RM4-FX

DIN Rail Mount
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-FX Monitor. The instrument operates as a frequency/ratemeter/tachometer and will accept pulse inputs from a wide range of input types. The instrument can be scaled to read in any process units e.g. R.P.M., Litres/min etc. All function setup and scaling is accomplished via the front pushbuttons. Input sensor selection is accomplished via link settings.

In “low frequency” mode (input less than 1kHz) the user has the choice of displaying the rate or the period of the input waveform. Also in this mode a “timeout” function allows the display of very low frequency inputs without the alternate display of an actual reading followed by a zero reading often seen in instruments without this feature. An “averaging” mode allows the display to indicate the average rate over a user selectable (1 to 9999) number of seconds.

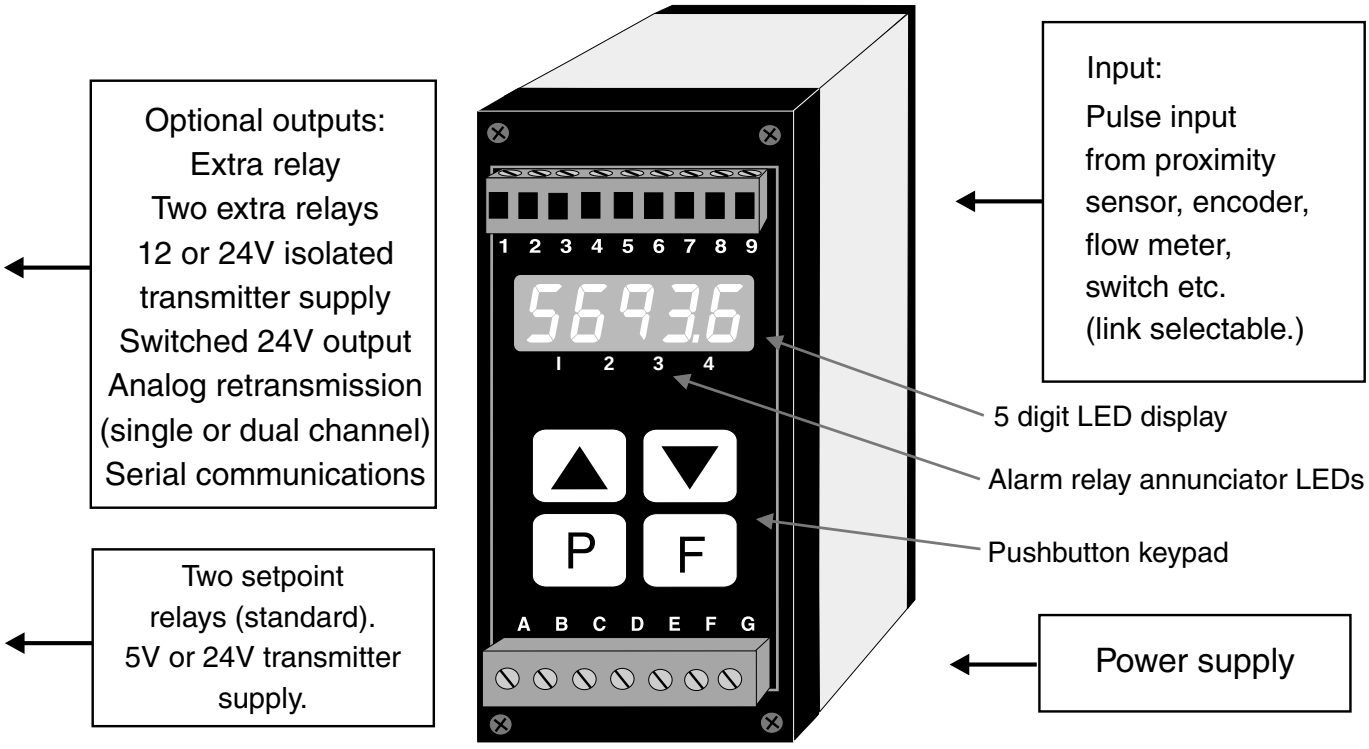
Two standard inbuilt relays provide alarm/control functions. A standard transmitter supply of 5VDC or 24VDC (link selectable) unregulated is also provided on both AC and DC powered models.

Various combinations of one or two optional extra relays, single or dual analog (4-20mA, 0-1V or 0-10V) retransmission or serial (RS232, RS485 or RS422) communications and an isolated 12 or 24VDC 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 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 Inputs & outputs



1 .2 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:-

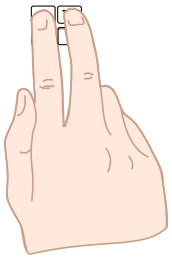
FUNC mode (simple push button sequence) allows access to alarm relay, preset value & display brightness functions. CAL mode (power up sequence plus push button sequence) allows access to all functions including calibration parameters.

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.



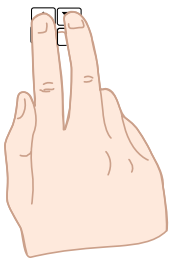
3. Within 2 seconds of releasing the F button press, then release the ▲ and ▼ buttons together. The display will now indicate FUNC followed by the first function.

