

**RM4-I4 & RM4-V4**  
Four input  
DIN Rail Process Monitor/Controller  
Inputs from 0-20mA, 4-20mA (RM4-I4)  
or  $\pm 1V$ ,  $\pm 10VDC$  (RM4-V4)  
Operation & Instruction Manual



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# 1 Introduction

This manual contains information for the installation and operation of the RM4-I4 and RM4-V4 Arithmetic or Scanning DIN rail mount monitor. The RM4 is a special purpose instrument which may be configured to accept up to four inputs of  $\pm 20\text{mA}$  or 4 to 20 mA (model RM4-I4) or  $\pm 1\text{VDC}$  or  $\pm 10\text{VDC}$  (model RM4-V4). Two basic modes of operation are available, namely arithmetic and scanning modes. The choice between arithmetic and scanning modes is made at the **SET OPER** function. In arithmetic mode the instrument may be programmed to perform an arithmetic function on the four inputs and provide a resultant display in engineering units. In scanning mode the inputs are individually scanned and displayed at a user programmable rate or manually scanned via the  and  buttons.

In arithmetic mode the primary display (channel 0) is the result of the arithmetic function performed by the instrument. Each channel (0 to 4 if four inputs are selected) may be individually displayed via the  or  pushbuttons. Each input channel may be individually calibrated to display the input in engineering units.

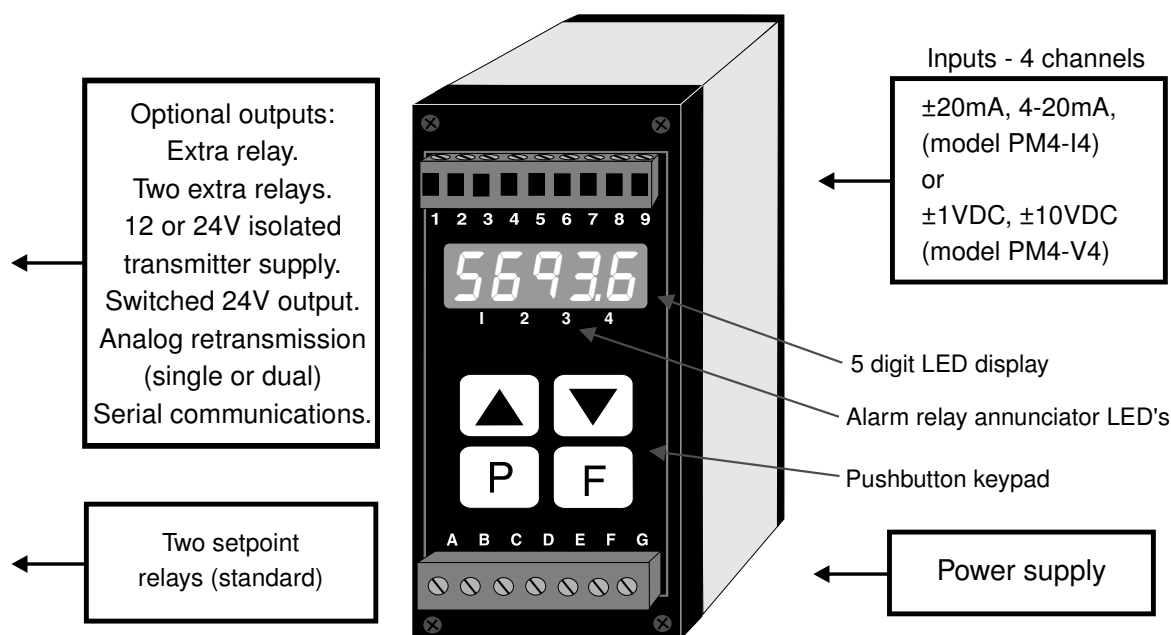
Various combinations of one or two optional extra relays, analog (4-20mA, 0-1V or 0-10V) retransmission (single or dual retransmission) or serial (RS232, RS485 or RS422) communications and an isolated 12 or 24VDC isolated transmitter supply may also be provided as an option. Alarms and retransmission may be set to operate from any channel or the result when arithmetic mode is used. The analog retransmission can alternatively be programmed to operate from the highest channel, the lowest channel, the average value or the retransmit the value of each channel in turn with a marker pulse to identify the start of the cycle.

Unless otherwise specified at the time of order, your RM4 has been factory set to a standard configuration. Like all other RM4 series instruments the configuration and calibration is easily changed by the user. Initial changes may require dismantling the instrument to alter PCB links, other changes are made by push button functions.

Electrical isolation between power supply, input voltage or current and retransmission output is provided by the RM4, thereby eliminating grounding and common mode voltage problems. This isolation feature makes the RM4 ideal for interfacing to computers, PLCs and other data acquisition devices.

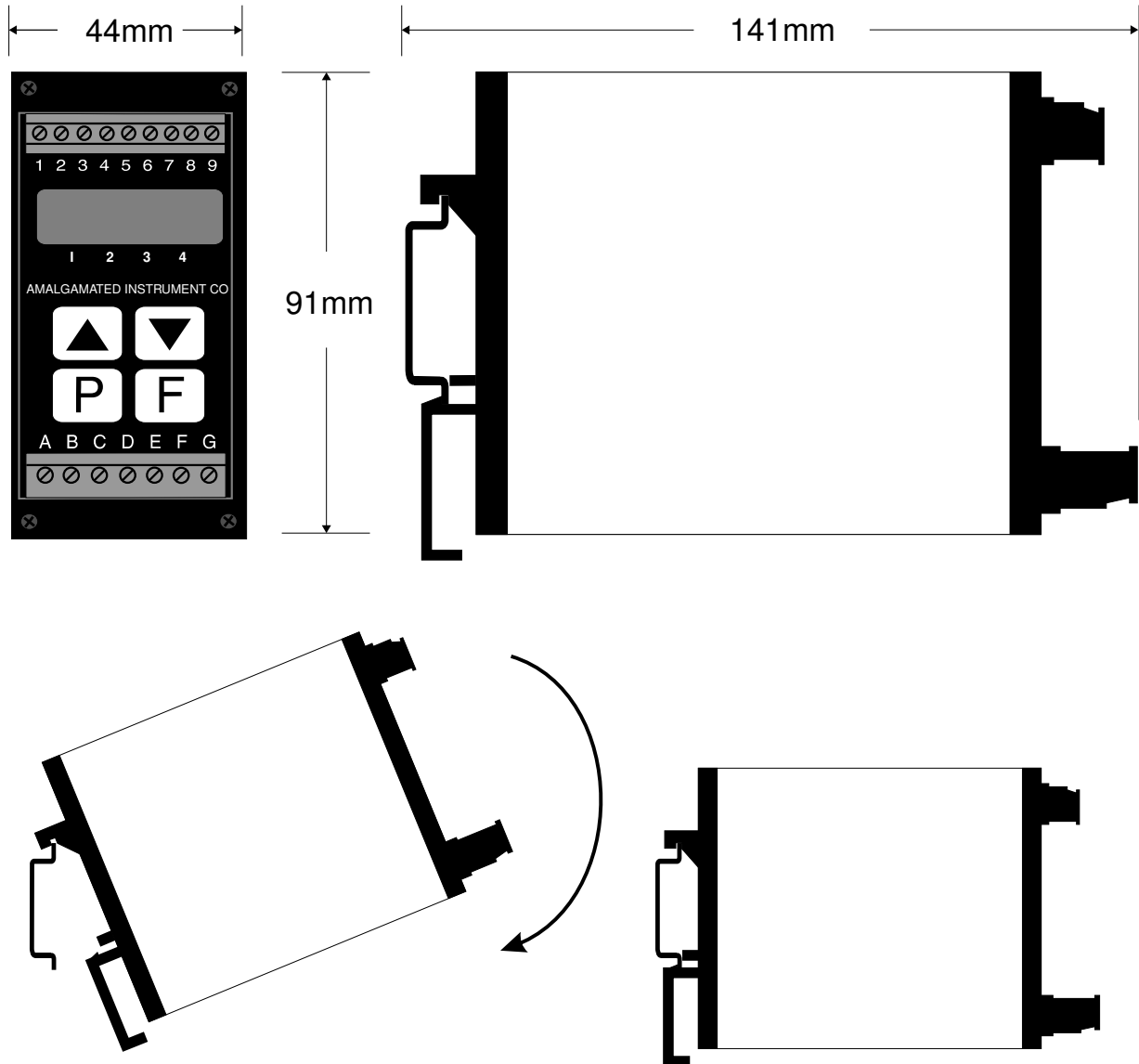
The RM4 series of DIN Rail Process Modules are designed for high reliability in industrial applications. The 5 digit LED display provides good visibility, even in areas with high ambient light levels. A feature of the RM4-IV is the programmable display brightness function, this allows the unit to be operated with low display brightness to reduce the instrument power consumption and to improve readability in darker areas. To reduce power consumption in normal use the display can be programmed to automatically dim or blank after a set time.

## Inputs & outputs



## 2 Mechanical installation

The RM4 is designed for DIN rail, horizontal mounting. The instrument snaps on 35mm DIN standard rails (EN50022). Cut the DIN rail to length and install where required. To install the RM4, simply clip onto the rail as shown below. To remove the RM4 lever the lower arm downwards using a broad bladed screwdriver to pull the clip away from the DIN rail.



### 3 Electrical installation

The RM4 Meter is designed for continuous operation and no power switch is fitted to the unit. It is recommended that an external switch and fuse be provided to allow the unit to be removed for servicing.

