RM4-QC

DIN Rail Mount
Quadrature Signal Input
Totaliser/Ratemeter
Process Monitor/Controller
Operation and Instruction Manual

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1 Introduction

This manual contains information for the installation and operation of the RM4-QC Monitor. The instrument may be set to operate as a ratemeter or totaliser or allow toggling between rate and total displays. The RM4-QC requires an input from a quadrature output (A & B pulses) encoder. The **SEt OPEr** function allows selection of one of these three operation modes. A brief description of each mode is given below. The three modes of operation are:

1. totl - totaliser/counter display

The input pulses are totalised, scaled in engineering units and displayed e.g. a display showing Total litres, mm etc. A total and grand total may be viewed and reset separately. The grand total is a separate total memory which adds together all the previous totals. The totaliser display scaling functions are the **totL InPt** and **totL SCLE** functions. Explanation and examples of the totaliser functions are given in the "Totaliser Explanation of Functions" chapter.

2. FrEq - frequency/rate display

The frequency or rate of the input may be scaled in engineering units and displayed e.g. a display showing R.P.M, Bottles/min., Litres/hour etc. The rate display scaling functions are the **rAtE InPt** and **rAtE SCLE** functions. Explanation and examples of the ratemeter functions are given in the "Ratemeter Explanation of Functions" chapter.

3. both - total/rate display (display may be toggled to either total or rate)

This mode is primarily used when the display is required to toggle between a rate and total display via an external contact closure or via the front panel ▲ and ▼ buttons. . A total and grand total may be viewed and reset separately.

Two standard inbuilt relays provide alarm/control functions. A standard encoder supply of 5VDC or 24VDC (link selectable) unregulated is also provided on both AC and DC powered models.

Various combinations of one or two optional extra relays, analog (4-20mA, 0-1V or 0-10V) retransmission or serial (RS232, RS485 or RS422) communications and an isolated 12 or 24VDC isolated transmitter supply may also be provided as an option.

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. Full electrical isolation between power supply, input voltage or current and retransmission output is provided by the RM4, thereby eliminating grounding and common 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-QC 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.

1 .1 Entry to setup and scaling 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.

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.

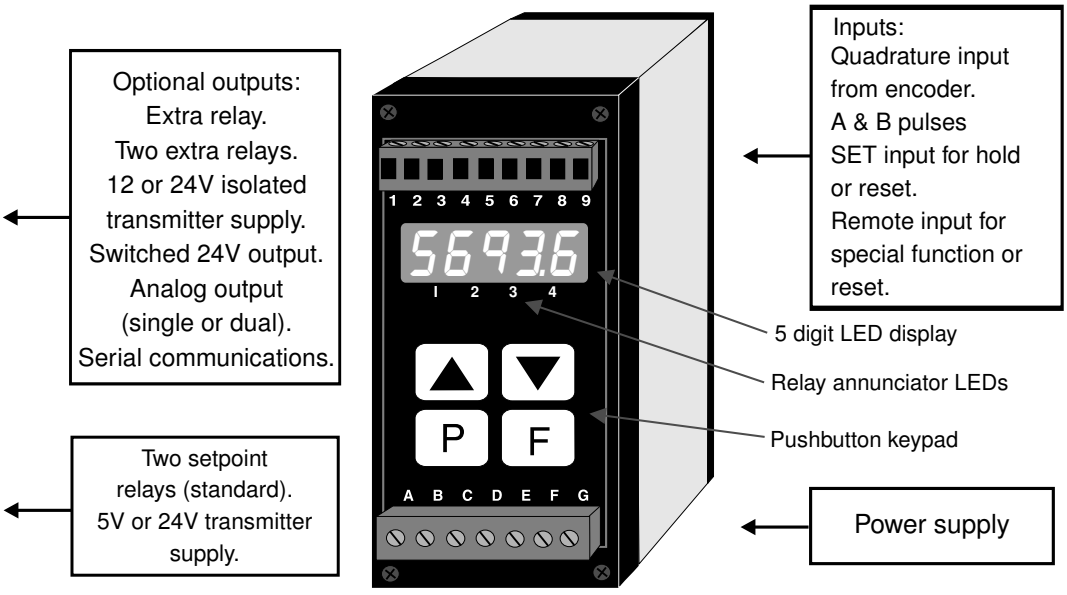
Entering FUNC Mode

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.

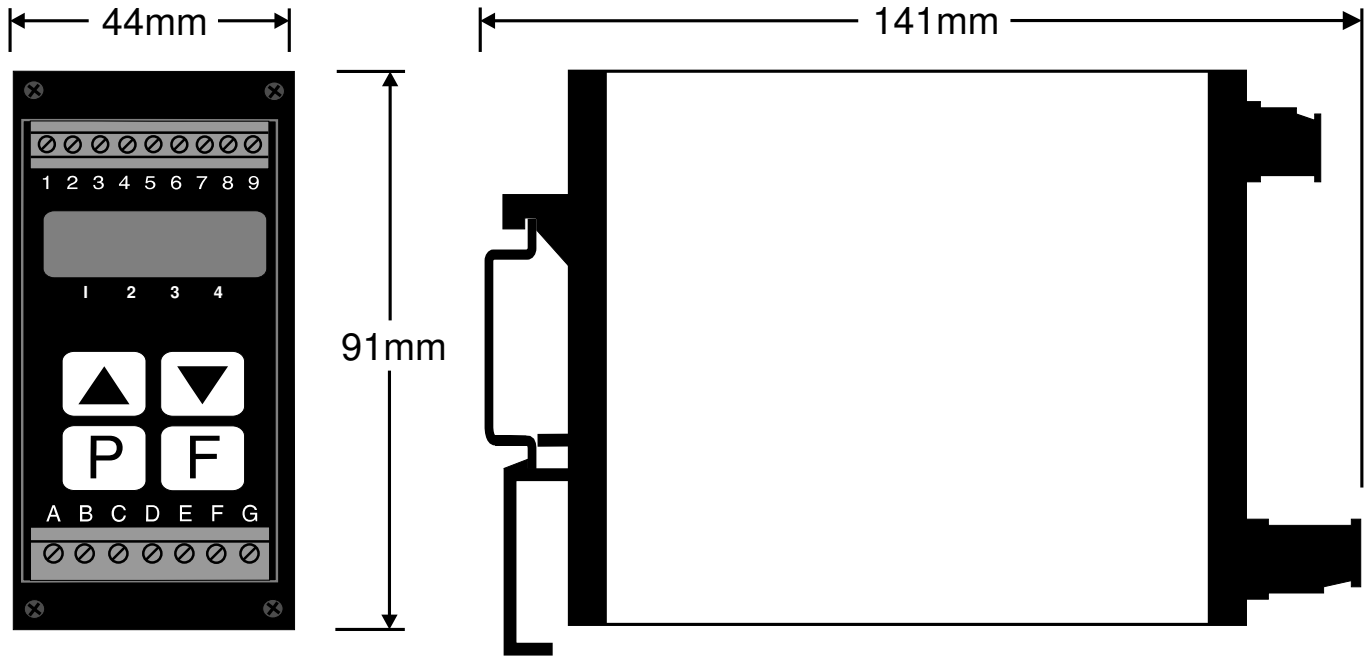
2. Within 2 seconds of releasing the F button press, then release the ▲ and ▼ buttons together. The display will now indicate FUNC followed by the first function.

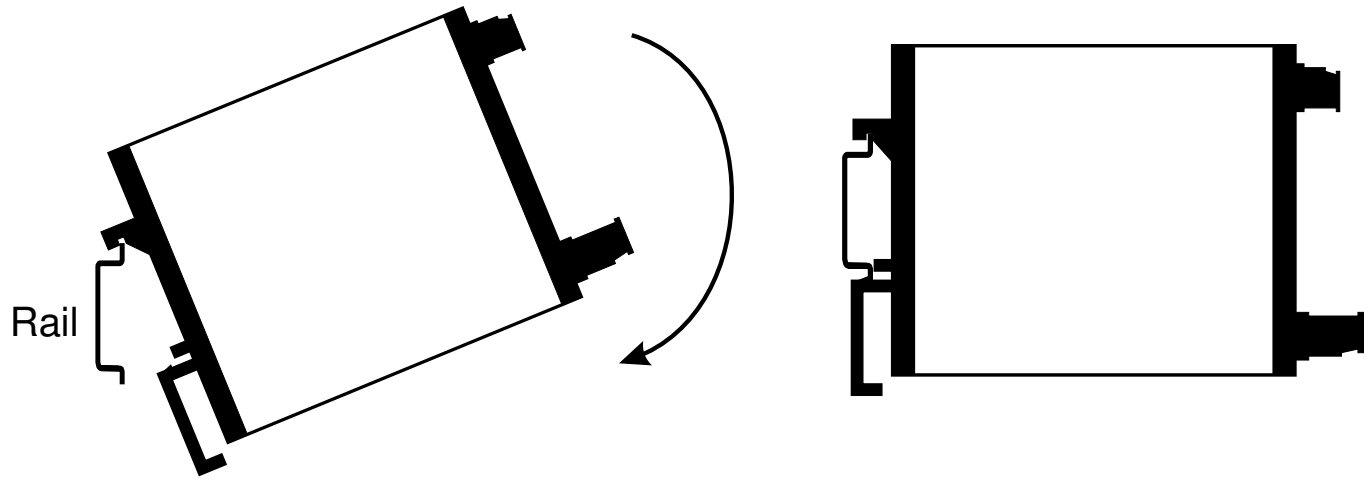
1 .2 Inputs & outputs



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.