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

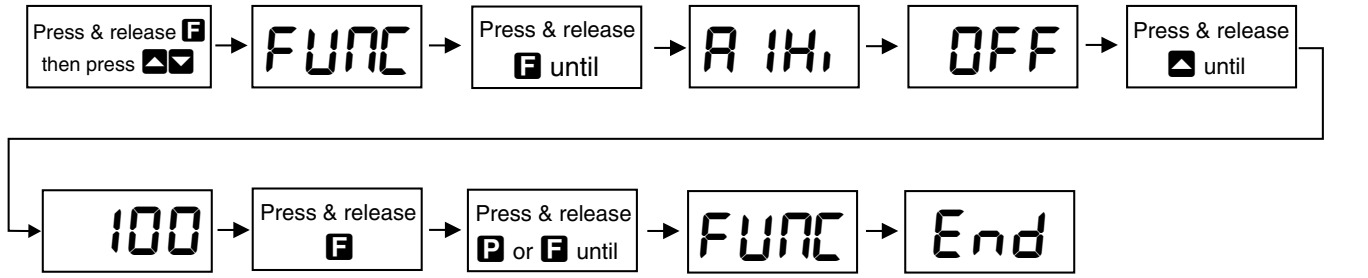
No special power up procedure is required to enter FUNC mode.

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

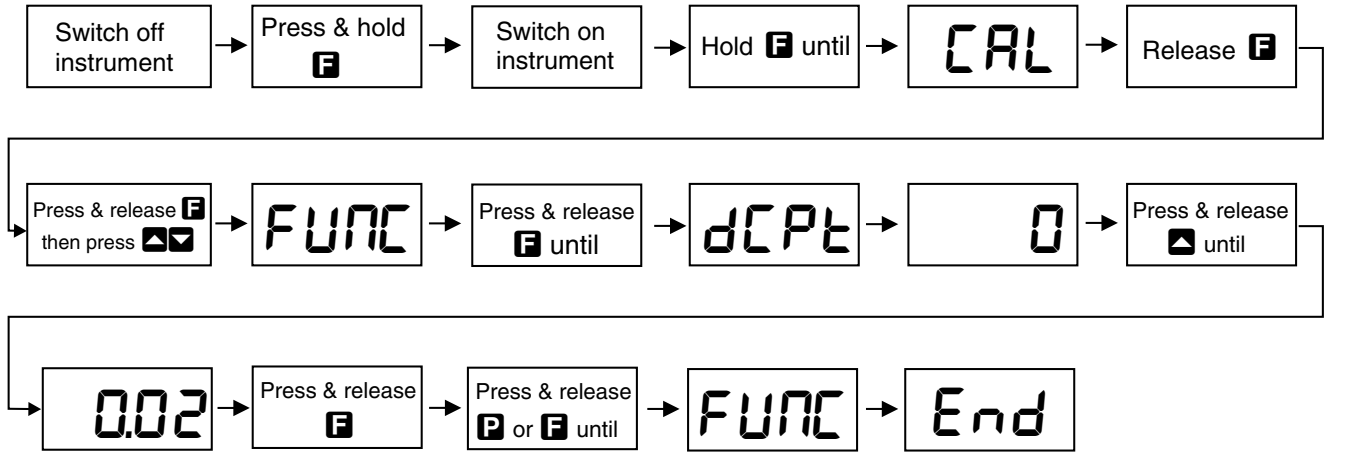


2. Within 2 seconds of releasing the F button press, then release the ▲ and ▼ buttons together. The display will now indicate FUNC followed by the first function.