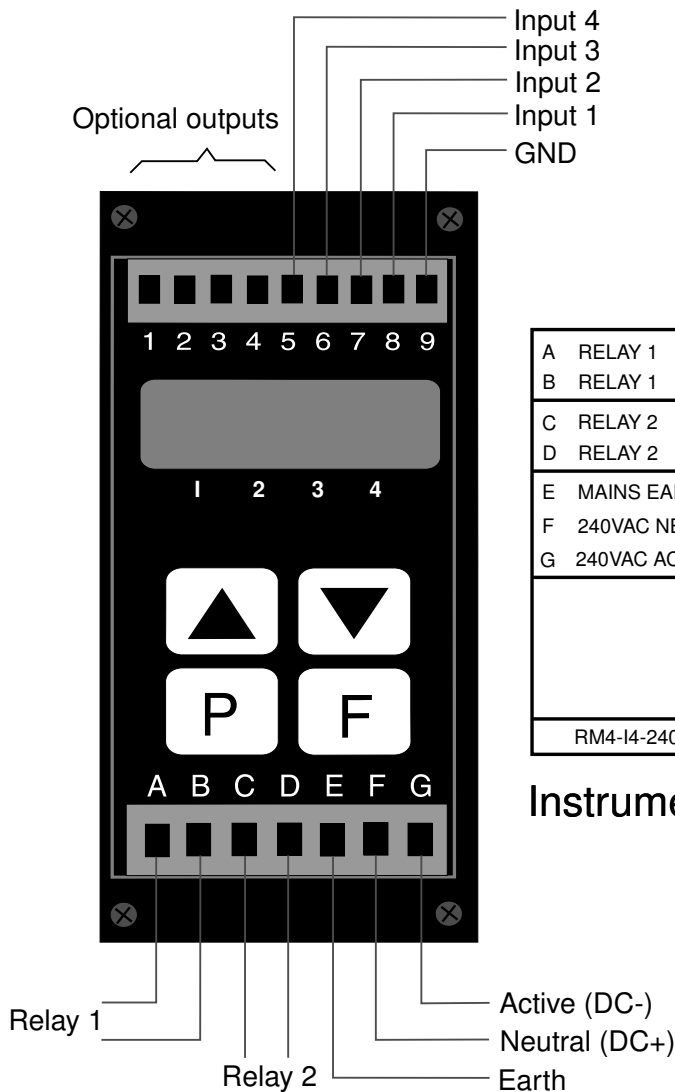
The terminal blocks allow for wires of up to 2.5mm<sup>2</sup> to be fitted for power supply and relays 1 and 2 or 1.5mm<sup>2</sup> for input signal connections and optional outputs. Connect the wires to the appropriate terminals as indicated below. Refer to other details provided in this manual to confirm proper selection of voltage, polarity and input type before applying power to the instrument. When power is applied the instrument will cycle through a display sequence, indicating the software version and other status information, this indicates that the instrument is functioning. Acknowledgement of correct operation may be obtained by applying an appropriate input to the instrument and observing the resultant reading.

#### 3.1 Optional output wiring

Refer to the appropriate appendix in this manual for wiring and link setting details of any optional outputs fitted.

#### 3.2 Electrical connections

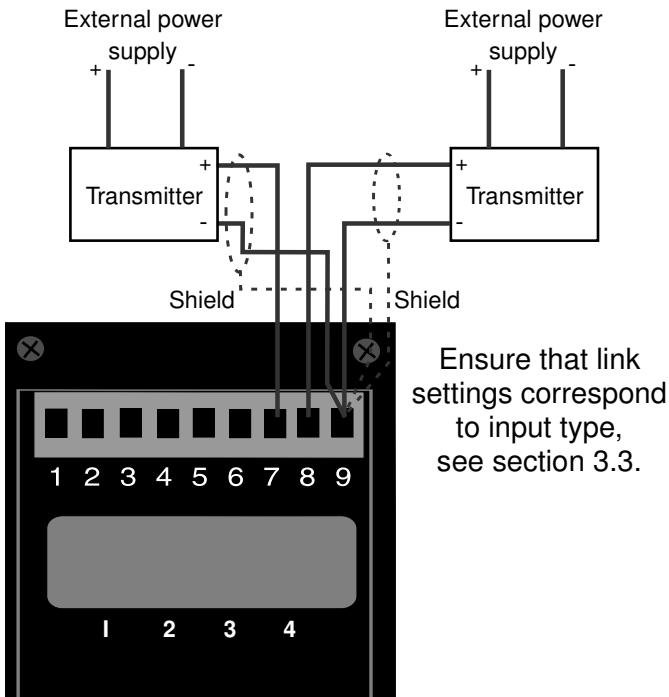
Examples continued overleaf.



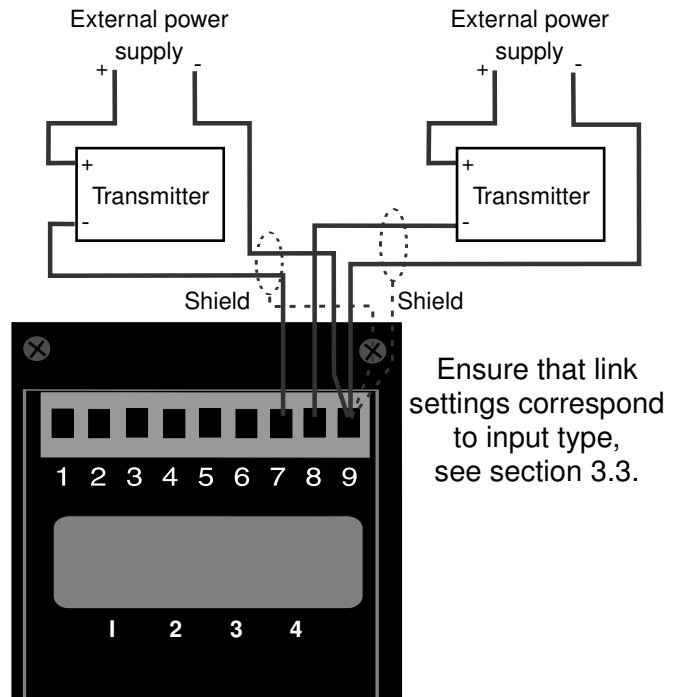
A	RELAY 1	COM	1
B	RELAY 1	N/O	2
C	RELAY 2	COM	3
D	RELAY 2	N/O	4
E	MAINS EARTH		5 INPUT 4
F	240VAC NEUTRAL		6 INPUT 3
G	240VAC ACTIVE		7 INPUT 2
			8 INPUT 1
			9 GND
RM4-I4-240-5E			SERIAL No.

Instrument data label (example)

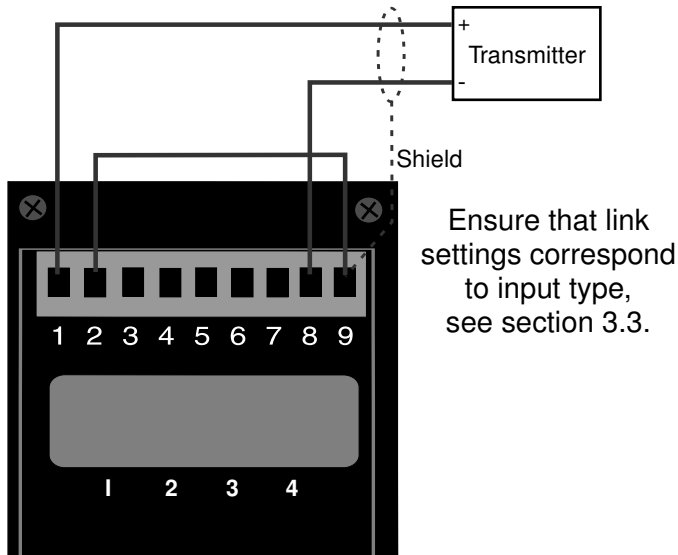
4 wire  $\pm 20$  or 4-20mA.  
Externally powered.  
Two input example shown.



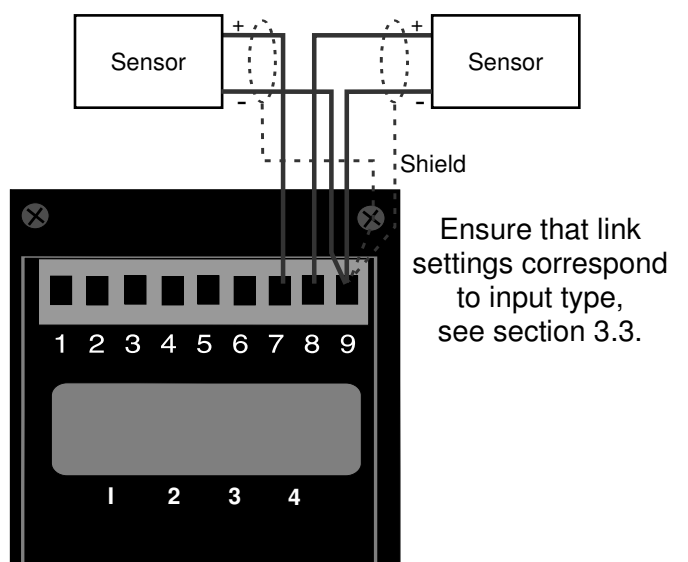
2 wire  $\pm 20$  or 4-20mA.  
Externally powered.  
Two input example shown.



2 wire  $\pm 20$  or 4-20mA.  
Powered via optional  
12 or 24V regulated.  
One input example shown.



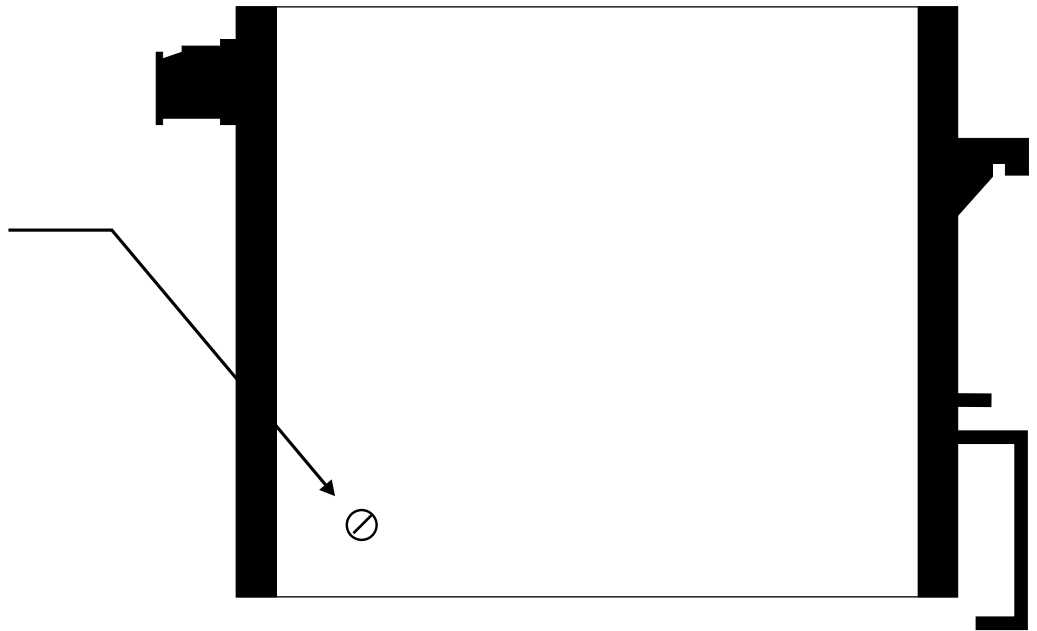
DC voltage input.  
Two input example shown.