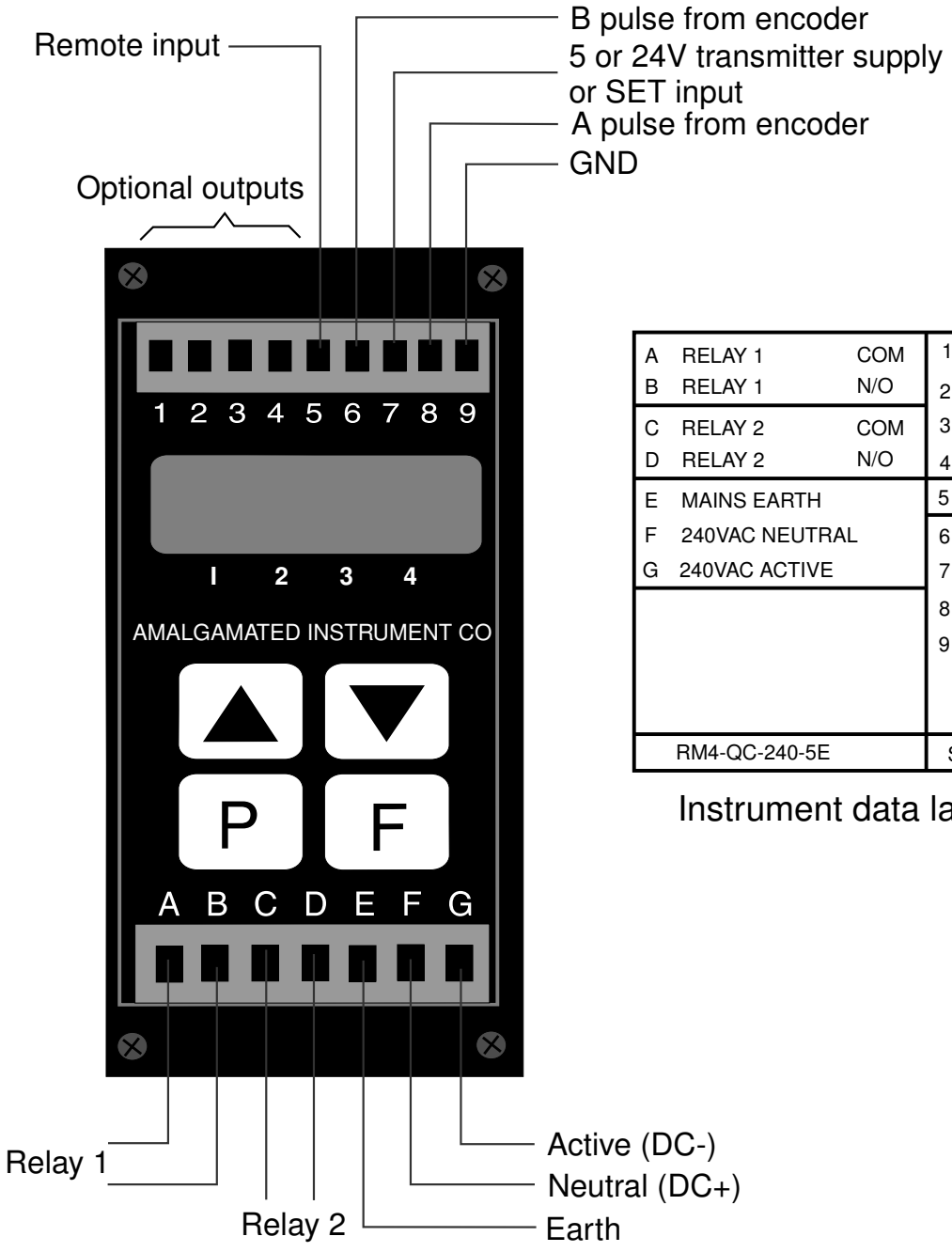


3 Electrical installation

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^2 to be fitted for power supply and relays 1 and 2 or 1.5mm^2 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.

Refer to the separate “RM4 DIN Rail Meter Optional Output Addendum” booklet for optional output wiring and link settings if optional outputs are fitted to the instrument.



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 REMOTE INPUT
F	240VAC NEUTRAL		6 B
G	240VAC ACTIVE		7 TRANSMITTER SUPPLY
			8 A
			9 GND
RM4-QC-240-5E			SERIAL No.

Instrument data label (example)

3 .1 Power supply connections

The power supply for the instrument is factory fitted and is of a fixed type. If you are unsure of the supply requirement for your instrument it can be determined by the model number on the instrument label:-

RM4-QC-240-..... Requires 240VAC
RM4-QC-110-..... Requires 110VAC
RM4-QC-32-..... Requires 32VAC
RM4-QC-24-..... Requires 24VAC
RM4-QC-DC-..... Requires between 12 and 48VDC

3 .2 Relay connections

The RM4 is supplied with two alarm relays as standard. Relay 1 is connected across terminals A and B. Relays 2 is connected across terminals C and D. One or two extra relays are optionally available. Relays 1 & 2 are single pole, single throw types (form A) and are rated at 5A, 240VAC into a resistive load Relays 3 and 4 are form A rated 0.5A resistive 30VAC or DC. The relay contacts are voltage free and may be programmed for normally open or normally closed operation. If only 3 relays are fitted and no other options are fitted then Relay 3 can be configured as form C.

3 .3 Reset input

The remote input (see 3.4 below) can be programmed for use as the reset input by setting the **r.i nP** function to **2Er0**. The remote input can be used to reset the grand total. Alternatively the **P** button function **P.but** can be set to **2Er0** allowing the **P** button to be used to reset the total. Note that the **P** button has to be held pressed for 2-3 seconds before the total will zero.

See also the **c.rSt** and **P.CLr** functions for details of the counter reset modes available.

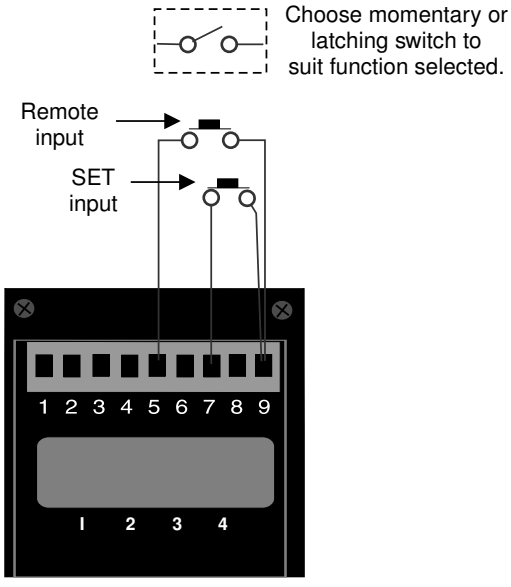
The SET input can also be programed to reset the total to the preset value. If the preset (**PSEt**) value is 0 then the total will be reset to zero. Note the SET input can only be used if the SET link is **in**, the IN+ link is **in** and the 5VEX link is **out**.

3 .4 Remote and SET input connections

The selected remote input function (see **r.i nP** function) can be operated via an external contact closure via a switch, relay or open collector transistor switch (5VDC max.).

A momentary action is required for functions such as **2Er0** and **Hd** , a latching switch or normally closed momentary switch may be required for functions such as peak hold or display hold.

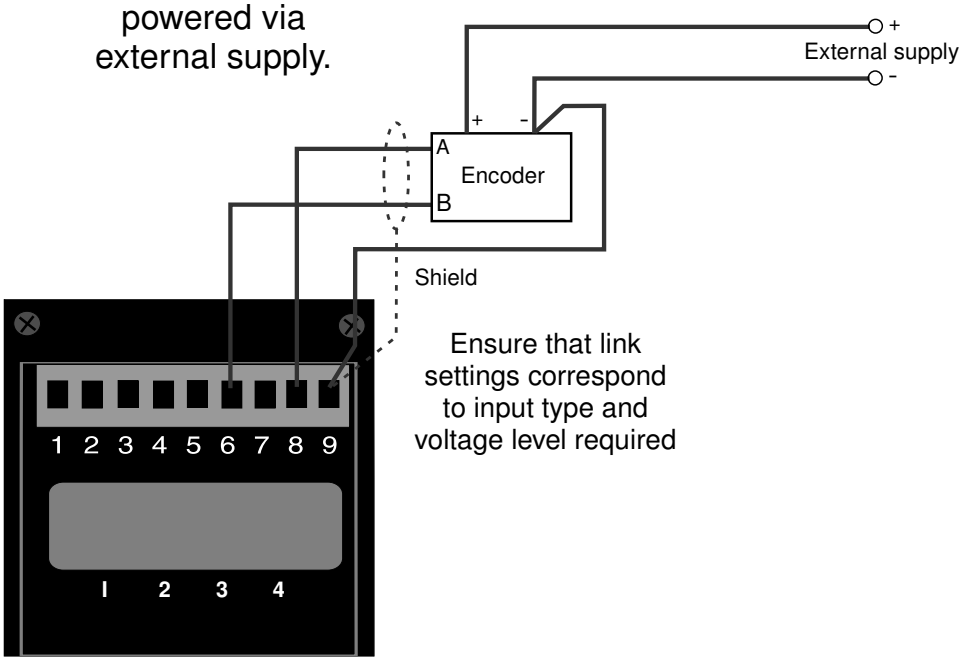
The SET input may only be used if the 5VEX internal link is **out** and the SET internal link is **in** and the IN+ link is **in**. See “Configuring the input board” section for link location. The **SEt i nPt** function sets the operation of this input to either preset (**PSEt**) or hold (**Hold**) operation.



