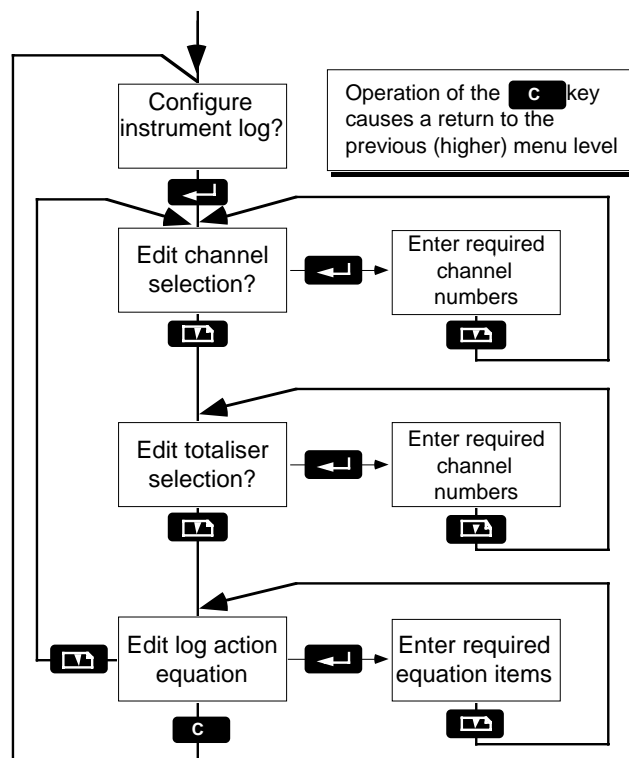
Figure 5.3 Instrument log configuration menu arrangement

5.4 CUSTOM MESSAGE OPTION

Custom Messages can be up to 16 alpha-numeric characters long and can be printed at any time by using the operator menu or an internal trigger as described in Section 3.4.   The up/down arrow keys are used to select a message number from one to 10.

5.4.1 MESSAGE ENTRY

The up/down/side arrow keys are used to define a 16-character message string. See section 4.4 for the library of message characters and numbers. When scrolling through the character listing, the speed of the scroll increases after the first six characters and again after the next six characters.   Stopping the scroll causes a return to the initial, slow, speed.

5.4.2 COLOUR SELECT

The up/down arrow keys are used to select the colour in which the message is to be printed.   This is a known software error; the model 345 can print only in violet, and will print in violet no matter what colour selection is made.

5.4.3 ACTION EQUATION

Operation of the ENTER key allows editing of the custom-message action equation.   This action equation defines the internal triggers that cause each custom message to print. See Section 3.4 for a discussion of internal triggers and action equations.

5.4 CUSTOM MESSAGE (Cont.)
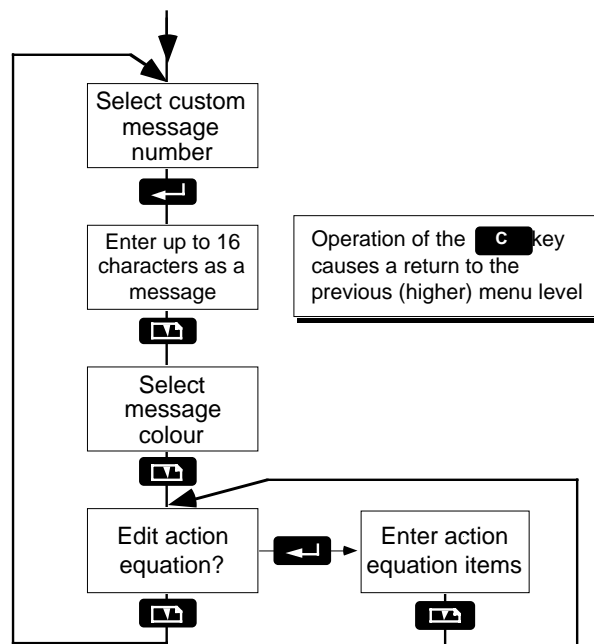
Figure 5.4 Custom message configuration menu arrangement

5.5 TRACE HISTORY

5.5.1 INTRODUCTION

This feature stores pre-event trace history for a channel and replays it when commanded to by an event (internal trigger, see section 3.4) or manual selection from the operator menu (see section 3.3).   Because each playback gives the most recent pre-event history, repeated playback of the same history is not possible.

The channel input is sampled and stored at a rate determined by the history chart speed selected. Actual playback is done at the fastest practical chart speed.   The playback chart span can be different from the span of the stored channel. A single 'magnification' factor can be applied to all selected channels as they are played back.

The time period of trace history that can be stored is related to the selected history chart speed.   75 mm of chart record is stored (1.5 hrs. of record at a history chart speed of 50 mm/hr). Faster chart speeds require more stored data values and decrease the time period of the trace history that can be stored.

In order to present the complete picture of conditions surrounding an event, an additional 75 mm of post-event data is stored starting at the event which triggered history.

The post-event data is then played back on the chart at maximum speed after the trace history.   Replay ends when it catches up with 'real-time' or when the content of the chart buffer has been printed.   Current data is followed by the printing of all history scales in Break-trace Mode (chart timing is interrupted).

5.5.2 CONFIGURATION PAGES

CHART SPEED

This selection determines the time period of the replayed record on the chart.   The Up/-Down/Side Arrow keys are used to enter the History Chart Speed.   To determine the time (in hours) covered by Trace History, the selected History Chart Speed is divided into 75 mm (3 in). (See examples in the table below.

History chart speed (mm/hr)	History time
20	3.75 hours
100	45 minutes
300	15 minutes
3000	1.5 minuts

MAGNIFICATION FACTOR

The playback of History can use the Configured Channel Range or it can be 'Magnified' to a different Range. Although it operates similarly, this is not the same Range Magnify function as that described in the next section (5.6).   The Up/Down/Side Arrow keys are used to set the single Magnification Factor (between .05 and 20) for all History Traces selected for Magnification.

MAGNIFICATION CENTRE

A value can be set up in the channel configuration to act as a centre point for the magnification function.   If such a value is not entered, the range history will be centered about the input value at the time 'history' is requested.

5.5 TRACE HISTORY (Cont.)
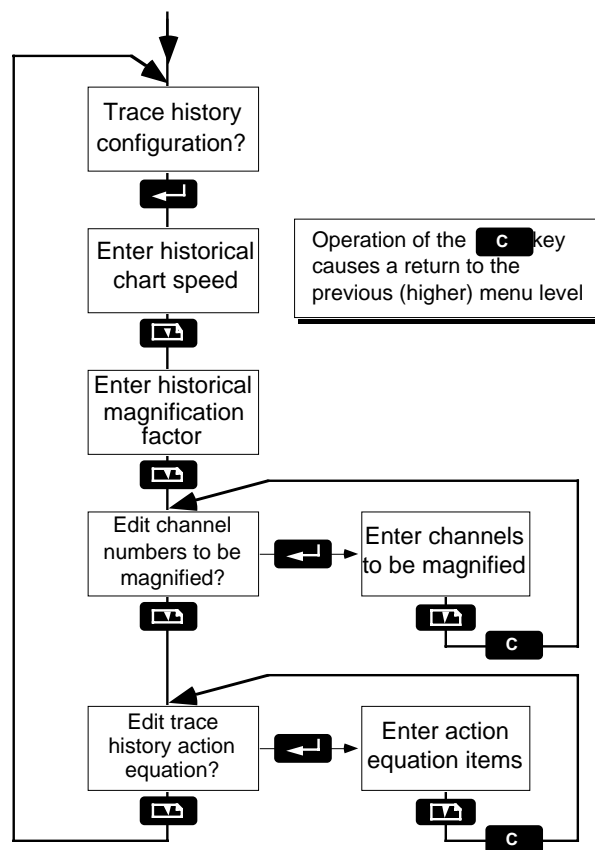
Figure 5.5 Trace history configuration menu arrangement

CHANNEL SELECTION

Press Enter to review or change the listing of the channels that will be magnified when history is replayed.Use the up/down/side arrow keys to enter the channels to be Magnified when History is replayed.

HISTORY ACTION EQUATION

Press Enter to review or change the action equation which is to initiate trace history.

This Action Equation defines the internal triggers that are to activate the trace history function. See section 3.4 for a discussion of internal triggers and action equations. Use up/down/side arrow keys to enter internal triggers for history action equations.

5.6 RANGE MAGNIFY

5.6.1 INTRODUCTION

When signalled by an internal trigger (section 3.4) or when manually selected from the operator menu (section 3.3), this feature changes the ranges of all selected channels. Range magnify is independent of the History Magnify feature described above, except in that the Mag. Centre' function (described below) applies to both.

The term 'magnification factor' is used for the number that determines how much and in which direction the range will be changed. A factor of greater than 1.0 expands the range, so that a smaller part of the range appears on the chart, but with more detail. A factor of less than 1 contracts the range giving less detail.

MAGNIFICATION CENTRE (MEASURING CHANNELS)

The 'Mag center' value is set up in the channel configuration pages for each relevant channel, and providing that it lies within the channel's range, this value acts as a centre point for the magnified range.

EXAMPLE

The normal input range for a channel is 0 to 1200 ˚C; the magnification factor is set to 6; the magnification centre is set to 900 ˚C.With the above settings, the magnified range (normal range divided by the magnification factor) is 1200 / 6 = 200 ˚C. The range ($\pm$100 ˚C) is centred about the centre value, giving a new scale of 900 $\pm$ 100 ˚C i.e. 800 to 1000 ˚C.

If the centre value lies outside the normal range, it is ignored and the magnified range is centred about the process value existing at the time of Range Magnify initiation.   In such a situation, on-chart printing is assured, but the resulting scale end values can be non-integer.

MAGNIFICATION CENTRE CONFIGURATION (MEASURING CHANNELS)

The Magnification display page appears after the 'Set Chart Range' display page in the channel configuration menu (section 4.8)

MAGNIFICATION CENTRE (DERIVED CHANNELS)

The operation of the Magnification Centre feature for derived channels is the same as that described above for measuring channels, with the following exception:

The high and low range inputs in the derived channel configuration are used to enable / disable the Magnification Centre function.   The function is active when the high and low range are set above and below the centre value respectively.   The feature is disabled if both low and high range values are set either above or below the centre value.

MAGNIFICATION CENTRE CONFIGURATION (DERIVED CHANNELS)

The 'Range High', 'Range Low' and 'Mag Center' display pages appear after the 'Enter Descriptor String' page in the derived configuration (section 5.7.3)

5.6 RANGE MAGNIFY (Cont.)
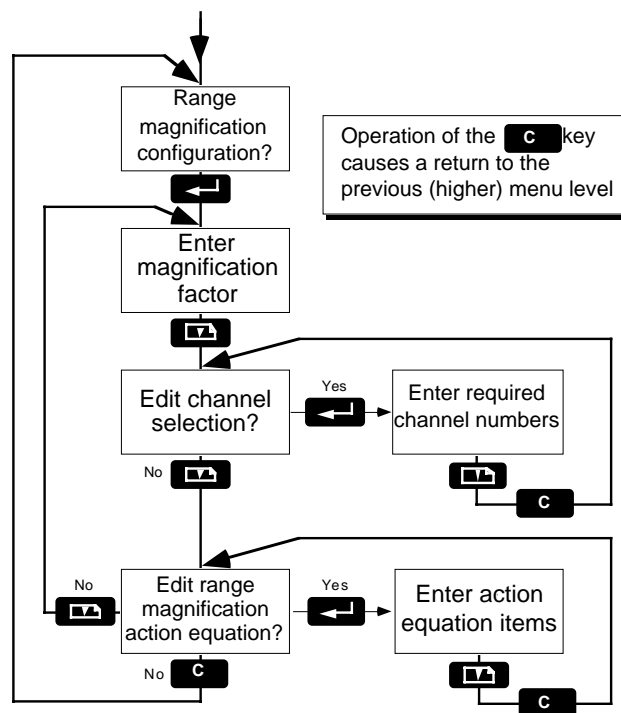
Figure 5.6 Range magnify menu arrangement

5.6.2 RANGE MAGNIFICATION CONFIGURATION PAGES

MAGNIFICATION FACTOR ENTRY

Factors between 0.05 and 20.00 can be entered using the Up/Down/Side Arrow keys. This is not the same factor used in the Trace History function, described above.

MAGNIFICATION CHANNEL ENTRY

Press Enter to review or change the channels selected for Range Magnification. All selected channels Magnify by the same factor. Use the Up/Down Arrow keys to select channels to Magnify

MAGNIFICATION ACTION EQUATION

The ENTER key is operated to review or change the action equation which will activate range magnify.   This equation defines the internal triggers that are to activate the range magnify function. See section 3.4 for a discussion of internal triggers and action equations. The up/down/side arrow keys are used to enter the action equation internal triggers.

5.7 DERIVED VARIABLES

5.7.1 INTRODUCTION

The derived variable feature provides basic and specialised maths functions.   These functions combine channel inputs, user-entered constants and pre-configured equations to derive variables which may be viewed, recorded and/or used in other calculations.There are two classes of DV: basic and specialised.   Because of processing time allocations, only two specialised DVs can be used at any one time.   The 'basic' functions are as follows:

Off	No Derived Variable (default state)
Add	A + B
Subtract	A - B
Divide	A B
Multiply	A X B
Lin. Slope	(A X B) + C
High Select	A > B = A
Low Select	A > B = B
High Peak	Highest value since reset
Low peak	Lowest value since reset
Average	Single point average
Polynomial	$B + CA + DA^2 + EA^3$

The specialised functions are:

Log 10	B x log10A
Power 10	$B \times 10^A$
Flow, Sq.Rt	Mass flow - Square Law
Flow, Linr.	Mass flow - Linear
F value	Sterilization F value (Fo)
RH	Relative humidity
ZrO_2 Sensor	Zirconia oxygen probe (Nernst oxygen equation)

Note...
   The above formulae use letters A, B, C, etc. for derived variable inputs. In the configuration menu, the Inputs are identified as 'Input 1', 'Input 2', 'Input 3' and so on, respectively.

Derived variables (DV's) take their inputs from channel inputs, other derived variables or constants and are updated once every second.   Each DV channel includes three registers for individual DVs.   With two (or three) DV channels, the six (or nine) DV registers are freely assignable to any DV channel.

DVs can be used like building blocks to construct formulae and equations as shown in the example below.

5.7 DERIVED VARIABLES (Cont.)

```
            Ch1    Ch2      Ch3
           ┌─────────────┐
           │     Add     │    │
           └─────────────┘    │
         DV1                   │
         Ch1 + Ch2 │           │
                  ┌───────────────┐
                  │      Add      │
                  └───────────────┘
                   DV2 │
Constant = 3 │             │
                   │           Ch1 + Ch2 + Ch3
                 ┌───────────────┐
                 │      Div      │
                 └───────────────┘
                  DV3 │
                       Ch4
```

$$Ch4 = \frac{Ch1 + Ch2 + Ch\,3}{3}$$
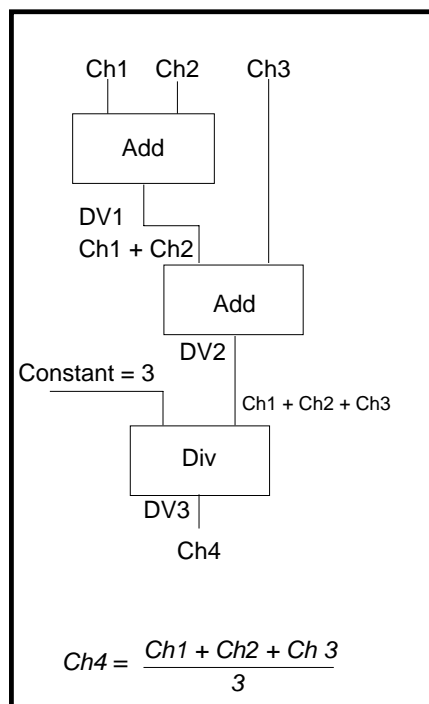
EXAMPLE

To calculate the average of the measured inputs of channel 1 to channel 3 and output it to channel 4.

Note...

   Derived Variables operate on the engineering units of an input channel. If a 4 to 20 mA input is measured as 1 to 5 Vdc and scaled 0-1000 kPa the DV calculations use values of kPa.

5.7.2 MATHS FUNCTIONS

The following functions are scrollable in the DV configuration menu:

Off	Used to turn a DV off, all DVs are initially in the off state.
Add	Add input 1 to input 2
Subtract	Subtract input 1 from input 2
Divide	Divide Input 1 by input 2. Should input 2 be, or become 0, the output goes to 99999.
Multiply	Multiply Input 1 by input 2
Lin. Slope	ax + b function where x is input 1, 'a' (slope) is input 2 and b, (offset), is input 3.
High select	High Select. The value is the higher of IN1 or IN2 values.
Low select	Low Select. The value is the lower of IN1 or IN2 values.
High peak	High Peak. The value is the highest value of IN1 measured since the function was last reset (by action equation). Function resets to current value.
Low peak	Low Peak. The value is the lowest value of IN1 measured since the function was last reset (by action equation). Function resets to current value.

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

5.7.2 MATHS FUNCTIONS (Cont.)

Average   Single-point cumulative average. The value of input 1 is sampled every 'input 2' seconds (minimum 5 seconds; maximum 32767 seconds). The sample is then added to the cumulative total and divided by the cumulative number of samples.

Since the number of samples is limited to 65536 (91 hours if at 5 seconds per sample), this average is most useful for a batch rather than as a continuous measurement. The function resets (by Action Equation (see 3.4) or after 65536 samples) to the current input value.

Note...
    The input filter (channel menu, section 4.8) is, in effect, a running average with the number of samples held continuously equal to the number of filtering seconds.

Polynomial Third order polynomial curve fit: $A+BX+CX^2+DX^3$, where:

Input 1 =   variable (X)
Input 2 =   constant A
Input 3 =   constant B
Input 4 =   constant C
Input 5 =   constant D

Log 10   Log to the Base 10: Output is input 2 x $\log_{10}$ input 1 where, input 1 is the variable, and input 2 is a scaling factor.

Power 10   Power of 10: Output is input 2 x $10^{input\ 1}$ where input 1 is the variable and input 2 is a scaling factor. Input 1 must lie between +30 and -30, or else the output is 0000.0

Flow, Sq. Rt   Square Root Mass Flow (AGA 3 Gas Flow):

$$Output = Input1\,x\sqrt{\frac{Input2\,x\,Input3}{Input4\,x\,Input5}}$$

where: Input 1 =   (C') universal scaling constant.
                Input 2 =   (h_w) differential pressure in inches of water.
                Input 3 =   (pf) static pressure in PSI(A).
                Input 4 =   (Tf) flow temp in degrees Rankine (˚F + 460)
                Input 5 =   compressibility correction

Should Input 4 or Input 5 ever be 0.0, the DV value will limit at 99999.

Flow, Linr.   Linear Mass Flow (AGA 3 Gas Flow):

$$Output = Input1\,x\frac{Input2\,x\,Input3}{Input4\,x\,Input}$$

where: Input 1 =   (C') universal scaling constant.
                Input 2 =   (hw) differential pressure in inches of water.
                Input 3 =   (pf) static pressure in PSI(A).
                Input 4 =   (Tf) flow temp in degrees Rankine (˚F + 460)
                Input 5 =   compressibility correction

Should Input 4 or Input 5 ever be 0.0, the DV value will limit at 99999.

5.7.2 MATHS FUNCTIONS (Cont.)

$$Fo_t = Fo_{t-1} + 0.00839166 \times 10^{\frac{Input1 - Input2}{Input3}}$$

F value   F Value (Sterilization Constant)

where: Fo_t = Current Fvalue
                          Fo_{t-1} = Last time's F value
                    Input 1 = input temperature
                    Input 2 = sterilising temperature
                    Input 3 = 'z' value.

The constant 0.00839166 is a minutes/sample factor, derived by dividing the sample time of 503.5 msec. by 60

Fo reset sets the Fo_{t-1} term to zero.

Should Input 3 (z value) ever be zero, the output limits at 99999.

RH Relative Humidity.

The % relative humidity equation requires the following inputs:

                    Input 1 = wet bulb temperature (in ˚C)
                    Input 2 = dry bulb temperature (in ˚C)
                    Input 3 = atmospheric pressure (in BAR)
                    Input 4 = psychrometric constant (6.660×10^{-4})

ZRO2Sensor ZrO_2 Sensor - Zirconia Oxygen Probe.

The output is the partial pressure of oxygen

$$Output = \frac{Input\ 1}{10^B}$$

where: Input 1 = partial pressure at electrode in %

$$B = \frac{Input\ 2}{0.0496 \times Input\ 3}$$

Input 2 = probe emf in mV
Input 3 = Probe temperature in degrees Rankine (Fahrenheit + 460)

5.7.2 MATHS FUNCTIONS (Cont.)

DERIVED VARIABLE EXAMPLE

Two transmitters measuring the same flow for High/Low split range giving increased resolution and accuracy for low flow: flow transmitter No.1 functions from 0 to 100 Litres per sec (l/s); flow transmitter No.2 functions from 100 to 1000 l/s

```
┌─────────────────────────────────────────────────────────────┐
│                                                               │
│        Transmitter 1          Transmitter 2                   │
│       (0 to 100 GPM)        (100 to 1000 GPM)                 │
│                                                               │
│      ┌──────────────┐        ┌──────────────┐                │
│      │  Channel 1   │        │  Channel 2   │                │
│      │Scaled 0 to 100│       │Scaled 100 to │                │
│      │    GPM       │        │   900 GPM    │                │
│      └──────────────┘        └──────────────┘                │
│  Constant: 100                       Constant: 0              │
│      ┌──────────────┐        ┌──────────────┐                │
│      │     DV1      │        │     DV2      │                │
│      │  Low select  │        │  High select │                │
│      └──────────────┘        └──────────────┘                │
│                  ┌──────────────┐                            │
│                  │     DV3      │                            │
│                  │     Add      │                            │
│                  └──────────────┘                            │
│                  ┌──────────────┐                            │
│                  │  Channel 4   │                            │
│                  └──────────────┘                            │
│                                                               │
└─────────────────────────────────────────────────────────────┘
```
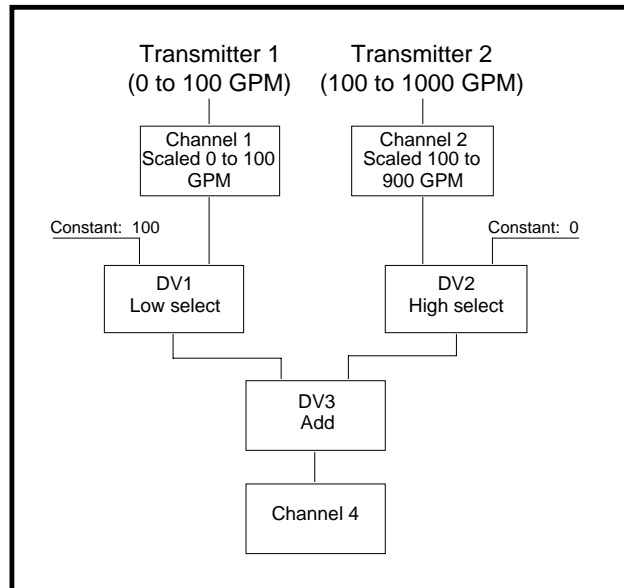
DV1   Low Select - Input from Transmitter No. 1 cannot go above 100 when flow is greater than 100 litres/sec

DV2   High Select - Input from Transmitter No. 2 cannot go below 0.0 when flow is less than 100 l/s (making Scaled flow less than 0).

DV3   Add - Adds the two scaled inputs. At full flow 900 + 100 = 1000.

Ch4   Chart Range = 0 to 1000 litres per second.   Source DV = DV3.

5.7.2 MATHS FUNCTIONS (Cont.)

WORKSHEET FOR TWO TRANSMITTER EXAMPLE

DV	Type	Input					Out to	Reset by
		1	2	3	4	5		
1	LSL	Ch1					DV3	
	Low select prevents channel 1 signal from going above 100 (constant value)							
2	HSL	Ch2					DV3	
	High select prevents channel 2 signal from going below 0 (constant value)							
3	ADD	DV1	DV2				Chan 4	
	Adds low and high range inputs to give total flow							

5.7.3 DERIVED CHANNEL CONFIGURATION

The configuring of a derived channel is similar to that of a normal measuring channel, but there are fewer steps. The figure below shows the steps and section 4.8 should be referred to as necessary for more information about the various parameters.

As can be seen, the channel source is defined as a derived variable.   The definition of these variables is given in the next section.

One further requirement is to define which pen is to trace the derived channel (i.e. what colour the trace will be). The scrollable items are Pen 1 (Blue), Pen 2 (Red), Pen 3 (Green). As with measuring channels, the annotator pen (violet) can be used to trace a derived channel.

MAGNIFICATION CENTRE

The operation of the Magnification Centre feature for derived channels is the same as that described in section 4.8, for measuring channels, with the exception that the High and Low range inputs in the derived channel configuration can be used to enable / disable the Magnification Centre function.

Magnification centre is enabled when the 'Mag. Center' value lies between the high and low range values.   To disable the function, both range values are set either above or below the centre value.