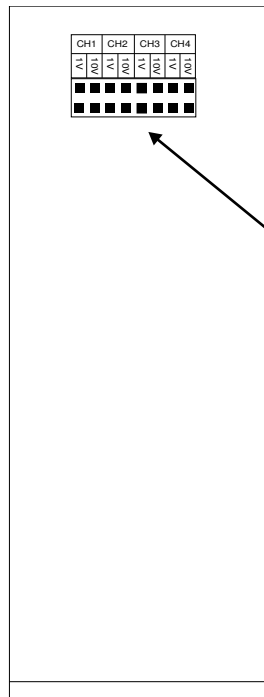
### 3.3 Removal & configuration of circuit boards & link settings

Remove the circuit boards from the case following the instructions below.

Remove the connectors, the four front bezel screws and the earth screw at the side of the case. Hold the front bezel and slide out the circuit boards.



Link settings for the main input board are as shown below. For optional output link settings consult the appropriate appendix in this manual.



Input link selection for model RM4-V4. There are no link settings for model RM4-I4

CH1	CH2	CH3	CH4
1V	10V	1V	10V
1V	10V	1V	10V
1V	10V	1V	10V
1V	10V	1V	10V

Input links, select the required voltage for each input channel.

## 4 Explanation of functions

The RM4 setup and calibration functions are configured through a push button sequence. Two levels of access are provided for setting up and calibrating:-

**FUNC** mode (simple push button sequence) allows access to alarm relay, preset value & display brightness functions.

**CAL** mode (power up sequence plus push button sequence) allows access to all functions including calibration parameters. Note: if the **ACCESS** function is set to **ALL** there is no need to enter via **CAL** mode.

Push buttons located at the front of the instrument are used to alter settings. Once **CAL** or **FUNC** mode has been entered you can step through the functions, by pressing and releasing the **F** push button, until the required function is reached. Changes to functions are made by pressing the **▲** or **▼** push button (in some cases both simultaneously) when the required function is reached.

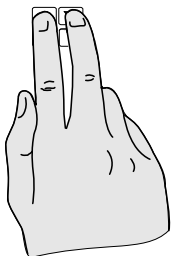
### Entering **CAL** Mode



1. Remove power from the instrument. Hold in the **F** button and reapply power. The display will indicate **CAL** as part of the "wake up messages" when the **CAL** message is seen you can release the button.



2. When the "wake up" messages have finished and the display has settled down to its normal reading press, then release the **F** button.



3. Within 2 seconds of releasing the **F** button press, then release the **▲** and **▼** buttons together. The display will now indicate **FUNC** followed by the first function.

Note: If step 1 above has been completed then the instrument will remain in this **CAL** mode state until power is removed. i.e. there is no need to repeat step 1 when accessing function unless power has been removed.

### Entering **FUNC** Mode

No special power up procedure is required to enter **FUNC** mode.



1. When the "wake up" messages have finished and the display has settled down to its normal reading press, then release the **F** button.



2. Within 2 seconds of releasing the **F** button press, then release the **▲** and **▼** buttons together. The display will now indicate **FUNC** followed by the first function.

Function	Description
<b>RxLo</b>	Alarm relay low setpoint - see "Alarm relays" chapter. Displays and sets each alarm low setpoint value.
<b>RxHi</b>	Alarm relay high setpoint - see "Alarm relays" chapter. Displays and sets each alarm high setpoint value.
<b>RxHy</b>	Alarm relay hysteresis [deadband] - see "Alarm relays" chapter. Displays and sets the alarm hysteresis limit. This value is common for both high and low setpoint values.
<b>RxTt</b>	Alarm relay trip time - see "Alarm relays" chapter. Displays and sets the alarm trip time in seconds from 0 to 9999 seconds. This value is common for both alarm high and low setpoint values.
<b>Rxrt</b>	Alarm relay reset time - see "Alarm relays" chapter. Displays and sets the alarm reset time in seconds from 0 to 9999 seconds. This value is common for both alarm high and low setpoint values.
<b>Rxn.o</b> or <b>Rxn.c</b>	Alarm relay normally open or normally closed - see "Alarm relays" chapter. Displays and sets the alarm relay action to normally open (de-energised) or normally closed (energised), when no alarm condition is present.
<b>Rx.SP</b> , <b>Rx.t 1</b> , <b>Rx.t 2</b> etc.	Alarm relay operation independent setpoint or trailing - see "Alarm relays" chapter.
<b>brgt</b>	Display brightness - displays and sets the digital display brightness. The display brightness is selectable from <b>1</b> to <b>15</b> where <b>1</b> = lowest intensity and <b>15</b> = highest intensity. This function is useful for reducing glare in darkened areas.
<b>dull</b>	Remote display brightness - displays and sets the level for remote input brightness switching, see "Remote input functions" chapter. See also <b>d.OFF SECS</b> function below.
<b>d.OFF SECS</b>	Auto display dimming timer - this function allows a time to be set after which the display brightness (set by the <b>brgt</b> function) will automatically be set to the level set at the <b>dull</b> function. The auto dimming feature can be used to reduce power consumption. The function can be set to any value between <b>0</b> and <b>9999</b> seconds. A setting of <b>0</b> disables the auto dimming. The display brightness can be restored by pressing any of the instruments front push buttons. The display brightness will also be restored whilst one or more alarm relays is activated.
<b>rEC-</b>	Analog recorder/retransmission output low value - seen only when the analog retransmission option is fitted. Displays and sets the analog retransmission output low value (4mA or 0V) in displayed engineering units. e.g. for a 4-20mA retransmission if it is required to retransmit 4mA when the display indicates <b>0</b> then select <b>0</b> at this function via the <b>▲</b> or <b>▼</b> button.
<b>rEC+</b>	Analog recorder/retransmission output high value - seen only when the analog retransmission option is fitted. Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when this option is fitted. Displays and sets the analog retransmission output high value (20mA, 1V or 10V) in displayed engineering units. e.g. if it is required to retransmit 20mA when the display indicates <b>500</b> then select <b>500</b> at this function via the <b>▲</b> or <b>▼</b> button.
<b>rEC- Ch 2</b>	Second analog recorder/retransmission output low value - seen only when the dual analog retransmission option is fitted. See <b>rEC-</b> function for description of operation. Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when this option is fitted.
<b>rEC+ Ch 2</b>	Second analog recorder/retransmission output high value - seen only when the dual analog retransmission option is fitted. See <b>rEC+</b> function for description of operation. Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when this option is fitted.

## **CAL** mode functions

Entry via **CAL** mode (see first page of this chapter) must be made in order to view and adjust the functions which follow. Alternatively the **ACCESS** function can be set to **ALL** which will allow all functions to be accessed via **FUNC** mode.

<b>drnd</b>	Display rounding - displays and sets the display rounding value. This value may be set to <b>0 - 5000</b> displayed units. Display rounding is useful for reducing the instrument resolution without loss of accuracy in applications where it is undesirable to display to a fine tolerance. For example if <b>drnd</b> is set to <b>10</b> the instrument will display in multiples of 10 only.
<b>dCPE</b>	Decimal point selection - displays and sets the decimal point for the arithmetic result i.e channel 0. By pressing the <b>▲</b> or <b>▼</b> keypads the decimal point position may be set. The display will indicate as follows: <b>0</b> (no decimal point), <b>0. 1</b> (1 decimal point place), <b>0.02</b> (2 decimal point places), <b>0.003</b> (3 decimal point places) or <b>00004</b> (4 decimal point places).
<b>FLtr</b>	Digital filter - displays and sets the digital filter value. Digital filtering is used for reducing susceptibility to short term interference. The digital filter range is selectable from <b>0</b> to <b>8</b> , where <b>0</b> = none and <b>8</b> = most filtering. A typical value for the digital filter would be <b>3</b> . The digital filter uses a weighted averaging method of filtering which will increase the display update time at higher settings.
<b>Ch no.</b>	Number of input channels displays and selects the number of input channels used. One, two, three or four channels can be selected as active. The individual setup functions described in this chapter will not be seen for channels which are not used.
<b>Ch 1dCPE</b>	Channel 1 decimal point position - allows selection of decimal point for channel 1 input. By pressing the <b>▲</b> or <b>▼</b> keypads the decimal point position may be set. The display will indicate as follows: <b>0</b> (no decimal point), <b>0. 1</b> (1 decimal point place), <b>0.02</b> (2 decimal point places), <b>0.003</b> (3 decimal point places) or <b>00004</b> (4 decimal point places). <b>Note:</b> in arithmetic mode the decimal point for each individual channel can be selected for display purposes but for arithmetic purposes the decimal point selection for channel 0 ( <b>dCPE</b> function) determines the decimal point position of all channels for calculation purposes. For example if channel 1 is set to one decimal place and channel 0 set to no decimal place when channel 1 is showing a value of <b>14.5</b> this will be treated as <b>145</b> for purposes of calculation. If required adjustment can be made for this in the arithmetic formula.
<b>Ch 2dCPE</b>	Channel 2 decimal point position - allows selection of decimal point for channel 2 input. See - <b>Ch 1dCPE</b> for description.
<b>Ch 3dCPE</b>	Channel 3 decimal point position - allows selection of decimal point for channel 3 input. See - <b>Ch 1dCPE</b> for description.
<b>Ch 4dCPE</b>	Channel 3 decimal point position - allows selection of decimal point for channel 3 input. See - <b>Ch 1dCPE</b> for description.