Example: Entering FUNC mode to change alarm 1 high function A1H from OFF to 100

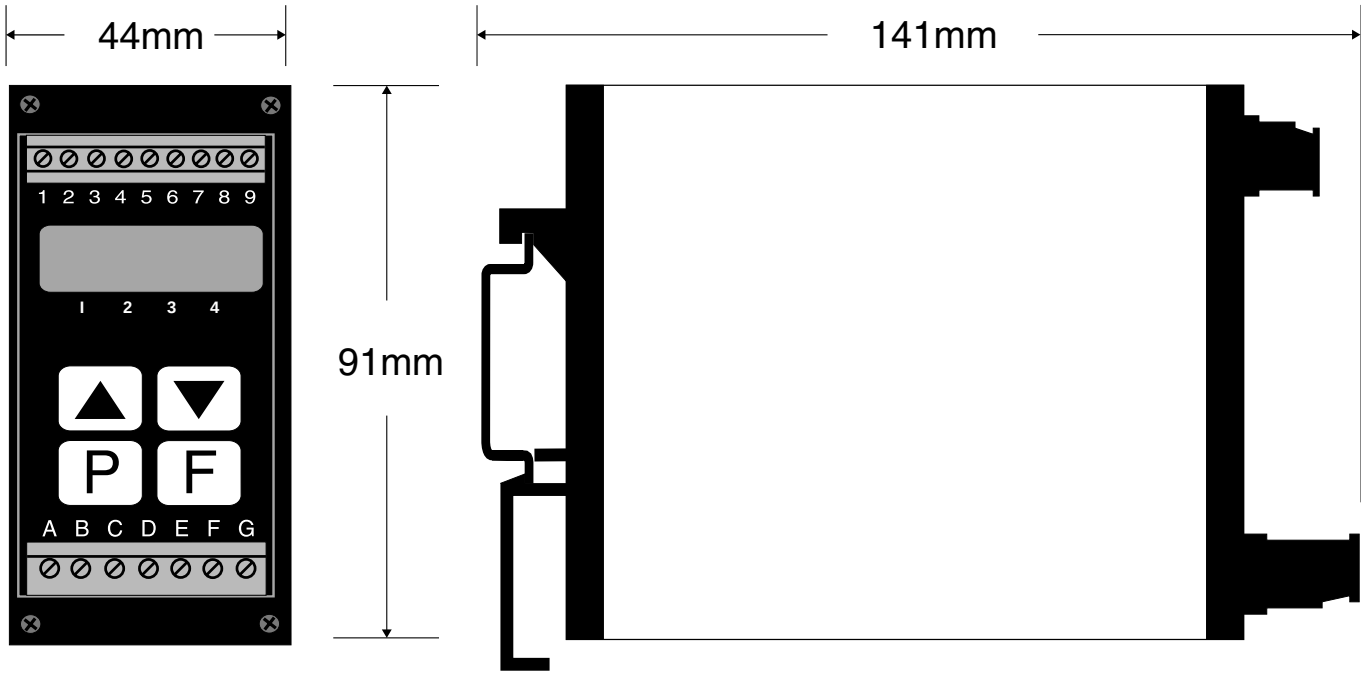


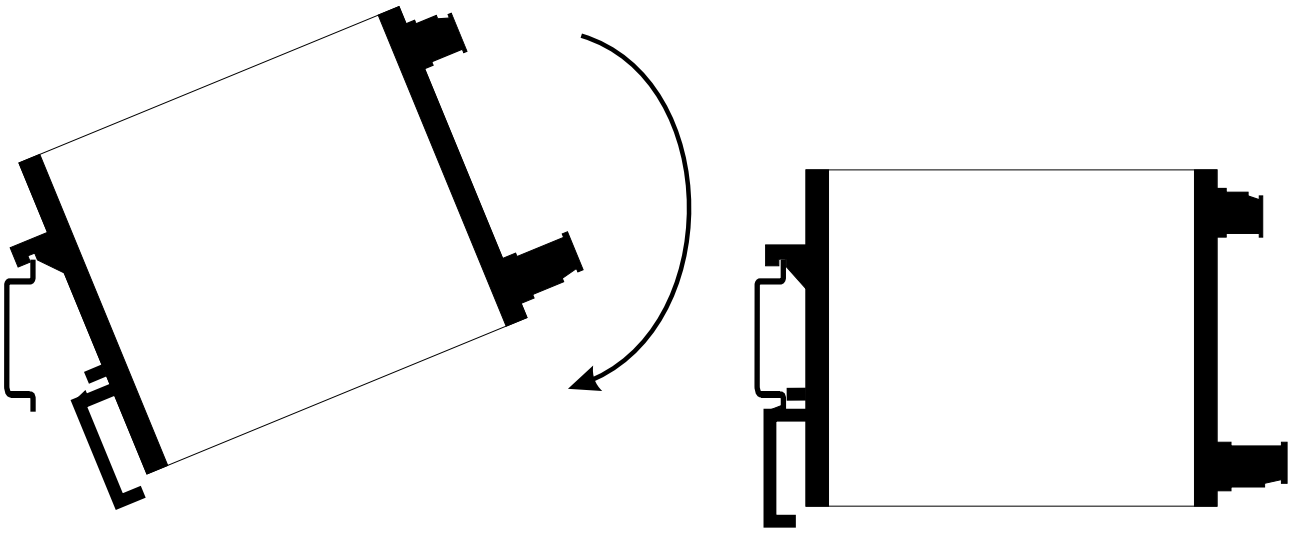
Example: Entering CAL mode to change decimal point dCPt function from 0 to 0.02



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.