5.7.3 DERIVED CHANNEL CONFIGURATION (Cont.)
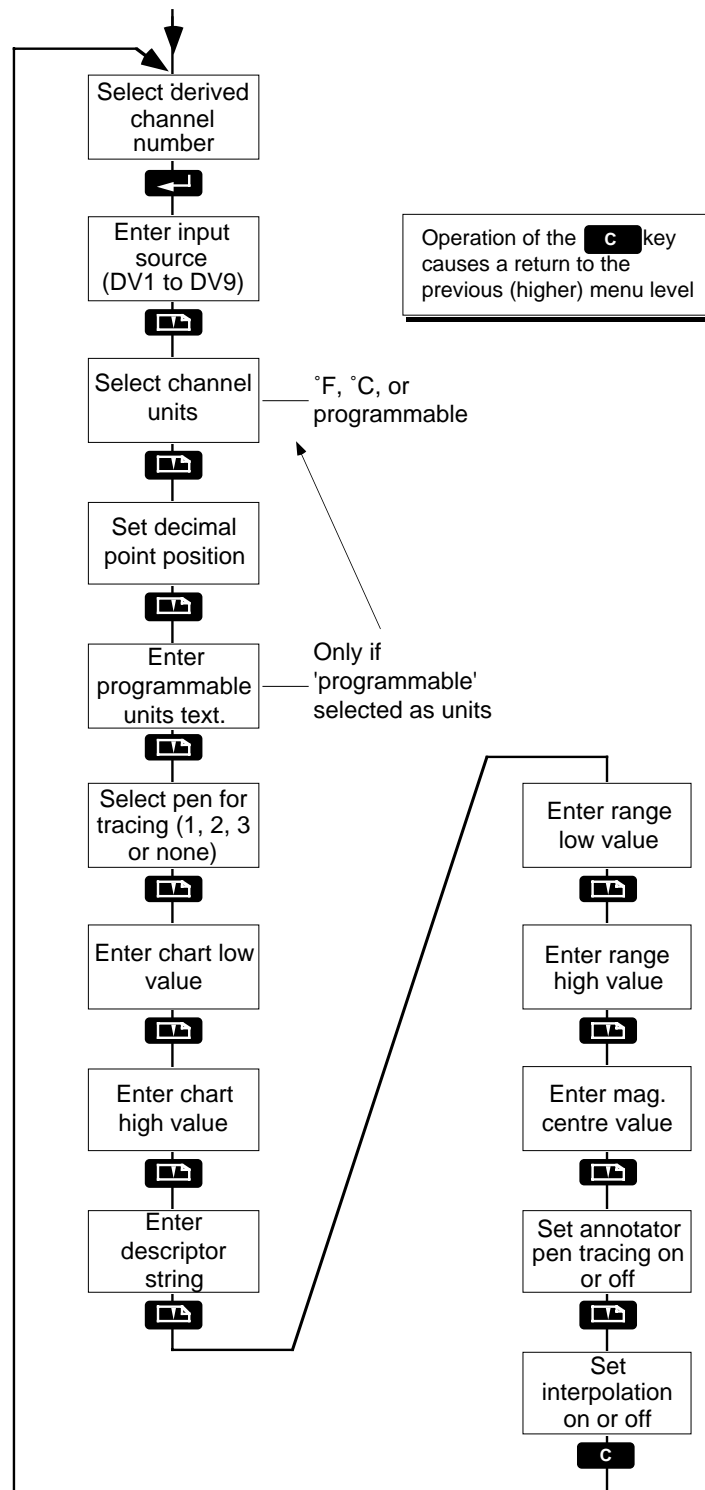
Figure 5.7.3 Derived channel configuration menu arrangement

5.7.4 DERIVED VARIABLE CONFIGURATION

DV NUMBER

```
Derived Var. ?
       N
```

The up/down arrow keys are used to select a DV for configuration.   Each optional derived channel brings with it the ability to define three DV's.

DV FUNCTION

```
DV Function
       Add
```

The Up/Down arrow keys are used to select a derived variable function

DV SOURCE SELECT

```
DV1 Input 1
     Constant
```

The Up/Down arrow keys are used to select: Input Channel, DV 1 to 9 or constant.

CONSTANT ENTRY

These displays appear only if 'Constant' has been selected as one of the DV's inputs.

```
DV1 Const.?
       N
```

The up/down arrow keys are used to scroll through inputs that have been chosen as constants, above. Operation of the ENTER key calls the mantissa and exponent pages for the constant.

Constants are entered on two pages; the mantissa page and the exponent (power of 10) page.   The constant is entered as a number between 0 and 9.9999 on the mantissa page, followed on the exponent page by the relevant power of 10, (in the range -30 to +30). Thus, a constant of 6.25 would have an entry in the mantissa page of 6.2500, and an exponent of 0. A constant of 625 would have a mantissa of 6.2500, but with an exponent value of 2,   and a constant of 6,250,625 would have a mantissa of 6.2506, with an exponent value of 6.

```
DV1 Input 1
 _1.0000 Mant.
```

CLEAR returns to the 'DV1 Const.?' display above.   ENTER, followed by page scroll calls the exponent page.

```
DV1 Input 1
     _2 Exp.
```

The up/down/side arrows are used to enter the mantissa and exponent values.CLEAR returns to the 'DV1 Const.?' display above.   ENTER, followed by page scroll re-calls the mantissa page.

5.7.4 DERIVED VARIABLE CONFIGURATION (Cont.)
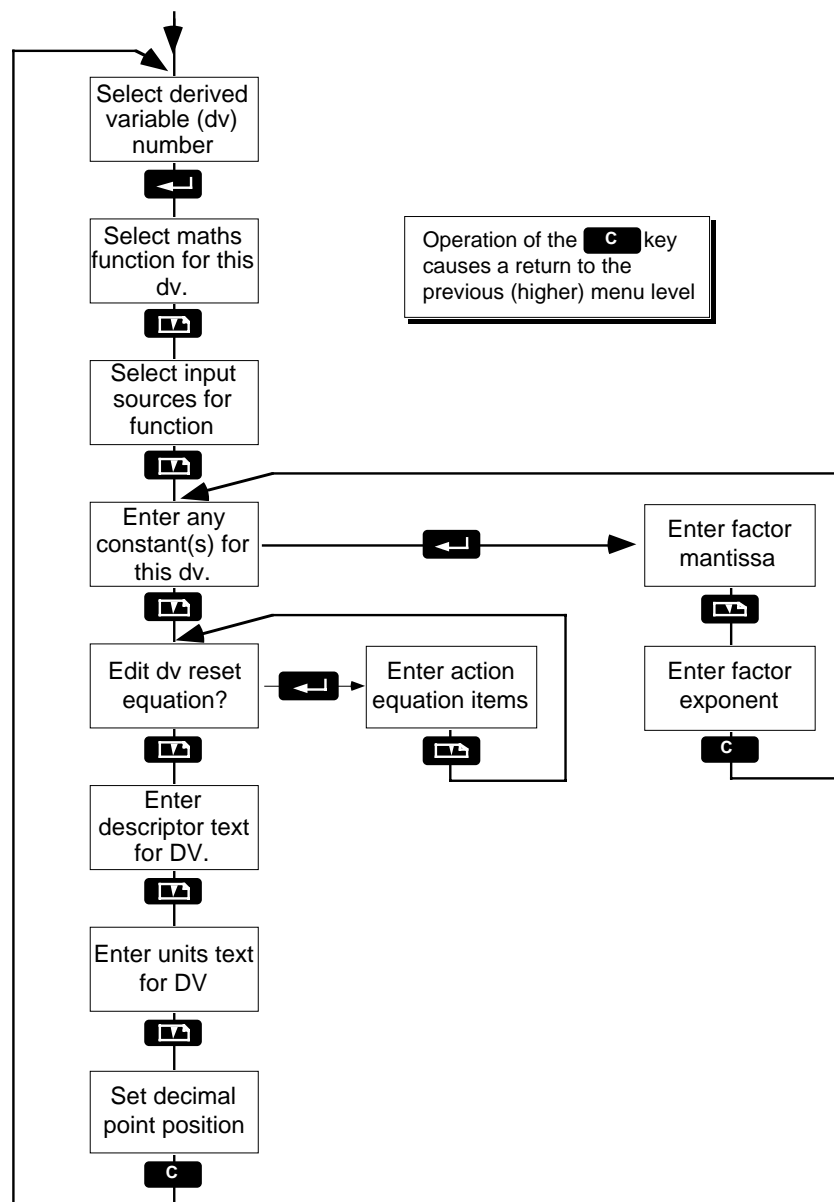
Figure 5.7.4 Derived variable configuration arrangement

5.7 DERIVED VARIABLES (Cont.)

DERIVED VARIABLE RESET

```
DV1 Rset Eq
```

The reset equations page appears only if a resettable DV has been configured.   The ENTER key is used to view and allow editing of the action equation

```
DV1 Rset Eq P1
____,____,____,____,
```

The action equation defines the internal triggers that are to be used to trigger the reset of cumulative variables.

DERIVED VARIABLE DESCRIPTOR

```
 DV1 Descript.
??????????????????
```

The derived variable descriptor is a character string, of up to 16 characters, which appears above the current value in a single channel display, and which is printed on the chart when the dv range is printed, or the channel logged.   The descriptor string is entered using the up/down/side arrow keys as described in section 4.4.

DERIVED VARIABLE UNITS

```
  DV1 Units
   ?????
```

The derived variable units entry is a character string, of up to 5 characters.   The string appears whenever the associated dv appears. The descriptor string is entered using the up/down/side arrow keys as described in section 4.4.

DERIVED VARIABLE DECIMAL POINT

The currently selected decimal position is shown. The up/down arrow keys move the decimal point that appears in the displayed value.   These positions are selectable:

X.XXXX, XX.XXX, XXX.XX, XXXX.X, XXXXX.

If a value is to be displayed, the use of number positions to the right of the Decimal Point should be considered carefully.   The use of multiple decimal positions can imply a reading accuracy beyond the sensor and/or recorder capability.

Also, the least significant (right end) digits will be the fastest changing digits.   Multiple decimal positions may change so quickly that the display will be difficult to read.

5.8 COMMUNICATIONS OPTION

5.8.1 INTRODUCTION

The communications option allows a host computer to obtain (read) or change (write) most of the values and operational states within the recorder.   The exceptions are: a) that it is not possible to access the communications parameters (eg. Baud rate), and b) the host is not able to calibrate the recorder.

5.8.2 INSTALLATION

The communications option consists of a communications circuit board (which may include event inputs, if required), terminal connectors and operating software.   If the communications option is being retro-fitted, an upgrade to the recorder software may also be necessary: please contact the local agent for details.The locations of the communications connectors are shown in figure 5.8.2b below.   If the communications board is fitted with event input circuitry, then the connectors are also as shown below, otherwise, a blanking piece is fitted.

WIRING

The Tx- and Tx+ terminals of the recorder are connected to Tx- and Tx + of all the other recorders in the communications link, and to the Rx- and Rx+ connections, respectively, of the host computer.   The Rx- and Rx+ terminals of the recorder are connected to Rx- and Rx+ of all other recorders in the communications link, and to the Tx- and Tx+ connections, respectively, of the host.   Figure 5.8.2a shows a simple wiring diagram with two recorders.   The following sections on biassing and terminating resistors give further details.

For computers with RS232 connections, an RS232 to RS422 conversion module is available from the manufacturer, stocked under the part number LA245282.
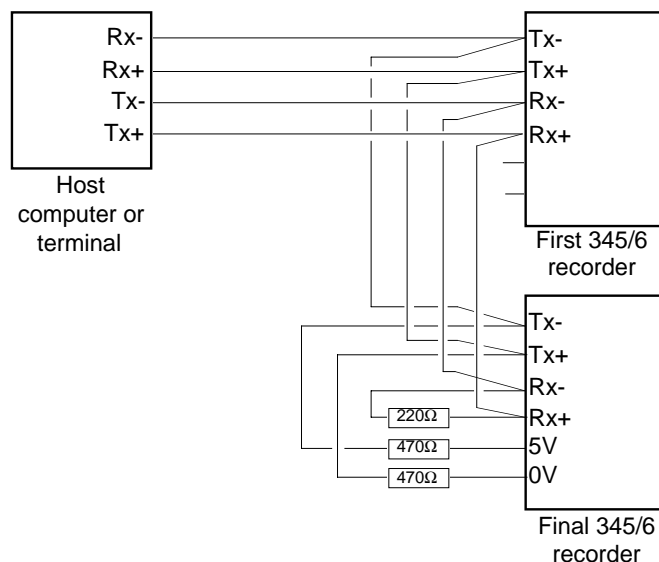
Figure 5.8.2a Link wiring

5.8.2 INSTALLATION (Cont.)

TERMINATING RESISTOR

At the recorder furthest from the host computer, it is recommended that a 220 Ω resistor be fitted across the recorder Rx+ and Rx- terminals to reduce unwanted signal reflections.   The resistor can be of almost any type, but 1/4 Watt is recommended for mechanical strength coupled with manageable size.

BIASSING RESISTORS

At one of the recorders in the link, the recorder Tx- terminal must be 'pulled down' to signal ground and the Tx+ terminal must be 'pulled up' to 5 Volts, using 470Ω resistors. As the Terminating Resistor has to be fitted at the end of the link, it is recommended that the biassing resistors are also fitted there as shown in figure 5.8.2 above. For resistor type, see under 'Terminating Resistor' above.
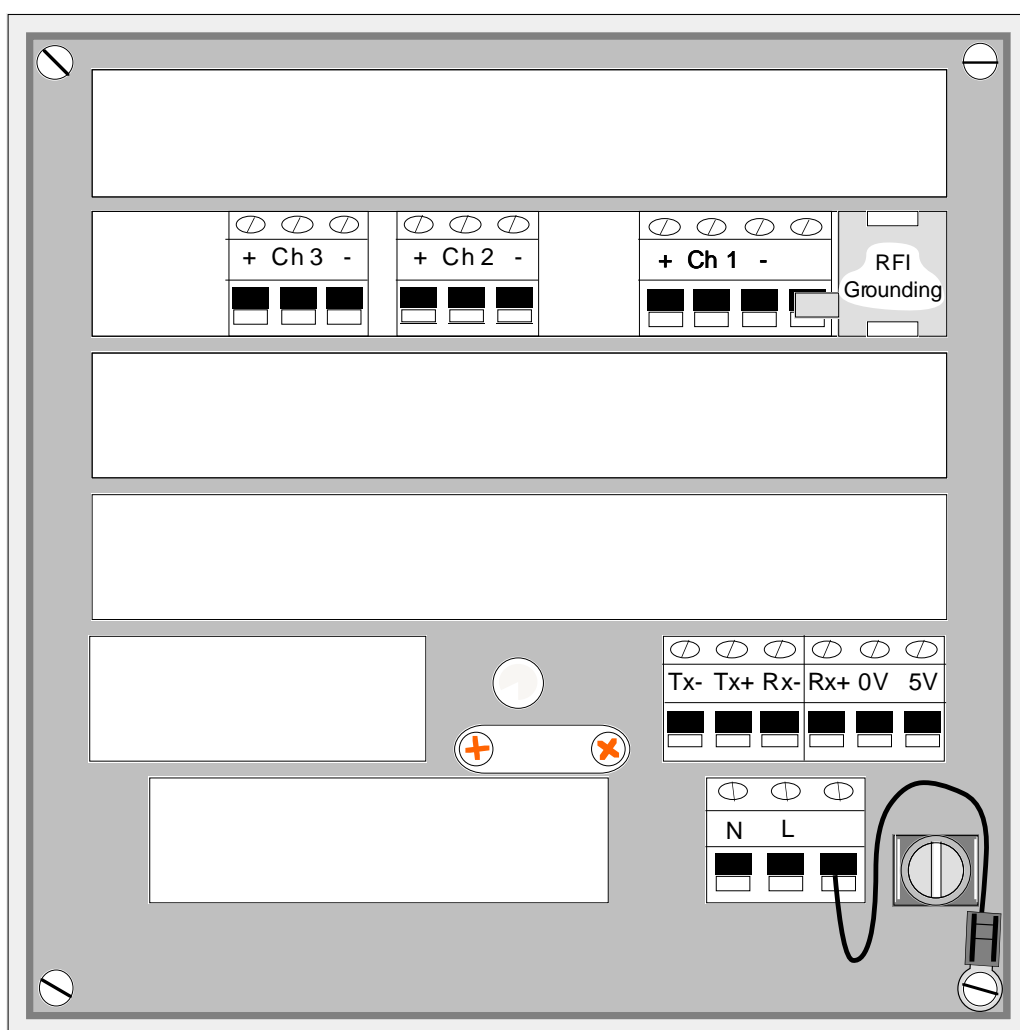
The communications terminals are shown here in option board 3 position (Slot 5). The board can alternatively be fitted in option board position 1 (slot 3) or 2 (slot 4) provided the position is free. See section 2.4.5 for further details.

Figure 5.8.2b Communications link connector locations

CAUTION
DAMAGE WILL BE CAUSED TO THE TERMINAL BLOCKS IF THE SCREWS ARE OVER-TIGHTENED.   THE RECOMMENDED MAXIMUM TORQUE IS 0.4 Nm.

5.8.3 CONFIGURATION

The communications configuration pages are accessed from the 'Comms' item in the main menu.

BAUD RATE
The up/down arrow keys are used to scroll through 300, 600, 1200, 2400, 4800, 9600, any of which may be chosen as Baud rate.

PARITY
The up / down arrow keys are used to scroll through 'even', 'odd' and 'none', as the available parity settings. When using seven data bits, 'odd' or 'even' setting may be used.   With 8 bits, only 'none' may be used success-fully.

FLOW CONTROL
The up / down arrow keys are used to scroll between 'none' and 'XON/XOFF'

DISABLE SCHEME
The up / down arrow keys are used to scroll between 'Read/Write' and Read only'.

GROUP ID (G)
The up / down arrow keys are used to scroll through 0 to 15.

UNIT ID (U)
The up / down arrow keys are used to scroll through 0 to 15.

Once all the Communications parameters have been set up, operation of the <C> key causes a return to the main menu

5.8.3 COMMUNICATIONS CONFIGURATION (Cont.)
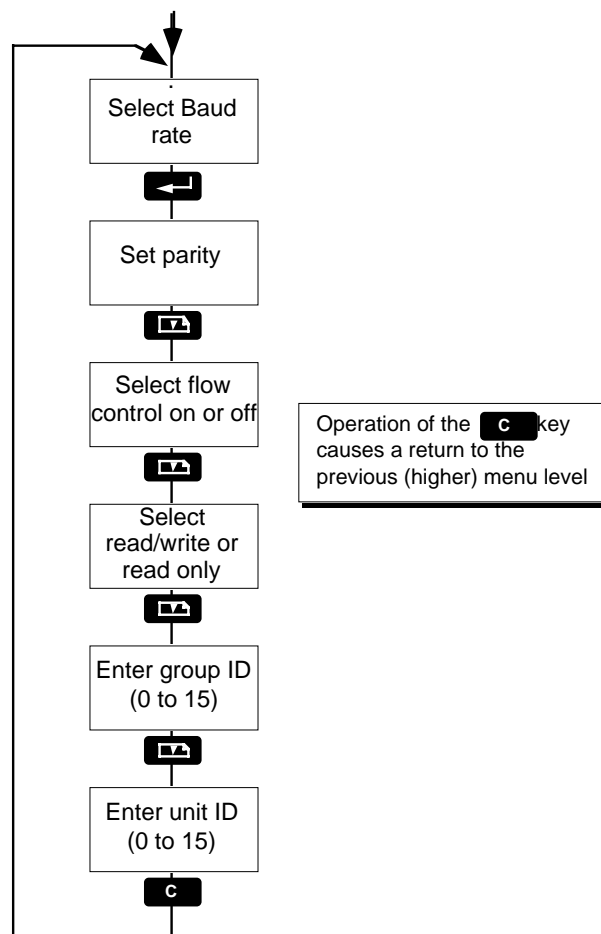
Figure 5.8.3 Communications configuration menu arrangement

5.8.4 PROTOCOL

Protocol defines the control codes, data format, sequencing etc. that is required for the successful implementation of a serial communications link.   The EI bi-synch protocol used by the 340 series of recorders is derived from ANSII standard X3.28-2.5-A4.   This is a character-oriented protocol which supports multi-drop linkage to allow a host (computer or 'dumb terminal') to communicate with a number of recorders.

Certain control characters are used as shown in the table below.   The use of these control codes is described as and when they arise in the following polling and selection sequence description.

ASCII	Hex	Binary	Control key
STX	0 2	0000 0010	CTRL B
ETX	0 3	0000 0011	CTRL C
EOT	0 4	0000 0100	CTRL D
ENQ	0 5	0000 0101	CTRL E
ACK	0 6	0000 0110	CTRL F
NAK	0 7	0000 0111	CTRL U

Table 5.8.4a Control character codes

TERMINOLOGY

POLL
This refers to the sequence in which a particular recorder is interrogated and responds with data.   Recorder configuration and data values are not altered.

SELECT
This refers to the sequence in which the data values or configuration of a particular recorder are changed by instructions from the host.

POLL SEQUENCE

Note...
  The spaces between 'characters' in the poll sequence message below are inserted for clarity.   These spaces must not be inserted into the data sent to the recorder, or the message will not be understood.

The sequence of characters used to poll a parameter is EOT G G U U CN C1 C2 ENQ where the various parts of the sequence have the following meanings:

EOT   End of text.   This character resets the data lines and causes all the recorders to examine the next four characters to see if they match the address set up in the configuration pages.

G   Group address. This should match the Group ID of the relevant recorder, as set up in that recorder's communication configuration pages, but see the Unit Address note below.

U   Unit address. This should match the Unit ID of the relevant recorder, as set up in that recorder's communication configuration pages.

Note...
  As can be seen, G and U are each only a single character, and a numeric value cannot therefore be entered for addresses 10 to 15.   The characters shown in table 5.8.4b below, are used instead:

CN   Channel number. This character is used to address a channel, derived variable, alarm etc. within the relevant recorder.   A full list of CN values is given later in this document.

C1 C2   Command mnemonic.   These two characters form a command code which tells the recorder which parameter the host wishes to access. For example, to read the measured (present) value, C1 and C2 would be P and V respectively. A full list of parameters appears later in this document.

5.8.4 PROTOCOL (Cont.)

POLLING SEQUENCE (CONT.)

ENQ   Enquiry. The polling message is terminated by the ENQ control character.

Address	Character
10	:
11	;
12	<
13	=
14	>
15	?

Table 5.8.4b Group and Unit IDs 10 to 15

POLL RESPONSE

In response to the poll message, the recorder will respond with either a poll completed message or a poll incomplete message.   If however, the address sent is not recognised, the recorder will not respond at all.

POLL COMPLETED

A successful poll will result in the recorder returning the required data held within a message of the following type: **STX CN C1 C2 D1 to DN ETX BCC**   where CN, C1 and C2 are as described above, and the other mnemonics are as follows:-

STX   Start of Text. This immediately precedes the text to be sent to the host

D1 to DN Data bytes. The N data bytes containing the parameter value requested.   The number of characters sent depends on the format of the particular parameter.   These formats are detailed later in this document.

ETX   End of Text. This character terminates the data transmission and alerts the host to the fact that the next character to arrive will be the block check control (BCC) byte.

BCC   Block Check Control.   This is a form of data checking, to ensure that no errors have occurred in the transmission of the message.   BCC is calculated by exclusive ORing the hex values of CN with C1, then the result of this with C2, the result of this with D1, and so on up to and including ETX. The final XORing produces BCC.   For details see the example below.

POLL INCOMPLETE

If the recorder recognises the group and unit addresses, but some other part of the message cannot be deciphered, it will respond with a message of the type: **STX CN C1 C2 EOT**. The host must then initiate a complete new polling sequence before it can receive any more parameter data.

5.8.4 PROTOCOL (Cont.)

To calculate the BCC of the message STX2PV12.34ETX (present value of channel 2 is 12.34). In ASCII hex, this is 32 xor 50 xor 56 xor 31 xor 32 xor 2E xor 33 xor 34 xor 03 to give a BCC of 1D as follows.

Character	ASCII	Binary	
2	32	0011	0010
P	XOR 50	0101	0000
	=	0110	0010
V	XOR 56	0101	0110
	=	0011	0100
1	XOR 31	0011	0001
	=	0000	0101
2	XOR 32	0011	0010
	=	0011	0111
.	XOR 2E	0010	1110
	=	0001	1001
3	XOR 33	0011	0011
	=	0010	1010
4	XOR 34	0011	0100
	=	0001	1110
ETX	XOR 03	0000	0011
	= BCC	0001	1101 = 1 D

The exclusive OR (XOR) function

Each bit in the two Hex bytes making up the ASCII character is compared with the equivalent bit in the ASCII character it is being XORed with. I.E. the two bits 0 are compared, the two bits 1 are compared and so on.

If both bits are 0, the result is also 0
If both bits are 1, the result is 0
If one bit is 1 and the other is 0, the result is a 1.

SELECTION SEQUENCE

The message sent to the recorder to write a new value is:**EOT G G U U STX CN C1 C2 D1 to DN ETX BCC** where each of the characters/mnemonics is as described in the polling section above.

SELECTION COMPLETE.

If all is well, the recorder will respond with a single ACK to indicate that the message has been accepted as correct, and that the change has taken place. The host may now re-enter the selection procedure at STX to access a further parameter in the same channel, or it may initiate a complete new selection sequence.

SELECTION INCOMPLETE

If the group and unit addresses are recognised, but some other part of the message is not valid (e.g. the parameter is read only) the recorder will respond with a NAK. The host must now initiate a complete new selection sequence.