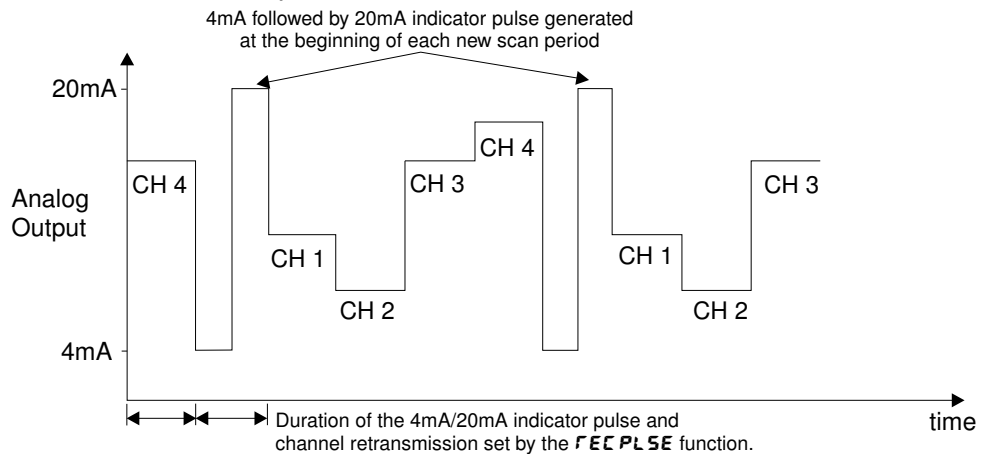
<p><b>EA1, Eb1, EC1</b> etc.</p>	<p>Arithmetic values - seen only in <b>Arth</b> operation mode. See also "Mathematical functions" chapter. The instrument may be set up to perform a variety of mathematical functions according to the equation:</p> $  \begin{array}{c}  \left. \begin{array}{l} \text{add} \\ \text{sub} \\ \text{prod} \\ \text{div} \\ \text{high} \\ \text{low} \\ \text{sine} \\ \text{cos} \end{array} \right\} \frac{A1 \times (Ch1 + B1)}{C1}  \end{array}  \quad  \begin{array}{c}  \left. \begin{array}{l} \text{add} \\ \text{sub} \\ \text{prod} \\ \text{div} \\ \text{high} \\ \text{low} \\ \text{sine} \\ \text{cos} \end{array} \right\} \frac{A2 \times (Ch2 + B2)}{C2}  \end{array}  \quad  \begin{array}{c}  \left. \begin{array}{l} \text{add} \\ \text{sub} \\ \text{prod} \\ \text{div} \\ \text{high} \\ \text{low} \\ \text{sine} \\ \text{cos} \end{array} \right\} \frac{A3 \times (Ch3 + B3)}{C3}  \end{array}  \quad  \begin{array}{c}  \left. \begin{array}{l} \text{add} \\ \text{sub} \\ \text{prod} \\ \text{div} \\ \text{high} \\ \text{low} \\ \text{sine} \\ \text{cos} \end{array} \right\} \frac{A4 \times (Ch4 + B4)}{C4}  \end{array}  $ <p>The A, B &amp; C value for each channel may be individually entered over the 5 digit range of -19999 to 99999 (note: A &amp; C are whole numbers, B has the same decimal place as its associated channel). The display for each parameter is as follows:</p> <p style="text-align: center;"> <b>EA1      EA2      EA3      EA4</b>  <b>Eb1      Eb2      Eb3      Eb4</b>  <b>EC1      EC2      EC3      EC4</b> </p>
<p><b>OP1, OP2 &amp; OP3</b></p>	<p>Arithmetic operation - seen only in <b>Arth</b> operation mode. See also "Mathematical functions" chapter. <b>OP1</b> is the arithmetic operation performed between channels 1 &amp; 2. <b>OP2</b> is the arithmetic operation performed between channel 3 and the result of the channel 1 &amp; 2 operation. <b>OP3</b> is the arithmetic operation performed between channel 4 and the result of the channel 1 &amp; 2 &amp; 3 operation. The operations available are: <b>Add</b> add the previous result to the next channel result <b>Sub</b> subtract the previous result from the next channel result <b>Prod</b> product or multiply the previous result with the next channel result <b>Div</b> divide the previous result by the next channel result <b>High</b> highest value of the previous result and the next channel result <b>Low</b> lowest value of the previous result and the next channel result <b>SINE</b> multiply the previous result by the sine of the angle displayed at the next channel <b>COS</b> multiply the previous result by the cosine of the angle displayed at the next channel</p>
<p><b>Ch0, Ch1, Ch3 &amp; Ch4</b></p>	<p>Display polarity for selected channel. Displays and sets the polarity selection for the display of the engineering value for the selected channel (note; channel 0 is the result channel). If set to <b>BOTH</b> then the display will indicate both positive and negative values. If set to <b>POS</b> the display will allow only positive values with any values below zero being rounded to zero. If set to <b>NEG</b> then the display will allow only negative values with any value above zero being rounded to zero. If set to <b>ABS</b> then the absolute value will be displayed i.e. negative numbers will be displayed as positive numbers.</p>
<p><b>Ch1CAL1, Ch1CAL2</b> etc.</p>	<p>Individual calibration functions for each channel - see "Calibration" chapter.</p>
<p><b>UCALCh1, UCALCh2</b> etc.</p>	<p>Individual uncalibration for each channel - see "Calibration" chapter.</p>

<p><b>P.but</b></p>	<p><b>P</b> button function - the function of the <b>P</b> button is programmable. By pressing the <b>P</b> button the function selected will be performed. Note: To prevent accidental operation of the <b>P</b> button in the <b>ZERO</b> function it is necessary to hold the button in for approx. 2 seconds to perform this operation. When in <b>H</b>, <b>Lo</b> or <b>H, Lo</b> the high/low values held in memory can be reset (i.e. the memory is cleared) by holding the <b>P</b> button pressed for longer than 2 seconds. The <b>H</b>, <b>Lo</b> and <b>H, Lo</b> values shown will be for the channel being viewed at the time (channels 0 to 4).</p> <p>Choices available for the <b>P</b> button function are:</p> <p><b>NONE</b> (None) - this function is selected when none of the special functions are required.</p> <p><b>H</b>, (Peak Memory) - the peak memory (max) is displayed when the <b>P</b> button is pressed momentarily i.e. the maximum display value since the last reset. The display is returned to the normal display after 20 seconds. To reset the peak memory the <b>P</b> button must be pressed for 2 seconds or longer. Note: the <b>H</b>, function will be reset 5 seconds after instrument switch on i.e. the <b>H</b>, readings will only start to be stored once 5 seconds have elapsed.</p> <p><b>Lo</b> (Valley Memory) - the valley memory (min) operates in a similar way to the peak memory but shows the lowest display value since last reset. Note: the <b>Lo</b> function will be reset 5 seconds after instrument switch on i.e. the <b>Lo</b> readings will only start to be stored once 5 seconds have elapsed.</p> <p><b>H, Lo</b> (Peak/Valley Memory) - The display may be toggled between peak and valley memory indications i.e. press once for peak and press a second time for valley memory display.</p> <p><b>ZERO</b> (Pushbutton Zero) - allows the display to be set to zero by pressing the <b>P</b> button for approximately 2 seconds. This zero value will be retained even if the power is removed. Note: only individual channels 1 to 4 can zeroed, the arithmetic result on channel 0 cannot be zeroed via the <b>P</b> button. The message <b>ZERO</b> will be shown just prior to the zero operation.</p>
<p><b>FINP</b></p>	<p>Remote input functions - Not applicable to this instrument.</p>
<p><b>ALCS</b></p>	<p>Alarm relay access mode - see "Alarm relays" chapter.</p>
<p><b>SPAC</b></p>	<p>Setpoint access - sets the <b>FUNC</b> mode access to the alarm relays set points. The following choices are available; <b>A 1</b> - Allows setpoint access to alarm 1 only. <b>A 1-2</b> - Allows access to alarms 1 and 2 only. <b>A 1-3</b> - Allows access to alarms 1, 2 and 3 only etc. up to the maximum number of relays fitted. To allow this function to operate the remote input <b>FINP</b> function must be set to <b>SPAC</b>.</p>
<p><b>SCAN PERd</b></p>	<p>Scanning period - displays and sets the automatic scanning period between channels in seconds from <b>0</b> to <b>240</b>. If set to <b>0</b> the instrument will not automatically scan but can be manually scanned via the <b>▲</b> and <b>▼</b> buttons.</p>
<p><b>FECOPER &amp; FECE2 OPER</b></p>	<p>Analog retransmission operation mode - seen only if single or dual analog retransmission options fitted. Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when this option is fitted. Displays and sets the operating mode of the analog retransmission, the options are:</p> <p><b>Arth</b> - retransmits the value of the arithmetic result (channel 0)</p> <p><b>Ch 1</b> - retransmits the value of channel 1</p> <p><b>Ch 2</b> - retransmits the value of channel 2</p> <p><b>Ch 3</b> - retransmits the value of channel 3</p> <p><b>Ch 4</b> - retransmits the value of channel 4</p> <p><b>HI 9H</b> - retransmits the value of whichever channel is the highest</p> <p><b>Lo</b> - retransmits the value of whichever channel is the lowest</p> <p><b>AUSE</b> - retransmits the average value of all the input channels</p> <p>Continued overleaf.</p>

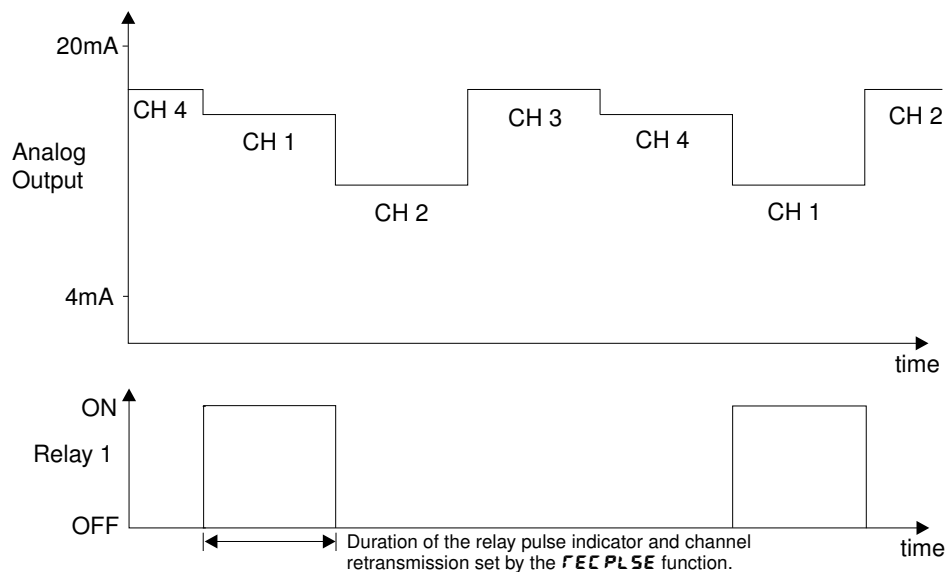
**FEC OPEr**  
**& FEC2**  
**OPEr**

continued

**S.PLS** - - causes the output to retransmit each active channel in turn. As an indication that a new scan cycle is beginning the output will drop to 4mA then rise to 20mA (or 0 to 1V/0 to 10V for voltage retransmission), this indication can be used to communicate to a PLC etc. that a new cycle is beginning. The time duration of the 20mA pulse is determined by the setting of the **FEC PLSE** or **FEC2 PLSE** function. Note: channel 0 is not retransmitted in this operation mode.



**S.FLY** - causes the recorder output to retransmit each active channel in turn. An alarm relay contact closure (relay 1 for analog output 1 and relay 2 for analog output 2) is activated at the beginning of each new scan to give an indication to a PLC etc. that a new scan is beginning. The time duration of the relay closure is determined by the setting of the **FEC PLSE** or **FEC2 PLSE** function. Note: channel 0 is not retransmitted in this operation mode.



**FEC PLSE**  
**& FEC2**  
**PLSE**

Sets the pulse width for the analog retransmission or relay marker pulse and channel retransmission duration when **FEC OPEr** or **FEC2 OPEr** is set to **S.PLS** or **S.FLY**. The pulse width can be set from 1 to 10 seconds. Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when this option is fitted.