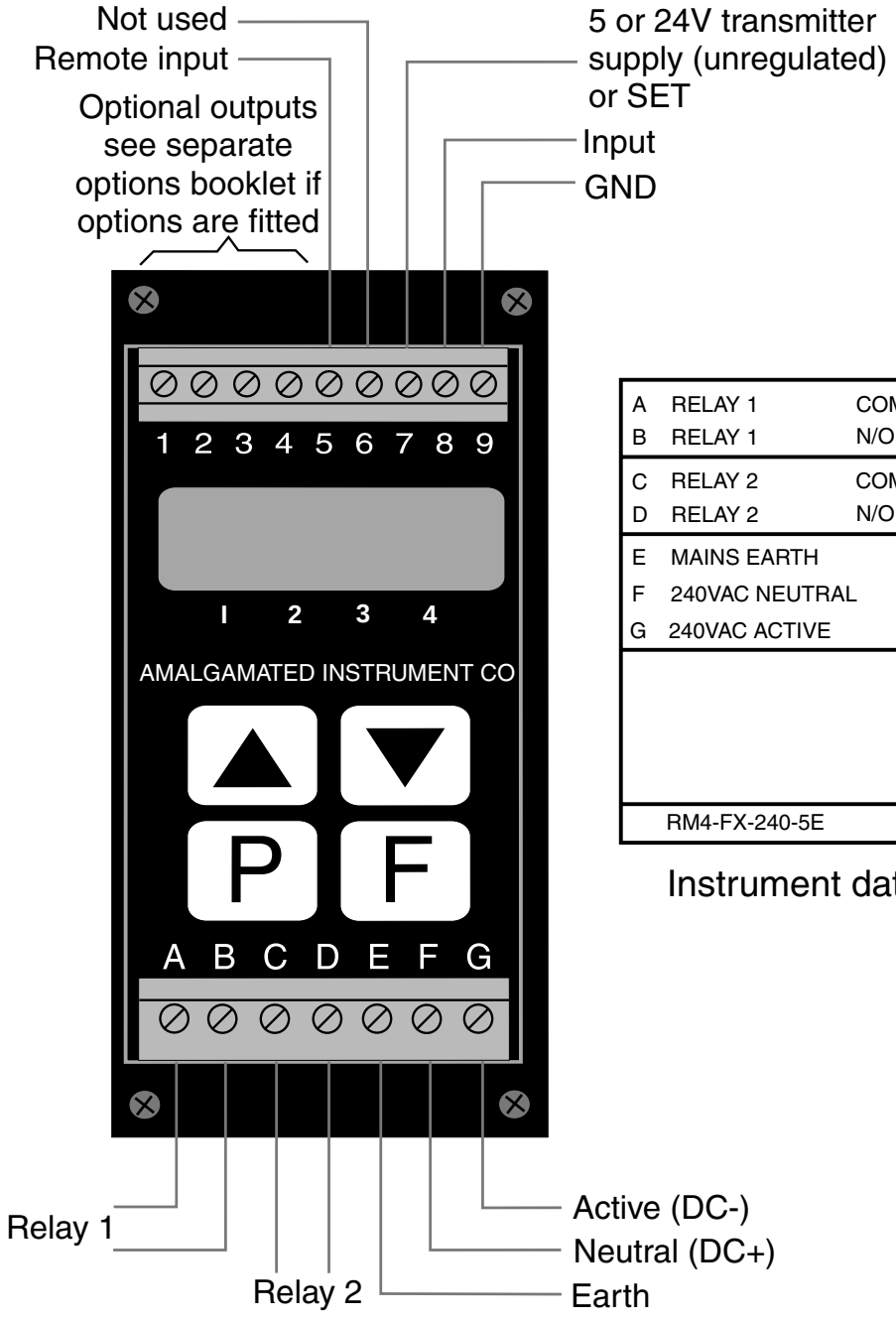




3 Electrical installation

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.



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 NOT USED
G	240VAC ACTIVE		7 TRANSMITTER SUPPLY
			8 INPUT +
			9 GND
RM4-FX-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-FX-240-..... Requires 240VAC
RM4-FX-110-..... Requires 110VAC
RM4-FX-32-..... Requires 32VAC
RM4-FX-24-..... Requires 24VAC
RM4-FX-DC-..... Requires between 12 and 48VDC

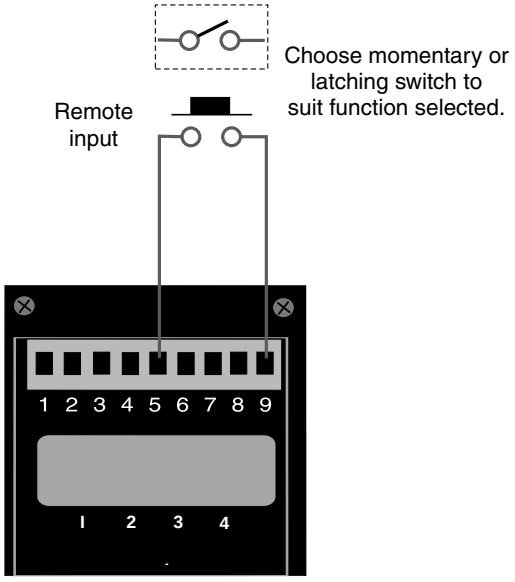
3 .2 Relay connections

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 Remote input connections

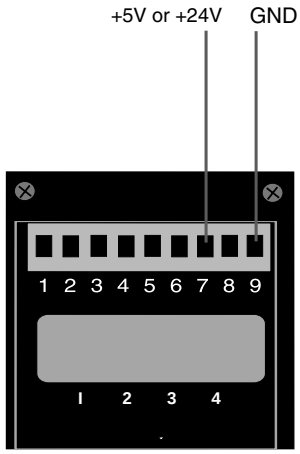
The selected remote input function can be operated via an external contact closure via a switch, relay or open collector transistor switch.

A momentary action is required for functions such as Hi and Lo, a latching switch or normally closed momentary switch may be required for functions such as peak hold.