If the group or unit address is not recognised, the recorder will make no response.

5.8.5 PARAMETER ACCESS

The parameter address consists of a Group ID (G), a Unit ID (U), a channel address (CN) and the parameter mnemonic C1 C2. The Group and Unit IDs have already been described in the polling section above.

The channel address CN covers not only measuring and derived channels, but also alarms totalisers etc. as in the table below.

CN	Definition	CN	Definition
0	Relay 1	Y	Not used
1	Measuring channel 1 or relay 2	Z	Not used
2	Measuring channel 2 or relay 3	a	Not used
3	Measuring channel 3 or relay 4	b	Not used
4	Derived channel 1 or relay 5	c	Not used
5	Derived channel 2 or relay 6	d	Not used
6	Derived channel 3 or relay 7	e	Not used
7	Relay 8	f	Not used
8	Relay 9	g	Not used
9	Relay 10	h	Not used
A	Measuring channel 1 Alarm 1 (A11)/Relay 11	i	Not used
B	Measuring channel 1 Alarm 2 (A12)/Relay 12	j	Not used
C	Measuring channel 1 Alarm 3 (A13)/Relay 13	k	DV1 calculations
D	Measuring channel 1 Alarm 4 (A14)/Relay 14	l	DV2 calculations
E	Measuring channel 2 Alarm 1 (A21)/Relay 15	m	DV3 calculations
F	Measuring channel 2 Alarm 2 (A22)/Relay 16	n	DV4 calculations
G	Measuring channel 2 Alarm 3 (A23)	o	DV5 calculations
H	Measuring channel 2 Alarm 4 (A24)	p	DV6 calculations
I	Measuring channel 3 Alarm 1 (A31)	q	DV7 calculations
J	Measuring channel 3 Alarm 2 (A32)	r	DV8 calculations
K	Measuring channel 3 Alarm 3 (A33)	s	DV9 calculations
L	Measuring channel 3 Alarm 4 (A34)	t	Totaliser 1
M	Derived channel 1 Alarm 1 (A41)	u	Totaliser 2
N	Derived channel 1 Alarm 2 (A42)	v	Totaliser 3
O	Derived channel 1 Alarm 3 (A43)	w	Totaliser 4
P	Derived channel 1 Alarm 4 (A44)	x	Totaliser 5 or timer 1
Q	Derived channel 2 Alarm 1 (A51)	y	Totaliser 6 or timer 2
R	Derived channel 2 Alarm 2 (A52)	z	Timer 3
S	Derived channel 2 Alarm 3 (A53)	{	Timer 4
T	Derived channel 2 Alarm 4 (A54)		
U	Derived channel 3 Alarm 1 (A61)		
V	Derived channel 3 Alarm 2 (A62)		
W	Derived channel 3 Alarm 3 (A63)		
X	Derived channel 3 Alarm 4 (A64)		

Table 5.8.5a CN definition

The mnemonic C1, C2 defines the actual parameter to be accessed within the channel, alarm, totaliser etc. selected by CN. The following table lists each parameter along with its mnemonic, together with cross references to a further table which give details of the parameter itself.

PARAMETER TABLES.

The tables later in this section give details of how the recorder configuration parameters can be accessed using a serial link.   For full details of the functions described by the parameters, the relevant sections of the manual should be referred to.   The parameter tables refer to a note which is given opposite.   The tables also refer to a data format.   A full discussion of formats is given in Section 5.8.6

5.8.5 PARAMETER ACCESS (Cont.)

NOTE...
Action Equations

Action equations are set up using Format 3, as described in section 5.8.6. Format 3 consists of 16 characters, each of which can contain the hex value 0 to F, where each of the hex bits set refers to a particular trigger. In order to clear an action equation, the value 0000 0000 0000 0000 is sent, to clear all bits. (The gaps between the above groups of four bits are inserted only for clarity. They must not be included in the data string.)

5.8.5 PARAMETER ACCESS (Cont.)

Parameter	Mne-monic	Table		Parameter	Mne-monic	Table
Alarm deadband	AB	5.8.5e		DV Calcs. reset action equation	VA	5.8.5g
Alarm hysteresis	AH	5.8.5e		DV calculation units	VU	5.8.5g
Alarm message	DE	5.8.5e		History chart speed	V3	5.8.5c
Alarm message print control	AE	5.8.5e		Instrument error code	EE	5.8.5c
Alarm setpoint	SP	5.8.5e		Instrument ID number	ID	5.8.5c
Alarm rate-of-change time base	TB	5.8.5e		Instrument identifier	II	5.8.5c
Alarm type	AT	5.8.5e		Log start action equation	LQ	5.8.5d
Alternative chart speed	V2	5.8.5c		Logged channels	LG	5.8.5d
Alt. chrt. spd. action equation	SQ	5.8.5c		Logged totalisers	TC	5.8.5f
Batch number	BN	5.8.5c		Miscellaneous operator bits	BE	5.8.5h
Block length	BL	5.8.5c		Misc. instrument menu bits	BF	5.8.5c
Channel adjust	BV	5.8.5d		Misc.channel menu bits	CF	5.8.5d
Channel alarm status	AS	5.8.5e		primary chart speed	V1	5.8.5c
Channel decimal point position	DP	5.8.5d		Print mode	PM	5.8.5c
Channel descriptor	CD	5.8.5d		Range magnification factor	ZF	5.8.5h
Channel engineering units	EU	5.8.5d		Range mag. action equation	ZQ	5.8.5h
Channel filter setting	SF	5.8.5d		Range magnify channels	ZC	5.8.5h
Channel input high	IH	5.8.5d		Relay action equation	RQ	5.8.5e
Channel input low	IL	5.8.5d		Relay source (totaliser number)	RS	5.8.5f
Channel input type	IU	5.8.5d		Relay status	DS	5.8.5e
Channel linearisation	FN	5.8.5d		Relay type	$0-$F	5.8.5e
Channel process value	PV	5.8.5d		set time and date	ST	5.8.5c
Channel printing colour	PC	5.8.5d		Softkey descriptor	SS	5.8.5c
Channel range high	FH	5.8.5d		Softkey enable	SK	5.8.5c
Channel range low	FL	5.8.5d		Time remaining	Tc	5.8.5c
Channel units select	SU	5.8.5d		Timer clock setting	Ts	5.8.5c
Chart range high	OH	5.8.5c		Timer duration	Td	5.8.5c
Chart range low	OL	5.8.5c		Timer reset action equation	Tl	5.8.5c
Chart hold action equation	CQ	5.8.5c		Timer type	Te	5.8.5c
Cold junction temperature	CJ	5.8.5c		Totaliser counter output	OC	5.8.5f
Cold junction type	JT	5.8.5d		Totaliser counter output factor	TO	5.8.5f
Custom curve CJC ˚C points	1J-3J	5.8.5h		Totaliser descriptor	TT	5.8.5f
Custom curve CJC mV points	1M-3M	5.8.5h		Totaliser factor	TF	5.8.5f
Custom curve decimal position	OP	5.8.5h		Totaliser high cut-off	TH	5.8.5f
Custom curve signal	x0-xA	5.8.5h		Totaliser low cut-off	TL	5.8.5f
Cstm curve signal decimal posn.	IP	5.8.5h		Totaliser manual reset	TR	5.8.5f
Custom curve units	y0-yA	5.8.5h		Totaliser preset value	VP	5.8.5f
Custom message action eqn.	01-91	5.8.5h		Totaliser reset action equation	TL	5.8.5f
Cstm message manual trigger	DM	5.8.5h		Totaliser reset equation	TE	5.8.5f
Custom message text	s0	5.8.5h		Totaliser source	SO	5.8.5f
DV calculation current value	DV	5.8.5g		Totaliser type	TY	5.8.5f
DV calculation comms reset	VM	5.8.5g		Totaliser units	UT	5.8.5f
DV calculation constants	K1-K5	5.8.5g		totaliser value	TV	5.8.5f
DV calculation decimal posn.	VD	5.8.5g		Trace history action equation	HQ	5.8.5d
DV calculation descriptor	VS	5.8.5g		Trace history mag. channels	HC	5.8.5d
DV calculation function	FD	5.8.5g		Trace history mag. factor	HM	5.8.5d
DV calculation inputs	1I-5I	5.8.5g		Version number	V0	5.8.5c

Figure 5.8.5b Parameter list

5.8.5 PARAMETER ACCESS (Cont.)

Mne-monic	For-mat	CN *	Bits	Instrument parameter description	Access wrt. host
BF	FF	Any	0 1 2 3 to 15	Miscellaneous instrument menu bits Time format: 0 = 12 hour; 1 = 24 hour Chart speed units: 0 = mm/hour; 1 = inches/hour Operator alarm setpoint access: 0 = off; 1 = on Not used	R/W R/W R/W
BL	FE	Any	N/A	Block length. EI protocol definition. Always returns >8080	Read only
BN	A	Any	N/A	Six character batch number for ID line on chart	R/W
CJ	6	Any	N/A	Cold junction temperature Determines the external CJC temperature in ˚C	R/W
CQ	3	Any	N/A	Chart hold action equation (See note page 5-37)	R/W

EE	FE	Any	N/A	Instrument error code
				Digits 1 & 2
				     00 = No error since last initialisation
				     01= Invalid mnemonic
				     02 = Bad checksum
				     03 = Comms offline
				     04 = Read attempt on write only
				     05 = Write attempt on read only
				     06 = Invalid CN
				     07 = Invalid data format (too many digits, missing sign etc.)
				     08 = Not enough characters
				     09 = Not used
				Digit 3
				     0 = No error since last initialisation
				     4 = One or more errors since last initialisation
				Digit 4
				     0 = No error since last initialisation
				     1 = Communications error
				     7 = Invalid message
				     8 = Bad message content
					Read only

ID	5	Any	N/A	Instrument ID as entered in the instrument menu	R/W
II	FE	Any	N/A	Instrument type. Always returns >3400	Read only

PM	6	Any	N/A	Print mode
				     00 = No print
				     01 = Overprint
				     02 = Break trace
					R/W

SK	5	Any	N/A	Softkey operator access enable
				     00 = Softkey does not appear in menu (access disabled)
				     01 = Softkey appears in menu (access enabled)
					R/W

SQ	3	Any	N/A	Alternative chart spd. action equation (See note page 5 - 37)	R/W
SS	B	Any	N/A	Softkey descriptor (up to 16 characters)	R/W
ST	D	Any	N/A	Time and date setting for the instrument	R/W
Tl	3	x to {	N/A	Timer reset action equation (See note page 5 - 37) CHANGING THIS PARAMETER RESETS THE TIMER	R/W
Tc	2	x to {	N/A	Timer current value. Gives time remaining for periodic timer	Read only
Td	7	x to {	N/A	Time period for periodic timer	R/W
Te	0	x to {	N/A	Timer type. >0000 = off; >0001 = Periodic; >0002 = Clock CHANGING THIS PARAMETER RESETS THE TIMER	R/W
Ts	D	x to {	N/A	Time and date for clock timer. The following values result in blank (don't care) settings Minutes = 60; Hours = 24; Days = 32, Months = 13, Year = 00	R/W
V0	0	Any	N/A	Communications software version. Version 1.0 =>0100	Read only
V1	6	Any	N/A	Primary chart speed. Integer values followed by decimal point only.	R/W
V2	6	Any	N/A	Alternative chart speed as for V1 above.	R/W
V3	6	Any	N/A	History record chart speed. The apparent chart speed (amount of history time) that will be presented in the 50mm of chart playback. expressed as a chart speed. See V1 above.	R/W

* 'Any' in the CN column, means that any valid CN may be used - see table 5.8.5a

Table 5.8.5c Instrument parameter definitions

5.8.5 PARAMETER ACCESS (Cont.)

Mne-monic	For-mat	CN *	Bits	Channel parameter description	Access wrt. host
BV	6	1 to 3	N/A	<u>Channel adjust</u> (offset)	R/W
CD	B	1 to 6	N/A	<u>Channel descriptor</u> (up to 16 characters)	R/W
CF	FF	1 to 6		<u>Channel menu miscellaneous bits</u>	
			0	Annotator on / off	R/W
			1	Interpolation on / off	R/W
			2 to 15	Not used	
DP	5	1 to 6	N/A	<u>Channel decimal point position</u>	R/W
				00 = XXXXX. 03 = XX.XXX	
				01 = XXXX.X 04 = X.XXXX	
				02 = XXX.XX	
EU	9	1 to 6	N/A	<u>Programmable units</u> string.	R/W
FH	6	1 to 6	N/A	<u>Channel function high</u>. High end of range in engineering units	R/W
FL	6	1 to 6	N/A	<u>Channel function low</u>. Low end of range in engineering units	R/W
FN	5	1 to 6	N/A	<u>Linearisation function</u> to be applied to the channel input, or DV function used as input to a derived channel	R/W

<div align="center">

Input (1 to 3)	Derived (4 to 6)	Input	Derived
00 = Off	00 = Off	12 = TC type K	12 = Off
01 = Linear	01 = DV1	13 = TC type L	13 = Off
02 = Square root	02 = DV2	14 = TC type N	14 = Off
03 = 3/2 power	03 = DV3	15 = TC type R	15 = Off
04 = 5/2 power	04 = DV4	16 = TC type S	16 = Off
05 = Log base 10	05 = DV5	17 = TC type T	17 = Off
06 = Custom curve	06 = DV6	18 = 10Ω Cu	18 = Off
07 = TC Type B	07 = DV7	19 = 100Ω Pt (ANSII)	19 = Off
08 = TC Type C	08 = DV8	20 = 100Ω Pt (DIN)	20 = Off
09 = TC Type E	09 = DV9	21 = 100Ω Ni	21 = Off
10 = TC Type J	10 = Off	22 = 120Ω Ni	22 = Off
11 = TC Type Ni/Mo	11 = Off	23 = Comms	23 = Off

</div>

Mne-monic	For-mat	CN *	Bits	Channel parameter description	Access wrt. host
HC	1	Any		<u>Trace history magnified channels</u>. 0 = not magnified; 1 = magnified	
			0	Channel 1	R/W
			1	Channel 2	R/W
			2	Channel 3	R/W
			3	Channel 4	R/W
			4	Channel 5	R/W
			5	Channel 6	R/W
			6 to 15	Not used	
HM	6	Any	N/A	<u>Trace history magnification factor</u>.	R/W
				Maximum value 1000. Values <1 expand the range	
				Entered value is rounded to two decimal places when used.	
HQ	3	Any	N/A	<u>Trace history action equation</u> (See note page 5 - 37)	R/W
IH	6	1 to 3	N/A	<u>Input high</u>. High end of electrical input range.	R/W
IL	6	1 to 3	N/A	<u>Input low</u>. Low end of electrical input range	R/W
IU	5	1 to 3	N/A	<u>Type of input signal</u>	R/W
				00 = Millivolts 02 = Thermocouple (direct)	
				01 = Volts 03 = Ohms (for resistance thermometers)	
JT	5	1 to 3	N/A	<u>Cold junction location</u>. 00 = internal; 01 = external	
LG	1	Any		The channels to be logged (0 = not logged; 1 = logged).	
			0	Channel 1	R/W
			1	Channel 2	R/W
			2	Channel 3	R/W
			3	Channel 4	R/W
			4	Channel 5	R/W
			5	Channel 6	R/W
			6 to 15	Not used	
LQ	3	Any	N/A	<u>Log start action equation</u> (See note page 5-37)	R/W
PC	5	4 to 6	N/A	<u>Print colour for derived channels</u>	R/W
				00 = Violet (annotator pen) 02 = Red (pen 2)	
				01 = Blue (Pen 1) 03 = Green (pen 3)	
OH	6	1 to 6	N/A	<u>Chart high</u>. High end of chart range.	R/W
OL	6	1 to 6	N/A	<u>Chart low</u>. Low end of chart range.	R/W
PV	6	1 to 6	N/A	<u>Process variable</u>. Current value in engineering units	R/W
SF	5	1 to 3	N/A	<u>Channel filter select</u>. time constant applied to input signal	R/W
				00 = None 04 = 8 seconds	
				01 = 1 second 05 = 16 seconds	
				02 = 2 seconds 06 = 32 seconds	
				03 = 4 seconds	
SU	5	1 to 6	N/A	<u>Channel units select</u>. Defines channel units	R/W
				00 = ˚F 01 = ˚C	
				02 = Programmable units (See EU above)	

* 'Any' in the CN column, means that any valid CN may be used - see table 5.8.5a

Table 5.8.5d Channel parameter definitions

5.8.5 PARAMETER ACCESS (Cont.)

Mne-monic	For-mat	CN *	Bits	Alarm parameter description	Access wrt. host
AB	6	A to X	N/A	Alarm deadband. Defines the value of the deadband setting. The value is active if 'Deadband' is selected as alarm type (see AT below).	R/W
AE	0	A to X	N/A	Alarm message print control. Enables or disables printing of alarm status and alarm-on messages. 00 = Printing disabled 01 = Printing enabled	R/W
AH	6	A to X	N/A	Alarm hysteresis. Defines the hysteresis value for the selected alarm	R/W
AS	2	1 to 6	N/A	Alarm status for the selected channel Sent as >1122334455, where 11 to 44 give the status of alarms 1 to 4 respectively as shown below. 55 is not used. 00 = No active alarms 03 = Active deadband alarm 01 = Active Abs. high 04 = Active Rate-of-Change (rising) 02 = Active Abs. low 05 = Active Rate-of-Change (falling)	Read only
AT	5	A to X	N/A	Alarm type. Defines alarm type. See also AB and SP 00 = Off 03 = Deadband (deviation) alarm 01 = Absolute high 04 = Rate-of-Change (rising) 02 = Absolute low 05 = Rate-of-Change (falling)	R/W
DE	B	N/A	N/A	Alarm message. Allows a 16-character message to be printed on alarm.	R/W
DS	5	Any		Relay status. Energisation status for relays. (De-energised in alarm) 0 = energised 1 = de-energised (default)	
			0	Relay 1	Read only
			1	Relay 2	Read only
			2	Relay 3	Read only
			3	Relay 4	Read only
			4	Relay 5	Read only
			5	Relay 6	Read only
			6	Relay 7	Read only
			7	Relay 8	Read only
			8	Relay 9	Read only
			9	Relay 10	Read only
			10	Relay 11	Read only
			11	Relay 12	Read only
			12	Relay 13	Read only
			13	Relay 14	Read only
			14	Relay 15	Read only
			15	Relay 16	Read only
RQ	3	(0 to 9 & A to F)	N/A	Relay action equation. Specifies relay trigger (See note page 5-37). Channel entry: 0 to 9 and A to F (relays 1 to 16 respectively)	R/W
SP	6	A to X	N/A	Alarm Setpoint. Allows alarm setpoint to be accessed. See also AB	
TB	5	A to X	N/A	Rate-of-change time base. 0 = per hour 1 = per minute 2 = per second	R/W
$0 to $F	5	Any	N/A	Relay Source. Selects the trigger source for relays. 00 = Off 01 = Action equation 02 = Totaliser counter output Note... $0 = relay 1 $8 = relay 9 $1 = relay 2 $9 = relay 10 $2 = relay 3 $A = relay 11 $3 = relay 4 $B = relay 12 $4 = relay 5 $C = relay 13 $5 = relay 6 $D = relay 14 $6 = relay 7 $E = relay 15 $7 = relay 8 $F = relay 16	R/W

* 'Any' in the CN column, means that any valid CN may be used - see table 5.8.5a

Table 5.8.5e Alarm parameter definitions

5.8.5 PARAMETER ACCESS (Cont.)

Mne-monic	For-mat	CN *	Bits	Totaliser parameter description	Access wrt. host
OC	0	t to y	N/A	Totaliser counter output. Sets totaliser output on or off. >0000 = Off >0001 = On	R/W

RS	0	(0 to 9 & A to F)	N/A	Relay source. Defines a totaliser source to activate a relay.
				Parameters $0 to $F (table 5.8.5e) define whether each relay is to be operated by totaliser output or by action equation.
				Channel entry: 0 to 9 and A to F (relays 1 to 16 respectively).
				  0000 = totaliser 1 0003 = totaliser 4
				  0001 = totaliser 2 0004 = totaliser 5
				  0002 = totaliser 3 0005 = totaliser 6
					R/W

SO	0	t to y	N/A	Totaliser source. The input for the selected totaliser
				  0000 = channel 1 0006 = contact (event) input 1
				  0001 = channel 2 0007 = contact (event) input 2
				  0002 = channel 3 0008 = contact (event) input 3
				  0003 = channel 4 0009 = contact (event) input 4
				  0004 = channel 5 000A = contact (event) input 5
				  0005 = channel 6 000B = contact (event) input 6
					R/W

TC	0	Any		Logged totalisers. Determines which totalisers' values are to appear in the log. 0000 = not logged 0001 = logged	
			0	Totaliser 1	R/W
			1	Totaliser 2	R/W
			2	Totaliser 3	R/W
			3	Totaliser 4	R/W
			4	Totaliser 5	R/W
			5	Totaliser 6	R/W
			6 to 8	Not used	
TD	6	t to y	N/A	Totaliser low cutoff. Determines the value of input, below which the totaliser will not count. **Changing the value of this parameter resets the totaliser.**	R/W
TE	0	t to y	N/A	Totaliser reset enable. Allows the totaliser reset function in the Operator menu to reset the selected totaliser. 0000 = Totaliser is not resettable 0001 = Totaliser is resettable **Changing the value of this parameter resets the totaliser.**	R/W
TF	8	t to y	N/A	Totaliser factor. Determines the rate at which the totaliser will count from a given input. **Changing the value of this parameter resets the totaliser.**	R/W
TH	6	t to y	N/A	Totaliser high cutoff. Determines the value of input, above which the totaliser will not count. **Changing the value of this parameter resets the totaliser.**	R/W
TL	3	t to y	N/A	Totaliser reset action equation. Specifies triggers to reset the selected totaliser (see note on page 5 - 37). **Changing the value of this parameter resets the totaliser.**	R/W
TO	8	t to y	N/A	Totaliser output factor. Determines the ratio between the totaliser count and the output rate. **Changing the value of this parameter resets the totaliser.**	R/W
TR	0	t to y	N/A	Totaliser manual reset. Resets selected totaliser. Any data value written will reset the totaliser.	R/W
TT	B	t to y	N/A	Totaliser descriptor. 16-character descriptor.	R/W
TV	9	t to y	N/A	Totaliser value	Read only

TY	0	t to y	N/A	Totaliser type
				  0000 = Off 0002 = Preset up
				  0001 = Continuous 0003 = Preset down.
				Changing the value of this parameter resets the totaliser.
					R/W

UT	9	t to y	N/A	Totaliser units. A five-character engineering units string. **Changing the value of this parameter resets the totaliser.**	R/W
VP	7	t to y	N/A	Totaliser preset value. The preset value for the selected totaliser.	R/W

* 'Any' in the CN column, means that any valid CN may be used - see table 5.8.5a

Table 5.8.5f Totaliser parameter definitions.