**Ar** to **Ar4**

Alarm relay operation mode - The alarm relays can be set to operate from either the arithmetic result **Ar**, or any of the input channels **Ch 1**, **Ch 2**, **Ch 3**, or **Ch 4**. See "Alarm relays" chapter for further information.

**SEt OPEr**

Set operation mode - the operation mode can be set to either arithmetic **Ar** or scanning mode **SCAN**.

**BAud**

Set baud rate - seen only with serial output option - Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when this option is fitted. Select from **300**, **600**, **1200**, **2400**, **4800**, **9600**, **19.2** or **38.4**.

**Prty**

Set parity - seen only with serial output option - Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when this option is fitted. Select parity check to either **NONE**, **EVEN** or **odd**.

<b>Output</b>	<p>Set RS232/485 interface mode - Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when this option is fitted.</p> <p>Select <b>di SP</b>, <b>cont</b>, <b>POLL</b>, <b>R.buS</b> or <b>ā.buS</b></p> <p>Allows user to select the RS232/485 interface operation as follows:-</p> <p><b>di SP</b> Sends image data from the display without conversion to ASCII.</p> <p><b>Cont</b> Sends ASCII form of display data every time display is updated.</p> <p><b>POLL</b> Controlled by computer or PLC as host. Host sends command via RS232/485 and instrument responds as requested.</p> <p><b>R.buS</b> A special communications mode used with Windows compatible optional PC download software. Refer to the user manual supplied with this optional software.</p> <p><b>ā.buS</b> Modbus RTU protocol.</p>
<b>Addr</b>	<p>Set unit address for polled (<b>POLL</b>) mode (0 to 31)) - Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when this option is fitted.</p> <p>Allows several units to operate on the same RS485 interface reporting on different areas etc. The host computer or PLC may poll each unit in turn supplying the appropriate address.</p> <p>The unit address ranges from 0 to 31 (DEC) but is offset by 32 (DEC) to avoid clashing with ASCII special function characters (such as &lt;STX&gt; and &lt;CR&gt;). Therefore 32 (DEC) or 20 (HEX) is address 0, 42 (DEC) or 2A (HEX) addresses unit 10.</p>
<b>SEFL</b>	<p>Serial communications output mode - allows the same output options as the analog retransmission see <b>FEC OPEr</b> function for description. Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when this option is fitted.</p>

### Returning to the normal measure mode

When the calibration procedure has been completed it is advisable to return the instrument to the normal mode (where calibration functions cannot be tampered with). To return to the normal mode, turn off power to the instrument, wait a few seconds and then restore power.


### 4.1 Error Messages

" - - - - " - This display indicates that the actual input is higher than the selected input range e.g. 0 to 10V range selected but the input is more than 10V. Check the input range selected and if this is OK then measure the input.

" - or - " - This display indicates an overrange reading. This means that the instrument is not being able to display the number because it is too large e.g. above 99999 on a 5 digit display. Check that the calibration scaling figures are correct.

## 5 Function table

Initial display	Meaning of display	Next display	Default Setting	Record Your Settings
<i>RxLo</i>	Alarm x low setpoint value	Setpoint value or <b>OFF</b>	<b>OFF</b>	See following table
<i>RxHi</i>	Alarm x high setpoint value	Setpoint value or <b>OFF</b>	<b>1000</b>	See following table
<i>RxHY</i>	Alarm x hysteresis	Hysteresis value in measured units	<b>10</b>	See following table
<i>RxTt</i>	Alarm x trip time	No of seconds before relay x trips	<b>0</b>	See following table
<i>Rxrt</i>	Alarm x reset time	No of seconds before relay x resets	<b>0</b>	See following table
<i>Rxn.o</i> or <i>Rxn.c</i>	Alarm x action N/O or N/C	<i>Rxn.o</i> or <i>Rxn.c</i>	<b>Rxn.o</b>	See following table
<i>Rx.SP</i> or <i>Rx.t 1</i>	Alarm x independent or trailing setpoint 1,2 etc.	<i>Rx.SP</i> or <i>Rx.t 1</i>	<b>Rx.SP</b>	See following table
<i>brgt</i>	Digital display brightness	<b>1</b> to <b>15</b> ( <b>15</b> = highest brightness)	<b>15</b>	
<i>dULL</i>	Remote brightness control	<b>0</b> to <b>15</b> ( <b>15</b> = highest brightness)	<b>1</b>	
<i>d.OFF SECS</i>	Display auto dimming timer (seconds)	<b>0</b> to <b>9999</b>	<b>0</b>	
<i>rEC-</i>	Analog output 1 low limit	Value in memory	<b>0</b>	
<i>rEC+</i>	Analog output 1 high limit	Value in memory	<b>1000</b>	
<i>rEC- Ch2</i>	Analog output 2 low limit	Value in memory	<b>0</b>	
<i>rEC+ Ch2</i>	Analog output 2 high limit	Value in memory	<b>1000</b>	
<b>Functions below are accessible via <i>CRL</i> mode only</b>				
<i>drnd</i>	Display rounding selects resolution	Value in memory	<b>1</b>	
<i>dCPE</i>	Display decimal point for result, channel 0	Decimal Pt position (e.g. <b>0. 1</b> or <b>0.02</b> )	<b>0</b>	
<i>FLtr</i>	Digital filter range <b>0</b> to <b>8</b>	<b>0</b> to <b>8</b> ( <b>8</b> = most filtering)	<b>2</b>	
<i>Ch 1 dCPE</i>	Channel 1 decimal point	Decimal point (e.g. <b>0. 1</b> or <b>0.02</b> etc.)	<b>0</b>	
<i>Ch 2 dCPE</i>	Channel 2 decimal point	Decimal point (e.g. <b>0. 1</b> or <b>0.02</b> etc.)	<b>0</b>	
<i>Ch 3 dCPE</i>	Channel 3 decimal point	Decimal point (e.g. <b>0. 1</b> or <b>0.02</b> etc.)	<b>0</b>	
<i>Ch 4 dCPE</i>	Channel 4 decimal point	Decimal point (e.g. <b>0. 1</b> or <b>0.02</b> etc.)	<b>0</b>	
<i>#ER1</i>	Channel 1 A function	Value in memory	<b>1</b>	
<i>#Eb1</i>	Channel 1 b function	Value in memory	<b>0</b>	
<i>#EC1</i>	Channel 1 C function	Value in memory	<b>1</b>	
<i>#ER2</i>	Channel 2 A function	Value in memory	<b>1</b>	
<i>#Eb2</i>	Channel 2 b function	Value in memory	<b>0</b>	
<i>#EC2</i>	Channel 2 C function	Value in memory	<b>1</b>	
<i>#ER3</i>	Channel 3 A function	Value in memory	<b>1</b>	
<i>#Eb3</i>	Channel 3 b function	Value in memory	<b>0</b>	
<i>#EC3</i>	Channel 3 C function	Value in memory	<b>1</b>	
<i>#ER4</i>	Channel 4 A function	Value in memory	<b>1</b>	
<i>#Eb4</i>	Channel 4 b function	Value in memory	<b>0</b>	
<i>#EC4</i>	Channel 4 C function	Value in memory	<b>1</b>	
<i>#OP 1</i>	Operation 1	<i>Add, Sub, Prod, d. u. H, 9h, Lo, Si, RE</i> or <i>EOS</i>	<b>Add</b>	

#OP2	Operation 2	<i>Add.Sub.Prod.d.v. M, 9H.Lo.SI NE or COS</i>	<i>Add</i>	
#OP3	Operation 3	<i>Add.Sub.Prod.d.v. M, 9H.Lo.SI NE or COS</i>	<i>Add</i>	
Ch0	Display polarity, ch. 0	<i>b0tH.P0S.NE9 or Ab5</i>	<i>b0tH</i>	
Ch1	Display polarity, ch. 1	<i>b0tH.P0S.NE9 or Ab5</i>	<i>b0tH</i>	
Ch2	Display polarity, ch. 2	<i>b0tH.P0S.NE9 or Ab5</i>	<i>b0tH</i>	
Ch3	Display polarity, ch.3	<i>b0tH.P0S.NE9 or Ab5</i>	<i>b0tH</i>	
Ch4	Display polarity, ch.4	<i>b0tH.P0S.NE9 or Ab5</i>	<i>b0tH</i>	
Ch1CAL1	Channel 1 cal point 1	Value in memory	n/a	
Ch1CAL2	Channel 1 cal point 2	Value in memory	n/a	
Ch2CAL1	Channel 2 cal point 1	Value in memory	n/a	
Ch2CAL2	Channel 2 cal point 2	Value in memory	n/a	
Ch3CAL1	Channel 3 cal point 1	Value in memory	n/a	
Ch3CAL2	Channel 3 cal point 2	Value in memory	n/a	
Ch4CAL1	Channel 4 cal point 1	Value in memory	n/a	
Ch4CAL2	Channel 4 cal point 2	Value in memory	n/a	
UCALCh1	Uncalibrate channel 1	<i>CALCLr</i>	n/a	
UCALCh2	Uncalibrate channel 2	<i>CALCLr</i>	n/a	
UCALCh3	Uncalibrate channel 3	<i>CALCLr</i>	n/a	
UCALCh4	Uncalibrate channel 4	<i>CALCLr</i>	n/a	
FINP	Remote Input - not applicable to this instrument			
P.but	 Button function	<i>NONE.M,.Lo.M.Lo or 2EFO</i>	<i>NONE</i>	
ACCS	Setpoint access mode	<i>OFF, EASY, NONE or ALL</i>	<i>OFF</i>	
SPAC	Setpoint access (only seen if 2 or more relays fitted)	<i>R1.R1-2.R1-3 etc.</i>	<i>R1</i>	
SCANPERfd	Select scan period (secs).	<i>0 to 240</i>	<i>0</i>	
FECOPER	Analog output 1 operation	<i>Arth.Ch1.Ch2.Ch3. Ch4.MI 9H.Lo.AU9E. S.PLS or S.FLY</i>	<i>Ch1</i>	
FEC2OPER	Analog output 2 operation	<i>Arth.Ch1.Ch2.Ch3. Ch4.MI 9H.Lo.AU9E. S.PLS or S.FLY</i>	<i>Ch1</i>	
FECPLSE	Analog output 1 indicator pulse width (secs)	<i>1 to 10</i>	<i>1</i>	
FEC2PLSE	Analog output 2 indicator pulse width (secs)	<i>1 to 10</i>	<i>1</i>	
R1	Alarm mode for relay 1	<i>Arth.Ch1.Ch2.Ch3. or Ch4</i>	<i>Ch1</i>	
Rx	Alarm mode for subsequent relays	<i>Arth.Ch1.Ch2.Ch3. or Ch4</i>	<i>Ch1</i>	
SEtOPER	Set operation mode	<i>Arth or SCAN</i>	<i>Arth</i>	
bAUDFRATE	Baud rate	<i>300, 600, 1200, 2400, 4800, 9600, 19.2 or 38.4</i>	<i>9600</i>	
Prty	Parity select	<i>NONE, EVEN or Odd</i>	<i>NONE</i>	
O.Put	Output, continuous or controlled	<i>Cont.d! SP.POLL. A.buS or a.buS</i>	<i>Cont</i>	
Addr	Set unit address for poll mode	<i>0 to 31</i>	<i>0</i>	
SEFL	Serial communications mode	<i>Arth.Ch1.Ch2.Ch3. Ch4.MI 9H.Lo.AU9E. S.PLS or S.FLY</i>	<i>Ch1</i>	

Note: Functions in the shaded areas on this table will be displayed only when those particular options are fitted. Functions marked # are accessible only in arithmetic mode. Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when optional outputs are fitted.