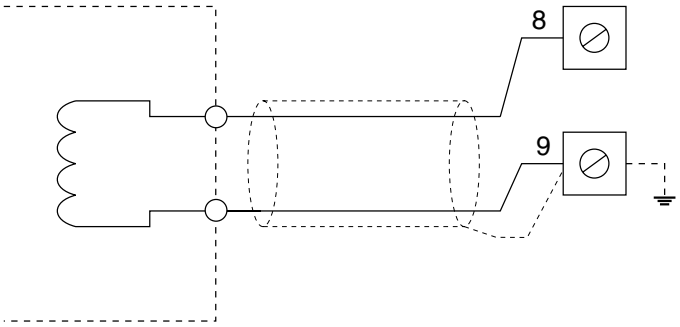
3 .4 Transducer power supply

The standard internal dc power supply may be link selected to provide a regulated 5V or unregulated 5V or 24V to power the sensor, the maximum current available is 25mA. See section 3.6 for link setting details. The optional isolated & regulated supply can be link selected to provide either 12V @ 50mA max. or 24V @ 25mA. Refer to the separate “RM4 DIN Rail Meter Optional Output Addendum” booklet supplied when this option is fitted.



3 .5 Signal input connections

INDUCTIVE SENSOR TERMINAL



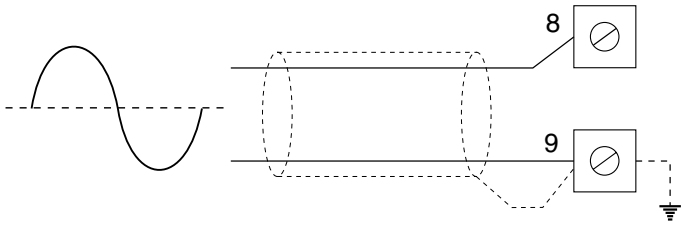
Inductive Sensor (48V RMS Max)

Typical Internal Link Settings

FREQ	Link LK1	in or out *
BIAS	Link LK2	out
DC	Link LK3	in
HYST	Link LK4	in or out *
HYST2	Link LK5	in or out *
GND	Link LK6	in
LOW FREQ	Link LK7	out
AC	Link LK8	out
VCC	Link LK9	out

* See “Input link settings”.

AC MEASUREMENT TERMINAL



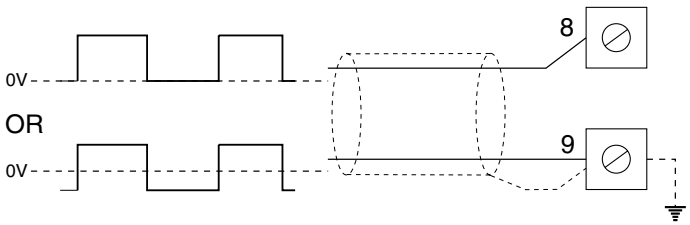
AC Measurement (48V RMS Max)

Typical Internal Link Settings

FREQ	Link LK1	in or out *
BIAS	Link LK2	out
DC	Link LK3	in or out *
HYST	Link LK4	in or out *
HYST2	Link LK5	in or out *
GND	Link LK6	in
LOW FREQ	Link LK7	out
AC	Link LK8	out
VCC	Link LK9	out

* See “Input link settings”.

SQUARE WAVE INPUT TERMINAL



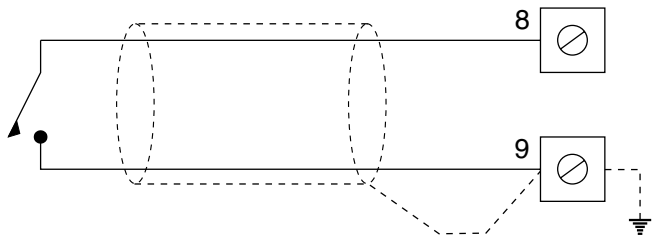
Square wave (48V Max)

Typical Internal Link Settings

FREQ	Link LK1	out
BIAS	Link LK2	in or out *
DC	Link LK3	in
HYST	Link LK4	in or out *
HYST2	Link LK5	in or out *
GND	Link LK6	in
LOW FREQ	Link LK7	out
AC	Link LK8	out
VCC	Link LK9	out

* See “Input link settings”.

CONTACT CLOSURE TERMINAL



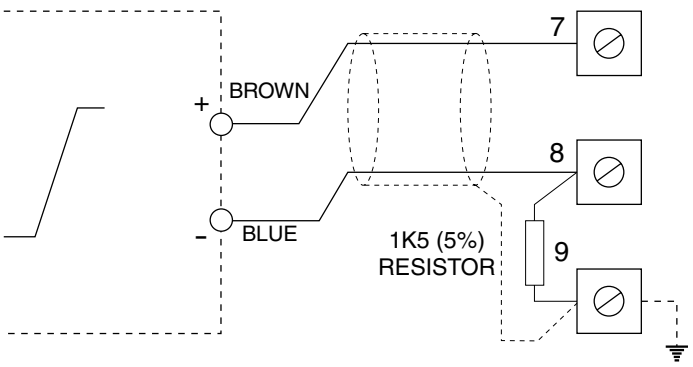
Voltage free contact

Typical Internal Link Settings

FREQ	Link LK1	out
BIAS	Link LK2	in
DC	Link LK3	in
HYST	Link LK4	in
HYST2	Link LK5	out
GND	Link LK6	out
LOW FREQ	Link LK7	in
AC	Link LK8	out
VCC	Link LK9	in

* See “Input link settings”.