5.8.5 PARAMETER ACCESS (Cont.)

Mne-monic	For-mat	CN *	Bits	Derived variable parameter description	Access wrt. host

1I to 5I	5	k to s	N/A	Derived variable input. Specifies source of input to derived variable calculations
				    00 = Channel 1 07 = DV5
				    01 = Channel 2 08 = DV6
				    02 = Channel 3 09 = DV7
				    03 = DV1 10 = DV8
				    04 = DV2 11 = DV9
				    05 = DV3 12 = Constant
				    06 = DV4
					R/W

DV	6	1 to 9	N/A	Derived variable calculation value.	Read only

FD	5	k to s	N/A	Derived variable calculation function.
				    00 = Off 10 = Average
				    01 = Add 11 = Polynomial
				    02 = Subtract 12 = Log base 10
				    03 = Divide 13 = Power of 10
				    04 = Multiply 14 = Mass flow (square root)
				    05 = Linear slope 15 = Mass flow (linear)
				    06 = High select 16 = Sterilization constant
				    07 = Low select 17 = Relative humidity
				    08 = High peak 18 = Zirconia probe
				    09 = Low peak
					R/W

K1 to K5	8	k to s	N/A	DV Calculation constant. Defines the mantissa and exponent for each constant. See format 8 definition in table 5.8.6a for details.	R/W
VA	3	k to s	N/A	DV calculations reset action equation. Specifies triggers to reset a DV calculation. See format 3 definition in table 5.8.6a for details. **Changing this parameter resets the DV calculation.**	R/W

VD	5	k to s	N/A	Derived variable calculation decimal point position.
				    00 = DDDDD. 03 = DD.DDD
				    01 = DDDD.D 04 = D.DDDD
				    02 = DDD.DD
					R/W

VM	0	k to s	N/A	Derived variable calculation communications reset. Any value written with this parameter will cause a reset of the selected DV calculation. When read, this parameter always returns >0001.	R/W
VS	B	k to s	N/A	Derived Variable calculation descriptor. 16-character descriptor.	R/W
VU	9	k to s	N/A	Derived variable calculations engineering units. Five character string.	R/W

Table 5.8.5g Derived variable calculation parameter definitions

5.8.5 PARAMETER ACCESS (Cont.)

Mne-monic	For-mat	CN *	Bits	Miscellaneous parameter description	Access wrt. host
1J to 3J	6	Any	N/A	Custom curve CJC points. The temperature (˚C) for each pair of the three point-pair custom curve cold junction compensation.	R/W
1M to 3M	6	Any	N/A	Custom curve CJC points. The mV values for each pair of the three point-pair custom curve cold junction compensation.	R/W
IP	5	Any	N/A	Custom curve input signal (electrical units) decimal point position. 00 = DDDDD. 03 = DD.DDD 01 = DDDD.D 04 = D.DDDD 02 = DDD.DD	R/W
OP	5	Any	N/A	Custom curve measuring units decimal point position. 00 = DDDDD. 03 = DD.DDD 01 = DDDD.D 04 = D.DDDD 02 = DDD.DD	R/W
x0 to xA	6	Any	N/A	Custom curve signal. Defines electrical inputs for each of the 11 point-pairs in the custom curve.	R/W
y0 to yA	6	Any	N/A	Custom curve units. The units (%) for each of the 11 point-pairs in the custom curve.	R/W
01 to 91	3	Any	N/A	Custom message action equation. Allows an action equation to be accessed for each of the 10 custom messages (see note on Page 5-37). For message 1 use parameter 01 For message 2 use parameter 11 For message 3 use parameter 21 and so on.	R/W
DM	0	0 to 9	N/A	Custom message manual trigger. Writing any value to this parameter causes the selected custom message to be printed. Channel entry: 0 to 9 (Message 1 to 10 respectively).	Write only
s0 to s9	B	Any	N/A	Custom message texts 1 to 10. 16-character alpha-numeric message.	R/W
BE	FF	Any		Miscellaneous operator bits. Toggle various commands on and off.	R/W
			0	Low to high transition cancels instrument alarms	
			1,2	Not used	
			3	Chart advance. 0 = off; 1 = on	R/W
			4	Pen park. 0 = pens not parked; 1 = pens parked	R/W
			5	Not used	
			6	Low to high transition triggers replay history.	R/W
			7	Low to high transition cancels alarm messages.	R/W
			8	Softkey enable. 0 = softkey off; 1 = softkey on.	R/W
			9	Not used	
			10	Comms key enable. 0 = Comms key off; 1 = comms key on.	R/W
			11 to 15	Not used	
ZC	1	Any	N/A	Range magnified channels. The channels to be range magnified. 0001 = channel 1 0002 = channel 2 0004 = channel 3 0008 = channel 4 0010 = channel 5 0020 = channel 6 Examples: For channels 3 and 4, data entry is >000C For channels 4, 5 and 6, data entry is >0038	R/W
ZF	6	Any	N/A	Channel magnification factor. Values less than 1 expand the range (making the signal appear smaller). Maximum value = 1000. The entered value is rounded to two decimal places.	R/W
ZQ	3	Any	N/A	Range magnify action equation. The triggers which are to activate range magnification (see note on page 5 - 37).	R/W

* 'Any' in the CN column, means that any valid CN may be used - see table 5.8.5a

Table 5.8.5h Miscellaneous parameter definitions

5.8.6 DATA FORMATS

Table 5.8.6a lists the data formats used in the accessing of recorder parameters.   The following conventions are used:

A   An alpha-numeric character.
D   A decimal numeric entry.
H   A hexadecimal character. (four bits) from 0 to F.
>   ASCII 3E. This character precedes a Hex value.
↓   ASCII 1F. This character is used as a unit separator.
↑   ASCII 1E. This character is used as a record separator.
'   ASCII 60. This character precedes an alpha-numeric value.

Format		N° of bytes	Description
340 *	EI Bisynch		
0	5	5	Four hex characters (only two used). i.e. >00HH
1	5	5	Four hex characters i.e. >HHHH
2	23	11	10 hex characters i.e. >HHHHHHHHHH
3	23	17	16 hex characters i.e. >HHHHHHHHHHHHHHHH. Each bit defines .an action equation trigger as defined in table 5.8.6b.
5	6	2	Two decimal characters i.e. DD
6	20	6	A five-digit decimal number as shown below. At least one character must precede the decimal point. DDDDD. -DDDDD. (For negative values) DDDD.D -DDDD.D (For negative values) DDD.DD -DDD.DD (For negative values) DD.DDD -DD.DDD (For negative values) D.DDDD -D.DDDD (For negative values)
7	21	10	A nine digit decimal number with the decimal point after the final character i.e. DDDDDDDDD.
8	25 (20:6)	15	A 'scientific notation' decimal number with a five-digit mantissa and two digit exponent. The + sign before the mantissa is optional, but + or - must occur before the exponent: ↑+D.DDDD↓-DD
9	22	6	Five alphanumeric characters used for units of measure i.e. 'AAAAA
A	22	7	Six alphanumeric characters used for a batch number i.e. 'AAAAAA
B	22	17	Sixteen alphanumeric characters used for descriptor srings i.e. 'AAAAAAAAAAAAAAAA
D	25 (6:6)	18	Twelve digits in separated pairs: ↑mm↓HH↓DD↓MM↓YY↓SS used for time and date. If SS = 0, then the year number is read. If SS = 1, he year number is ignored. mm = minutes; HH = hours; DD = day number; MM = month number; YY = year least significant digits.
FE	5	5	Four hex characters for Read Only parameters i.e. >HHHH
FF	5	5	Four hex characters for changing bit parameters i.e. >HHHH

*   340 format is that quoted in the 'Format' column in tables 5.8.5c to 5.8.5 h inclusive

Table 5.8.6 a Data Format definition

5.8.6 DATA FORMATS (Cont.)

FORMAT THREE (ACTION EQUATIONS).

Format three allows all possible combinations of triggers to be coded in a 16-character hex word:
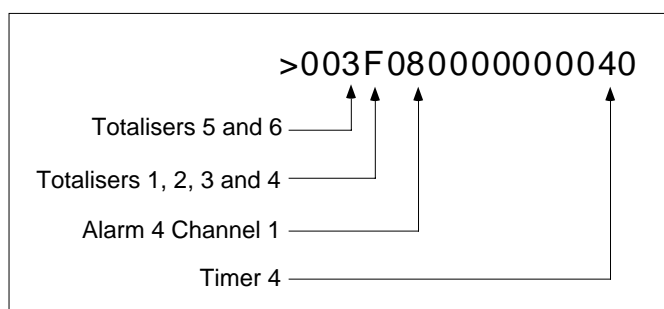
>HHHH HHHH HHHH HHHH

Where character 1 comes immediately after the > character.

The table opposite gives details of all the triggers, and the hex values to be inserted into each of the 16 characters.

EXAMPLE 1. An action equation is required to causes a log to occur whenever any of the totalisers (TT1 to TT6), Timer 4 (TM4), or Alarm four of channel one (A14) gives an output.

In order to achieve this, parameter LQ would have the value >003F080000000040 as follows:


```
            >003F080000000040
                      ↑ ↑  ↑            ↑
Totalisers 5 and 6 ───┘ │  │            │
Totalisers 1, 2, 3 and 4 ─┘  │            │
Alarm 4 Channel 1 ──────────┘            │
Timer 4 ────────────────────────────────┘
```

EXAMPLE 2. An ENQ of parameter SQ (alternative chart speed action equation) results in the return of the value:

>0000110100000001

Characters 5, 6, 8 and 16 all have the value 1, and with reference to table 4.8.6b, it can be seen that the alternative chart speed wil be initiated if Alarm 1 of channels 1, 2 or 3 becomes active, or if the softkey is operated.

5.8.6 (Cont.)

Character	Label																	Weight
Character 1	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	8
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	4
	CI6	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	2
	CI5	No	Yes	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	1
	Hex	0	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	
Character 2	CI4	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
	CI3	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	4
	CI2	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	2
	C11	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	1
	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Character 3	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	8
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	4
	TT6	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	2
	TT5	No	Yes	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	1
	Hex	0	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	
Character 4	TT4	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
	TT3	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	4
	TT2	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	2
	TT1	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	1
	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Character 5	A24	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
	A23	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	4
	A22	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	2
	A21	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	1
	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Character 6	A14	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
	A13	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	4
	A12	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	2
	A11	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	1
	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Character 7	A44	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
	A43	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	4
	A42	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	2
	A41	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	1
	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Character 8	A34	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
	A33	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	4
	A32	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	2
	A31	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	1
	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Character 9	A64	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
	A63	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	4
	A62	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	2
	A61	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	1
	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Character 10	A54	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
	A53	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	4
	A52	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	2
	A51	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	1
	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Character 11	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	8
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	4
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	2
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	1
	Hex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Character 12	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	8
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	4
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	2
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	1
	Hex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Character 13	COM	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	No	No	8
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	4
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	2
	GLA	No	Yes	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	1
	Hex	0	1	0	0	0	0	0	8	9	0	0	0	0	0	0	0	
Character 14	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	8
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	4
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	2
	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	1
	Hex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Character 15	---	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	8
	TM4	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	4
	TM3	No	No	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No	No	No	No	2
	TM2	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	No	No	No	No	No	1
	Hex	0	1	2	3	4	5	6	7	0	0	0	0	0	0	0	0	
Character 16	TM1	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
	LOG	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	4
	INA	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	2
	KEY	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	1
	Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	

Table 5.8.6b Format three (action equations)

5.8.7 CHARACTER SET

Two sets of characters are available for use with the communications link, as shown in tables 5.8.7a and 5.8.7b below.   The characters in table 5.8.7a can generally be sent direct form the keyboard, or alternatively, by using the <ESC> key, followed by the hex value of the character as shown in the table.

The characters in table 5.8.7b can only be transmitted to the recorder using the <ESC> key followed by the hex value of the character as shown in the table.   For example, to send a degree symbol, the keys <ESC><B><C> must be used.

Note...
   The # symbol may not be sent directly from the keyboard.   If required, it must be sent as <ESC><2><3>

Characters are transmitted by the recorder as ASCII codes 00 to 7F and escape sequences <ESC>80 to <ESC>DF

Table 5.8.7a Character set 1

5.8.7 CHARACTER SET (Cont.)

Table 5.8.7b Character set 2

5.8.8 BASIC PROGRAM

This section includes a simple basic program to run on IBM® compatible PCs. Unmodified, the program writes a 'random' number to the recorder, and then reads it back to ensure that the link is operating correctly. The program itself is not intended for use as it stands, but is included to give guidance, especially in the reading and writing routines.

Notes...

1. This section is included to give an example of the sort of program which may be used. The manufacturer does not guarantee that the program will run successfully with every version of BASIC, nor with every type of personal computer (PC)

2. It is assumed that the user is familiar with the PC to the extent that text files and simple programs can be entered.

3. Before any writing of PVs can take place, the relevant channel's 'Function' must be set to 'comms'.

PROGRAM LISTING

```
10      REM This program uses EIBISYNC protocol to read and write a channel
20      REM By changing the variables,  any of the recorder's parameters
30      REM can be written to or read, if permitted.
40      G$="2"                                          :REM  Set up group address
50      U$="1"                                          :REM  Set up Unit address
60      C$="1"                                          :REM  Set up Channel address
70      M$="PV"                                         :REM   Set up parameter mnemonic
80      V$=" 99.999                                     :REM  Set up value to be written to parameter
90      ANSWER$=""                                      :REM  Read from 34X
100     WRITE$=""                                       :REM  Write to 34X
110     On error GOTO 340                               :REM Use "REM" to disable this whilst de-bugging
120     CLS
130     CLOSE
140     OPEN "COM1:9600,e,7,1" AS #1                    :REM  Set comms parameters
150     OPEN "SCRN:" FOR OUTPUT AS #2                   :REM  Change for file later
160     If LOC(1) THEN ANSWER$=INPUT$(LOC(1),#1)        :REM  Clear input buffer
170     Z=TIMER+1                                       :REM  1 second delay between readings
180     WHILE TIMER<Z : WEND
190     PRINT
200     PRINT "WROTE,,"REC'D","ENQUIRED","REC'D"
210     GOSUB 3010:                                     :REM  Make up write string to send
220     PRINT #1,Write$:                                :REM  Send string to 34X
230     PRINT #2,MID$(WRITE$,2,LEN(WRITE$)-3),          :REM  Write string to file
240     GOSUB 1020                                      :REM  Get reply
250     PRINT #2,ANSWER$,                               :REM  Write reply to file
260     GOSUB 2010                                      :REM  Make up string to send
270     PRINT #1,WRITE$;                                :REM  Send enquire to 34X
280     PRINT #2,WRITE$                                 :REM  Print enquiry to file
290     GOSUB 1020:                                     :REM  Get reply
300     PRINT #2,MID$(ANSWER$,2,LEN(ANSWER$)-3)         :REM   Write reply to file
310     V$=STR$(100*RND(1)):                            :REM  Change the PV
320     V$=MID$(V$,1,7):                                :REM  Get in correct form
330     GOTO 160
340     Print "error No ";ERR:RESUME 130                :REM  Catch errors,  print error
350     REM number and resume
```

5.8.8 BASIC PROGRAM LISTING (Cont.)

```
1000   REM==============================================================================
1010   REM  Get a reply from the instrument
1020   Z1=TIMER+.8                                        :REM  Instrument latency
1030   ANSWER$=""
1040   WHILE TIMER<Z1 :WEND
1050   WHILE LOC(1)                                       :REM  Get next char. and wait 30ms.
1060      IF LOC(1) THEN ANSWER$=ANSWER$+INPUT$(LOC(1),#1)
1070      Z1 = TIMER + .03: WHILE TIMER <Z1:WEND          :REM 1 character at 300 Baud
1080   WEND
1090   RETURN


2000   REM==============================================================================
2010   REM To send an enquiry
2020   Q$=G$+G$+U$+U$+C$+M$
2030   WRITE$=CHR$(4)+Q$+CHR$(5)                          :REM  EOT GGUUCMn ENQ
2040   RETURN


3000   REM==============================================================================
3010   REM  Writing
3020   WRITE$=CHR$(4)+G$+G$+U$+U$+CHR$(2)                 :REM  EOT GGUU STX
3030   Q$=C$+M$+V$+CHR$(3)                                :REM  CMnValue ETX
3040   WRITE$=WRITE$+Q$
3050   B=0
3060   FOR N = 1 TO LEN(Q$)                               :REM  IF THE HOST SUPPORTS XOR
3070      T = ASC(MID$(Q$,N,1))                           :REM  REPLACE LINES 3080 TO 3190 INC.
3080      FOR M = 1 TO 8                                  REM   WITH "B = ASC(MID$(Q$,N,1)) XOR B"
3090         T=T/2
3100         TE=FIX(T)
3110         IF TE-T<>0 THEN O(M)=1 ELSE O(M)=0
3120         IF B(M)<>0 THEN B(M)=1 ELSE B(M)=0
3130         T=TE
3140      NEXT M:
3150   NEXT N:
3160   FOR M = 1 TO 8
3170      B = B + 2^(M-1) * B(M)
3180      B(M)=0:
3190   NEXT M
3200   WRITE$ = WRITE$ + CHR$(B)                          :REM  Append BCC character
3210   RETURN
```

Notes...

1. Where more than one statement (including REMark) is made on one line, the statements must be separated by a colon.

2. To leave the program, press <Shift><Ctrl><Break> simultaneously.

5.8.9 'C' PROGRAM

The following program, written in 'C', uses the EI Bisynch protocol to communicate with the recorder. The main program (MAIN) calls the following routines:

1. Init port. Sets the communications Baud rate (9600 Baud), seven data bits, one stop bit and even parity.
2. Send byte. Send a single character to the communications port.
3. Get byte. Receives a single character from the communications port.
4. Get byte filt. Receives a single character from the communications port, allowing for a latency delay.
5. Send address. Sends EOT GGUU to the communications port.
6. Select cmd. Sends STX, channel address and command mnemonic to the communications port.
7. Get reply. Waits for a message to be returned from the instrument.
8. Poll value. Reads the value of the parameter polled

USING THE PROGRAM

When the program starts running, the message:

```
Enter group and unit address (no spaces) e.g. 2211 :
```

appears, requesting the group and unit IDs (see section 5.8.3) for the recorder to be accessed. Entry of the appropriate address, followed by a carriage return causes the following message to appear:

```
Enter channel number 1 to {:
```

Entry of the appropriate CN (table 5.8.5a) for the required parameter, followed by a carriage return, causes the message:

```
Enter command and data (no spaces) e.g.PV12.345 or Q to quit: to appear.
```

To read the current value of the relevant mnemonic, the mnemonic should be entered, followed by a carriage return. The response will be a message containing the channel number, parameter mnemonic and the current value.

To write a new value to a parameter, its mnemonic should be entered, followed immediately (i.e. without any spaces) by the value to be written, followed by a carriage return. The response will be the message:

```
Acknowledged.
```

In either case, the response is followed by the

```
Enter channel number 1 to {: message.
```

In order to leave the program, or to address a further recorder, Q (or q) should be entered in response to the

```
Enter command and data e.g.PV+12.345 or Q to quit: message.
```

Note...
The + sign may be omitted, but if so, a space character MUST precede the value to be written.

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5.8.9 C PROGRAM (Cont.)

PROGRAM LISTING

```
/************************************************************************
FILENAME        :    345tst.c
VERSION         :    1.0
AUTHOR          :    CMAN
SYSTEMS         :    MSDOS compiled with Microsoft C 6.0
DESCRIPTION     :    This program uses the EI Bisync protocol to talk to a 345
************************************************************************/
#include   <stdio.h>
#include   <bios.h>
#include   <ctype.h>

#define    NUL   (char) 0x00
#define    NAK   (char) 0x15
#define    STX   (char) 0x02
#define    EOT   (char) 0x04
#define    ETX   (char) 0x03
#define    ENQ   (char) 0x05
#define    ACK   (char) 0x06
#define    TRE   0x8000

void send_byte(int,char);
void send_address(int,char *);
void init_port(int,int);
char poll_value( int, char *, char *, char *, char * );
char select_cmd( int, char *, char *, char *, char * );
char get_reply( int, char * )
char get_byte( int );
char get_byte( int );
char get_byte_filt( int );
```

5.8.9 C PROGRAM LISTING (Cont.)

```
/***********************************************************************
FUNCTION     :  INIT PORT
DESCRIPTION  :  This routine is used to initialise the comms port to the selected baud
                rate and sets 7 data bits with even parity.
ARGUMENTS    :  port   = port offset.
                baud   = Required baud rate of port.
RETURNS      :  Void
NOTES        :  Supported Baud rates are 300, 600, 1200, 2400, 4800 and 9600.
                Supported ports are COM1-4 (0-3)
***********************************************************************/

void init_port(port,baud)
int port,baud;
{
   unsigned status,service,  databyte;
       switch(baud)
   {
      case 300:
            baud=_COM_300;
            break;
      case 600:
            baud=_COM_600;
            break;
      case 1200:
            baud=_COM_1200;
            break;
      case 2400:
            baud=_COM_2400;
            break;
      case 4800:
            baud=_COM_4800;
            break;
      default  :
      case 9600:
            baud=_COM_9600;
            break;
   }
   service = _COM_INIT;/* _COM_SEND _COM_RECEIVE _COM_STATUS */
   databyte = _COM_CHR7 |_COM_STOP1 | _COM_EVENPARITY | baud ;
   (void) _bios_serialcom(service, port, databyte);
}
```

5.8.9 C PROGRAM LISTING (Cont.)

```
/************************************************************************
FUNCTION      :  SEND BYTE
DESCRIPTION   :  This routine sends a single char "byte" out of the comms port.
ARGUMENTS     :  port = port offset.
RETURNS       :  A character sent via the BIOS routines.
NOTES         :
*************************************************************************/
void send_byte( int port, char byte )
{
    while((_bios_serialcom(_COM_SEND,port,byte) & TRE) !=0)     ;
}


/************************************************************************
FUNCTION      :  GET BYTE
DESCRIPTION   :  This routine gets a single character "byte" from the comms port.
ARGUMENTS     :  port = port offset.
RETURNS       :  A character via the BIOS routines.NOTES:If there is no byte to get,
                 this will lock up on an XT or time-out after 1 sec. on an AT
*************************************************************************/
char get_byte( int port)
{
    return((char)_bios_serialcom(_COM_RECEIVE,port,0) & 0x7f    );
}
/************************************************************************
FUNCTION      :  GET BYTE FILT
DESCRIPTION   :  This routine gets a single character "byte" from the comms port,  but
                 allows for a latency time delay in the first character.
ARGUMENTS     :  port = port offset.
RETURNS       :  A character via the BIOS routines,  or NUL if nothing seen.NOTES:This
                 will lock up on an XT or time-out after 1 second on an AT
*************************************************************************/
char get_byte_filt( int port )
{
    char buff;int i = 10;/* Try char ten times then quit. */
    while( ((buff= get_byte( port )) == NUL ) && (i— >=0));
    return(buff);
}
```

5.8.9 C PROGRAM LISTING (Cont.)

```
/*************************************************************************
FUNCTION      : SEND ADDRESS
DESCRIPTION   : This routine sends the EOT character followed by group and unit
                addresses to "port".  It is assumed that addr contains GGUU in four
                characters.
ARGUMENTS     : port   = port offset.
                addr   = pointer to address buffer.
RETURNS       : Void
NOTES         :
**************************************************************************/

void send_address( int port, char *addr )
{
   int i;
   send_byte(port,EOT);
   for(i=0;i<4;i++)
      send_byte( port, *addr++ );
}
/*************************************************************************
FUNCTION      : SELECT CMD
DESCRIPTION   : This routine selects the 34X instrument
ARGUMENTS     : port   = port offset.
                addr   = pointer to instrument address (GGUU)
                cmd    = pointer to command to be used
                chan   = pointer to channel character
                reply  = pointer to reply buffer
RETURNS       : Should return ACK,  but also NUL, ETX, EOT or NAK NOTES
                **************************************************************************/
char select_cmd( int port, char *addr, char *cmd, char *chan, char *reply )
{
   char bcc;
   send_address(port,addr);
   send_byte(port,STX);
   send_byte(port,*chan);
   bcc= *chan;  /*Initialises BCC*/
   bcc ^= *cmd; /*XORs with first character*/
   while( *cmd != NUL )
   {
      send_byte( port, *cmd++ );     /*XOR with subsequent characters*/
      bcc ^= *cmd;
   }
   bcc ^=ETX;   /*XOR with ETX*/
   send_byte(port,ETX);    /*Send ETX*/
   send_byte(port,bcc);    /*Send BCC*/
   return( get_reply( port, reply ));     /* return ACK or NAK */
}
```

5.8.9 C PROGRAM LISTING (Cont.)

```
   /************************************************************************
FUNCTION      : GET REPLY
DESCRIPTION   : This routine waits for a message to be returned from the instrument.
                Latency delays are allowed for on the first character.  The checksum
                is tested in messages ending with ETX
ARGUMENTS     : port   = port offset
                reply  = pointer to character buffer for received message.
RETURNS       : NUL    = failed.  Otherwise,  last letter of message ETX, EOT, ACK,
                NAK.
NOTES         :
************************************************************************/
char get_reply( int port, char *reply )
{
   char bcc = NUL;   /* Initialise BCC */
   int i = 25;  /* Wait for first non NUL character of the reply.*/
   if ( (*reply = get_byte_filt( port )) == NUL )
     return( NUL ); /* Timeout: return NUL */
                   /****** Receive the rest of the message.******/
   while (( *reply != ETX ) && ( *reply !=EOT ) &&( *reply != ACK ) &&
          ( *reply !=NAK ) &&( −i >=0))
   {
      if ( *reply == STX ) /* In case another STX arrives */
           bcc = NUL;/* Re-initialise BCC */
      else bcc ^= *reply;  /* XOR with current character */
      *++reply = get_byte(port);
   }
                    /****** Verify the message checksum.******/
   if ( *reply == ETX )
   {
     bcc ^= *reply;
     (void) printf("calculated chsum= %x ",bcc);
     *++reply = get_byte(port);(void) printf("received cksum= %x \n", *reply );
     bcc ^= *reply;
     *reply = NUL;   /* Overwrite checksum with NUL */
     if ( bcc != NUL )
           return( NUL ); /* Checksum error: return NUL */
           return( ETX ); /* ETX: Good bcc received.    */
   }
   else
   {
     *++reply = NUL; /* Write NUL after non ETX character   */
     return( *−reply );   /* Return with last character received */
   }
}
```

5.8.8 C PROGRAM LISTING (Cont.)

```
/**********************************************************************
FUNCTION      : POLL VALUE
DESCRIPTION   : This routine polls (reads from) the 34X instrument
ARGUMENTS     : port   = port offset
                addr   = Pointer to instrument address (GID GID UID UID)
                cmd    = Pointer to the command to be used
                chan   = Pointer to channel character
                reply  = Pointer to reply buffer
RETURNS       : Should returnETX but also NUL, EOT, ACK, and NAK.
NOTES         :
**********************************************************************/
char poll_value( int port, char *addr, char *cmd, char *chan, char *reply )
{
   send_address(port,addr);
   send_byte(port,*chan);
   while( *cmd != NUL )
   send_byte( port, *cmd++ );
   send_byte(port,ENQ);
   return( get_reply(port,reply) );
}
```

5.8.9 C PROGRAM LISTING (Cont.)

```c
/**********************************************************************
FUNCTION      :  MAIN
DESCRIPTION   :  Top level of example of 345 comms program
ARGUMENTS     :  None
RETURNS       :  Void
NOTES         :
**********************************************************************/
void main()
{
   int i, port, baud;
   char address[5], chan[2], command[40];
   char reply[40];

   port = 0;
   baud = 9600;
   init_port( port, baud );

   (void) printf("\nEnter group address and unit address(no spaces)
           e.g. 2211 :");
   (void) gets( address );
   command[0] = '_';
   for(;;)
   {
     (void) printf("Enter channel number 1 to { : ");
     (void) gets( chan );(void) printf("Enter command and data (no spaces)
                                           e.g. PV12.345 or Q to quit: ");
     (void) gets( command );
     if ( !strcmp( command, "Q" ) || !strcmp( command, "q" ))
     exit(0);
     if ( command[2]== NUL )   /* Read */
     {
         if ((poll_value(port, address, command, chan, reply )) == NUL )
         {
             if (strlen(reply) != 0 )
                 (void) printf("\nChk Sum Failed\n");
             else (void) printf("\nNo reply\n" );
         }
         else
         {
             if ( reply[0] == EOT )
                 (void) printf("\nUnrecognised command\n");
             else (void) printf("\n %s \n\n", reply );
         }
     }
     else                  /* Write */
     {
     if ((select_cmd( port, address, command, chan, reply )) != ACK)
         (void) printf("\nNo acknowledge\n");else (void) printf("\nAcknowledged\n");
     }
   }
}
```

5.8.10 COMMUNICATIONS PROBLEMS

Assuming that the hardware and software configurations are correct, the following problems may arise.