<b>Settings for relays - record settings here</b>				
	<b>A1</b>	<b>A2</b>	<b>A3</b>	<b>A4</b>
<b>RxLo</b>				
<b>RxHi</b>				
<b>RxHY</b>				
<b>RxLt</b>				
<b>Rxrt</b>				
<b>Rxn.o or Rxn.c</b>				
<b>Rx.SP or Rx.t f</b>	n/a			
<b>Rx</b>				

## 6 Alarm relays

The RM4 is provided with 2 alarm relays as standard. One or two extra optional independent alarm relays may also be provided, these relays are designated **R1**, **R2** etc. Each alarm has the following parameters which may be set by the user:

1. Low trip point, adjustable in measurement units.
2. High trip point, adjustable in measurement units.
3. Alarm hysteresis, adjustable in measurement units.
4. Alarm trip time, adjustable in one second steps.
5. Alarm reset time, adjustable in one second steps.
6. Normally open or normally closed relay operation.
7. Independent or trailing alarms (available on relays 2 and upwards)
8. Alarm to follow the arithmetic value or any selected channel.

Note that the alarm settings are not changed when calibration scaling channels are changed. The alarms operate in the following way:

If the measured value is above the High Trip Point, or below the Low Trip Point, the alarm trip timer starts. This timer is reset if the measured value drops below the High Trip Point or above the Low Trip point. When the alarm trip timer's time exceeds the Trip delay time, the alarm is operated.

When the alarm has tripped, the measured value is compared to the High Set Point less the Hysteresis value and the Low Set Point plus the Hysteresis value. If it is less than the High Set Point less the Hysteresis value and greater than the Low Set Point plus the Hysteresis value, the alarm is reset.

### **RxL** (alarm low setpoint)

Displays and sets the low setpoint value for the designated alarm relay. The low alarm setpoint may be disabled by pressing the **▲** and **▼** keypads simultaneously. When the alarm is disabled the display will indicate **OFF**. Use **▲** or **▼** to adjust the setpoint value if required. The alarm will activate when the displayed value is lower than the **RxL** setpoint value. Each relay may be configured with both a low and high setpoint if required, if so the relay will be activated when the display reading moves outside the band set between low and high setpoints.

### **RxH** (alarm high setpoint)

Displays and sets the high setpoint value for the designated alarm relay. The high alarm setpoint may be disabled by pressing the **▲** and **▼** keypads simultaneously. When the alarm is disabled the display will indicate **OFF**. Use **▲** or **▼** to adjust the setpoint value if required. The alarm will activate when the displayed value is higher than the **RxH** setpoint value. Each relay may be configured with both a low and high setpoint if required, if so the relay will be activated when the display reading moves outside the band set between low and high setpoints.

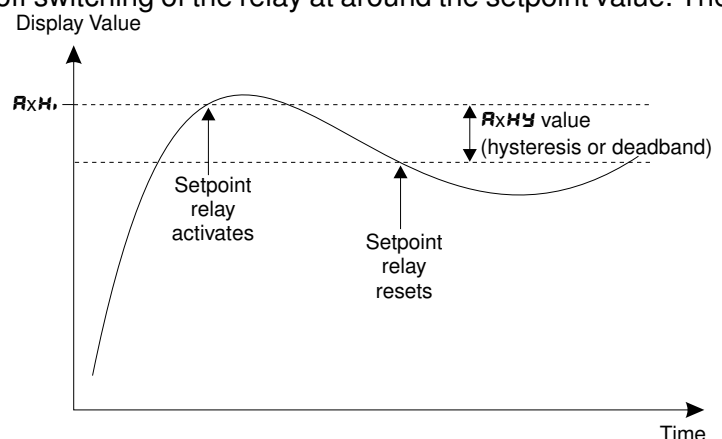
### **RxHY** (alarm hysteresis)

Displays and sets the alarm hysteresis limit and is common for both high and low setpoint values. The hysteresis value may be used to prevent too frequent operation of the setpoint relay when the measured value stays close to the setpoint. Without a hysteresis setting (**RxHY** set to zero) the alarm will activate when the display value goes above the alarm setpoint (for high alarm) and will reset when the display value falls below the setpoint, this can result in repeated on/off switching of the relay at around the setpoint value. The hysteresis setting operates as follows:

In the high alarm mode, once the alarm is activated the input must fall below the setpoint value minus the hysteresis value to reset the alarm.

e.g. if **RxH** is set to **50.0** and **RxHY** is set to **3.0** then the setpoint output relay will activate once the display value goes above **50.0** and will reset when the display value goes below **47.0** (**50.0** minus **3.0**).

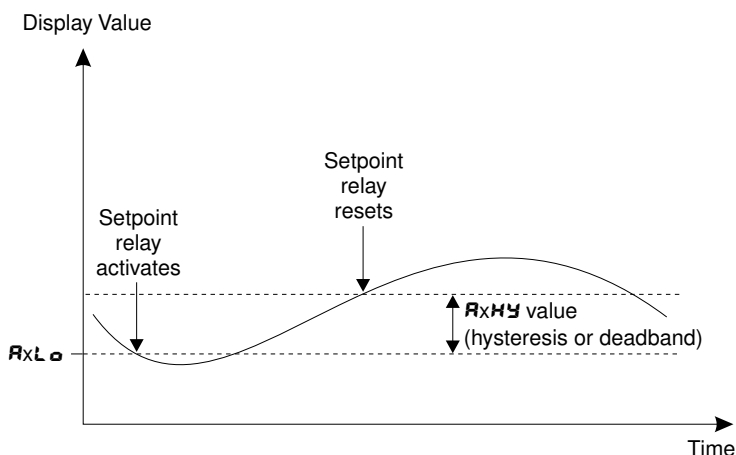
In the low alarm mode, once the alarm



is activated the input must rise above the setpoint value plus the hysteresis value to reset the alarm.

e.g. if **A1Lo** is set to **20.0** and **A1HY** is set to **10.0** then the alarm output relay will activate when the display value falls below **20.0** and will reset when the display value goes above **30.0** (20.0 plus 10.0).

The hysteresis units are expressed in displayed engineering units.



**A1t1 (alarm trip time)**

The alarm trip time determines how long the measured value has to be above the high trip point or below the low trip point before an alarm is given. This can be used to prevent false alarms on noisy inputs. The value is set in seconds, with a range of **0** to **50** seconds. For normal operation a delay of three to five seconds is suitable.

**A1r1 (alarm reset time)**

The alarm reset time determines how long the measured value has to be below the high trip point or above the low trip point before the alarm is reset. The value is set in seconds, with a range of **0** to **50** seconds. For normal operation a delay of zero seconds is suitable.

**A1n.o/A1n.c (alarm relay N/O or N/C operation)**

Each alarm may be programmed to operate as a normally open (N/O e.g. **A1 n.o**) or normally closed (N/C e.g. **A1 n.c**) device. A N/O relay is de-energised when no alarm condition is present and is energised when an alarm condition is present. A N/C relay is normally energised and is de-energised when an alarm condition is present. The N/C mode is useful for power failure detection.

**A1t1 /A1SP (trailing or independent set points)**

A function exists to allow relays, other than relay 1, to be used as independent relays with their own set points or they may be made to “trail” another relays setpoint. For example if **A2.SP** is selected then alarm 2 will act as an independent relay. If **A2.t1** is selected then the alarm 2 relay will trail alarm 1 relay. With **A2.t1** selected if alarm 1 high setpoint is set to 50 and alarm 2 high set point set to 20 then alarm 2 relay will operate at a display of 70 (50 + 20). Alternatively alarm 2 could be set to operate at 30 (50 - 20) by setting alarm 2 high setpoint to -20.

Trailing Alarm Table Showing Possible Alarm Assignments			
	<b>A2</b>	<b>A3</b>	<b>A4</b>
<b>A1</b>	<b>A2.t1</b>	<b>A3.t1</b>	<b>A4.t1</b>
<b>A2</b>		<b>A3.t2</b>	<b>A4.t2</b>
<b>A3</b>			<b>A4.t3</b>

**Access mode**

The access mode function **ACCS** has four possible settings namely **OFF**, **EASY**, **NONE** and **ALL**. If set to **OFF** the mode function has no effect on alarm relay operation. If set to **EASY** the easy alarm access mode will be activated, see details below. If set to **NONE** there will be no access to any functions via **FUNC** mode, entry via **CAL** mode must be made to gain access to alarm functions. If set to **ALL** then all functions can be accessed via **FUNC** mode i.e. there is no need to enter via **CAL** mode.

## 6.1 Easy Alarm Access

The RM4 has an easy alarm access facility which allows operator access to the selected alarm setpoints (only to the setpoints selected at the **SPAC** function) simply by pressing the **F** button. The first setpoint will then appear and changes to this setpoint may be made to this setpoint via the **▲** or **▼** buttons. Press the **F** button to accept any changes or to move on to the next setpoint.

The instrument must be set in the manner described below to allow the easy access facility to work:

1. Either the **ACCESS** function must be set to **ERSY** or the **RELAY** function must be set to **SPAC**. If the **ACCESS** function is used the remote input function **RELAY** can be assigned to a different use.
2. The selected relays must have a setpoint, nothing will happen if all the alarm relay setpoints are set to **OFF**.
3. The **SPAC** function must be set to allow access to the relays required e.g. if set to **R1-2** then the easy access will work only with alarm relays 1 and 2 even if more relays are fitted.
4. The instrument must be in normal measure mode i.e. if the instrument is powered up so that it is in **CAL** mode then the easy access will not function. If in doubt then remove power from the instrument, wait for a few seconds then apply power again.
5. If the easy access facility is used then the only way to view or alter any other function settings is to power up via **CAL** mode i.e. there is no entry to **FUNE** mode unless the instrument is powered up in **CAL** mode.