NAMUR SENSOR TERMINAL

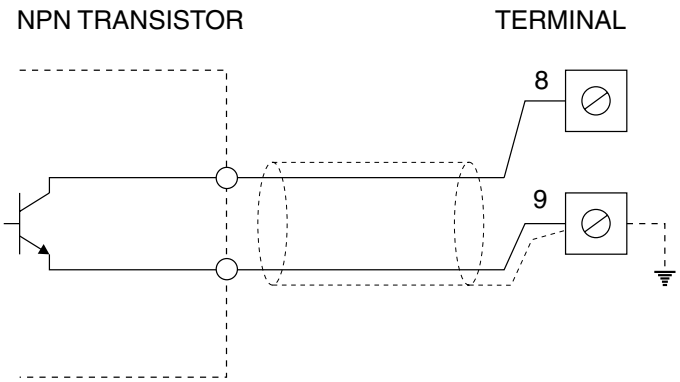


Namur sensor

Typical Internal Link Settings

FREQ	Link LK1	out
BIAS	Link LK2	in
DC	Link LK3	in
HYST	Link LK4	in
HYST2	Link LK5	out
GND	Link LK6	in
LOW FREQ	Link LK7	out
AC	Link LK8	out
VCC	Link LK9	out

* See “Input link settings”.



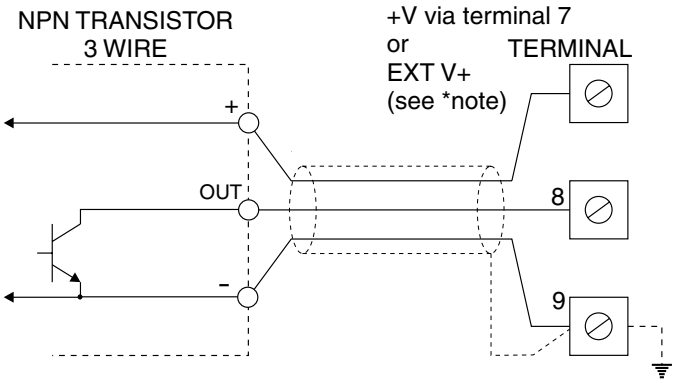
NPN transistor sensor

Typical Internal Link Settings

FREQ	Link LK1	out
BIAS	Link LK2	in
DC	Link LK3	in
HYST	Link LK4	in or out *
HYST2	Link LK5	in or out *
GND	Link LK6	out
LOW FREQ	Link LK7	out
AC	Link LK8	out
VCC	Link LK9	in

* See “Input link settings”.

Note: the transducer may require an external DC supply. This may be provided from a remote power source, by a DC output on terminal 7 or optional isolated DC supply (see "Transducer power supply").



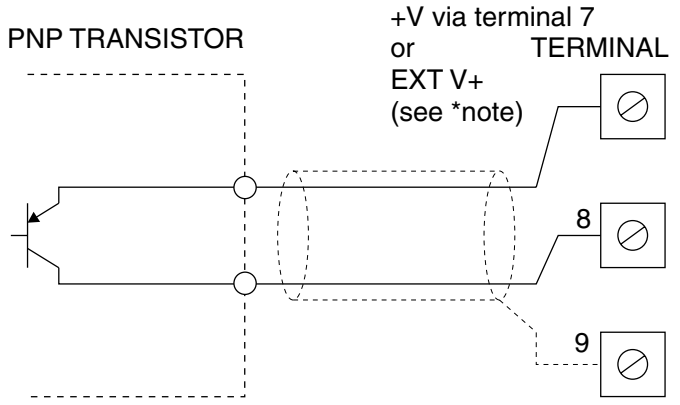
3 wire NPN transistor sensor

Typical Internal Link Settings

FREQ	Link LK1	out
BIAS	Link LK2	in
DC	Link LK3	in
HYST	Link LK4	in or out *
HYST2	Link LK5	in or out *
GND	Link LK6	out
LOW FREQ	Link LK7	out
AC	Link LK8	out
VCC	Link LK9	in

* See “Input link settings”.

Note: the transducer may require an external DC supply. This may be provided from a remote power source, by a DC output on terminal 7 or optional isolated DC supply (see "Transducer power supply").



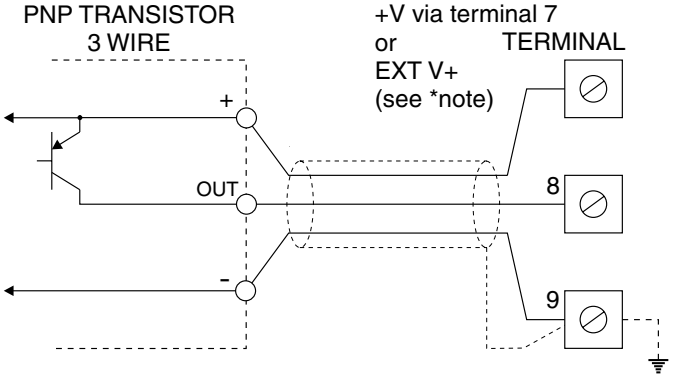
PNP transistor sensor

Typical Internal Link Settings

FREQ	Link LK1	out
BIAS	Link LK2	in
DC	Link LK3	in
HYST	Link LK4	in or out *
HYST2	Link LK5	in or out *
GND	Link LK6	in
LOW FREQ	Link LK7	out
AC	Link LK8	out
VCC	Link LK9	out

* See “Input link settings”.