1. It is essential that the correct case (ie. capitals or lower case) is used for the mnemonics as shown in table 5.8.5b.   Failure to ensure this will result in a NAK being returned.

2. It is essential that the correct 'leading character' is used when writing an alpha-numeric or Hexadecimal string.   Alpha-numeric values MUST be preceded by an apostrophe (') and Hex values must be preceded by >.   The format tables 5.8.6a and b explain the various formats used.   Failure to ensure this will result in a NAK being returned.

3. If the wiring is incorrect (e.g. Tx + and Tx - crossed over) it is possible that the host will pick up a reflection, and instead of 'No Response', a copy of the Enquire or Write message will be returned.

4. Before writing a value to a PV can be accomplished, the relevant channel's function must be configured to 'comms'.

5. Before writing to the instrument, Comms "Read/Write" must be set NOT Read Only.

5.9 RETRANSMISSION OPTION

5.9.1 INTRODUCTION

This option provides up to three isolated outputs, each capable of driving loads of up to 600Ω. These outputs are linearised and scaled versions of any input channel, derived channel or derived variable, and can be configured as either 0 to 20 mA or 4 to 20 mA, as a part of the software (menu) configuration described below.

At the rear terminals of the recorder, located as shown below,   the signal can be taken directly as a current output, or if a voltage output is required, the signal is taken from an integral 250 resistor.   If the output set up in the menu is defined as 0 to 20 mA, then the equivalent voltage range appearing across the resistor will be 0 to 5 Volts; if the output is defined as 4 to 20 mA, then the equivalent voltage range will be 1 to 5 Volts
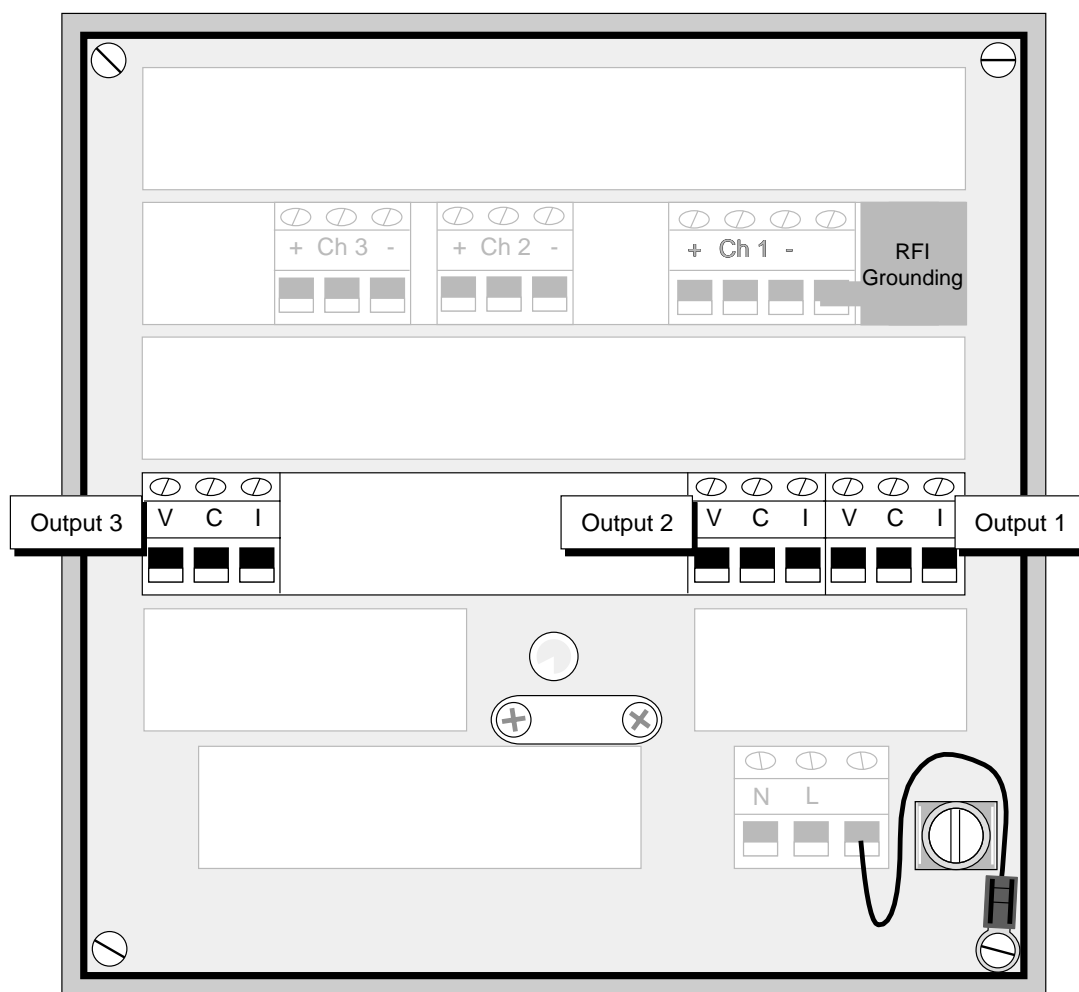
The retransmission terminations are shown here in option board 2 position (Slot 4). The board can alternatively be fitted in option board position 1 (slot 3) See section 2.4.5 for further details.

Figure 5.9.1 Re-transmission terminal locations

CAUTION
DAMAGE WILL BE CAUSED TO THE TERMINAL BLOCKS IF THE SCREWS ARE OVER-TIGHTENED.   THE RECOMMENDED MAXIMUM TORQUE IS O.4Nm.

5.9.2 SIGNAL WIRING

As shown in figure 5.9.2 below, each of the three re-transmission outputs has three connections associated with it. For current output, the signal is taken from I (source) and C terminals.   For voltage output, V and I terminals are linked, and the signal appears across the V (positive) and C terminals.
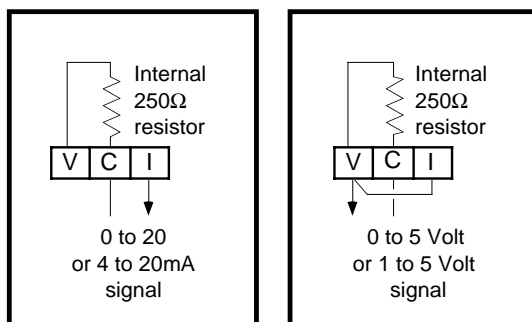
Figure 5.9.2 Signal wiring for current and voltage outputs

5.9.3 CONFIGURATION PAGES

RE-TRANSMISSION SOURCE

This page defines the signal which is to be re-transmitted.   Any channel or derived variable can be selected. In the case of channels, the re-transmitted voltage is linearised and scaled before being re-transmitted.

RE-TRANSMISSION OUTPUT RANGE

The up / down arrow keys are used to scroll between '0 to 20' or '4 to 20' mA for the output range.   If voltage outputs are required, a range of 0 to 20 mA will give a voltage range of 0 to 5 Volts; a range of 4 to 20 mA will give a voltage range of 1 to 5 Volts.

RE-TRANSMISSION LOW AND HIGH OUTPUTS

These two pages allow values to be assigned to the output range limits, in channel (DV) units.   For example, the input source may be scaled 0 to 1000 ˚C, but the required re-transmitted output may range only between 400 and 800 ˚C. In such a case, and if an output range of 4 to 20 mA has been chosen, then 4mA will represent 400 ˚C and 20mA will represent 800 ˚C. Thus 400 and 800 would be the re-transmission low and high outputs entered using the numeric keys.

5.9.3 RETRANSMISSION OPTION CONFIGURATION PAGES (Cont.)
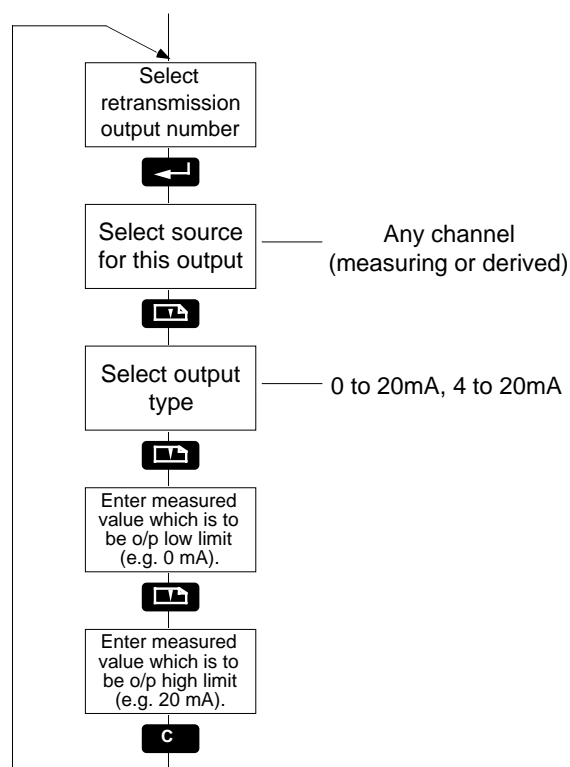
Figure 5.9.3 Re-transmission configuration menu arrangement

5.9.4 CALIBRATION

INITIAL SET-UP

For the channel concerned:

a. Connect 'V' re-transmission terminal to the input channel's '+' terminal
b. Connect 'C' re-transmission terminal to the input channel's '-' terminal
c. Connect re-transmission terminals 'I' and 'V' together using a short link or jumper.

Note... The above steps must be carried out before the calibration is started, or the calibration process will fail.

CALIBRATION

Referring to section 6.3 as necessary, access the 'Cal Retrans' calibration page.   Select the relevant re-transmission output and operate the ENTER key.

After the calibration of the first output is complete, this process can be repeated for any further re-transmission channels, wiring each one in turn to channel one, **before** operation of the ENTER key for that output.

5.10 TRANSMITTER POWER SUPPLY OPTION

This option supplies six 25-Volt (nominal) isolated outputs, each of which is intended to supply a remote transmitter running a 0 to 20 mA or 4 to 20 mA current loop.

Physically, the option consists of two circuit boards and associated output terminal blocks located in the rear terminal cover of the recorder. Figure 5.10 shows an overall view of the option.
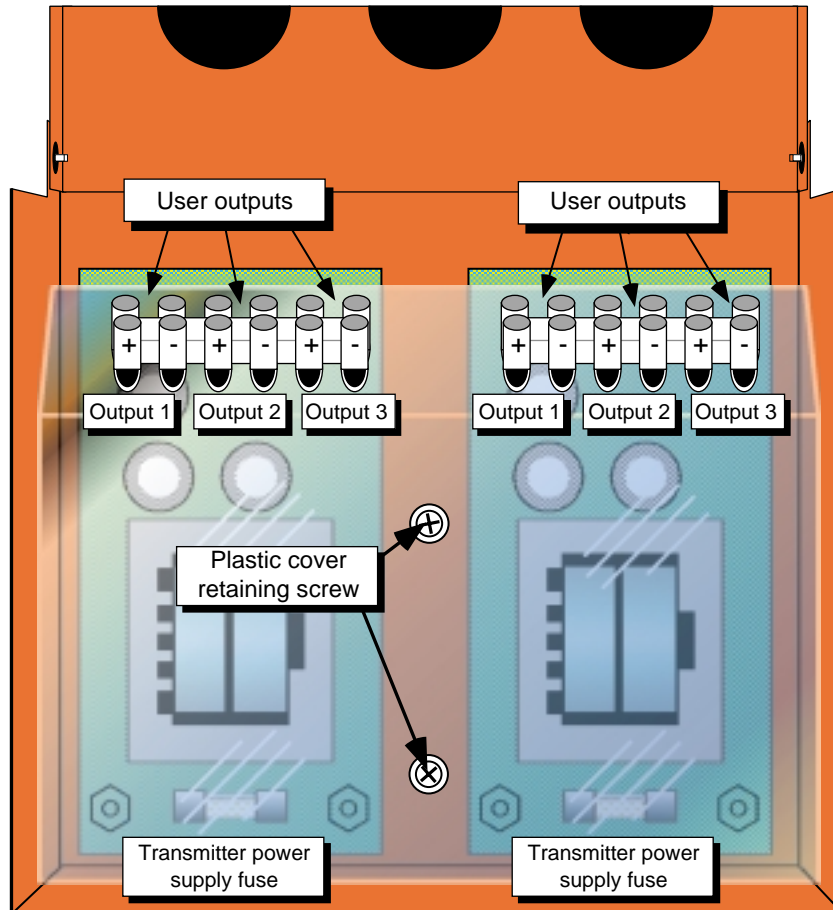
Figure 5.10 Over-all view of transmitter power supply option.

5.10.1 WIRING

SUPPLY VOLTAGE WIRING

With this option fitted, the mains (line) input is no longer applied by the user to the L and N terminals as indicated in figure 2.3.   Mains input is terminated instead, at a terminal block in the rear terminal cover. (The 'non-user' side of the terminal block is supplied already connected to the L and N terminals on the rear panel of the recorder.)

The Safety Earth connection must still be made to the Earth stud as indicated in figure 2.3.

FUSES

The value of the 20 mm. anti-surge fuse varies according to the supply voltage, as shown in the table below.

Supply Voltage	Fuse value	Fuse part Number
110/120	100 mA	CH050012
220/240	63 mA	CH050630

SIGNAL WIRING

Signal wiring for a typical channel is shown below.
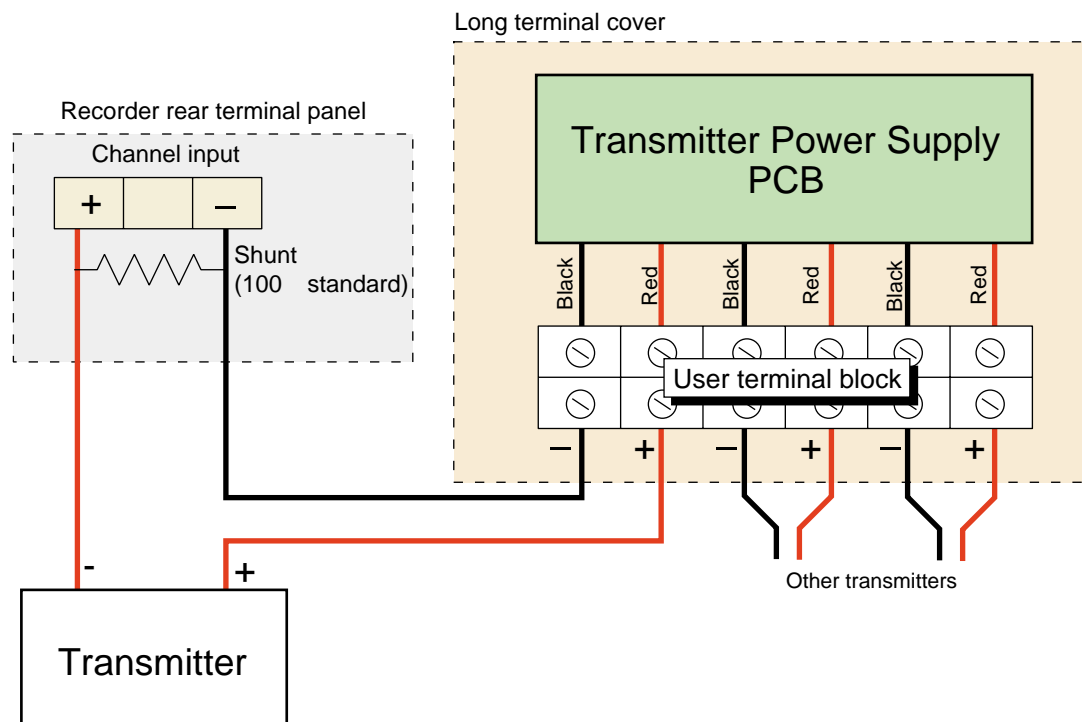
Figure 5.10.1 Transmitter power supply signal connections

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SECTION 6: SERVICING INFORMATION

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SECTION 6 SERVICING INFORMATION

6.1 WARRANTY STATEMENT

This product is warranted against defects in materials and workmanship for twelve months from the date of shipment. During the warranty period the manufacturer will, at its option, either repair or replace products which prove to be defective.

Warranty service at the buyer's facility can be provided only upon prior agreement by the manufacturer or its representative, and the buyer may be required to pay round-trip travel expenses.

In all cases the buyer has the option of returning the product for Warranty service to a facility designated by the manufacturer or its representatives.   The buyer shall prepay shipping charges for products returned to a service facility, and the manufacturer or its representative shall pay for the return of the product to the buyer.

6.1.1 LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects arising from:
1. Improper or inadequate maintenance by the user.
2. Improper or inadequate site preparation
3. Unauthorised modification or misuse.
4. Operation of the product in unfavourable environments, especially high temperature, high humidity, corrosive or other damaging atmospheres.

6.1.2 DISCLAIMER

No other warranty is expressed or implied. The manufacturer specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

6.1.3 EXCLUSIVE REMEDIES

The remedies provided above are the buyer's sole and exclusive remedies. The manufacturer shall not be liable for any direct, indirect, special incidental or consequential damages.

6.1.4 CALIBRATION ACCURACY

This product was thoroughly tested to ensure compliance with the published specifications. All instruments used in production and final test are regularly inspected to maintain accuracy of calibration traceable to the National Bureau of Standards. The user should be satisfied that the performance of the product as received meets expectations and, as a part of a program of planned maintenance, should periodically check calibration accuracy against reliable standards.

WARNING
THE PRODUCT COVER(S) SHOULD NOT BE REMOVED BY OTHER THAN QUALIFIED SERVICE PERSONNEL.   HIGH AND LETHAL VOLTAGES ARE PRESENT AT EXPOSED POINTS ON THE CHASSIS IF POWER IS APPLIED.   THE MANUFACTURER SHALL NOT BE LIABLE FOR PERSONAL INJURY OR PROPERTY DAMAGE SUFFERED IN SERVICING THE PRODUCT.   THE PRODUCT SHOULD NOT BE MODIFIED OR REPAIRED IN A MANNER AT VARIANCE WITH PROCEDURES ESTABLISHED BY THE MANUFACTURER.

6.2 INSTRUMENT ALARMS

The recorder has self test software to monitor all critical operations. Entry into the instrument alarms is through the last item in the main configuration menu and the last item in the operator menu.

If a flashing "I" appears, the following menu item should be accessed and the ENTER key operated to review the item(s) which may be causing an instrument alarm.

```
Inst. Alarm ?
```

The Instrument Alarm menu items are as follows:

1. Battery low.   The RAM battery is reported to have a voltage below 2.5 volts. At this point the battery should be replaced to ensure retention of accumulated data and operation of the clock/calendar when the recorder power is off. For recorders fitted with annotation pen trays, a 'Battery low' message is printed on the chart, after each power-up.

   Note...
   A battery low message is normal when the recorder is turned on after an extended shut down period. There is no battery problem if the alarm enunciator stops after a few minutes.

2. ROM bad.   The basic software PROM is checked during initialisation which occurs when the recorder is turned on or when abnormal operation is detected by self-test software. Any change sets the Instrument Alarm. If 'ROM Bad' is reported, call the supplier for service assistance.

At recorder initialisation, the integrity of stored information and calibration data is checked, and returns a failure message, as detailed below, if any of the checks fails.   Should the recorder determine that both the EEPROM and RAM memories of an item have changed, the recorder loads default data from the system PROM and sets the instrument alarm.

If any data has been lost, one or more of the following messages may be displayed by operating the page scroll key.

1. Input prog X.   Each measuring channel (X) is checked for lost input type, Hi/Lo limits, range Hi/Lo limits, units and CJC type. See Section 4.8 for channel configuration information.
2. Input Cal. X.   Each input channel (X) is checked for lost calibration data.   See Section 6.3 for calibration information.
3. Factory Cal. X.   Each input channel (X) is checked for lost factory calibration data. If 'Factory Cal.' is reported, the supplier should be contacted for service assistance.
4. CJC Cal. X.   The input board is checked for cold junction compensation calibration data. See section 6.3 for CJC calibration information.
5. Chan. Prog. X.   Each channel (X) is checked for lost chart Hi/Lo Limits, annotation choice, or interpolation data.   See Section 4.8 for channel configuration information.
6. Chart Prog.   The calibration of the servo carriage is checked.   See section 6.3 for carriage calibration information.

6.2 INSTRUMENT ALARMS (Cont.)

7.   History Prog.   The configuration of the trace history function is checked.   See section 5.5 for history configuration information.

8.   Misc. Prog.   Not used.

9.   Channel Adj. X   Each channel (X) is checked for loss of channel adjust settings. See Section 4.8 for channel adjust configuration information.

10.   Channel Desc. X. Each channel (X) is checked for loss of the channel descriptor.   See section 4.8 for channel descriptor configuration information.

11.   Alarm Prog. XX.   Each alarm (1-1 to 6-4) is checked for loss of configuration data.   See section 4.10 for Alarm configuration

12.   Custom Msg. XX.   Each custom message (XX) is checked for any change in text.   See section 5.4 for custom message information.

13.   Alarm Msg. XX.   Each alarm message (1-1 to 6-4) is checked for any change in text. See section 4.10 for alarm configuration information.

14.   Custom Curve.   All data for the custom curve is checked.   See instrument menu (section 4.9) for custom curve configuration information.

15.   Relay Prog. XX.   Each relay (XX) configuration is checked.   See section 5.1 for relay configuration information.

16.   D V Prog. X.   Each derived variable (DV X) is checked.   See section 5.7 Derived Variable configuration information.

17.   Totaliser X.   Each totaliser (X) is checked for configuration data changes.   See section 5.2 for totaliser configuration information.

18.   Timer X.   Both timers are checked. See section 4.12 for timer configuration information.

19.   Custom Msg. XX.   Each custom message (XX) is checked for any change in text.   See section 5.4 for custom message review information.

20.   Alarm Msg. XX.   Each alarm message (1-1 to 6-4) is checked for any change in text. See section 4.10 for alarm configuration information.

21.   Custom Curve.   All data for the custom curve is checked.   See instrument menu (Section 4.9) for custom curve configuration information.

22.   Relay Prog. XX.   Each relay (X) configuration is checked.   See section 5.1 for relay configuration information.

23.   D V Prog. X.   Each derived variable (DV X) is checked.   See section 5.7 for derived variable configuration information.

24.   Totaliser X.   Each totaliser (X) is checked for configuration data changes.   See section 5.2 for totaliser configuration information.

25.   Timer X.   Both timers are checked.   See section 4.12 for timer configuration information.

Note...

   Review all 'Lost' displays using the page key only. A double operation of the ENTER key with any of these displays present turns off the 'Lost' displays and confirms to the recorder that all present configuration and calibration data is acceptable for use.

6.3 CALIBRATION

The instrument calibration function permits:

1. The calibration of input channels, using precision signal standards.

2. Calibration of the thermocouple cold junction compernsation using a thermocouple at a known temperature, or a precision thermocouple simulator.

3. Alignment of pens with the chart.

4. Determination of which software features are installed in the recorder.

Note...Calibration of RTDs sets only the excitation current for the resistance device.   The actual measuring accuracy depends on the millivolt gain span in use.   Thus, to ensure maximum RTD accuracy, all millivolt ranges should first be calibrated.

6.3.1 CALIBRATION PAGES

```
 Change Cal?
No
```

This is the default selection.   The up/down arrow keys are used to change the selection to one of the following:
1. Annotator carriage. The ENTER key is used to start alignment of the annotator pen with the chart. 2. Inut channel.   The ENTER key is operated to gain entry to the channel calibration menus.

3. CJ sensor. The ENTER key is used to start calibration of the cold junction sensor.

4. Factory Cal.   Restores factory calibration.

5. Servo pen.   The ENTER key is used to start calibration of the pen tips relative to the chart.

6. View options.   Operation of the ENTER key causes the options display to appear.

7. Retransmission. Operation of the ENTER key calibrates the output channel.

ANNOTATOR CARRIAGE

```
Change Cal?
   Ann. Carriage
```

Operation of the ENTER key calls the display below, and moves the annotator pen tip to a position just beyond chart zero.   By opening the display and operating the side arrow, the pen trace can be moved to coincide with the chart zero grid line.   Should a mistake be made, and the adjustment go too far, operation of the CLEAR key causes the pen tip to return to its initial position to the left of chart zero.

```
Set Carr. Left
'C' avoids change
```

Once the adjustment is successfully accomplished, operation of the ENTER key saves the new alignment.   To exit the carriage alignment menu, the CLEAR key is operated. Otherwise the page scroll key is operated to call the display below, and the pen tip moves to a position just to the left of chart full scale.   With the display open, the pen tip can be aligned with the chart full scale grid line.   Should a mistake be made, and the adjustment go too far,   operation of the CLEAR key will reset the tipp position to the left of the full scale line.

```
Set Carr right
 'C' avoids change
```

Once the adjustment has been completed, operation of the ENTER key saves the new alignment.   To exit the carriage alignment menu, the CLEAR or Page scroll key is operated to return to the 'Change Cal?' display.