## 6.2 Alarm mode

The alarm mode functions (**R1** to **R4**) allow the alarm relays to follow either the arithmetic result, **Arth** (channel 0) when in arithmetic mode or any of the four input channels **Ch1** to **Ch4**.

Example - **R1** is set to **Arth** and **R2** is set to **Ch2**

If **Relo** is set to **5** then relay 1 will operate whenever the arithmetic result shows a value or **5** or below.

If **R2H** is set at **200** then relay 2 will activate whenever channel 2 reading is at a value of **200** or above.

### Optional relays

Two alarm relays are fitted as standard. One or two extra relays are optionally available. See appropriate appendix in this manual for details of optional relays.

### Switching Inductive Loads

If the alarm relay is to be used to switch an inductive load, such as a solenoid, it is advisable to use a suppressor circuit either across the load or across the relay contacts. Switching inductive loads without a suppressor circuit can cause arcing at the relay contacts resulting in electrical interference and wear on the contacts. A typical suppressor circuit consists of a 100Ω resistor in series with a 0.1 uF capacitor, this circuit is then placed across the load or relay contacts. Ensure that the resistor and capacitor are of sufficiently high rating to cope with the voltage and current encountered.

## 7 Calibration

The 2 point calibration method may be used to independently scale all of the four input channels.

### CH 1 CAL 1, CH 2 CAL 1, CH 3 CAL 1 & CH 4 CAL 1 (first scaling point for 2 point scaling method)

CAL 1 and CAL 2 are used together to scale the instruments display, values for both must be set when using this scaling method.

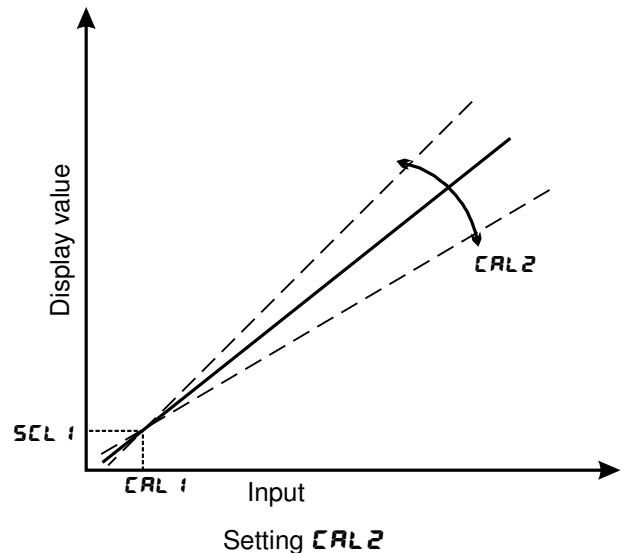
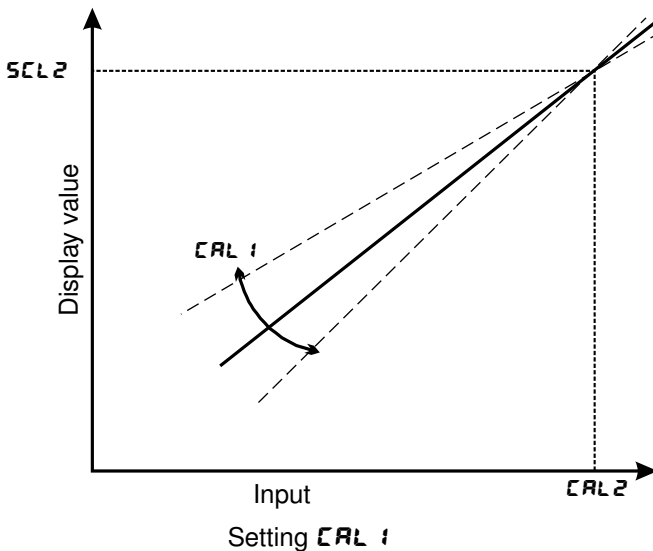
The CAL 1 function sets the first calibration point for live input calibration. When using this method a signal input must be present at the input terminals. Note: CAL 1 and CAL 2 can be set independently.

The procedure for entering the first scaling point is:

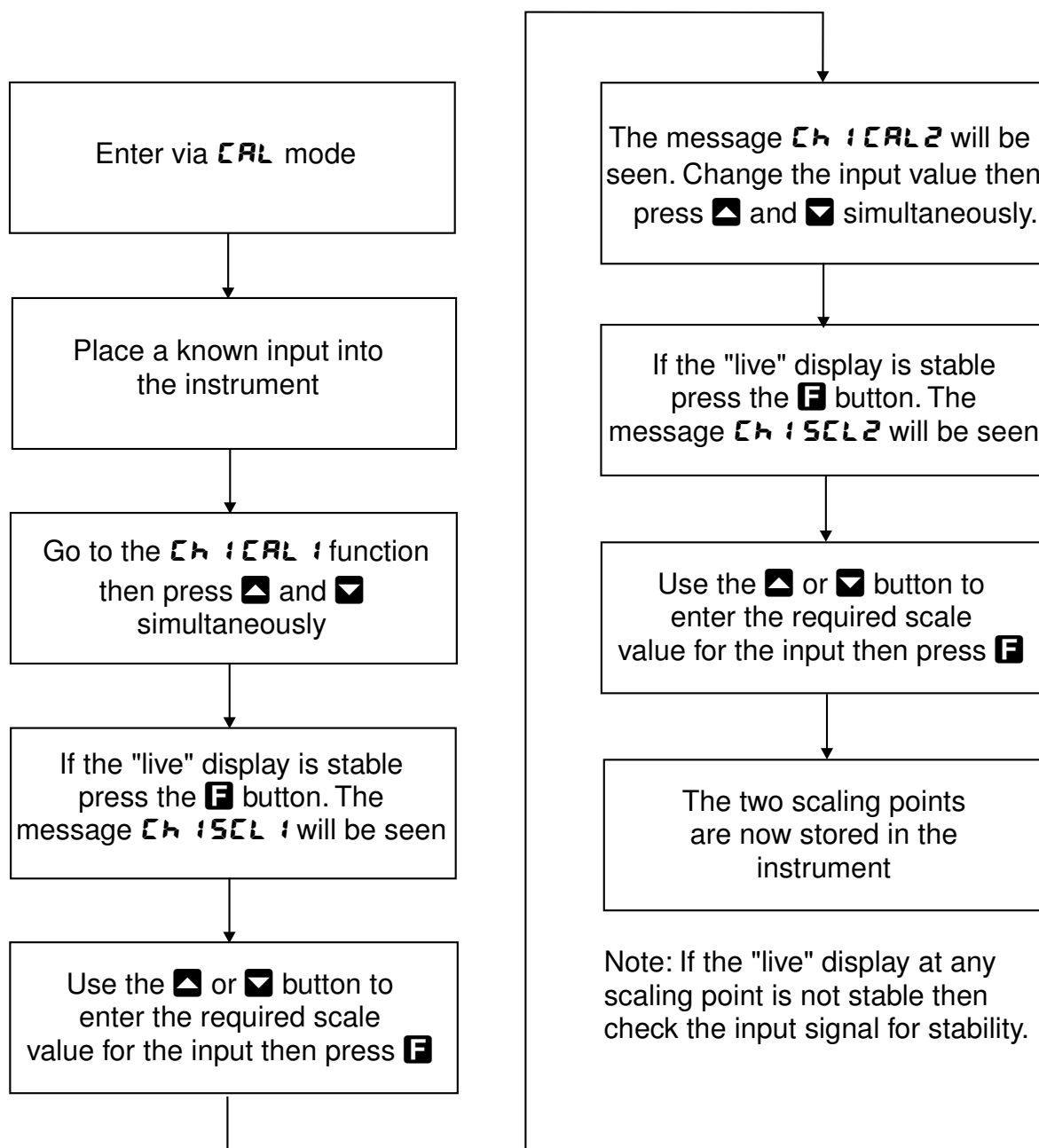
- Ensure that an input signal is present at the input terminals, this will usually be at the low end of the signal range e.g. 4mA for a 4-20mA input.
- At the CAL 1 function press  $\blacktriangle$  and  $\blacktriangledown$  simultaneously then release them. The display will indicate the live input value. Do not be concerned at this stage if the live input display value is not what is required. It is important that the live input value seen is a steady value, if not then the input needs to be investigated before proceeding with the scaling.
- Press, then release the F button. The display will indicate SCL 1 followed by a value. Use the  $\blacktriangle$  or  $\blacktriangledown$  button to change this value to the required display value at this input. e.g. if 4mA was input and the required display at 4mA was 0 then ensure 0 is selected at SCL 1. Press the F button to accept changes or the P button to abort the scaling.

### CH 1 CAL 2, CH 2 CAL 2, CH 3 CAL 2 & CH 4 CAL 2 (second scaling point for 2 point scaling method)

The second point scaling is performed in exactly the same manner as CAL 1 except that SCL 2 will be seen instead of SCL 1. It is essential that the live input is different in value to the CAL 1 input e.g. for a 4-20mA input use 20mA as the CAL 2 live input. Note; it is not essential that 4 and 20mA are used as the live inputs for a 4-20mA scaling but there must be at least a 10% of full scale difference between the CAL 1 and CAL 2 inputs, if this is not the case then a SPAN Err message will be seen and the calibration point will not be accepted.



## Example - Scaling channel 1



### **UCAL CH 1, UCAL CH 2, UCAL CH 3 & UCAL CH 4 (uncalibration)**

Used to set the individual channels back to the factory calibration values. This function should only be used when calibration problems exist, and it is necessary to clear the calibration memory. To clear the memory press the **▲** and **▼** buttons simultaneously at the chosen **UCAL** channel. The message **CAL CLR** will be seen to indicate that the memory has cleared.

### **Returning to the normal measure mode**

When the calibration procedure has been completed it is advisable to return the instrument to the normal mode (where calibration functions cannot be tampered with). To return to the normal mode, turn off power to the instrument, wait a few seconds and then restore power.

## 8 Mathematical functions

In arithmetic mode (**SEt OPER** set to **Arth**) the instrument may be set up to perform a variety of mathematical functions according to the equation:

$$\frac{A1 \times (Ch1 + B1)}{C1} \left\{ \begin{array}{l} \text{add} \\ \text{sub} \\ \text{prod} \\ \text{div} \\ \text{high} \\ \text{low} \\ \text{sine} \\ \text{cos} \end{array} \right. \frac{A2 \times (Ch2 + B2)}{C2} \left\{ \begin{array}{l} \text{add} \\ \text{sub} \\ \text{prod} \\ \text{div} \\ \text{high} \\ \text{low} \\ \text{sine} \\ \text{cos} \end{array} \right. \frac{A3 \times (Ch3 + B3)}{C3} \left\{ \begin{array}{l} \text{add} \\ \text{sub} \\ \text{prod} \\ \text{div} \\ \text{high} \\ \text{low} \\ \text{sine} \\ \text{cos} \end{array} \right. \frac{A4 \times (Ch4 + B4)}{C4}$$

For purposes of the description below the result of each channel arithmetic scaling e.g.  $A1 \times (Ch1 + B1)/C1$  will be referred to as the channel 1 result etc.