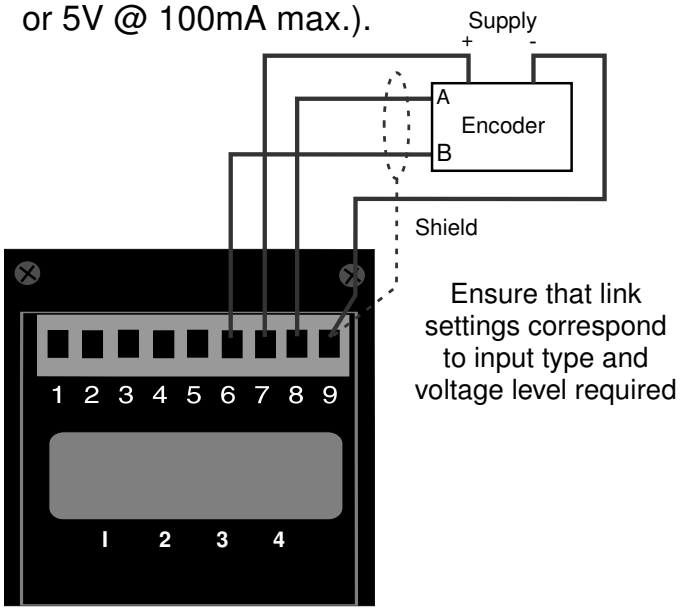
3 .5 Encoder connections

Most quadrature encoders will require external power supply since the current required is usually greater than that provided by the RM4. The standard internal DC power supply may be link selected to provide a regulated 5V or unregulated 24V to power the sensor, the maximum current available is 100mA at 5V or 25mA at 24V. The optional isolated & regulated supply provides 12VDC at 50mA or 24VDC at 25mA.

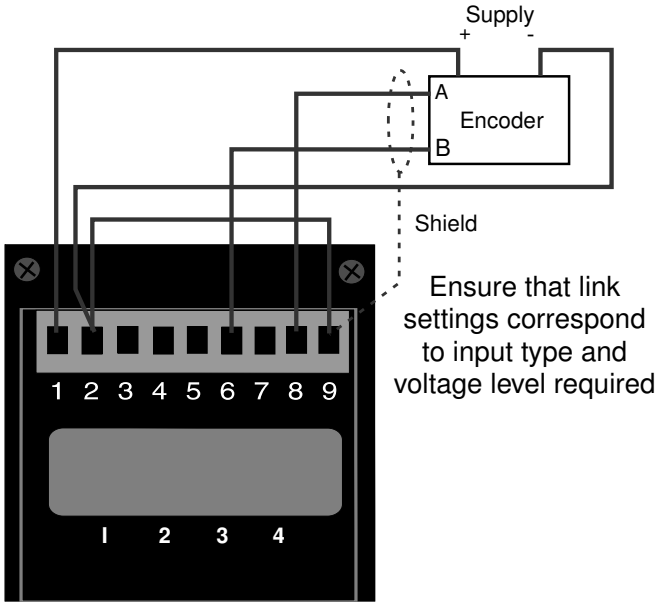
Encoder powered via external supply.



Encoder powered via standard 5V or 24V unregulated (24V @ 25mA max. or 5V @ 100mA max.).



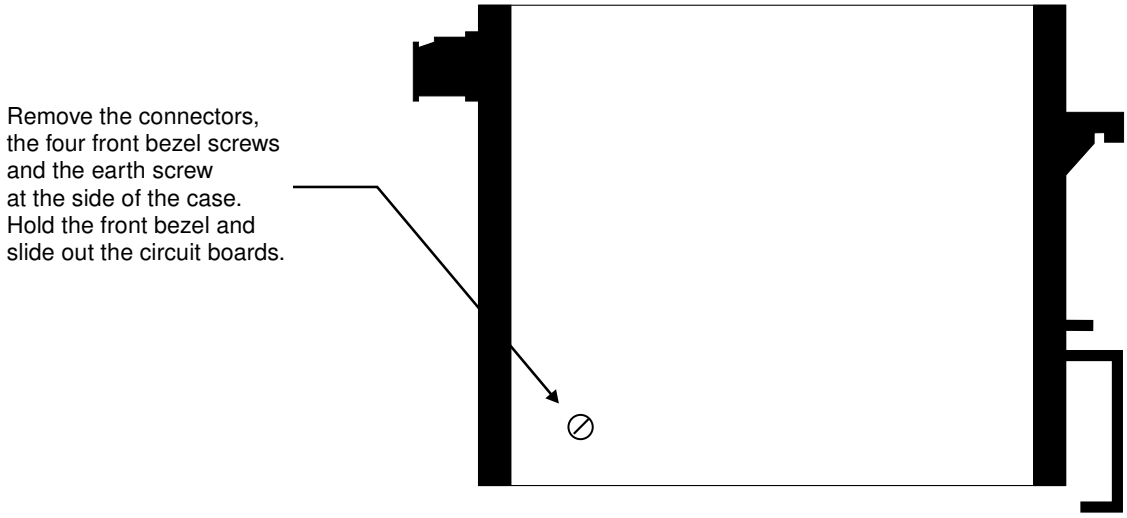
Encoder powered via optional 12 or 24V regulated (25mA max.).



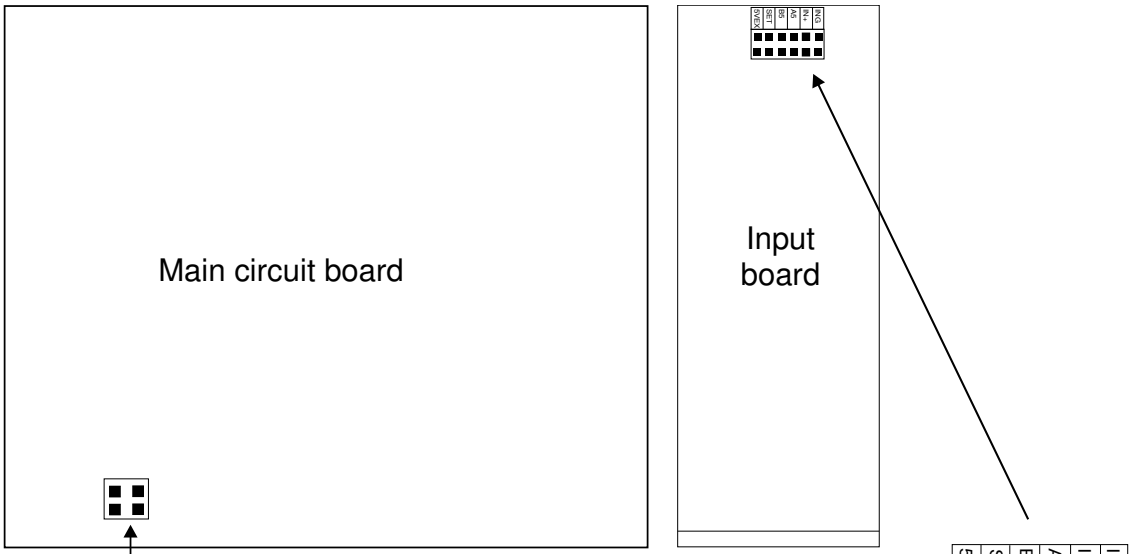
3 .6 Configuring the input board

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

Link settings for the main input boards are as shown below. For optional output link settings refer to the separate “RM4 DIN Rail Meter Optional Output Addendum” booklet.

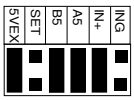


3 .7 Input link settings

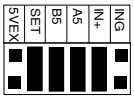


LK16 and 17 in for 24VDC encoder supply on terminal 7. Note: If terminal 7 is to be used as a 5VDC encoder supply or as a reset or hold input then LK16 and 17 must be out.

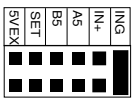
Examples:



Links set for:
Pull up
0-5V input signals
5V encoder supply



Links set for:
Pull up
0-5V input signals
No encoder supply
Terminal 7 can be used
as reset or hold input.



Links set for:
Pull down
Up to 24V input signals
24V encoder supply
(if LK16 & 17 are also in)

	Pulse signal Input	
Link	0 to 5V	5 to 24V
ING	OUT	IN
IN+	IN	OUT
A5	IN	OUT
B5	IN	OUT

SET - the SET link should be **in** if terminal 7 is to be used to hold or reset the display. Note that this can only be used if IN+ is **in** i.e. For 0-5V inputs It must be left **out** for if the 5VEX link is **in**.

5VEX - for 5V encoder supply this link should be **in** and the 24V links (LK16 & 17) on the main board **out**. For 24V encoder supply this link should be **out** and the LK16 & 17 on the main circuit board **in**.

4 Ratemeter explanation of functions

Ratemeter/Frequency operation

The description of functions in this chapter covers FREQ (frequency/rate) functions only. This mode is selected at the set operation (SEt OPEr) function.

Remember that you will need to enter via CAL or FUNC mode to gain access to functions, the function table for each mode shows which functions require entry via CAL mode. See "Introduction" chapter for details of how to enter FUNC and CAL modes.

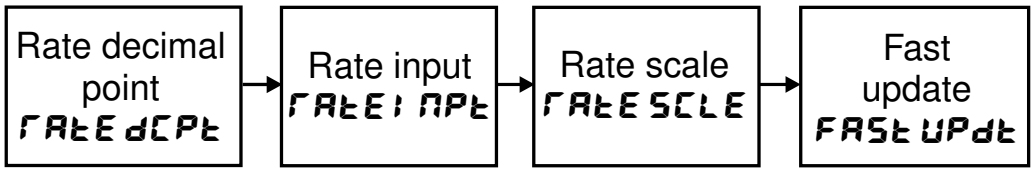
Frequency/rate mode operation modes.