Note: the transducer may require an external DC supply. This may be provided from a remote power source, by a DC output on terminal 7 or optional isolated DC supply (see "Transducer power supply").



3 wire PNP transistor sensor

Typical Internal Link Settings

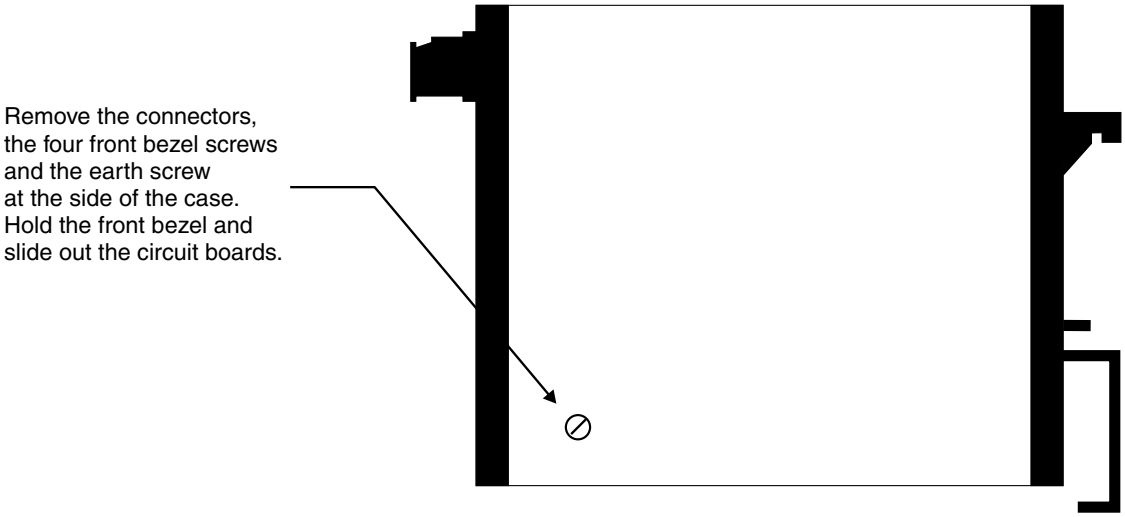
FREQ	Link LK1	out
BIAS	Link LK2	in
DC	Link LK3	in
HYST	Link LK4	in or out *
HYST2	Link LK5	in or out *
GND	Link LK6	in
LOW FREQ	Link LK7	out
AC	Link LK8	out
VCC	Link LK9	out

* See “Input link settings”.

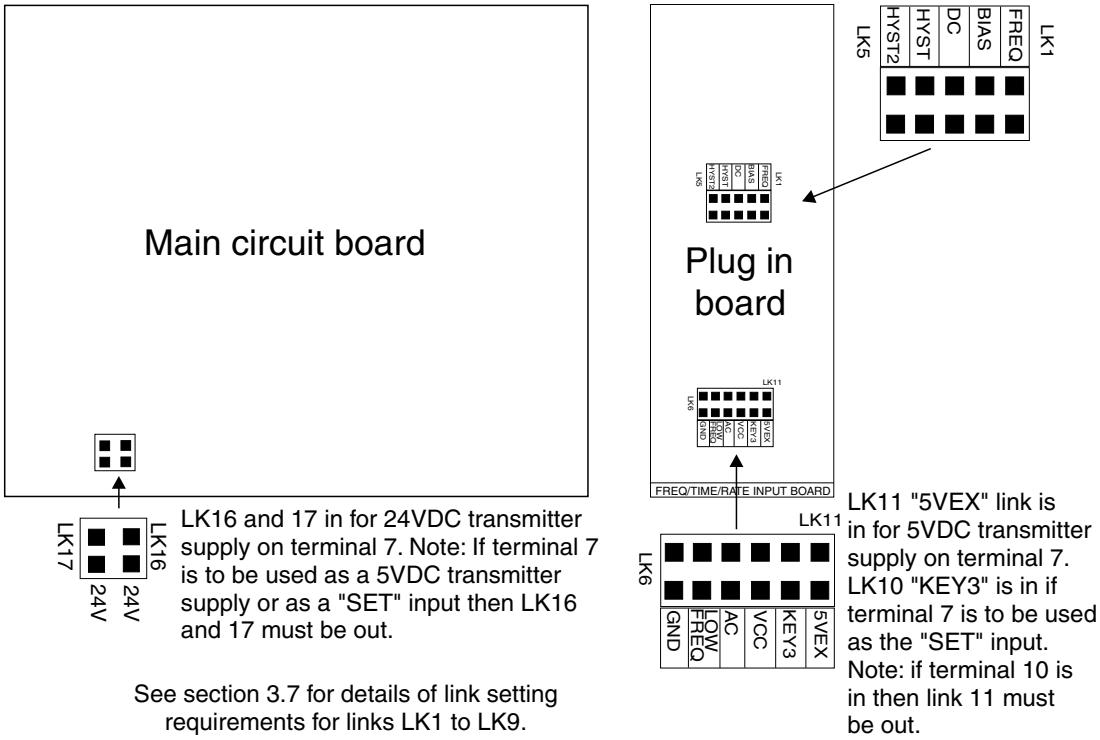
Note: the transducer may require an external DC supply. This may be provided from a remote power source, by a DC output on terminal 7 or optional isolated DC supply (see "Transducer power supply").