The A, B & C value for each channel may be individually set in engineering units over the display range (note: A & C are whole numbers, B has the same decimal place as its associated channel). The display for each parameter is as follows:

<b>EA1</b>	<b>EA2</b>	<b>EA3</b>	<b>EA4</b>
<b>Eb1</b>	<b>Eb2</b>	<b>Eb3</b>	<b>Eb4</b>
<b>EC1</b>	<b>EC2</b>	<b>EC3</b>	<b>EC4</b>

The operation of each channel may be set up as follows:

### **OP 1 (channel 1 result operated on channel 2 result)**

<b>Add</b>	channel 1 result plus channel 2 result
<b>Sub</b>	channel 1 result minus channel 2 result
<b>Prod</b>	channel 1 result times channel 2 result
<b>d, U</b>	channel 1 result divided by channel 2 result
<b>H, Sh</b>	highest of channel 1 result or 2 result
<b>Lo</b>	lowest of channel 1 result or 2 result
<b>Si NE</b>	channel 1 result times the sine of the angle displayed at channel 2 result
<b>COS</b>	channel 1 result times the cosine of the angle displayed at channel 2 result

### **OP 2 (result of previous calculation operated on channel 3 result)**

<b>Add</b>	result of (channel 1 result <b>OP 1</b> channel 2 result) plus channel 3 result
<b>Sub</b>	result of (channel 1 result <b>OP 1</b> channel 2 result) minus channel 3 result
<b>Prod</b>	result of (channel 1 result <b>OP 1</b> channel 2 result) times channel 3 result
<b>d, U</b>	result of (channel 1 result <b>OP 1</b> channel 2 result) divided by channel 3 result
<b>H, Sh</b>	highest of result of (channel 1 result <b>OP 1</b> channel 2 result) or channel 3 result
<b>Lo</b>	lowest of result of (channel 1 result <b>OP 1</b> channel 2 result) or channel 3 result
<b>Si NE</b>	result of (channel 1 result <b>OP 1</b> channel 2 result) times the sine of the angle displayed at channel 3 result
<b>COS</b>	result of (channel 1 result <b>OP 1</b> channel 2 result) times the cosine of the angle displayed at channel 3 result

**Note:** channel 1 result operated on channel 2 result is calculated, then this result is then operated on channel 3 result.

**OP3 (result of previous calculation operated on channel 4)**

- Add** result of (channel 1 result **OP 1** channel 2 result **OP2** channel 3 result) plus channel 4 result
- Sub** result of (channel 1 result **OP 1** channel 2 result **OP2** channel 3 result) minus channel 4 result
- Prod** result of (channel 1 result **OP 1** channel 2 result **OP2** channel 3 result) times channel 4 result
- d, U** result of (channel 1 result **OP 1** channel 2 result **OP2** channel 3 result) divided by channel 4 result
- H, Gh** highest of result of (channel 1 result **OP 1** channel 2 result **OP2** channel 3 result) or channel 4 result
- Lo** lowest of result of (channel 1 result **OP 1** channel 2 result **OP2** channel 3 result) or channel 4 result
- SINE** result of (channel 1 result **OP 1** channel 2 result **OP2** channel 3 result) times the sine of the angle displayed at channel 4 result
- COS** result of (channel 1 result **OP 1** channel 2 result **OP2** channel 3 result) times the cosine of the angle displayed at channel 4 result

The following examples may be used as a guide for setting up your instrument.

**Example 1:**

To get an average of channel 1 and channel 2:  $\left( \frac{Ch1}{2} + \frac{Ch2}{2} \right)$

Program **ER1=1.Eb1=0.EC1=2.ER2=1.Eb2=0.  
EC2=2.OP1=Add**

$$\frac{1 \times (Ch1+0)}{2} \text{ Add } \frac{1 \times (Ch2+0)}{2}$$

**Example 2:** It is required display KVA . Input 1 (channe1) measures a voltage range of 0 to 1000V and input 2 (channel 2) measures a current range of 0 to 10.00A. The desired display is 0 to 10.00 KVA.

Since  $KVA = \frac{V \times A}{1000}$  the equation =  $\frac{Ch1}{1000} \text{ Prod } Ch2$

Program **ER1=1.Eb1=0.EC1=1000.ER2=1.  
Eb2=0.EC2=1.OP1=Prod**

$$\frac{1 \times (Ch1+0)}{1000} \text{ Prod } \frac{1 \times (Ch2+0)}{1}$$

**Example 3:** It is required display true power in kW. Input 1 (channe1) has an input representing the voltage, input 2 (channel 2) has an input representing the current and channel 3 has an input representing the power factor over the range 0 to 1.000. The desired display is in kW.

Since  $kW = \frac{V}{1000} \times I \times \text{Power Factor}$

Program **ER1=1.Eb1=0.EC1=1000.ER2=1.  
Eb2=0.EC2=1.ER3=1.Eb3=0.  
EC3=1.OP1=Prod.OP2=Prod.**

$$\frac{1 \times (Ch1+0)}{1000} \text{ Prod } \frac{1 \times (Ch2+0)}{1} \text{ Prod } \frac{1 \times (Ch3+0)}{1}$$

### Alternative method for example 3

True power can also be calculated by the formula  $V \times I \times \cos(\theta)$  since the power factor =  $\cos(\theta)$ . The settings below will again give the power in kW.

Program     **EA1=1.Eb1=0.EC1=1000.EA2=1.  
Eb2=0.EC2=1.EA3=1.Eb3=0.EC3=1.  
OP1=Prod.OP2=COS.**

$$\frac{1 \times (\text{Ch1} + 0)}{1000} \text{ Prod } \frac{1 \times (\text{Ch2} + 0)}{1} \text{ COS } \frac{1 \times (\text{Ch3} + 0)}{1}$$

For example if Channel 1 displays **400**, Channel 2 displays **3.5** and Channel 3 displays **12** then the result (displayed on Channel 0) will be:-

$$\frac{1 \times (400 + 0)}{1000} \text{ Prod } \frac{1 \times (3.5 + 0)}{1} \text{ COS } \frac{1 \times (12 + 0)}{1}$$

$$= 0.4 \text{ Prod } 3.5 \text{ Cos } 12 = 137\text{kW}$$

**Example 4:** To multiply the figure displayed on channel 1 by the sine of the angle of the figure displayed on channel 2. The second channel would normally be scaled from 0 to 360 when either the sine or cosine is being used, however numbers outside this range are acceptable.

Program:     **EA1=1.Eb1=0.EC1=1.EA2=1.Eb2=0.  
EC2=1.OP1=SI NE.**

$$\frac{1 \times (\text{Ch1} + 0)}{1} \text{ SINE } \frac{1 \times (\text{Ch2} + 0)}{1}$$

**Example 5:** It is required is to display the result of  $\frac{\text{Input 1}}{\text{Input 2} \times 40}$

Program:     **EA1=1.Eb1=0.EC1=1.EA2=40.Eb2=0.  
EC2=1.OP1=diV**

$$\frac{A1 \times (\text{Ch1} + B1)}{C1} \text{ diV } \frac{A2 \times (\text{Ch2} + B2)}{C2}$$

substituting values for A1, B1, C1, A2, B2, C2 gives:

$$\frac{1 \times (\text{Ch1} + 0)}{1} \text{ diV } \frac{40 \times (\text{Ch2} + 0)}{1}$$

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## 9 Specifications

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### 9.1 Technical Specifications

Input Types:	Up to four input channels (common ground). Link selectable $\pm 0.20\text{mA}$ , $\pm 4$ to $20\text{mA}$ or DC Volts $\pm 1\text{V}$ , $\pm 10\text{V}$
Impedance:	$80\Omega$ (mA) & $1\text{M}\Omega$ (DC Volts)
ADC Resolution:	1 in 20,000
Accuracy:	0.1% when calibrated
Sample Rate:	4 per sec
Conversion Method:	Dual Slope ADC
Microprocessor:	MC68HC11 CMOS
Ambient Temperature:	LED -40 to $60^\circ\text{C}$ , LCD -10 to $50^\circ\text{C}$
Humidity:	5 to 95% non condensing
Display:	LED 5 digit 7.6mm + alarm annunciator LEDs
Power Supply:	AC 240V, 110V, 24V or 32V 50/60Hz. DC 12 to 48V wide range.
Power Consumption:	AC supply 6VA max, DC supply, 6W max., depends on load options
Relay Action:	Programmable N.O. or N.C.

### 9.2 Output Options

Third Relay:	Rated 0.5A resistive 30VAC, form C.
Third & Fourth Relay:	Rated 0.5A resistive 30VAC or DC, form A.
Switched Voltage:	Non isolated 24VDC output to be used for open collector or solid state relay driver output.
Analog Retransmission:	Isolated 4 to $20\text{mA}$ or 0 - 1V or 0 - 10V link selectable, 12 bit or 16 bit versions available. Dual analog version also available, two isolated analog output channels, 12 bit.
Serial Communications:	RS232, RS485 or RS422 factory configured
Transmitter supply:	Isolated & regulated. Link selectable 12VDC (50mA max) or 24VDC (25mA max)

### 9.3 Physical Characteristics

Case Size:	44mm (w) x 91mm (h) x 141mm (d)
Connections:	Plug in screw terminals (max $1.5\text{mm}^2$ wire for input signal and options $2.5\text{mm}^2$ for power and relays 1 & 2)
Weight:	500 gms basic model, 550 gms with option card

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## 10 Guarantee & Service

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The product supplied with this manual is guaranteed against faulty workmanship for a period of 2 years from the date of dispatch.

Our obligation assumed under this guarantee is limited to the replacement of parts which, by our examination, are proved to be defective and have not been misused, carelessly handled, defaced or damaged due to incorrect installation. This guarantee is VOID where the unit has been opened, tampered with or if repairs have been made or attempted by anyone except an authorised representative of the manufacturing company.

Products for attention under guarantee (unless otherwise agreed) **must be returned to the manufacturer freight paid** and, if accepted for free repair, will be returned to the customers address in Australia free of charge.

When returning the product for service or repair a full description of the fault and the mode of operation used when the product failed must be given.

In any event the manufacturer has no other obligation or liability beyond replacement or repair of this product.

Modifications may be made to any existing or future models of the unit as it may deem necessary without incurring any obligation to incorporate such modifications in units previously sold or to which this guarantee may relate.

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