6.3.1 CALIBRATION PAGES (Cont.)

CHANNEL RANGES

This calibration procedure allows the selection of a specific hardware range for the recorder to use.   Refer to section 1.3 for details of the available hardware ranges.

```
Change Cal?
   Input Channel
```

Operation of the ENTER key allows a channel number to be chosen, using the up/down arrows, followed by ENTER.

```
  Choose Range
     20mV
```

Operation of the up/down arrow keys allows the hardware range to be selected from the list below.   Because the recorder internal operating span (gain) is chosen automatically when range low and high are entered (section 4.8), it is recommended that all ranges are calibrated.20mV, 60mV (this range must be calibrated before the CJC is calibrated), 80mV, 200mV, 400mV, 1.7V (this range must be calibrated before the CJC), 2.5V, 5.0V, Ohms (RTD current defined.)

Note...
   Precision input sources must be connected and set to the proper value before this calibration procedure is continued.

```
C1 Apply High
      20.00    mV
```

The input source should be set to the displayed value (20mV in this example).   Operation of the page scroll key enters the new calibration, after a short delay accompanied by a 'Wait' message at the display.   The process is repeated for the apply low display.   Should it not be practical to attain exactly the suggested input value, the up/down /side arrow keys are used to enter that value which is attainable.

Once the adjustments are complete, the CLEAR key is operated twice to return to the 'Change Cal ?' display.

CJ SENSOR

This part of the calibration procedure requires the connection of a type J thermocouple, at a known temperature, or of a Type J thermocouple simulator.

```
Change Cal?
   C J Sensor
```

Operation of the ENTER key allows the selection of input board 1 or 2 for calibration, by means of the up/down arrow keys, followed by ENTER.

```
Enter Ref. Temp.
    XX.X  ˚C
```

The up/down/side arrows are used to enter the type J or simulator Input temperature.

An alternative method is to short-out the input of channel 1, measure the temperature between channel 1 and 2 input terminals (as closely as possible to the CJ sensor), and to enter this value as a reference temperature.

6.3 CALIBRATION (Cont.)
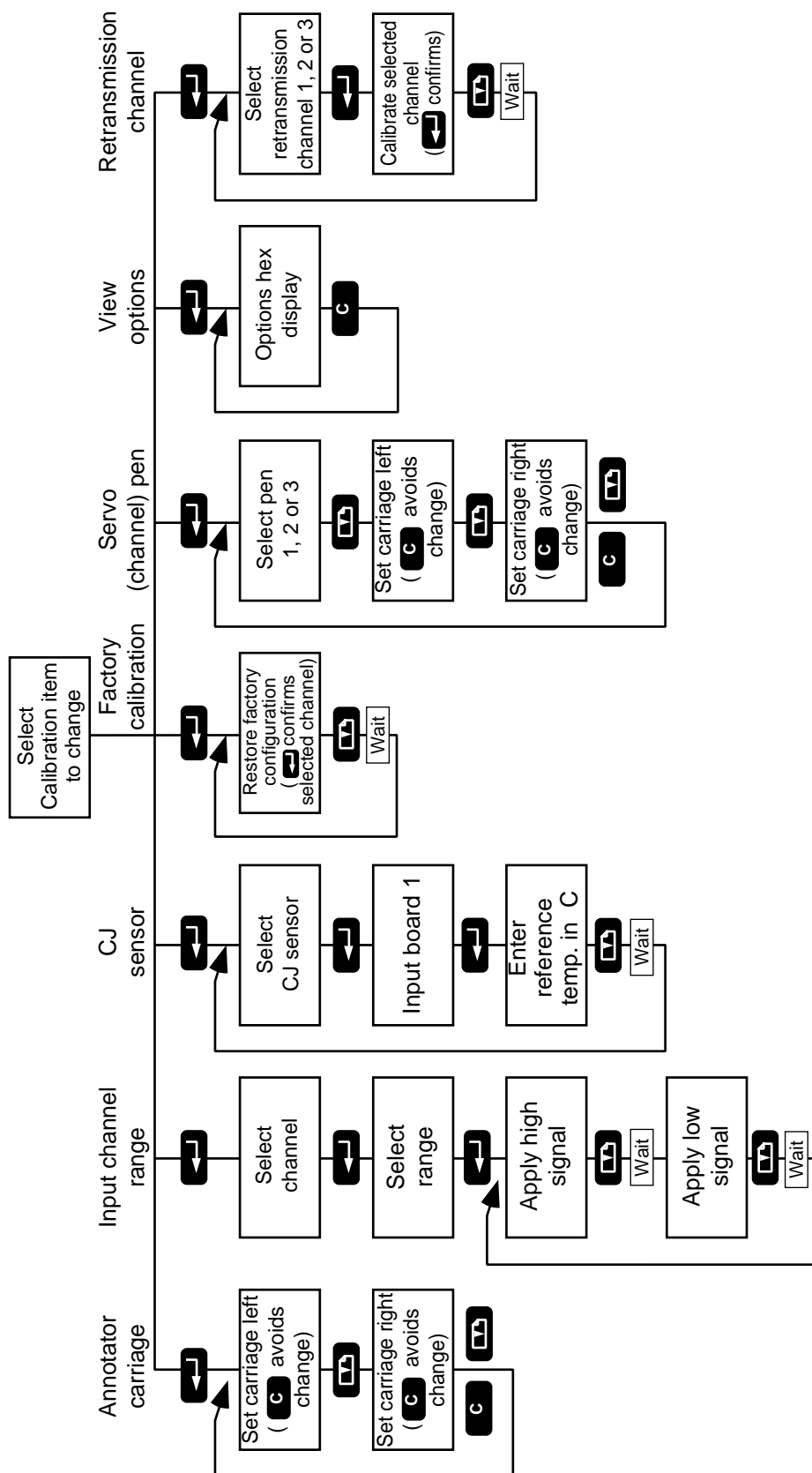
Figure 6.3 Calibration configuration menu arrangement

6.3.1 CALIBRATION PAGES (Cont.)

RESTORE FACTORY CONFIGURATION

```
Change Cal?
   Factory Cal
```

The ENTER key is operated to re-install the original factory calibration for all channels.

Note...This choice replaces current calibration with constants stored during manufacture of the input amplifier board(s). Restoration does not change user entered configuration data.

```
Factory Cal
ENTER to confirm
```

The ENTER key is operated to return all input amplifiers to initial factory calibration.

SERVO PEN ALIGNMENT

This procedure is used to align the pens with the chart zero and chart full-scale grid lines.

```
Change Cal?
   Servo Pen 1
```

Operation of the up and down arrow keys allow a channel to be selected. Once a channel has been selected, operation of the ENTER key calls the display below, and moves the pen to just to the left of chart zero. By opening the display, and operating the side arrow, the trace can be moved to align with the chart zero grid line. Should a mistake be made, and the adjustment go too far, operation of the CLEAR key causes the pen to return to the initial position to the left of chart zero.

```
Set Carr. Left
'C' avoids change
```

Once the adjustment is completed, operation of the ENTER key saves the new alignment. To exit the servo pen alignment menu, the CLEAR key is operated. Otherwise, the page scroll key is operated to call the display below, and the pen moves to a position to the left of chart full scale. With the display open, the pen can be aligned with the chart full-scale grid line. Should a mistake be made, and the adjustment go too far, operation of the CLEAR key will reset the pen position to the left of thhe full-scale line.

```
 Set Carr. Right
'C' avoids change
```

Once the adjustment is completed, operation of the ENTER key saves the new alignment. To exit the pen alignment menu, the CLEAR or Page Scroll key is operated to return to the Change Cal ? display.

VIEW OPTIONS

```
 Change Cal?
  View Options?
```

Operation of the Enter key calls the display below, which consists of 16 hexadecimal characters used to display the combination of options fitted to the recorder in question. The table below shows the interpretation of these characters. Character 1 is at the left-hand end of the display; character 16 at the right-hand end.

6.3.1 CALIBRATION PAGES (Cont.)

1st character values	Interpretation		
	Battery	Annotation	Comms
0	Yes	Yes	No
2	Yes	Yes	Yes
4	No	Yes	No
6	No	Yes	Yes
	Annotation is always enabled. For printing to take place, an annotator pen tray must also be present.		

2nd character values	Interpretation		
	1st retrans.	2nd retrans.	3rd retrans.
0	No	No	No
2	No	No	Yes
4	No	Yes	No
6	No	Yes	Yes
8	Yes	No	No
A	Yes	No	Yes
C	Yes	Yes	No
E	Yes	Yes	Yes

3rd character values	Interpretation		
	Custom curve	Pen offset comp.	Event Replay
0	No	No	No
2	No	No	Yes
4	No	Yes	No
6	No	Yes	Yes
8	Yes	No	No
A	Yes	No	Yes
C	Yes	Yes	No
E	Yes	Yes	Yes

4th character values	Interpretation		
	Derived channel 1	Derived channel 2	Derived channel 3
0	No	No	No
2	No	No	Yes
4	No	Yes	No
6	No	Yes	Yes
8	Yes	No	No
A	Yes	No	Yes
C	Yes	Yes	No
E	Yes	Yes	Yes

5th character values	Interpretation			
	Totaliser 1	Totaliser 2	Totaliser 3	Totaliser 4
0	No	No	No	No
1	No	No	No	Yes
2	No	No	Yes	No
3	No	No	Yes	Yes
4	No	Yes	No	No
5	No	Yes	No	Yes
6	No	Yes	Yes	No
7	No	Yes	Yes	Yes
8	Yes	No	No	No
9	Yes	No	No	Yes
A	Yes	No	Yes	No
B	Yes	No	Yes	Yes
C	Yes	Yes	No	No
D	Yes	Yes	No	Yes
E	Yes	Yes	Yes	No
F	Yes	Yes	Yes	Yes

6th character values	Interpretation	
	Totaliser 5	Totaliser 6
0	No	No
4	No	Yes
8	Yes	No
C	Yes	Yes

7th character values	Interpretation			
	Totaliser output 1	Totaliser output 2	Totaliser output 3	Totaliser output 4
0	No	No	No	No
1	No	No	No	Yes
2	No	No	Yes	No
3	No	No	Yes	Yes
4	No	Yes	No	No
5	No	Yes	No	Yes
6	No	Yes	Yes	No
7	No	Yes	Yes	Yes
8	Yes	No	No	No
9	Yes	No	No	Yes
A	Yes	No	Yes	No
B	Yes	No	Yes	Yes
C	Yes	Yes	No	No
D	Yes	Yes	No	Yes
E	Yes	Yes	Yes	No
F	Yes	Yes	Yes	Yes

8th character values	Interpretation	
	Totaliser output 5	Totaliser output 6
0	No	No
4	No	Yes
8	Yes	No
C	Yes	Yes

9th character values	Interpretation
	Customer messagge
0	No
8	Yes

10th character values	Interpretation
	Expanded character set
0	No
8	Yes

Character 1 is leftmost
Characters 11 to 16 are not used

Table 6.3 Interpretation of option display

6.3.1 CALIBRATION PAGES (Cont.)

RETRANSMISSION OPTION

PRE-CALIBRATION WIRING

Note...
Before carrying out the calibration of a retransmission channel, the following procedure must be carried out.

For retransmission channel 1, remove any existing wiring from input channel 1 and retransmission channel 1. Link retransmission channel V and I terminals, then link retransmission channel 1 V and C terminals to input channel 1 + and - terminals respectively (see figure below).

```
        ┌─────┬─────┬─────┐ Input channel
        │  +  │     │  −  │ connector
        └─────┴─────┴─────┘
           │       │
           │   ┌───┘
           │   │
        ┌─────┬─────┬─────┐ Retransmission
        │  V  │  C  │  I  │ channel connector
        └─────┴─────┴─────┘
```
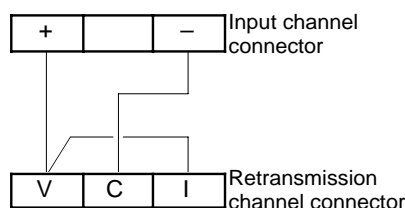
The wiring is identical for other channels, with retransmission channel 'n' output being connected across input channel 'n'.

CALIBRATION PROCEDURE

```
┌────────────────────────┐
│      Change Cal?        │
│      Cal Retrans        │
└────────────────────────┘
```

Operation of the enter key allows the relevant channel to be selected using the up and down arrows.

```
┌────────────────────────┐
│     Cal Retrans?        │
│           1             │
└────────────────────────┘
```

Once the required channel has been selected, a further operation of the enter key calls the 'confirm' page.

```
┌────────────────────────┐
│     Cal Retrans?        │
│   ENTER to confirm      │
└────────────────────────┘
```

A final operation of the enter key causes the calibration to take place, during which process, a 'Wait' message appears at the display. Once all the relevant channels have been calibrated, the outputs should be disconnected from the input channels, and any signal wiring connected.

6.4 PRINTING ADJUSTMENTS

6.4.1 ANNOTATOR PEN FORCE ADJUSTMENT

If the recorder is mounted with the rear of the case lowered in a sloping panel, it may be necessary to increase the annotator force to regain dot intensity lost as a result of panel angle. Conversely, if the rear of the case is raised, it may be desirable to decrease dot intensity to obtain the sharpest printing and longest pen life.

Access to the pen force adjustment potentiometer is made through a vertical slot located just behind the voltage selector switch. Rotating the potentiometer adjustment screw clockwise increases dotting force, and vice-versa. Force measurement is carried out with a deflection type gram gauge as follows:

Enter the Calibration Menu and choose 'Ann. Carriage'.

With the annotator pen slowly dotting at the left end, release the chart cassette latch. Place the gauge under a coloured tip to measure the force. The correct force range is 6 to 9 grams.

6.5 SERVICE PARTS LISTING

* = Recommended Spare Part.   Choose no. of channels, etc. to match instrument(s)

DESCRIPTION	PART NUMBER	DESCRIPTION	PART NUMBER
SERVO TRAY		**CHASSIS**	
Drive cord kit (channel pen)	LA245950	Battery board (Lithium)*	AH243850U100
Drive cord kit (annotator pen)	LA245957	Battery board (Alkeline) *	AH243850U200
Digital Display	LA242481	Annotator board	AH204348
Channel 1 pen tray assembly	LA243386	Mother board	AH204824
Channel 2 pen tray assembly	LA243387	Display/servo board (chan 1)	AH204131U451
Channel 3 pen tray assembly	LA243388	Display/servo board (chans 1,2)	AH204131U452
Annotator tray assembly	LA243389	Display/servo board (chans 1,2,3)	AH204131U453
PENS		2 Relay board (1-12)	AH204100U002
Channel 1 pen	LA235347	4 Relay board (1-12)	AH204100U004
Channel 2 pen	LA235348	6 Relay board (1-12)	AH204100U006
Channel 3 pen	LA235349	1 Retransmitter board	AH204220U100
Annotator pen	LA235350	2 Retransmitter board	AH204220U200
CHARTS		3 Retransmitter board	AH204220U300
Roll chart (xxx divisions)	GD128971Uxxx	6 Contact Input board	AH204000U200
Z-fold chart (xxx divisions)	GD128970Uxxx	RS422 comms and 6 contacts	AH204000U345
Where xxx = Number of chart divisions required.		1 Channel input board *	AH204120U100
Choose from 040, 045 050, 060, 070, 075		2 Channel input board *	AH204120U200
		3 Channel input board *	AH204120U300
CASE AND DOOR		Fuse, 1 Amp * (110 V supply)	CH050012
6 Term. Block (CJC)	LA243768	Fuse, 500 mA * (240V supply)	CH050630
1-way terminal Block (Gold)	LA235121		
3-way terminal Block (Gold)	LA235123	**CASSETTES**	
6 - way terminal Block (Tin)	LA235132	Chart Motor	LA246818
Shunt assembly (100 Ohms)	LA245132UK10	Roll chart cassette (Auto take-up)	LA243070
Shunt assembly (250 Ohms)	LA245132UK25	Roll chart cassette (Manual)	LA245781
Attenuator; 100:1 (1 Megohm)	LA245131	Take-up spool assembly*	LA241071
Transmitter PSU 120V	LA245786U130	Z-fold chart cassette	LA243800
Transmitter PSU 240V	LA245786U230	Z-fold paper guide	BD245066
Transmitter PSU 110V	LA245786U330		
Transmitter PSU 220V	LA245786U430		
DIN mounting clip and rod assy.	LA129716		
Door Lock: DIN with key	FI129237		
Door Hinge Pin	BE128709		
Door Pin Spring	BE243983		

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ANNEX A

CONFIGURATION GUIDE

LIST OF CONTENTS

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ANNEX A
CONFIGURATION GUIDE

A1.0 INTRODUCTION

This section is intended as a quick guide to the configuration menus of the recorder. The operator menu is presented first, followed by the configuration menus as the appear when using the page scroll key in the 'main menu', assuming that all available options are fitted.

The order is as follows:

1.   Operator menu
2.   Channel configuration. The channel number selected determines whether a measuring channel or a derived channel is selected for configuration.
3.   Instrument configuration
4.   Alarm configuration
5.   Relay option configuration
6.   Totaliser option configuration
7.   Logging functions configuration
8.   Custom message option configuration
9.   Timer option configuration
10. Trace history option configuration
11. Range magnify option configuration
12. Derived variable option configuration

The remaining two main menu displays, 'View instrument alarms' and 'Calibration change' are not discussed in this annex. Full details appear in section 6 of the manual.

A1.1 CLEAR KEY OPERATION

The Clear key has two functions as follows:

1.   During configuration, if a mistake is made in entering the required information, the Clear key can be used to restore the entry to its previous state, PROVIDING THE ENTER KEY HAS NOT BEEN OPERATED.

2.   Whilst scrolling through menu pages, the Clear key acts as the inverse of the Enter key. In other words, whenever the Enter key has been used to access a certain menu level, the Clear key can be used to return to the previous level. The menu diagrams in this annex are intended to show only the organisation of the various menus; for this reason they have been simplified and do not show all the Clear key operations.

A2.0 OPERATOR MENU

Entered by a single press of the right arrow key on the control panel, whilst any background (measured value) display is present.

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Softkey	On/off	This parameter appears only if operator access to the softkey function has been enabled in the Instrument Configuration menu. If enabled, by setting the softkey to 'ON', the operator can initiate any function that includes 'key' in its action equation. Refer to section 3.4 for further details.
View total.	1 to 6	Operation of the Enter key causes the current value of the selected totaliser to be displayed. Operation of any key returns the operator to the menu.
Rset Total?	1 to 6	Operation of the Enter key initiates the resetting of the selected totaliser's value.
Pri Chart Spd	None	Operation of the Enter key allows a chart speed to be entered using the up, down and side arrow keys. The units are set as mm/hr or in/hr as a part of the Instrument Configuration.
Chart Advance	On/Off	The up or down arrow keys are used to set the chart advance function on or off. When selected ON, the chart advances at full speed until chart advance is selected OFF again.
Chart Hold	On/Off	The up and down arrow keys are used to set chart hold on or off. When selected ON, the chart drive and printing functions are inhibited, until the Chart hold is selected OFF again.
Pen Park	On/Off	The up and down Arrow keys are used to set the Pen Park function on or off. When selected ON, the chart stops, and the pens are fanned to allow easy access for pen replacement. Once the pens have been changed, the up or down arrow key is used to set pen park to OFF.
Alarm configuration	None	This page appears only if operator access to alarm set-up has been enabled in the Instrument Configuration. If access is allowed, then the operator can configure alarms as described in the alarm configuration section of this manual.
Batch Number	None	This page allows the up, down and side arrow keys to be used to enter a batch number to appear on the chart.
Print Log	None	The enter key is used to cause the log to print. If not required, operation of the Clear key returns the operator to the menu.
Range Magnify	On/Off	The up or down arrow is used to select the Range Magnification function on or off. See section 5.5 for further details.
Replay Hist?	None	The enter key is used to initiate the printing of trace history. If not required, operation of the Clear key returns the operator to the menu.
Alt. Chart Spd	On/Off	The up or down arrow key is used to set the alternative chart speed (set up in the Instrument Configuration) on or off.
Alarm Msg Cancl	None	The Enter key is used to cause all queued alarm messages to be cancelled. If this is not required, operation of the Clear key returns the operator to the menu.
View DV val?	1 to 9	Operation of the Enter key causes the current value of the selected DV to be displayed. Subsequent operation of any key causes a return to the menu.
Reset DV?	1 to 9	Operation of the Enter key causes a reset of the selected derived variable value.
Print message	1 to 10	Operation of the Enter key initiates the printing of the selected custom (user entered) message.
Time and Date	None	Operation of the up, down, and side arrows allow a time and date to be entered in 24-hour format. The displayed and printed format (12- or 24-hour format is set in Instrument configuration.
Inst Alarms		See section 6.2 of this manual

Table A2.0 operator menu parameters

A2.0 OPERATOR MENU (Cont.)

```
        ┌─────────────┐
        │ Background  │
        │   Display   │
        └─────────────┘
             │
           [ ▶ ]
             │
        ┌─────────────┐
        │ Set softkey │   If enabled in
        │  on or off  │   instrument menu
        └─────────────┘
             │
           [ ▼ ]
             │
        ┌─────────────┐                    ┌──────────────┐
        │Select totaliser│ If option       │Select timer for│
        │to be displayed │ fitted          │   display    │
        └─────────────┘                    └──────────────┘
             │                                   │
           [ ▼ ]                               [ ▼ ]
             │                                   │
        ┌─────────────┐                    ┌──────────────┐
        │   Reset a   │   If option       │ Select range │ If option
        │  selected   │   fitted          │mag. on or off│ fitted
        │  totaliser  │                    └──────────────┘
        └─────────────┘                         │
             │                                 [ ▼ ]
           [ ▼ ]                                 │
             │                              ┌──────────────┐
        ┌─────────────┐                    │Start printing│ If option
        │ Set primary │                    │replay history│ fitted
        │ chart speed │                    └──────────────┘
        └─────────────┘                         │
             │                                 [ ▼ ]
           [ ▼ ]                                 │
             │                              ┌──────────────┐
        ┌─────────────┐                    │Select altern-│
        │  Set chart  │                    │ative chart   │
        │   advance   │                    │speed on or off│
        │  on or off  │                    └──────────────┘
        └─────────────┘                         │
             │                                 [ ▼ ]
           [ ▼ ]                                 │
             │                              ┌──────────────┐
        ┌─────────────┐                    │Inhibit alarm │
        │Set chart hold│                   │  message     │
        │  on or off  │                    │  priniting   │
        └─────────────┘                    └──────────────┘
             │                                   │
           [ ▼ ]                               [ ▼ ]
             │                                   │
        ┌─────────────┐                    ┌──────────────┐
        │ Set pen park│                    │Select derived│ If option
        │  on or off  │                    │variable to be│ fitted
        └─────────────┘                    │  displayed   │
             │                             └──────────────┘
           [ ▼ ]                                 │
             │                                 [ ▼ ]
        ┌─────────────┐  If access is enabled    │
        │ Set alarm   │  in Instrument menu ┌──────────────┐
        │  setpoints  │                     │   Reset a    │ If option
        └─────────────┘                     │ selected DV  │ fitted
             │                              └──────────────┘
           [ ▼ ]                                 │
             │                                 [ ▼ ]
        ┌─────────────┐                          │
        │ Enter batch │                    ┌──────────────┐
        │   number    │                    │Initiate printing│ If option
        └─────────────┘                    │of selected   │ fitted
             │                             │  message     │
           [ ▼ ]                           └──────────────┘
             │                                   │
        ┌─────────────┐                        [ ▼ ]
        │ Initiate log│                          │
        │  printing   │                    ┌──────────────┐
        └─────────────┘                    │ Set time and │
             │                             │    date      │
           [ ▼ ]                           └──────────────┘
```
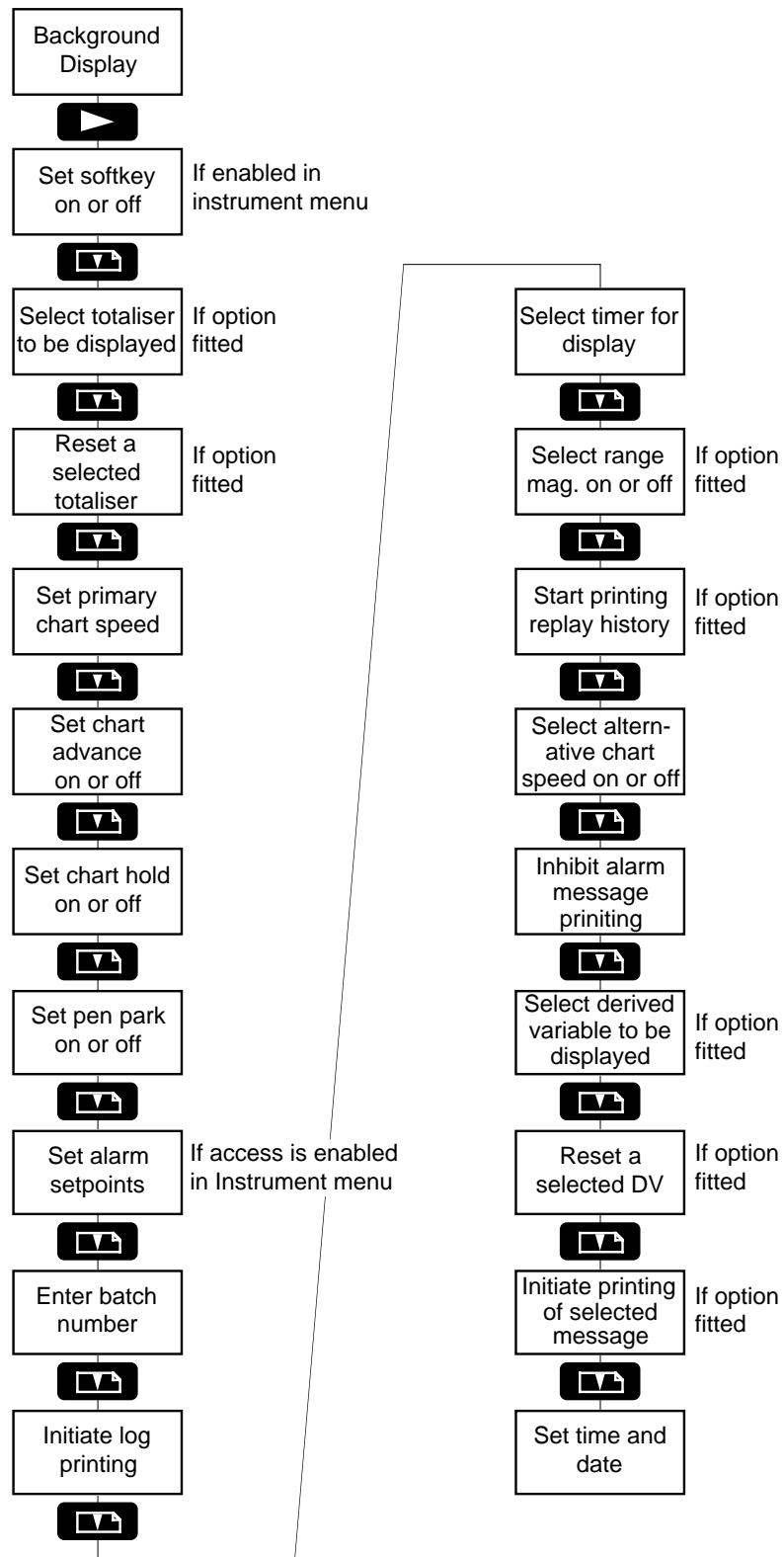
Figure A2.0 Operator menu

A3.0 CHANNEL CONFIGURATION

A 3.1 INPUT CHANNELS

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Lin. Func.	Off	Channel value is displayed OFF. Trace is printed at the left edge of chart, if not disabled.
	Linear	No linearisation is applied to the input signal
	Square Root	Applies square root function. E.G. input = 4; output = 2.
	3/2 Power	Applies square root function, then raises the result to the power of 3. E.G. input = 4; output = 8.
	5/2 Power	Applies square root function, then raises the result to the power of 5. E.G. input = 4; output = 32.
	Log Base 10	Applies anti-log function. E.G. input = 4, output = 10,000.
	Custom Curve	Applied a user entered function to the signal.
	T/C Type B, C, E, J, NiMol K, L, N, R, S, T 10 ohm Cu, 100 ohm PA 100 ohm PD, 100 ohm Ni 120 ohm Ni	Applies a linearisation function for the thermocouple or RTD selected.
	Comms	Must be selected if values are to be sent to PVs by a host computer

Note...