This mode is chosen by selecting FREQ at the SEt OPEr function. The ratemeter mode can operate in one of 4 basic ways to give different display options namely:

1. Rate display, high frequency.

If HI F is selected at the FREQ rnGE function the instrument acts as a general purpose frequency/ratemeter/tachometer. If a very low frequency (below approx. 4Hz) input is used then Lo F mode should be selected. With HI F selected at frequencies below 4Hz the display may alternate between an actual frequency reading and a zero reading, this is due to the higher sampling rate when HI F is selected.

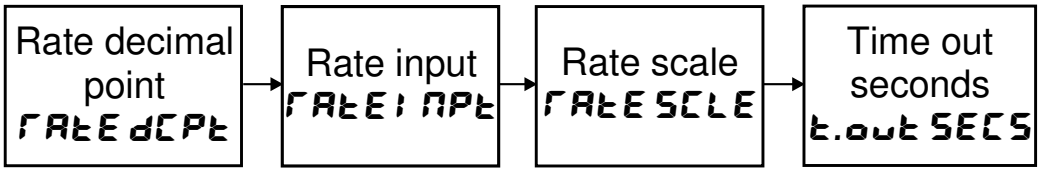
Functions specific to display with FREQrnGE set to HI F with a rate display



2. Rate display, low frequency.

If Lo F is selected at the FREQ rnGE function the instrument expects an input frequency of less than 1kHz. This mode allows very low frequency inputs without exhibiting the apparent display instability often seen with low frequency inputs. This display stability is accomplished by allowing the user to set a “time out” value - see the t.out SECS function.

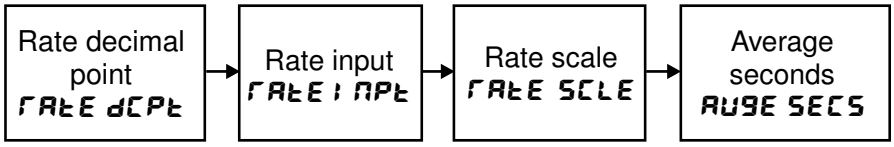
Functions specific to display with FREQrnGE set to Lo F with a rate display



3. Averaged rate display.

With AUGE selected at the FREQ rnGE function the display will average the rate input over the number of seconds selected at the AUGE SECS function. The display will only update at the end of the averaging period. This mode allows the user to see a steady averaged display for an input which produces short term irregularities.

Functions specific to display with FREQrnGE set to AUGE with an averaged rate display



Function	Description
AxLo	Alarm relay low setpoint - see “Alarm relays” chapter. Displays and sets each alarm low setpoint value.
AxHi	Alarm relay high setpoint - see “Alarm relays” chapter. Displays and sets each alarm high setpoint value.
AxHY	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.
Axtt	Alarm relay trip time - see “Alarm relays” chapter. Displays and sets the alarm trip time in seconds/tenths of seconds. This value is common for both alarm high and low setpoint values.
Axrt	Alarm relay reset time - see “Alarm relays” chapter. Displays and sets the alarm reset time in seconds/tenths of seconds. This value is common for both alarm high and low setpoint values.
Axno or Axnc	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.
Ax.SP, Ax.t1, Ax.t2 etc.	Alarm relay operation independent setpoint or trailing - see “Alarm relays” chapter.
brgt	Display brightness - displays and sets the digital display brightness. The display brightness is selectable from 1 to 15 where 1 = lowest intensity and 15 = highest intensity. This function is useful for reducing glare in darkened areas.
dull	Remote display brightness - displays and sets the level for remote input brightness switching, see "Remote input functions" chapter. See also d.oFF SECS function below. This function will only be seen if the r.i nP function is set to dull or if the d.oFF SECS function is set to a value other than zero.
d.oFF SECS	Auto display dimming timer - this function allows a time to be set after which the display brightness (set by the brgt function) will automatically be set to the level set at the dull function. The auto dimming feature can be used to reduce power consumption. The function can be set to any value between 0 and 9999 seconds. A setting of 0 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. If no buttons have been pressed after the display is powered up the display will dim at the selected time plus 2 minutes.
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.	
rEC_	Analog recorder/retransmission output low 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 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 0 then select 0 at this function via the ▲ or ▼ button.
rEC¯	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 500 then select 500 at this function via the ▲ or ▼ button.

rEC_ Ch 2	Second analog recorder/retransmission output low value - seen only when the dual analog retransmission option is fitted. See rEC_ function for description of operation. See also rEC2 function (analog output 2 mode).
rEC¯ Ch 2	Second analog recorder/retransmission output high value - seen only when the dual analog retransmission option is fitted. See rEC¯ function for description of operation. See also rEC2 function (analog output 2 mode).
drnd	Display rounding - displays and sets the display rounding value. This value may be set to 0 - 5000 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. (example: if set to 10 the instrument will display only in multiples of 10).
FLtr	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 0 to 8, where 0 = none and 8 = most filtering. A typical value for the digital filter would be 3. The digital filter uses a weighted averaging method of filtering which will increase the display update time at higher settings.
rAtE dCPt	Rate decimal point selection - displays and sets the decimal point position for the rate display. For example selecting 0 will mean no decimal points (e.g. a display such as 25), 0.1 means 1 decimal point place (e.g. 25.4), 0.02 gives 2 decimal point places (e.g. 25.35) etc. Note: If the number of decimal points is altered then the display scaling figure (rAtE SCLE) will also be affected. Always check the scaling figure following a decimal point change and alter as required.
rAtE InPt	Rate input scale factor - displays and sets the number of input pulses to be used with the rate scale function to generate the display scaling. See examples later in this chapter.
rAtE SCLE	Rate scale factor - displays and sets the scale factor to be used with the rate input setting. See examples later in this chapter. Scale and input work together as follows: $\text{Display} = \frac{\text{Input frequency (Hz)} \times \text{rAtE SCLE}}{\text{rAtE InPt}}$ The input frequency is defined as the frequency (Hz) of one phase of the input i.e. the frequency at the A or B input.
FrEq rnGE	Frequency range - displays and sets the frequency input range. Select Lo F if the input frequency is likely to be lower than 4Hz and not greater than 1kHz. Select Hi F for frequencies with a minimum input frequency of 3Hz or higher (maximum input frequency is 100kHz). Select AVGE for an averaged display. The averaged display allows the input rate to be averaged over a period of seconds set by the AVGE SECS function. An averaged display is particularly useful when the input is irregular. By averaging the pulses over a period of time the display will give a more stable reading for these irregular inputs.
FASt UPdt	Fast update (seen only when FrEq rnGE set to Hi F) - with FASt UPdt set to OFF the relay and analog retransmission updates will take place approximately twice per second. With FASt UPdt set to on the relay and analog retransmission updates will take place approximately six times per second.
rAtE SIGn	Sign for rate display - allows selection of whether a negative sign is seen when encoder changes directions. If set to OFF the rate display will never show a negative sign before the rate. If set to on the display will show a negative sign in one direction of rotation of the encoder. The negative sign is only required if an indication of direction as well as rate is needed.
t.out SECS	Time out (only seen if Lo F is selected under the FrEq rnGE function) - displays and sets the time out in seconds when using the low frequency (Lo F) range. The timeout allows very low frequency inputs to be used without the display reverting to zero between samples. If no input pulses are received the display hold the previous display value for the time out period. If a pulse is received during this time the display will update. If no pulses are received or the input period exceeds the time out value set then the display will indicate 0. The allowable time out range is 1 to 9999 seconds.

AUGE SECS	Average seconds (only seen if AUGE is selected under the FREQ RNGE function) - displays and sets the number of seconds over which the rate should be averaged when using the low frequency (LoF) range. The rate display will not update until the end of the average seconds time. This function allows the user to select a display update rate most suitable for applications in which the rate input may be irregular. The allowable averaging range is 1 to 9999 seconds.
r.i nP	Remote input function - terminals 5 and 9 are the remote input pins. When these pins are short circuited, via a pushbutton or keyswitch the instrument will perform the selected remote input function, only one remote input function can be selected at one time. A message will flash to indicate which function has been selected when the remote input pins are short circuited. The remote input functions are as follows: nonE - no remote function required. P.HLd - peak hold. The display will show the peak hold value whilst the remote input pins are short circuited. d.HLd - display hold. The display will hold its value whilst the remote input pins are short circuited. Hi - peak memory. The peak value stored in memory will be displayed if the remote input pins are short circuited, if the short circuit is momentary then the display will return to normal measurement after 20 seconds. If the short circuit is held for 1 to 2 seconds then the memory will be cleared. Lo - valley memory. The minimum value stored in memory will be displayed. Otherwise operates in the same manner as the Hi function. Hi Lo - toggle between Hi and Lo displays. This function allows the remote input to be used to toggle between peak and valley memory displays. The first operation of the remote input will cause the peak memory value to be displayed, the next operation will give a valley memory display. PHi or PLo will flash before each display to give an indication of display type. 2ERO - zero or preset the display. The total will be zeroed of the c.rSt funciton is set to 2ERO or will be forced to the preset value if the c.rSt funciton is set to PSEt when the remote input is short circuited. SP.Ac - setpoint access only. This blocks access to any functions except the alarm setpoint functions unless the remote input pins are short circuited or entry is made via CAL mode. no.Ac - no access. This blocks access to all functions unless the remote input pins are short circuited or entry is made via CAL mode. di SP - display toggle. This function will cause the display to toggle from the default display (rate or total selected at the dFlt di SP function in both mode) to the alternate display when the remote input pins are short circuited. PSEt - preset value. Not applicable to rate/frequency operation. Used to force the total display to a preset value set via the PSEt function or P button FUNC setting. duLL - display brightness control. The remote input can be used to change the display brightness. When this mode is selected the display brightness can be switched, via the remote input, between the brightness level set at the brgt function and the brightness level set at the duLL function. g.rSt - grand total reset. This mode allows the remote input to be used as a reset input for the grand total seen in the totl and both modes.