Hardware links on all the relevant input boards must be set up correctly for the type of input to be applied. See section 2.4 of this manual for details.

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Units	˚C, ˚F, Prog units	Allows degrees Celsius, degrees Fahrenheit or programmable units to be selected as the channel's displayed units. The programmable units string is entered later.
Dec. Point	None	The up and down arrow keys are used to move the decimal point position for the channel display left and right respectively, between 'X.XXXX' and 'XXXXX.'
Units Str.	Text entry	This page appears only if Prog.Units has previously been selected. The up, down and side arrow keys are used to enter a units string as described in section 4.4 of this manual.
Input type	Ohms, Millivolts, Volts, Thermocouple	Defines the type of input to be connected to the input amplifier. See section 2.4 for hardware configuration link details.
Range low	None	The up, down and side arrow keys are used to enter the lowest value to be measured, in engineering units.
Range high	None	Allows the highest value to be measured, to be entered in engineering units.
Input low	None	Present only when the input type chosen is Volts, millivolts or Ohms. The up, down and side arrow keys are used to enter the lowest value of input signal.
Input high	None	As for Input low, above, but for the highest value of input signal.
Chart low	None	The up, down and side arrow keys are used to enter chart 'zero'.
Chart high	None	The up, down and side arrow keys are used to enter chart full scale.
Filter Time	None, 1, 2, 4, 8, 16, 32 seconds	This function changes the response from the normal 0.5 seconds (none) to the scrolled value of seconds.
Mag. centre	None	Allows a value to be entered for use as a centre point for Range Magnify and Trace History options.
C.J.Type	Internal, External	Appears only when thermocouple is selected as input type. The up or down arrow key is used to select the internal or an external source for cold junction reference. If external is selected, the external temperature is entered in the Instrument Configuration.
Ch. Desc.	Text entry	The up, down and side arrow keys are used to enter a channel descriptor as described in section 4.4 of this manual.
Anno. trace	On, Off	If selected ON, the annotator pen traces the channel value. Can be used when the channel pen is being used to trace a derived channel.
Interplt.	On, Off	Allows interpolation to be carried out for annotator pen traces. See section 4.8 of this manual for details.
Ch. Adjust	None	The up, down and side arrow keys are used to adjust the measured/recorded values to agree with other measurements.

Table A3.1 Measuring channel configuration parameters
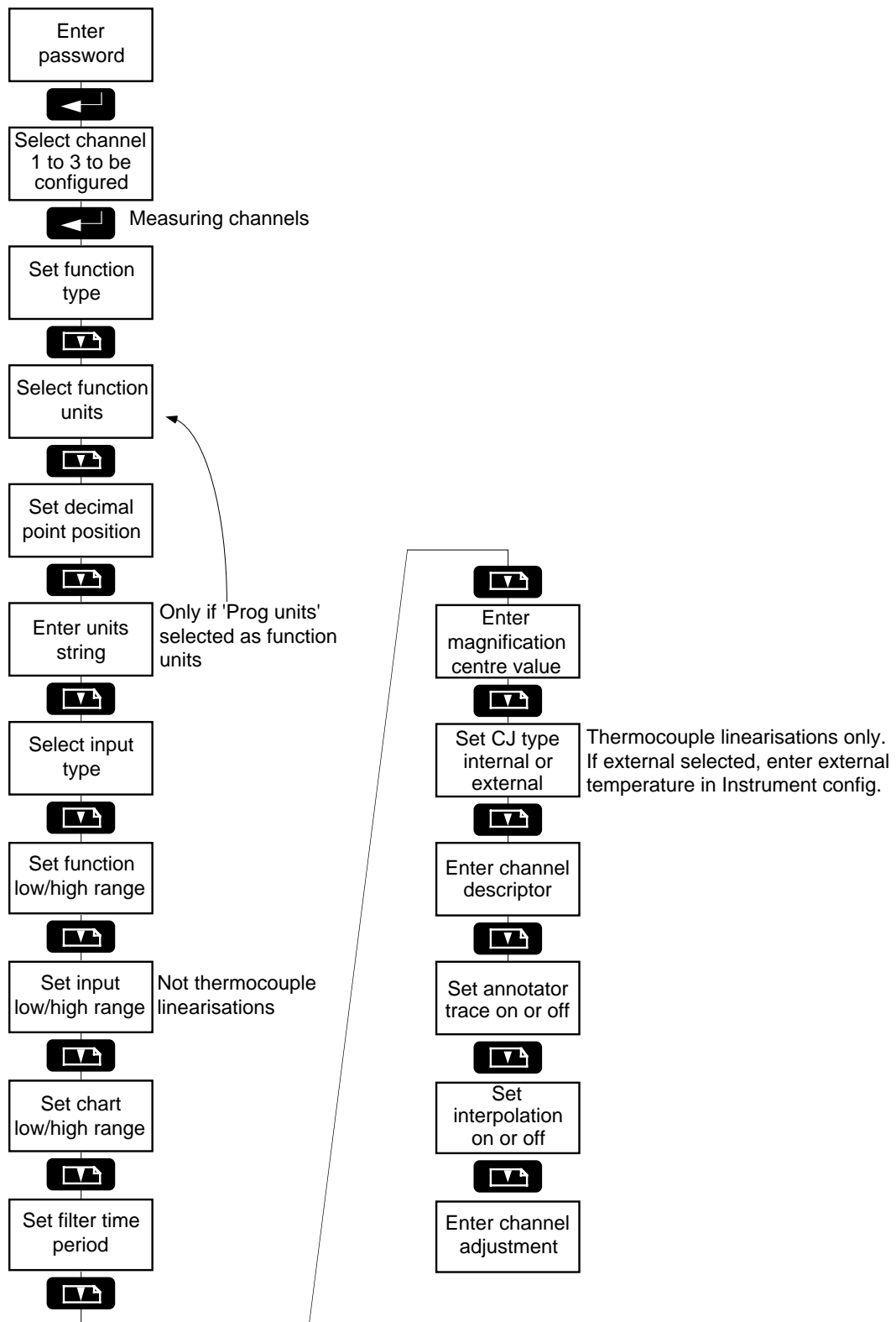
A3.1 INPUT CHANNEL CONFIGURATION (Cont.)

Enter
password

Select channel
1 to 3 to be
configured

Measuring channels

Set function
type

Select function
units

Set decimal
point position

Only if 'Prog units'
selected as function
units

Enter units
string

Select input
type

Set function
low/high range

Set input
low/high range

Not thermocouple
linearisations

Set chart
low/high range

Set filter time
period

Enter
magnification
centre value

Set CJ type
internal or
external

Thermocouple linearisations only.
If external selected, enter external
temperature in Instrument config.

Enter channel
descriptor

Set annotator
trace on or off

Set
interpolation
on or off

Enter channel
adjustment

Figure A3.1 Measurement channel configuration menu

A3.2 DERIVED CHANNELS

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Source DV	Off, DV1 to DV9	Allows the input source for the channel to be defined.
Units	˚C, ˚F, Prog units	Allows degrees Celsius, degrees Fahrenheit or programmable units to be selected as the channel's displayed units. The programmable units string is entered later.
Dec. Point	None	The up and down arrow keys are used to move the decimal point position for the channel display left and right respectively, between 'X.XXXX' and 'XXXXX.'
Units Str.	Text entry	This page appears only if Prog.Units has previously been selected. The up, down and side arrow keys are used to enter a units string as described in section 4.4 of this manual.
Pen select	1, 2, 3, none	Allows a pen to be chosen to trace the derived channel's value. See also 'Anno. Trace' below.
Chart low	None	The up, down and side arrow keys are used to enter chart 'zero'.
Chart high	None	The up, down and side arrow keys are used to enter chart full scale.
Range low	None	The up, down and side arrow keys are used to enter a range low value for use with Range Magnify and Trace History options.
Range high	None	The up, down and side arrow keys are used to enter a range high value for use with Range Magnify and Trace History options.
Mag. centre	None	Allows a value to be entered for use as a centre point for Range Magnify and Trace History options.
Ch. Desc.	Text entry	The up, down and side arrow keys are used to enter a channel descriptor as described in section 4.4 of this manual.
Anno. trace	On, Off	If selected ON, the annotator pen traces the channel's value. May be chosen for more than one channel.
Interplt.	On, Off	Allows interpolation to be carried out for annotator pen traces. (See section 4.8 of this manual for details)
Ch. Adjust	None	The up, down and side arrow keys are used to adjust the measured/recorded values to agree with other measurements.

Table A3.2 Derived channel configuration parameters

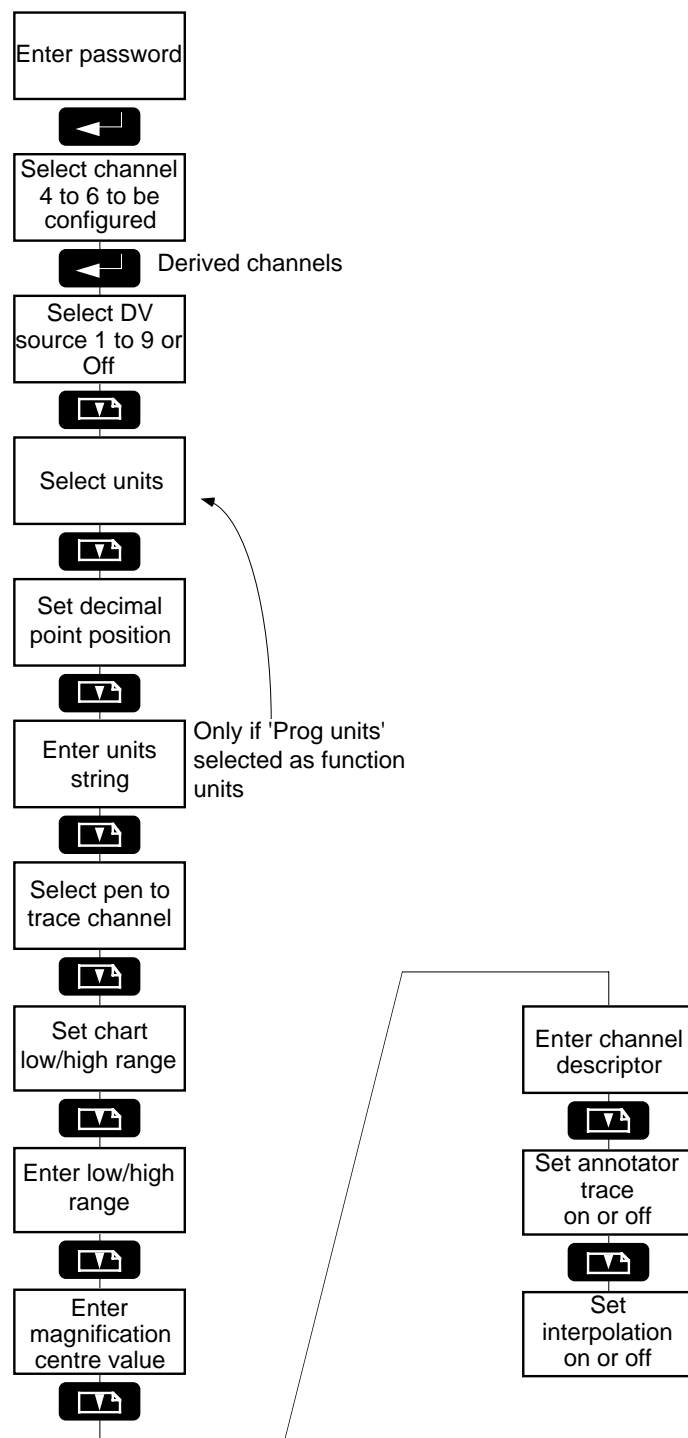## A3.2 DERIVED CHANNEL CONFIGURATION (Cont.)

Figure A3.2 Derived channel configuration menu

A4.0 INSTRUMENT CONFIGURATION

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Alt Chart Spd	None	The up, down and side arrows are used to enter the 'alternative' chart speed. The conditions under which the chart drive switches to this setting are determined by the alternative chart speed action equation (below).
Spd Act Eq	CI1 to CI6, TT1 to TT6, A11 to A64 GLA, KEY, INA, LOG, TM1 to TM4	The up, down and side arrow keys are used to scroll through the available triggers for changing chart speed. See section 3.4 of the manual for full details. Once the action equation entries have been made, the Enter key is used once to confirm them, and the Clear key used to return to the menu.
Cht Hold Eq.	As Spd Act Eq. above	As for alternative chart speed action equation above, but for chart hold
Print Mode	Overprint, Breaktrace, No print	The up and down arrow keys are used to enter the required print mode. See section 3.5 of this manual for more details.
ID Number	None	The up, down and side arrow keys are used to enter the required identification number for printing on the chart.
Time Format	12, 24	The up and down arrow keys are used to select the required time format (i.e. 12 or 24 hour clock).
Chart spd Unit	mm/hr, in/hr	The up and down arrow keys are used to select the required chart speed units.
Soft key En.	Yes, No	The up and down arrow keys are used to define whether the softkey is to be accessible from the operator menu. If NO is selected, the softkey on/off display does not appear in the operator menu.
Soft key Desc.	Text entry	The up, down and side arrow keys are used to enter a descriptor for the softkey, as described in section 4.4 of this manual.
Password	None	The up, down and side arrow keys are used to enter a new password.
Alarm access	On, Off	The up and down arrow keys are used to define whether alarm configuration is to be available from the operator menu. If Off is selected, then the 'Alarm configuration' display does not appear in the operator menu.
Custom Curve	None	Operation of the Enter key allows access to the custom curve configuration. See section 4.9 of this manual for full details.
Ext. CJC Temp	None	The up and down arrow keys are used to enter the temperature of the external cold junction, if the internal compensation of the recorder id not to be used. **A TEMPERATURE MUST BE ENTERED HERE IF COLD JUNCTION COMPENSATION IS SET TO 'EXTERNAL' FOR ANY CHANNEL.**

Table A4.0 Instrument configuration parameters
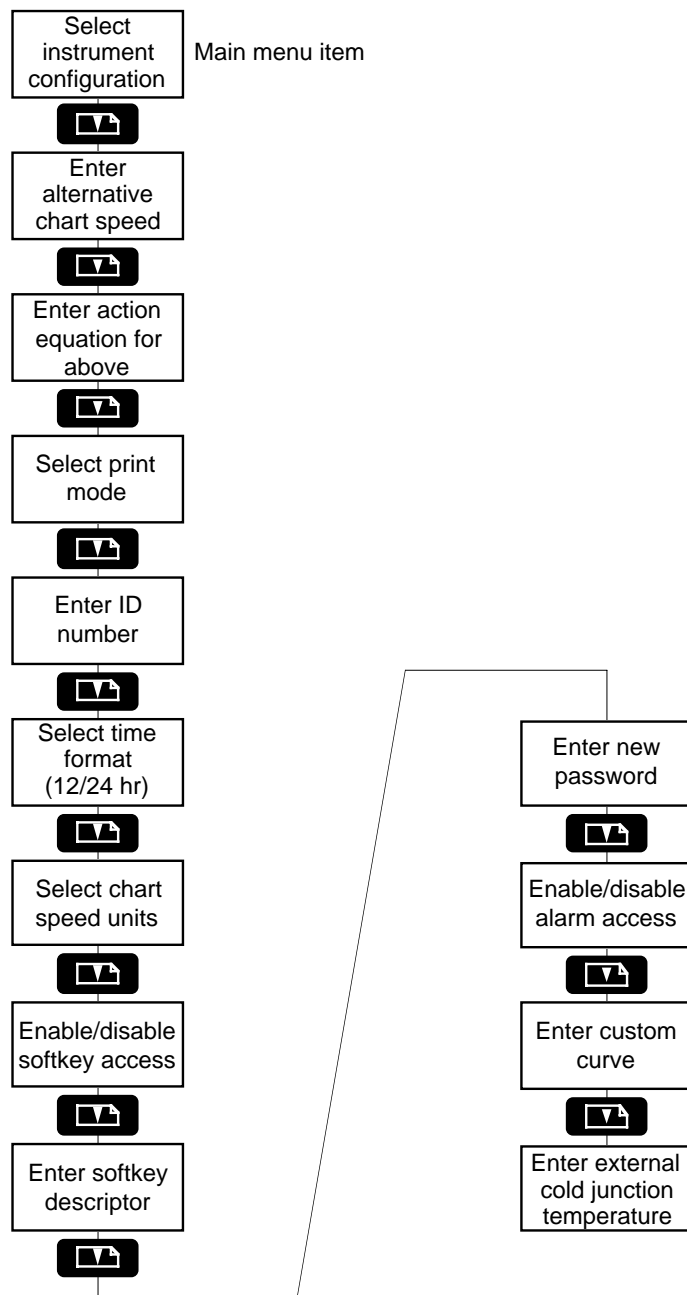
A4.0 INSTRUMENT CONFIGURATION (Cont.)

Figure A4 Instrument configuration menu

A5.0 ALARM CONFIGURATION

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Alarm channel	1, 2, 3, 4, 5, 6	The up and down arrow keys are used to select the channel for which the alarm is to be configured. Operation of the Enter key confirms.
Alarm number	1, 2, 3, 4	The up and down arrow keys are used to select which of the four alarms associated with the chosen channel is to be configured. Operation of the Enter key confirms.
Alarm type	Off, High, Low, Deadband Rate-Rising, Rate-Falling	The up and down arrows are used to scroll through the available types of alarm . See section 4.10 of this manual for further details. If OFF is selected, no further configuration is possible for the alarm; operation of the Clear key causes a return to the 'Alarm Number' display, where further alarms for the selected channel can be configured.
Setpoint	None	The up, down and side arrow keys are used to enter the setpoint for the alarm, in channel display units.
Hysteresis	None	The up, down and side arrow keys are used to enter the hysteresis for the alarm in channel display units.
Deadband	None	This display appears only if the selected alarm type is 'Deadband'. The up, down and side arrow keys are used to enter the deadband value for the alarm, in channel display units. Note that the value set here is set both above and below the setpoint previously entered. For example, a setpoint of 50 units with a deadband of 10 units will have a total deadband with of 20 units, stretching from 40 to 60 units.
Alrm Print	On, Off	Allows printing of the alarm on and off messages (see below) to be enabled (selected ON), or disabled (selected OFF).
Rate Base	/sec, /min, /hour	This display appears only if the selected alarm type is 'Rate-Rising', or 'Rate-Falling'. The up and down arrow keys are used to select a base time over which the rate-of-change setpoint value is to be measured.
Message	Text entry	The up, down and side arrow keys are used to enter message string to be printed whenever the alarm becomes active and whenever it becomes inactive. The enabling of the printing of this message is described in 'Alrm Print' above.

Table A5.0 Alarm configuration parameters
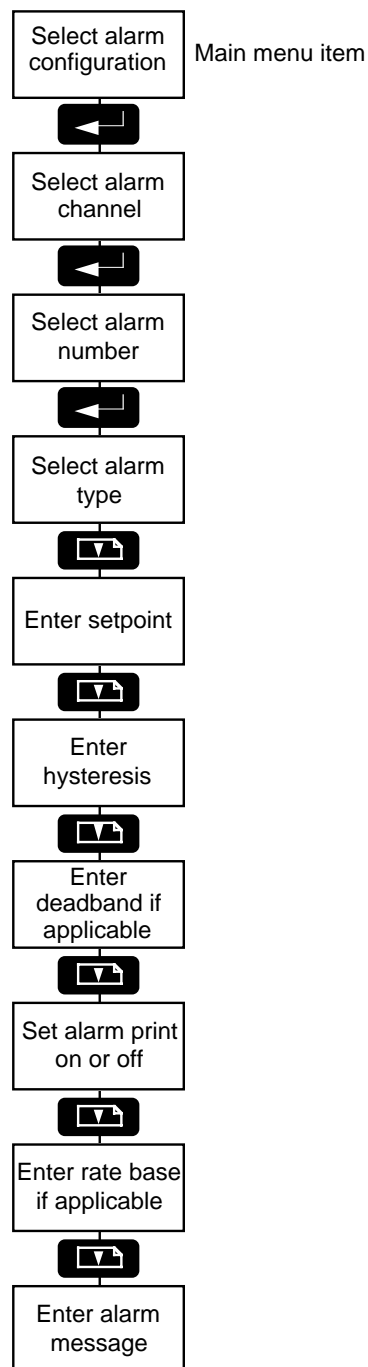
A5.0 ALARM CONFIGURATION (Cont.)

Figure A5.0 Alarm configuration menu

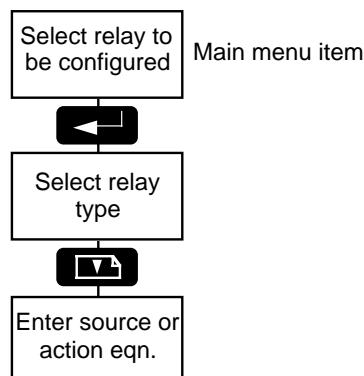This page is deliberately left blank

A6.0 RELAY CONFIGURATION

```
┌─────────────┐
│Select relay to│  Main menu item
│be configured │
└─────────────┘
      │
   ◄─┘
      │
┌─────────────┐
│Select relay │
│    type     │
└─────────────┘
      │
   ▼
      │
┌─────────────┐
│Enter source or│
│ action eqn. │
└─────────────┘
```

Figure A6.0 Relay configuration menu

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Type	Off	Output relay inoperative (always energised).
	Act eq Output	Output relay state depends on action equation (below).
	Tot. Retrans.	Output relay operates momentarily every N counts of a totaliser (selected in 'Source' below), where N is set up as a part of the totaliser's configuration. Refer to section 5.2 of this manual for further details. The up and down arrow keys, followed by Enter, are used to select relay type.
Act Eq	CI1 to CI6, TT1 to TT6, A11 to A64 GLA, KEY, INA, LOG, TM1 to TM4	The up, down and side arrow keys are used to scroll through the available triggers for operating 'Act Eq Output' relay types. See section 3.4 of the manual for full details. Once the action equation entries have been made, the Enter key is used once to confirm them, and the Clear key used to return to the menu.
Source	Tot. 1 to Tot. 6	Operation of the up or down arrow key allows a totaliser to be selected for 'Tot. Retrans.' type relays.