P.but	P button function - the P button may be set to operate some of the remote input functions. With some functions, to prevent accidental operation the P button must be held pressed for 2-3 seconds before the function will operate. If both the remote input and P button function are operated simultaneously the P button will override the remote input. The functions below with the exception of FUNC and P.SEt are as described in the r.i nP function above. Functions available are: nonE, Hi , Lo, Hi Lo, 2Er0 .PSEt . di SP .FUNC and 9.rSt The 2Er0, di SP .PSEt .FUNC and 9.rSt functions are not applicable to rate only operation. The FUNC option is used to allow easy access to the preset value. When the P button is pressed the message P.SEt will appear followed by the preset value. The ▲ or ▼ button can now be used to alter the preset value. Press the F button to accept the new value or the P button if you wish to abort the change. The new preset value will appear on the display when the total is next reset to the preset value. To force the display to the preset value the remote input or SET input or P button must be used to reset the display with the r.i nP function or P.but function set to 2Er0 and the c.rSt function set to P.SEt. When the remote input is activated the message 2Er0 will be seen but the display will then show the preset value.
ACCS	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 “Alarm relays” chapter. 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 entry to all functions can be made via FUNC mode i.e. CAL mode entry is not required.
SPAC	Setpoint access - allows control of which relay setpoints are accessible via FUNC mode. The following choices are available: A 1 - Allows setpoint access to relay 1 A 1-2 - Allows access to relays 1 & 2 A 1-3 - Allows access to alarms 1, 2 & 3 (if one or two optional relays are fitted) A 1-3 - Allows access to alarms 1, 2, 3 & 4 (if two optional relays are fitted) To allow the SPAC function to operate the remote input r.i nP function must be set to SPAC and the ACCS function set to OFF.
di SP rAtE	Display rate - set display update rate. Select 1.2.4.8. 16 or 32 updates per second.
c.rSt	Counter reset value - not applicable to rate operation
c.rSt	Counter reset mode - not applicable to rate operation
SEt OPEr	Set operating mode - displays and sets the selected operating mode, e.g. select toti for totaliser operation. See the dedicated chapter in this manual for description of the required operating mode. Options are: both - Frequency and total measurement - allows toggling via the ▲ and ▼ buttons between rate and total display totL - Total measurement only FrEq - Frequency/rate measurement only
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.

O.Put	Set RS232/485 communication mode - 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 di SP, Cont , POLL or M.buS Allows user to select the RS232/485 interface operation as follows:- di SP Sends image data from the display without conversion to ASCII. Cont Sends ASCII form of display data every time display is updated. POLL Controlled by computer or PLC as host. Host sends command via RS232/485 and instrument responds as requested. M.buS Modbus RTU protocol
Addr	Set unit address for polled (POLL) mode (0 to 31)) Refer to the separate "RM4 DIN Rail Meter Optional Output Addendum" booklet supplied when this option is fitted. 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. 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 <STX> and <CR>). Therefore 32 (DEC) or 20 (HEX) is address 0, 42 (DEC) or 2A (HEX) addresses unit 10.

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 Examples

Note: quadrature encoder specifications vary in stating the number of pulses per revolution. The values stated in the examples below may be out depending on how the encoder is specified. Typically if an error occurs the display will read half the expected rate, double the expected rate, a quarter the expected rate or four times the expected rate. If this is found to be the case the figures in the examples may need to be adjusted.

Rate display examples

The rate input factor must always be a whole number but the rate scale factor may have decimal points if decimal points are used in the display. The formula for the rate display is:

$$\text{Display} = \frac{\text{Input frequency (Hz)} \times \text{rAtE SCLE}}{\text{rAtE I nPt}}$$

Example - Low frequency input rate display

An encoder is being used to give a pulse for every bottle passing a point on a track. The display is required to show bottles per minute. The number of bottles passing can be as low as one every five seconds up to two per second. No decimal points or alarm functions are required. The rAtE I nPt value will be 1 and the rAtE SCLE value will be 60 i.e. 1 bottle per second = 60 bottles per minute. The procedure is as follows:

1. Follow the procedure shown on page 4 to enter the setup functions via CAL mode.
2. Step through the functions by pressing and releasing F until the rAtE I nPt function is seen.
3. Use the ▲ or ▼ push button to change the setting to 1.
4. Press F, the function rAtE SCLE will appear followed by the previous input value.
5. Use the ▲ or ▼ push button to change the setting to 60.
6. Press F, the function FFEQ rnGE will appear followed by the previous setting.
7. Use the ▲ or ▼ push button to change the setting to Lo F.
8. Step through the functions by pressing and releasing F until the t.out SECS function is seen.
9. Use the ▲ or ▼ push button to change the setting to a value greater than 5 seconds e.g. 8.
10. Press F to accept the change then either press P to exit or continue pressing and releasing F until the FUnC End message is seen and the unit returns to normal measure mode.

Example - Low frequency input averaged rate display

In applications similar to the bottles/minute one above where the input rate is irregular it is sometimes preferable to show an averaged rate display. The averaged display will update at the end of the averaged period, set at the **AVGE SECS** function and will therefore show less short term variation in the rate figure. To use the average mode the **FREQ RNGE** function must be set to **AVGE**.

Example - RPM display

An encoder connected to a flywheel produces 20 pulses per revolution. The RM4 is required to display in RPM with 1 decimal point place.

The standard setpoint relay is required to close if the RPM figure falls below 518.5 or goes above 600.0 with a hysteresis of 20.0 RPM. Note that the first setting which needs to be altered is the decimal point position. The alarm settings will therefore come after the other settings in this example.

In this example 20 pulses per second would equal 1 revolution/sec which equals 60 RPM. The **totl inPt** figure and **totl SCLE** figure could be 20 and 60.0 respectively but we will use 1 and 3.0 since they give the same ratio and hence will give the same reading on the display.

1. Follow the procedure shown on page 4 to enter the setup functions via **CAL** mode.
2. Step through the functions by pressing and releasing **F** until the **RATE dCPt** function is seen.
3. Use the ▲ or ▼ push button to change the setting to **0. 1.**
4. Press **F**, the function **RATE inPt** will appear followed by the previous input value.
5. Use the ▲ or ▼ push button to alter the previous input value to the new input value of **1**.
6. Press **F**, the function **RATE SCLE** will appear followed by the previous scale value.
7. Use the ▲or ▼ push button to alter the previous scale value to the new scale value of **3.0**.
8. Press **F** to accept the change then either press **P** to exit or continue pressing and releasing **F** until the **FUNC End** message is seen and the unit returns to normal measure mode.
9. Follow the procedure shown on page 3 to enter the setup functions via **FUNC** mode.
10. The first function is **A1Lo** this will be seen followed by the previous low alarm setting.
11. Use the ▲or ▼ push button to change the **A1Lo** setting to **518.5**. Press **F** to accept the change.
12. Press **F**, the function **A1Hi** will appear followed by the setpoint value.
13. Use the ▲or ▼ push button to alter the previous setpoint value to the new setpoint value of **600.0**.
14. Press **F**, the function **A1HY** will appear followed by the previous hysteresis value.
15. Use the ▲ or ▼ push button to alter the previous hysteresis value to the new hysteresis value of **20.0**.
16. Step through the functions by pressing and releasing **F** until the **A1n.o**/**A1n.c** function is seen.
17. Use the ▲ or ▼ push button to change the setting to **A1n.o** (normally open operation).
18. Press **F** to accept the change then either press **P** to exit or continue pressing and releasing **F** until the **FUNC End** message is seen and the unit returns to normal measure mode.

4.2 Error Messages

"**-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 i.e. above **99999** . Check that the scaling figures are correct. If displaying total this error message may indicate that the total is beyond the value **99999**, resetting the total should restore a normal display.

5 Ratemeter Function Table

Initial display	Meaning of display	Next display	Default setting	Record your settings
AxLo	Alarm relay low setpoint value	Setpoint value or OFF	OFF	See following table
AxHi	Alarm relay high setpoint value	Setpoint value or OFF	OFF	See following table
AxHY	Alarm relay hysteresis	Hysteresis value in measured units	10	See following table
Axtt	Alarm relay trip time	No of seconds before relay trips	0	See following table
Axrt	Alarm relay reset time	No of seconds before relay resets	0	See following table
Axn.o or Axn.c	Alarm relay action N/O or N/C	Axn.o or Axn.c	Axn.o	See following table
AxSP or Axti	Setpoint or trailing alarm relay	AxSP or Axti	AxSP	See following table
brgt	Digital display brightness	0 to 15 (15 = highest brightness)	15	
dULL	Remote input brightness control	0 to 15 (15 = highest brightness)	0	
Functions below are accessible only via CAL mode				
d.oFF SECS	Display auto dimming timer (seconds)	0 to 9999	0	
rEC_	Analog retransmission low value	Value in memory	0	
rEC^	Analog retransmission high value	Value in memory	1000	
rEC_ Ch2	Analog output 2 low limit	Value in memory	0	
rEC^ Ch2	Analog output 2 high limit	Value in memory	1000	
drnd	Display rounding selects resolution	Value in memory	1	
FLtr	Digital filter range 0 to 8	0 to 8 (8 = most filtering)	2	
rAtE dCPt	Decimal point setting for rate display	Value in memory	0	
rAtE InPt	Rate input setting (Hz)	Value in memory	1	
rAtE SCLE	Rate scale setting	Value in memory	1	
FrEq rnGE	Frequency range low or high frequency	Hi F. LoF or AUGE	Hi F	
FASt UPdt	Fast update mode (seen only when FrEq rnGE set to Hi F)	on or OFF	OFF	
rAtE SIGn	Rate display sign	on or OFF	OFF	
t.out SECS	Timeout (seen only when FrEq rnGE set to LoF)	value in memory	0	
AUGE SECS	Averaging time (seen only when FrEq rnGE set to AUGE)	value in memory	0	
r.i nP	Remote input	nonE, P.HLd, d.HLd, Hi .Lo, Hi Lo, 2Er0, SP.Ac, no.Ac, PSEt, di SP. dULL or 9.rSt	nonE	
P.but	P button operation.	nonE, Hi .Lo, Hi Lo, 2Er0. PSEt .di SP. FUnC or 9.rSt	nonE	
ACCS	Alarm relay access mode	OFF, EASY. nonE or ALL	OFF	
SPAC	Setpoint access	A1. A1-2 etc.	A1	
di SP rAtE	Display update rate	1. 2. 4. 8. 16 or 32	4	
c.rSt	Reset value	2Er0 or P.SEt	2Er0	
c.rSt	Reset mode	Lo , Hi , LoE or Hi E	Lo	
SEti nPt	SET terminal input mode	PSEt or Hold	PSEt	
c.SEt	SET terminal input level	Lo .Hi .LoE or Hi E	Lo	
SEt OPEr	Set operating mode	both. toti or FrEq	FrEq	
bAUd rAtE	Baud rate	300. 600. 1200. 2400. 4800. 9600. 19.2 or 38.4	9600	
PrtY	Parity select	nonE. EUEn or Odd	nonE	
O.Put	Serial communications mode	POLL. Cont. di SP or modbUS	POLL	
Addr	Set unit address for POLL mode	0 to 31	0	

Functions shown shaded will be seen only if the appropriate option is fitted.

Settings for relays - record settings here				
	A1	A2	A3	A4
AxLo				
AxHi				
AxHY				
AxtE				
Axrt				
Axn.o or Axn.c				
Ax.SP or Ax.t 1				

6 Totaliser Explanation of Functions

Totaliser functions

The description of functions in this chapter covers tOt1 (counter/totaliser) functions only. This mode is selected at the set operation (SEt OPEr) function.

Remember that you will need to enter via CAL or FUNC mode to gain access to functions, the function table for each mode shows which functions require entry via CAL mode. See "Introduction" chapter for details of how to enter FUNC and CAL modes.

Functions which are common to both rate and total modes are not described in this chapter, refer to the "Ratemeter Explanation of Functions" chapter for details of these common functions.

Note: a number relays are available with certain option combinations (a maximum of 4 relays may be fitted to the RM4 if no other options such as retransmission are required), the alarm functions are displayed only for the actual number of relays provided. The "x" shown in the following display messages represents the alarm number i.e. AxLo as shown in the text will appear as A1 Lo, A2Lo etc. on the instrument display.

AxPS	Alarm pass value (seen if Ax.PS, Ax.rP, Ax.rH or Ax.rL is selected but applicable only for pass mode Ax.PS selection) - see "Alarm relays" chapter.
AxPt	Alarm pass time (only seen if Ax.PS, Ax.rP, Ax.rH or Ax.rL is selected at the Ax.PS/Ax.tL function) - see "Alarm relays" chapter.
tOt1 dCPt	Totaliser decimal point selection - displays and sets the decimal point position for the totaliser display. For example selecting 0 will mean no decimal points (e.g. 25), 0.1 means 1 decimal point place (e.g. 25.4), 0.02 gives 2 decimal point places (e.g. 25.35) etc. The maximum number of decimal point places is one less than the number of digits on the display e.g. a 4 digit display can have 3 decimal points, a 5 digit display can have 4 decimal points etc. Note: If the number of decimal point is altered then the display scaling figure (tOt1 SCLE) will also be affected. Always check the scaling figure following a decimal point change and alter as required.
tOt1 1nPt	Totaliser input pulse count - displays and sets the number of input pulses to be used with the total scale function to generate the display scaling. See examples which follow.
tOt1 SCLE	Totaliser scale factor - displays and sets the scale factor for totaliser. Scale and input work together as follows: $\text{New Total} = \text{Old Total} + \frac{\text{Input pulses counted} \times \text{tOt1 SCLE}}{\text{tOt1 1nPt}}$

G.tot

Grand total operating mode - by using the ▲ or ▼ pushbutton the display may be toggled between a total or a grand total display (or between rate, total and grand total in **both** mode). The display will briefly show either **rAtE**, **tot1** or **G.tot** to indicate what the following total display is showing. To reset the grand total the remote input must be set to **G.tot**, see the **r.1 nP** function. Six modes of grand total display are provided. The following table illustrates each mode of operation.

Grand Total Mode	Up Count	Down Count
nonE	No effect	No effect
For	The grand total will increase with each up count input pulse. The grand total can show positive and negative totals.	The grand total will decrease with each down count input pulse. The grand total can show positive and negative totals.
rEU	The grand total will decrease with each up count input pulse. The grand total can show both positive and negative totals.	The grand total will increase with each down count input pulse. The grand total can show both positive and negative totals.
POS	The grand total will increase with each up count input pulse. The grand total display cannot go negative.	The grand total will not register any down count inputs i.e. the grand total will not change when down count only inputs are present. The grand total display cannot go negative.
nEG	The grand total will not register any up count inputs i.e. the grand total will not change when up count only inputs are present. The grand total display cannot go negative.	The grand total will increase with each down count input pulse. The grand total display cannot go negative.
Abs	The grand total will increase with any input pulse whether up or down count. The grand total display cannot go negative.	The grand total will increase with any input pulse whether up or down count. The grand total display cannot go negative.

rAP.L

Total display wrap around low value - displays and sets the low value at which the display will wrap around. The manner in which this works is set by the wrap around mode function also called **rAP.L** described below.

rAP.H

Total display wrap around high value - displays and sets the high value at which the display will wrap around. The manner in which this works is set by the wrap around mode function also called **rAP.H** described below.

rAP.L

Total display wrap around low value operation mode - sets the mode in which the low value total display wrap around will function. Choices are:

nonE - the display will not wrap around at any value .

rAP -

StOP - the display will stop when the value is reached.

rAP.H

Total display wrap around high value operation mode - sets the mode in which the low value total display wrap around will function. Choices are:

nonE - the display will not wrap around at any value .

rAP -

StOP - the display will stop when the value is reached.

P.CLr	Power on total value clear mode - set the mode in which the total will be displayed at power on. Choices are: nonE - no effect. The display will show the previous total when powered up. P.SEt - preset. On power up the total display will revert to the value set at the P.SEt function. r.SEt - reset. On power up the total display will reset to zero.
P.SEt	Preset value - this function displays and sets the preset value which the total count can be reset to. For example, if the RM4 is set to count down from a preset value then the P.SEt function sets this value. See also c.rSt function which sets the reset mode and the P.but function FUnC which allows easy access for alteration of the preset value. To force the display to the preset value the r.inP function must be set to 2Er0 and the c.rSt function set to P.SEt. When the remote input is activated the message 2Er0 will be seen but the display will then show the preset value.
c.rSt	Counter reset value - the reset terminal can be programmed to cause the display to reset to either zero or the preset value programmed at the P.SEt function. Choose either 2Er0 or P.SEt to select the required operation.
c.rSt	Counter reset mode - Allows selection of reset level or edge to force a counter reset. If set to Lo a low input level or closed switch on the reset line will force a reset. If set to Hi a high input level or open switch on the reset line will force a reset. If set to LoE then a falling edge or switch closure on the reset line will force a reset. If set to Hi E then a rising edge or switch opening on the reset line will force a reset.
Ax.tL/ Ax.PS/ Ax.rP/ Ax.rH or Ax.rL	Alarm relay operation mode - refer to “Alarm relays” chapter.

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.

6.1 Examples

Flow Totalising

Flowmeters produce output pulses which may be counted and scaled to give the total flow. The number of pulses produced per litre, kilolitre etc. may be determined using the information provided by the manufacturer or from test results. The flow total scaling may be configured as follows:

Example - An encoder produces 56 pulses per litre. The display is required to show total litres with 1 decimal point place. The procedure is as follows.

1. Follow the procedure shown on page 4 to enter the setup functions via CAL mode.

2. Step through the functions by pressing and releasing F until the totl dCPt function is seen followed by the previous decimal point setting.

3. Use the ▲ or ▼ push button to change the totl dCPt setting to 0.1. Press F to accept the change.

4. Step through the functions by pressing and releasing F until the totl inPt function followed by the previous input value is seen.

5. Use the ▲ or ▼ push button to alter the previous input value to the new input value of 56.

6. Press F, the function totl SCLE will appear followed by the previous scale value.

7. Use the ▲ or ▼ push button to alter the previous scale value to the new scale value of 1.

8. Press F to accept the change then either press P to exit of continue pressing and releasing F until the FUnC End message is seen and the display returns to normal measurement mode.

Example - Item counting

For applications in which items are being counted e.g. bottles, or pulses are being counted to give displays in total revolutions or length travelled you will need to find out how many pulses equals a given number of display units. From this information you can work out suitable input and scale factors. The table below gives some general scaling examples. The examples which follow illustrate the calculation of scaling figures and settings required for typical applications.