Table A6.0 Relay configuration parameters

A7.0 TOTALISER CONFIGURATION

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Type	Off	Totaliser inoperative
	Continuous	Totaliser increments until reset by overflow, manual reset, or action equation.
	Preset down	Totaliser resets to a preset figure, then counts to zero.
	Preset up	Totaliser resets to zero, then counts to a preset figure.
Note...		
	Both preset types output an internal trigger which can be used (amongst other things) to reset the totaliser.	
Source	Ch 1 to 6; Contact inputs 1 to 6	Allows the totaliser input source to be defined as any channel or any event input contact closure.
Factor	None	Allows entry of a scaling factor. See section 5.2 of this manual for details.
Units	Text entry	Allows the entry of a five-character text string as a units-of-measurement for the totaliser value. See section 4.4 of this manual for further details.
Preset	None	This display appears only if 'preset up' or 'preset down' is selected as totaliser type. Allows the entry of either a high or a low preset value for the totaliser.
Low Cutoff	None	Allows a minimum count level to be established. For input signals below this value, the totaliser will not be incremented.
Hi Cutoff	None	Allows a maximum count level to be established. For input signals above this level, the totaliser will not be incremented. The default value is the channel's Overrange value (full scale + 10%).
Resettable	Yes, No	If NO is selected, the totaliser will not reset under any reset equation or operator action conditions.
		If YES is selected, the totaliser will respond to all reset stimuli from reset equation or operator action.
Rset Eq	CI1 to CI6, TT1 to TT6, A11 to A64 GLA, KEY, INA, LOG, TM1 to TM4	The up, down and side arrow keys are used to scroll through the available triggers for resetting the totaliser. See section 3.4 of the manual for full details. Once the action equation entries have been made, the Enter key is used once to confirm them, and the Clear key used to return to the menu.
Cntr. Out	On, Off	Used to switch the counter on or off. The scaling described below can be used to reduce the totaliser output counter frequency if required. It is this output which can be used as the 'Tot. N' source for output relays.
Out. Fact?	None	Allows the division factor to be entered.
Tot Desc.	Text entry	Allows a descriptor for the totaliser to be entered. See section 4.4 of this manual for details of text entry.

Table A7.0 Totaliser configuration parameters
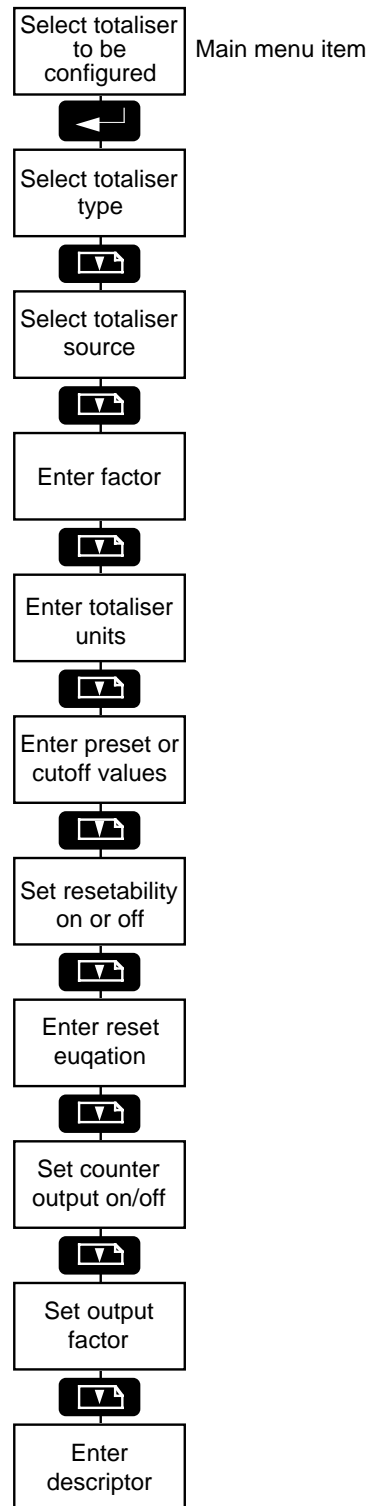
A7.0 TOTALISER CONFIGURATION (Cont.)

```
┌─────────────┐
│Select totaliser│   Main menu item
│    to be    │
│ configured  │
└─────────────┘
      [←]
┌─────────────┐
│Select totaliser│
│    type     │
└─────────────┘
      [▽△]
┌─────────────┐
│Select totaliser│
│   source    │
└─────────────┘
      [▽△]
┌─────────────┐
│             │
│ Enter factor│
│             │
└─────────────┘
      [▽△]
┌─────────────┐
│Enter totaliser│
│    units    │
└─────────────┘
      [▽△]
┌─────────────┐
│Enter preset or│
│cutoff values│
└─────────────┘
      [▽△]
┌─────────────┐
│Set resetability│
│  on or off  │
└─────────────┘
      [▽△]
┌─────────────┐
│ Enter reset │
│  euqation   │
└─────────────┘
      [▽△]
┌─────────────┐
│ Set counter │
│ output on/off│
└─────────────┘
      [▽△]
┌─────────────┐
│ Set output  │
│   factor    │
└─────────────┘
      [▽△]
┌─────────────┐
│   Enter     │
│ descriptor  │
└─────────────┘
```

Figure A7.0 Totaliser configuration menu

A8.0 LOGGING CONFIGURATION
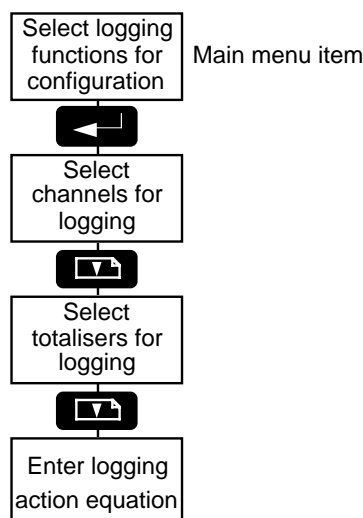
Figure A8.0 Logging configuration menu

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Log Chans	1 to 6	Allows the numbers of those channels which are to be logged, to be entered. Operation of the Clear key causes a return to the menu.
Log total.	1 to 6	Allows the numbers of those totalisers which are to be logged, to be entered. Operation of the clear key causes a return to the menu.
Log Act Eq	CI1 to CI6, TT1 to TT6, A11 to A64 GLA, KEY, INA, LOG, TM1 to TM4	The up, down and side arrow keys are used to scroll through the available triggers for initiating the log. See section 3.4 of the manual for full details. Once the action equation entries have been made, the Enter key is used once to confirm them, and the Clear key used to return to the menu.

Table A8.0 Logging configuration parameters

A9.0 CUSTOM MESSAGE CONFIGURATION

Figure A9.0 Customer message configuration menu

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Message	text entry	Allows the entry of the selected message string. Refer to section 4.4 of the manual for more details.
Color	Violet, brown, blue, green, black, red	The recorder can print only in violet. Colour selection has no effect
Logic	CI1 to CI6, TT1 to TT6, A11 to A64 GLA, KEY, INA, LOG, TM1 to TM4	The up, down and side arrow keys are used to scroll through the available triggers for initiating message printing. See section 3.4 of the manual for full details. Once the action equation entries have been made, the Enter key is used once to confirm them, and the Clear key used to return to the menu.

Table A9.0 Customer message configuration parameters

A10.0 TIMER CONFIGURATION

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Type	Off	Timer inoperative
	Clock	The timer 'follows' the recorder clock, and outputs an internal trigger when the specified time and date occur. Refer to section 4.11 of the manual for further details.
	Periodic	The timer outputs a trigger at the end of a specified time period. The trigger can be used as a self reset, so the timer becomes a repetitive timer. A clock timer can be used to initiate a periodic timer at a particular time and date. See section 4.11 for further details.
Clockout	Minutes only	Clock triggers once every hour at the minutes setting.
	Minutes and hour	Clock triggers once a day at the time specified.
	Minutes, hour and day number	Clock triggers once a month on the specified date and time
	Minutes, hour, Day, Month	Clock triggers once a year at the specified time on the specified date.
	Mins, Hour, Day, Month, Year	Clock triggers at the time and date specified.
		This display appears only if 'Clock' has been specified as timer type.
Duration	None	Allows the duration (in minutes), of a periodic timer to be set.
		This display appears only if 'Periodic' has been selected as timer type.
Rset Eq?	CI1 to CI6, TT1 to TT6, A11 to A64 GLA, KEY, INA, LOG, TM1 to TM4	The up, down and side arrow keys are used to scroll through the available triggers for resetting the periodic timer. See section 3.4 of the manual for full details. Once the action equation entries have been made, the Enter key is used once to confirm them, and the Clear key used to return to the menu.
		This display appears only if 'Periodic' has been selected as timer type. Note that a timer can be used to reset itself if required.

Table A10.0 Timer configuration parameters
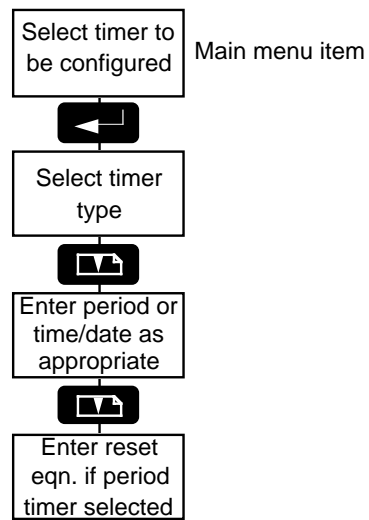
A10.0 TIMER CONFIGURATION (Cont.)

```
        ┌──────────────┐
        │ Select timer to │  Main menu item
        │ be configured │
        └──────────────┘
             [ ← ]
        ┌──────────────┐
        │ Select timer │
        │     type     │
        └──────────────┘
             [ � ]
        ┌──────────────┐
        │ Enter period or │
        │  time/date as  │
        │  appropriate   │
        └──────────────┘
             [ ▲ ]
        ┌──────────────┐
        │  Enter reset   │
        │ eqn. if period │
        │ timer selected │
        └──────────────┘
```
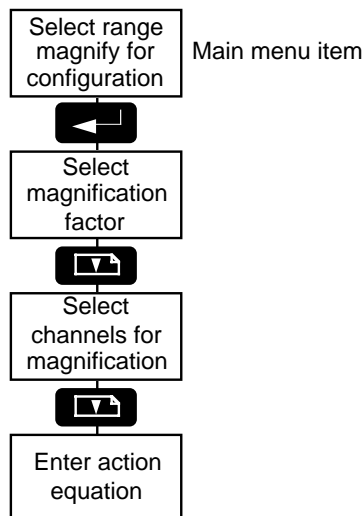
Figure A10.0 Timer configuration menu

A11.0 TRACE HISTORY CONFIGURATION

Figure A11.0 Trace history configuration menu

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Hist Chart Spd	None	Allows the chart speed for chart history to be selected
Mag. Factor	None	Allows a trace magnification factor to be entered for trace history.
Mag Chans.	1 to 6	Allows those channels, the traces of which are to be magnified during trace history, to be entered.
Hist Act Eq?	CI1 to CI6, TT1 to TT6, A11 to A64 GLA, KEY, INA, LOG, TM1 to TM4	The up, down and side arrow keys are used to scroll through the available triggers for initiating trace history. See section 3.4 of the manual for full details. Once the action equation entries have been made, the Enter key is used once to confirm them, and the Clear key used to return to the menu.

Table A11.0 Trace history configuration parameters

A12.0 RANGE MAGNIFY CONFIGURATION

```
┌──────────────┐
│ Select range │
│ magnify for  │   Main menu item
│configuration │
└──────┬───────┘
    [ ◀┘ ]
┌──────┴───────┐
│   Select     │
│ magnification│
│    factor    │
└──────┬───────┘
    [ ▽ ]
┌──────┴───────┐
│   Select     │
│ channels for │
│ magnification│
└──────┬───────┘
    [ ▽ ]
┌──────┴───────┐
│ Enter action │
│   equation   │
└──────────────┘
```

Figure A12.0 Range magnification configuration menu

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER FUNCTION
Mag. Factor	None	Allows a magnification value to be entered.
Mag. Chans.	1 to 6	Allows the numbers of those channels which are to be magnified to be entered. Once confirmed, using the Enter key, the Clear key is used to return to the menu.
Mag Act Eq?	CI1 to CI6, TT1 to TT6, A11 to A64 GLA, KEY, INA, LOG, TM1 to TM4	The up, down and side arrow keys are used to scroll through the available triggers for initiating range magnification. See section 3.4 of the manual for full details. Once the action equation entries have been made, the Enter key is used once to confirm them, and the Clear key used to return to the menu.

Table A12.0 Range magnification configuration parameters

A13.0 DERIVED VARIABLE CONFIGURATION

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Function	Off	Used to turn a DV function off.
	Add	Add input 1 to input 2.
	Subtract	Subtract input 1 from input 2.
	Divide	Divide input 1 by input 2
	Multiply	Multiply input 1 by input 2
	Lin. slope	Input 2 times input 1 plus input 3 (i.e. ax + b).
	High select	Output is the higher of input 1 and input 2
	Low select	Output is the lower of input 1 and input 2
	High peak	Output is the highest value reached since last reset.
	Low peak	Output is the lowest value reached since last reset.
	Average	Input 1 is sampled every (input 2) seconds and added to the total so far.
	Polynomial	Output = Input 2 + (input 3 x input 1) + (input 4 x input 1^2) + (input 5 x input 1^3). (I.E. $Y = A + BX + CX^2 + DX^3$)
	Log 10	Output = input 2 x $\log_{10}$ of input 1
	Power 10	Output = input 2 x $10^{input\ 1}$
	Flow, Sq.Rt	See section 5.7
	Flow, Linr.	See section 5.7
	F_{value}	See section 5.7
	RH	See section 5.7
	ZrO_2 Sensor	See section 5.7
Input N	Constant	Enter a constant value for input N
	Channel 1 to 3	Enter the number of a measuring channel for input N
	DV 1 to 9	Enter the number of a derived variable for input N
Const. N	None	Enter mantissa and exponent values for any constant.
		This display appears only if one of the inputs has been defined as 'constant'.
Descript.	Text entry	The up, down and side arrow keys are used to enter a string to be used as the derived variable descriptor.
Units	Text entry	The up, down and side arrow keys are used to enter a string to be used as the derived variable units.
Dec. Point	None	the up and down arrow keys are used to move the decimal point position for the channel display, left and right respectively, between 'X.XXXX' and 'XXXXX.'.

Table A13.0 Derived variable configuration parameters

A13.0 DERIVED VARIABLE CONFIGURATION (Cont.)

```
┌──────────────┐
│ Select derived│    Main menu item
│  variable for │
│ configuration │
└──────────────┘
      ⏎
┌──────────────┐
│ Select maths │
│   function   │
└──────────────┘
     ▼
┌──────────────┐
│    Define    │
│   equation   │
│    inputs    │
└──────────────┘
     ▼
┌──────────────┐
│  Enter reset │
│  equation if │
│  applicable  │
└──────────────┘
     ▼
┌──────────────┐
│    Enter     │
│  descriptor  │
└──────────────┘
     ▼
┌──────────────┐
│ Enter units of│
│   variable   │
└──────────────┘
     ▼
┌──────────────┐
│ Define decimal│
│point position│
└──────────────┘
```
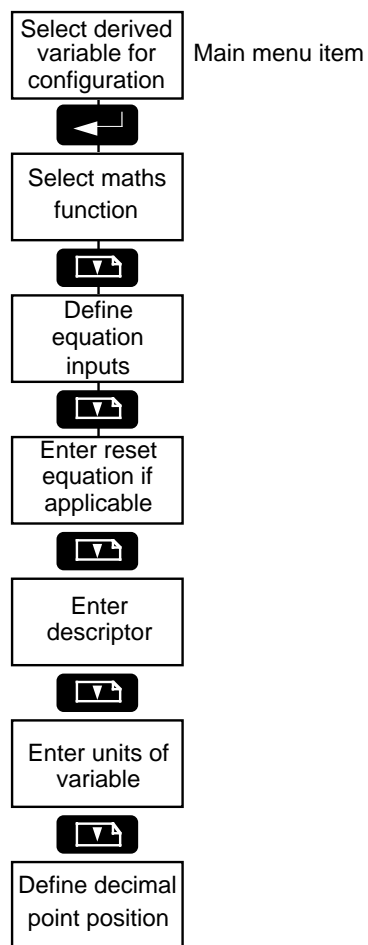
Figure A13.0 Derived variable configuration menu

A14.0 COMMUNICATIONS CONFIGURATION

```
        ┌──────────────┐
        │ Select comms.│
        │     for      │   Main menu item
        │configuration │
        └──────────────┘
             ◄──┘
        ┌──────────────┐
        │ Set Baud rate│
        └──────────────┘
             [▼]
        ┌──────────────┐
        │  Set parity  │
        └──────────────┘
             [▼]
        ┌──────────────┐
        │  Set flow    │   XON/XOFF
        │  control     │
        └──────────────┘
             [▼]
        ┌──────────────┐
        │ Set disable  │   Read only;
        │   scheme     │   Read/Write
        └──────────────┘
             [▼]
        ┌──────────────┐
        │Enter group ID│
        │    (GID)     │
        └──────────────┘
             [▼]
        ┌──────────────┐
        │ Enter Unit ID│
        │    (UID)     │
        └──────────────┘
```
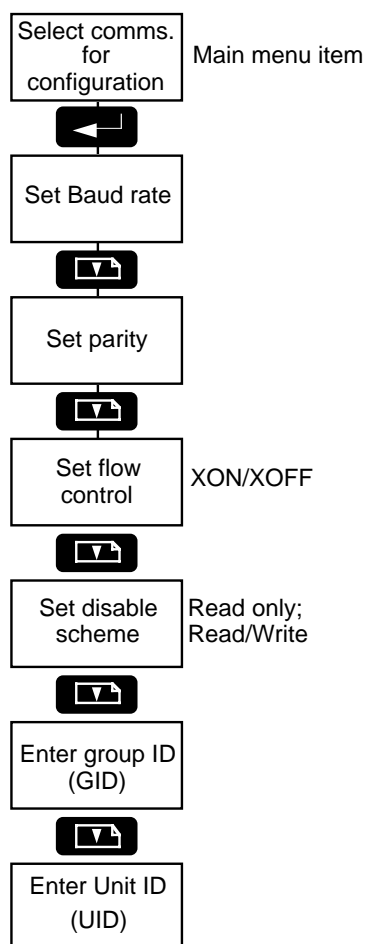
Figure A14.0 Communications configuration menu arrangement

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Baud rate	9600, 4800, 1200, 600, 300	Sets transmission rate to be used between the recorder and the host computer.
Parity	Even, Odd, None	Sets parity.
Flow control	None, XON/XOFF	Allows hardware handshake to be enabled/disabled.
Disable scheme	Read only, Read/Write	Allows the recorder to be configured such that the operator can read parameters, but not write new values to them (read only) or such that the operator can both read and write values (Read/write).
Group ID	None	Allows a group ID to be entered as a part of parameter address.
Unit ID	None	Allows Unit ID to be entered as a part of parameter address.

Table A14.0 Communications option configuration parameters

A15.0 RETRANSMISSION CONFIGURATION
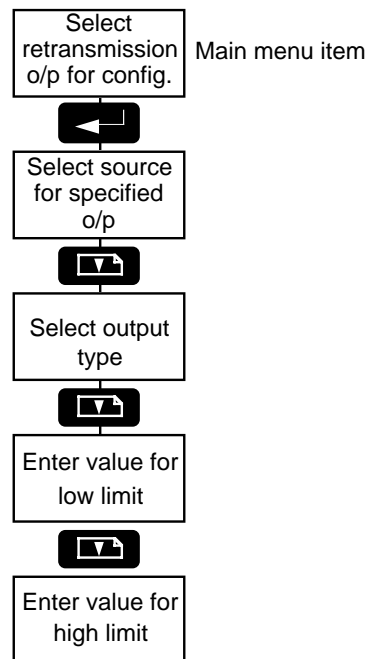
Figure A15.0 Retransmission option configuration menu arrangement

DISPLAY	SCROLLABLE VALUES	DESCRIPTION OF PARAMETER OR FUNCTION
Source	1 to 6	Allows any input or derived channel to be selected for retransmission.
Output type	0 to 20mA, 4 to 20 mA	Allows one of two input ranges to be selected. The selected current range is available either as a current or as a voltage signal according to how the output is wired. See section 5.9 for details.
Low limit	None	Allows a value (in the engineering units of the source channel) to be assigned to the minimum output (0 or 4 mA) of the selected range.
High limit	None	Allows a value (in the engineering units of the source channel) to be assigned to the maximum output (20 mA) of the selected range.

Table A15.0 Retransmission option configuration parameters

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A16.0 ACCESS TO CONFIGURATION

CHANNEL | INSTRUMENT | ALARM | RELAY | †TOTALISER | LOGGING | † CUSTOM MESSAGES | TIMER | † TRACE HISTORY | † RANGE MAGNIFY | † DERIVED VARIABLES | † COMMUNI-CATIONS | † RETRANS-MISSION | INSTRUMENT ALARMS | CALIBRATION

Background display

Enter password

Select channel for configuration — Channels 1 to 3 / Channels 4 to 6

Set softkey on or off — If access enabled in instrument menu

Select totaliser to be displayed — If option is fitted

Reset selected totaliser — If option is fitted

Set primary chart speed

Set chart advance on or off

Set chart hold on or off

Set pen park on or off

Set alarm setpoints — If access enabled in instrument menu

Enter batch number

Initiate log printing

Select timer for display — Note 2

Select range mag on or off — If option is fitted

Print replay history? — If option is fitted

Set alternative chart speed on or off

Inhibit alarm message printing?

Select derived variable for viewing — If option is fitted

Select derived variable for reset — If option is fitted

Print custom message — If option is fitted

Set time and date

View instrument alarms? — If any instrument alarm active

CHANNEL
Set function type
Set function units
Set decimal point position
Enter programmable units string
Select input type
Set function low/high range
Set input low/high range — Note 1
Enter mag. centre value
Set filter time period
Set CJ type internal or external
Enter channel descriptor
Set annotator trace on or off
Set interpolation on or off
Enter channel adjustment

Select DV1 to DV9, or Off as source
Select units
Set decimal point position
Enter programmable units string
Select pen for trace
Select chart low/high range
Set range low/high for mag.
Enter mag. centre value
Set annotator trace on/off
Set interpolation on/off

INSTRUMENT
Select Instrument configuration
Enter alternative chart speed
Enter action equation for above
Enter action equation for chart hold
Select print mode
Enter ID number
Select time format (12/24 hr)
Select chart speed units
Enable/disable softkey access
Enter softkey descriptor (if enabled above)
Enter new password
Enable/disable alarm access
Enter custom curve
Enter external cold junction temperature

ALARM
Select alarm configuration
Select alarm channel
Select alarm number
Select alarm type
Enter setpoint
Enter hysteresis
Enter deadband if applicable
Set alarm print on or off
Enter rate base if applicable
Enter alarm mesage

RELAY
Select relay to be configured
Select relay type
Enter source or action equation

†TOTALISER
Select totaliser for configuration
Select totaliser type
Select totaliser source
Enter factor
Enter totaliser units
Enter preset or cut-off values
Enable/disable resetability
Enter reset equation
Set counter output on or off — If option is fitted
Set output factor — If option is fitted
Enter descriptor

LOGGING
Select logging functions for configuration
Select channels for logging
Select totalisers for logging
Enter logging action equation

CUSTOM MESSAGES
Select message to be configured
Enter message
Enter message action equation

TIMER
Select timer to be configured
Select timer type
Select period or time-of-day
Enter period or time as appropriate
Enter reset eqn. if period timer selected

TRACE HISTORY
Select trace history for configuration
Select history chart speed

RANGE MAGNIFY
Select range magnify for configuration
Select magnification factor
Select magnification factor
Select channels for magnification

DERIVED VARIABLES
Select derived variable for configuration
Select maths function
Define equation inputs
Enter action equation
Enter reset equation if applicable
Enter descriptor
Enter units for variable
Define decimal point position

COMMUNI-CATIONS
Select comms for configuration
Select Baud rate
Select parity
Select XON or XOFF
Select read/write or read only
Enter group ID (GID)
Enter unit ID (UID)

RETRANS-MISSION
Select retrans-mission output for configuration
Select output source
Select 0 to 20 or 4 to 20 mA for output
Select low and high o/p limits

INSTRUMENT ALARMS
View instrument alarms — Note 3
Battery low
Bad ROM
Detail lost

CALIBRATION
Select calibration change
Select annotator carriage for cal.
Select channel for cal.
Select CJC sensor calibration
Restore factory calibration
Select servo pen for calibration
View options
Select retransmission o/p for cal.

† These menus appear only if the relevant options are fitted

Notes:
1. Not applicable to thermocouple inputs
2. For thermocouple linearisations only, enter actual external temperature in Instrument configuration.

Figure A16.0 Access to configuration

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