An encoder is connected to a shaft. The encoder puts out 1000 pulses per revolution. The encoder is connected to a threaded shaft. The totaliser is to show the distance travelled by an object connected to the shaft. The object travels a distance of 2.5 mm per revolution of the shaft i.e. 1000 pulses = 2.5 mm travel or 400 pulses = 1 mm travel. The measurement is to be in metres with 3 decimal points to give a resolution in mm.

1. Follow the procedure shown on page 3 to enter the setup functions via CAL mode.

2. Step through the functions by pressing and releasing F until the tot1 dCPt function is seen followed by the previous decimal point setting.

3. Use the ▲ or ▼ push button to change the tot1 dCPt setting to 0.003. Press F to accept the change.

4. Step through the functions by pressing and releasing F until the tot1 1 nPt function followed by the previous input value is seen.

5. Use the ▲ or ▼ push button to alter the previous input value to the new input value of 400.

6. Press F, the function tot1 SCLE will appear followed by the previous scale value.

7. Use the ▲ or ▼ push button to alter the previous scale value to the new scale value of 0.001.

8. Press F to accept the change then either press P to exit or continue pressing and releasing F until the FUNC End message is seen and the display returns to normal measurement mode.

7 Totaliser Function Table

Initial display	Meaning of display	Next display	Default Setting	Record Your Settings
AxPS	Alarm pass value	Pass value or OFF	OFF	See following table
AxPt	Alarm pass time	Time in seconds	0.0	See following table
AxLo	Alarm low setpoint value	Setpoint value or OFF	OFF	See following table
AxHi	Alarm high setpoint value	Setpoint value or OFF	OFF	See following table
AxHY	Alarm hysteresis	Hysteresis value in measured units	10	See following table
Axtt	Alarm trip time	No of seconds before relay trips	0	See following table
Axrt	Alarm reset time	No of seconds before relay resets	0	See following table
Axn.o or Axn.c	Alarm action N/O or N/C	Axn.o or Axn.c	Axn.o	See following table
AxSP or Axti	Setpoint or trailing alarm	AxSP or Axti	AxSP	See following table
brgt	Digital display brightness	0 to 15 (15 = highest brightness)	15	
dULL	Remote input brightness control	0 to 15 (15 = highest brightness)	0	
P.SEt	Preset value	Value in memory	0	
Functions below are accessible only via CAL mode				
d.oFF SECS	Display auto dimming timer (seconds)	0 to 9999	0	
rEC_	Analog output low limit	Value in memory	0	
rEC¯	Analog output high limit	Value in memory	1000	
rEC_ Ch2	Analog output 2 low limit	Value in memory	0	
rEC¯ Ch2	Analog output 2 high limit	Value in memory	1000	
toti dCPt	Decimal point setting for totaliser display	Value in memory	0	
toti inPt	Totaliser input setting	Value in memory	1	
toti SCLE	Totaliser scale setting	Value in memory	1	
g.tot	Grand total operating mode	NONE, For, rEU, POS, nEg or Abs	NONE	
rAP.L	Total wrap around low value	Value in memory	0	
rAP.H	Total wrap around high value	Value in memory	1000	
rAP.L	Total wrap around low mode	NONE, rAP or StOP	NONE	
rAP.H	Total wrap around high mode	NONE, rAP or StOP	NONE	
P.CLr	Power on reset mod	NONE, P.SEt or r.SEt	NONE	
r.in P	Remote input	NONE, P.Hld, d.Hld, Hi .Lo, Hi Lo, 2Er0, SP.Ac, no.Ac, PSEt, di SP, dULL or g.rSt	NONE	
P.but	P button operation.	NONE, Hi .Lo, Hi Lo, 2Er0. PSEt, di SP, FUnC or g.rSt	NONE	
ACCS	Alarm relay access mode	OFF, EASY, NONE or ALL	OFF	
SPAC	Setpoint access	A 1, A 1-2 etc.	A 1	
di SP rAtE	Display update rate	1, 2, 4, 8, 16 or 32	4	
Ax.tL/Ax.PS/ Ax.rP/Ax.rH or Ax.rL	Alarm operation mode rate, total or pass	Ax.rt, Ax.tL, Ax.PS, Ax.rP, Ax.rH or Ax.rL	Ax.rt	See following table
P.SEt	Preset value	Value in memory	0	
c.rSt	Reset value	2Er0 or P.SEt	2Er0	
c.rSt	Reset mode	Lo, Hi, LoE or Hi E	Lo	
SEti inPt	SET input mode	PSEt or Hold	PSEt	
c.SEt	SET input operation level	Lo, Hi, LoE or Hi E	Lo	
SEt OPEr	Set operating mode	both, toti or FrEq	FrEq	
bAUd rAtE	Baud rate	300, 600, 1200, 2400, 4800, 9600, 19.2 or 38.4	9600	
PrtY	Parity select	NONE, EUEn or Odd	NONE	
O.Put	Serial communications mode	POLL, Cont, di SP or n.buS	POLL	
Addr	Set unit address for POLL mode	0 to 31	0	

Functions shown shaded will be seen only if the appropriate option is fitted.

Settings for relays - record settings here				
	A1	A2	A3	A4
AxPS				
AxPt				
AxLo				
AxHi				
AxHY				
Axtt				
Axrt				
Axn.o or Axn.c				
Ax.SP or Ax.t1	n/a			
Ax.t1 , Ax.PS , Ax.rP , Ax.rH , Ax.rL				

8 Both Mode

When both mode is selected at the SEt OPEr function the user has the option of toggling between the displays available in both totaliser and ratemeter modes. This allows the meter to be used as a ratemeter/totaliser. When both mode is used the functions available allow for both the ratemeter and totaliser scaling and setup.

If front panel pushbuttons are fitted to the display type being used then the ▲ and ▼ buttons can be used to toggle between totaliser (plus grand total if selected) and ratemeter displays. The message toti or 9.tot or rAtE will precede the values. Alternatively a remote input contact closure can be used across terminals 5 and 9 to toggle between rate and total (not grand total). If these terminals are to be used to toggle between displays then the remote input function r.i nP must be set to di SP.

Since the functions available in this mode are a combination of ratemeter and totaliser functions the explanation of both mode functions can be found by referring to the appropriate ratemeter or totaliser chapter. The function table below lists all of the functions available in both mode.

In both mode the optional analog output can be set to either toti or rAtE via the rEC or rEC2 functions i.e. it can be set to retransmit the total value or the rate value. Similarly the alarm relays can be set to operate from rate or total in this mode set via the AX.rt / AX.ti etc function.

8.1 Both Mode Function Table

Initial display	Meaning of display	Next display	Default Setting	Record Your Settings
AxPS	Alarm relay pass value	Pass value or OFF	OFF	See following table
AxLo	Alarm relay low setpoint value	Setpoint value or OFF	OFF	See following table
AxHi	Alarm relay high setpoint value	Setpoint value or OFF	OFF	See following table
AxPt	Alarm relay pass time	Time in seconds	0.0	See following table
AxHY	Alarm relay hysteresis	Hysteresis value in measured units	10	See following table
Axtt	Alarm relay trip time	No of seconds before relay trips	0	See following table
Axrt	Alarm relay reset time	No of seconds before relay resets	0	See following table
Axn.o or Axn.c	Alarm relay action N/O or N/C	Axn.o or Axn.c	Axn.o	See following table
AxSP or Axti	Setpoint or trailing alarm relay	AxSP or Axti	AxSP	See following table
br9t	Digital display brightness	0 to 15 (15 = highest brightness)	15	
dULL	Remote input brightness control	0 to 15 (15 = highest brightness)	0	
P.SEt	Preset value	Value in memory	0	
Functions below are accessible only via CAL mode				
d.oFF SECS	Display auto dimming timer (seconds)	0 to 9999	0	
rEC_	Analog output low limit	Value in memory	0	
rEC¯	Analog output high limit	Value in memory	1000	
rEC_ Ch2	Analog output 2 low limit	Value in memory	0	
rEC¯ Ch2	Analog output 2 high limit	Value in memory	1000	
drnd	Display rounding selects resolution	Value in memory	1	
FLtr	Digital filter range 0 to 8	0 to 8 (8 = most filtering)	2	
rAtE dCPt	Decimal point setting for rate display	Value in memory	0	
rAtE i nPt	Rate input setting (Hz)	Value in memory	1	
rAtE SCLE	Rate scale setting	Value in memory	1	
toti dCPt	Decimal point setting for totaliser display	Value in memory	0	
toti i nPt	Totaliser input setting	Value in memory	1	
toti SCLE	Totaliser scale setting	Value in memory	1	
9.tot	Grand total operating mode	nonE, For, rEU, POS, nEG or AbS	nonE	
rAP.L	Total wrap around low value	Value in memory	0	

Initial display	Meaning of display	Next display	Default Setting	Record Your Settings
rAP.H	Total wrap around high value	Value in memory	1000	
rAP.L	Total wrap around low mode	nonE, rAP or StOP	nonE	
rAP.H	Total wrap around high mode	nonE, rAP or StOP	nonE	
P.CLr	Power on reset mod	nonE, P.SEt or r.SEt	nonE	
FrEq rnGE	Frequency range low or high frequency	Hi F, LoF or AUGE	Hi F	
FASt UPdt	Fast update mode (seen only when FrEq rnGE set to Hi F)	on or OFF	OFF	
rAtE Si gn	Rate display sign	on or OFF	OFF	
t.out SECS	Timeout (seen only when FrEq rnGE set to LoF)	Value in memory	0	
AUGE SECS	Averaging time (seen only when FrEq rnGE set to AUGE)	Value in memory	0	
r.i nP	Remote input	nonE, P.HLd, d.HLd, Hi Lo, Hi Lo, 2Er0, SP.Ac, no.Ac, PSEt, di SP, duLL or 9.rSt	nonE	
P.but	P button operation.	nonE, Hi Lo, Hi Lo, 2Er0, PSEt, di SP, FUnC or 9.rSt	nonE	
ACCS	Alarm relay access mode	OFF, EASY, nonE or ALL	OFF	
SPAC	Setpoint access	A1, A1-2 etc.	A1	
di SP rAtE	Display update rate	1, 2, 4, 8, 16 or 32	4	
Axrt/Ax.tL/Ax.PS/ Ax.rP/Ax.rH or Ax.rL	Alarm operation mode rate, total or pass	Axrt, Ax.tL, Ax.PS, Ax.rP, Ax.rH or Ax.rL	Ax.rt	See following table
rEC	Analog output mode	toti or rAtE	rAtE	
rEC2	Analog output 2 mode	toti or rAtE	rAtE	
c.rSt	Reset value	2Er0 or P.SEt	2Er0	
c.rSt	Reset mode	Lo, Hi, LoE or Hi E	Lo	
SEti nPt	SET input mode	PSEt or Hold	PSEt	
c.SEt	SET input operation level	Lo, Hi, LoE or Hi E	Lo	
dFlt di SP	Default display rate, total or period, total depending upon the di SP setting	rAtE or toti	rAtE	
SEt OPEr	Set operating mode	both, toti or FrEq	FrEq	
bAUd rAtE	Baud rate	300, 600, 1200, 2400, 4800, 9600, 19.2 or 38.4	9600	
PrtY	Parity select	nonE, EUEn or Odd	nonE	
O.Put	Serial communications mode	POLL, Cont, di SP or n.buS	POLL	
Addr	Set unit address for POLL mode	0 to 31	0	

Note: Functions shown shaded will be seen only if the appropriate option is fitted

Settings for relays - record settings here				
	A1	A2	A3	A4
AxPS				
AxPt				
AxLo				
AxH,				
AxHy				
Axtt				
Axrt				
Axn.o or Axn.c				
Ax.SP or Ax.t1	n/a			
Axrt , Ax.t1 , Ax.PS , Ax.rP , Ax.rH , Ax.rL				

9 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 A1 , A2 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. N/O or N/C relay operation.
7. Independent or trailing alarms (available on relays 2 and upwards).
8. Pass alarm mode (totaliser operation only).
9. Wrap around mode (totaliser operation only).
10. Rate or total operation (both mode only).

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.

Alarm low setpoint (AxLo)

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 AxLo 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.

Alarm high setpoint (AxHi)

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 AxHi 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.

Alarm hysteresis (AxHY)

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 (AxHY 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 A 1Hi is set to 50.0 and A 1HY 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 A 1Lo is set to 20.0 and A 1HY 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.

Alarm trip time (**A**x**tt**)

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 **60** seconds. For normal operation a delay of three to five seconds is suitable.

Alarm reset time (**A**x**rt**)

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 **60** seconds. For normal operation a delay of zero seconds is suitable.

Alarm relay N/O or N/C operation (**A**x**no**/**nc**)

Each alarm may be programmed to operate as a normally open (N/O e.g. **A1 no**) or normally closed (N/C e.g. **A2nc**) 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.

Alarm pass value (**A**x**PS**) - used only when **A**x**PS** selected.

Displays and sets the alarm pass value. The alarm relay will activate at multiples of the pass value e.g. if **A**x**PS** is set to **50** then the relay will activate at a total display value of **50**, **100**, **150** etc. The time for which the relay remains activated at each pass value is set via the **A**x**Pt** function which follows. The pass value may be set anywhere in the display range of the instrument.

Alarm pass or wrap around time (**A**x**Pt**) - only seen if **A**x.**PS** or **A**x.**rP** or **A**x.**rH** or **A**x.**rL** selected.

Displays and sets the alarm pass or wrap around time in seconds & tenths of seconds within the range **0.0** to **999.9** seconds. The value set is the time for which the relay will remain energised when activated at a pass or wrap around value e.g. if set to **2.0** with a **A**x**PS** value of **50** then the relay will remain energised for 2.0 seconds every time the display passes a multiple of 50. **Note:** If the pass time exceeds the time taken to reach consecutive pass values then the RM4 will "store" any relay operations it does not have time to activate and will perform these activations when the total display update rate allows. For this reason the relay may be seen to activate repeatedly for a period after the total update rate has slowed down or stopped.

Alarm relay operation mode (**A**x.**rt** . **A**x.**tL** . **A**x.**PS** . **A**x.**rP** . **A**x.**rH** . **A**x.**rL**)

In **both** and **totl** modes a choice of alarm relay operation modes is offered, these are:

Ax.**rt** - the alarm relay operated from the rate value e.g. if **A 1H,** is set to **100** the alarm relay will activate when the rate value reaches **100** or higher. Values for hysteresis, trip time, reset time, normally open/normally closed operation and setpoint or trailing alarms can also be set. This option is seen only in **both** mode. In **FrEq** mode the alarm relays automatically operate from the rate.

Ax.**tL** - the relay will operate from the total. e.g. if **A 1H,** is set to **1500** the alarm relay will activate when the total value reaches 1500 or higher. Values for hysteresis, trip time, reset time, normally open/normally closed operation and setpoint or trailing alarms can also be set.

Ax.**PS** - the relay will operate on a pass value i.e. it will operate on multiples of the **A**x**PS** value set. For example if **A 1PS** is set to **1000** the alarm relay will operate at the total display value of 1000, 2000, 3000 etc. The length of time for which the relay remains activated at each pass is set at the **A**x**Pt** function. Note that if **A**x.**PS** is selected a separate function with almost the same name (**A**x**PS**) will appear early in the functions, the pass value is set at this **A**x**PS** function.

Ax.**rP** - the relay will operate at both the high and low wrap around values. If the wrap around mode and value functions have been set (**rAP.H** & **rAP.L**) the and **A**x.**rP** is selected then the relay will activate at both the low and high total wrap around values. For example if the high and low wrap around modes have been set to **rAP** and **rAP.H** is set to 10000 and **rAP.L** is set to 0 then the relay will activate whenever the total display wraps around from 10000 or 0. The length of time for which the relay remains activated at each wrap around is set at the **A**x**Pt** function.

Ax.**rH** - the relay will operate at only the high wrap around value. For example if the high wrap around modes have been set to **rAP** and **rAP.H** is set to 10000 then the relay will activate whenever the total display wraps around from 10000. The length of time for which the relay remains activated at each wrap

around is set at the AxPt function.

Ax.rL - the relay will operate at only the low wrap around value. For example if the low wrap around modes have been set to rAP and rAP.L is set to 0 then the relay will activate whenever the total display wraps around from 0. The length of time for which the relay remains activated at each wrap around is set at the AxPt function.

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.t 1 is selected then the alarm 2 relay will trail alarm 1 relay. With A2.t 1 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			
	A2	A3	A4
A 1	A2.t 1	A3.t 1	A4.t 1
A2		A3.t2	A4.t2
A3			A4.t3

9.1 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 ACCS function must be set to EASY or the r.I nP function must be set to SP.AC. If the ACCS function is used the remote input function r.I nP 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 SP.AC function must be set to allow access to the relays required e.g. if set to A 1-2 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 FUNC mode unless the instrument is powered up in CAL mode.

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 0.1uF 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.

10 Specifications

10 .1 Technical Specifications

Count/rate input:	Link selectable internal pull up resistor, internal pull down resistor, biassed input, DC couple and 2V added hysteresis
Display update:	Programmable 1, 2, 4, 8, 16 or 32 updates per second.
Totaliser functions:	Scaleable up or down counter. Total and grand total memory.
Ratemeter functions:	Scaleable rate display, rate averaging also available.
Impedance:	10KΩ
Max count rate:	100kHz
Memory retention:	Total/grand total memory retained for a minimum of forty days with power removed.
Totaliser reset:	Total or Grand Total reset via contact closure (or 0V/5V control voltage) across terminals 5 & 9. Note: **r.i nP** function must be set to **2Er0** for reset or **9.rSt** if grand total reset operation is required. Alternative Total reset or Hold input across terminals 7 & 9 when SET internal link is **in** , IN+ link is **in** and 5VEX link is **out**. The front **P** button may also be programmed to reset the Total or Grand Total.
Microprocessor:	MC68HC11 CMOS.
Ambient temperature:	-10 to 60°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 4 VA max, DC supply, consult supplier (depends on options fitted).
Output (standard):	2 x relays, form A rated 5A resistive 240VAC 5VDC (100mA max) or 24VDC(25mA max) unregulated transmitter supply (common ground), available on both AC and DC powered models.

10 .2 Output Options

Third Relay:	Rated 0.5A resistive 30VAC or DC. May be configured for either form A or form C if the third relay is the only option fitted.
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 20mA or 0 - 1V or 0 - 10V link selectable, 12 bit or 16 bit versions available. Configurable as retransmission
Serial Communications:	RS232, RS485 or RS422 - factory configured
Transmitter supply:	Isolated & regulated. Link selectable12VDC (50mA max) or 24VDC (25mA max)

10 .3 Physical Characteristics

Case Size:	44mm (w) x 91mm (h)x 141mm (d)
Connections:	Plug in screw terminals (max 1.5mm^2 wire for input signal and options, 2.5mm^2 for power and relays 1 & 2)
Weight:	470 gms basic model, 500 gms with option card

Guarantee and Service

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.

This product is designed and manufactured in Australia.