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 consult the appropriate appendix in this manual.



3 .7 Input link settings

The AC link LK8 is only in when the RM4 is to be used to measure the frequency of its own AC supply input, this mode also requires other factory fitted components and is therfore only available when if this mode is specified when ordered. No signal input other than the AC supply is required when this method is used i.e. there is no input to signal fed to terminal 8.

HYST2 link LK5 should be in for signals greater than 1V . HYST link LK4 should be in for signals greater than 5V. For signals lower than 1V both links should be out (100mV minimum signal). A maximum of one hysteresis link should be fitted.

The DC coupling link LK3 should be in for frequencies less than 10Hz.

The BIAS link LK2 should be in when input signal does not go below 0V.

The FREQ link is used to create a sharply rising edge to give a more definite pulse signal and will be used mainly for input signals with slowly rising edges, typically sinewave AC inputs and inductive inputs.

4 Explanation of functions

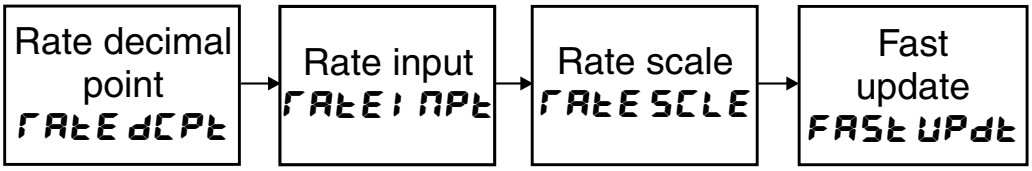
Operation modes.

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 **LoF** mode should be selected. At frequencies below 4Hz, if **HI F** is selected, 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.

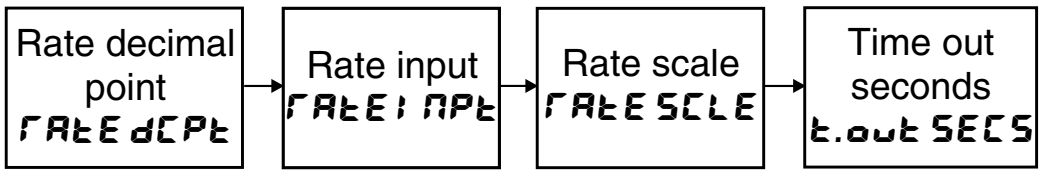
Functions specific to display with **FREQRNGE** set to **HI F** with a rate display



2. Rate display, low frequency.

If **LoF** 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 **tout SECS** function.

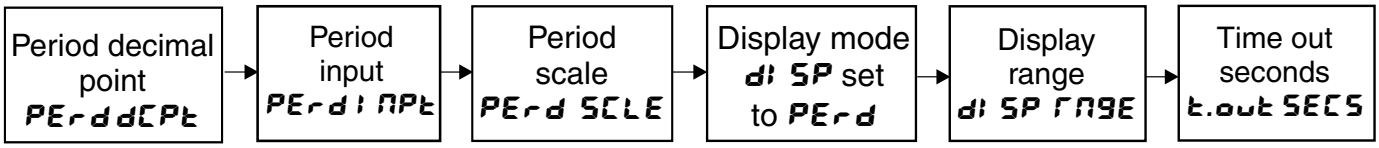
Functions specific to display with **FREQRNGE** set to **LoF** with a rate display



3. Period display, low frequency.

With **LoF** selected at the **FREQ RNGE** function the user has the option of either displaying the rate (**RATE**) or period (**PERd**) of the input (chosen via the **dISP** function). If **PERd** is selected then the display will show the period (or scaled period if required) of the input pulse rather than the rate.

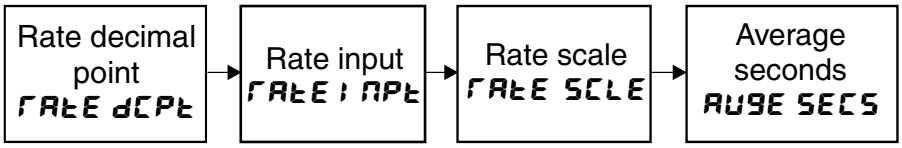
Functions specific to display with **FREQ RNGE** set to **Lo F** with a period display



4. 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.
AxtE	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.
Axn.o or Axn.c	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.
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_ Ch2	Second analog recorder/retransmission output low value - seen only when the dual analog retransmission option is fitted. See rEC_ function for description of operation. Refer to the separate “RM4 DIN Rail Meter Optional Output Addendum” booklet supplied when this option is fitted.
rEC¯ Ch2	Second analog recorder/retransmission output high value - seen only when the dual analog retransmission option is fitted. See rEC¯ 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.	
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.
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.
PErd dCPt	Period decimal point selection (only seen when period display selected) - displays and sets the decimal point for the period display. Note that the decimal point display is tied to the display range (di SP rnGE) function e.g. if the display range function is set to 0.00.02 then the two decimal place setting will show up as 0.00.02 and one decimal place will show as 0.00.1.
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: Display = $\frac{\text{Input frequency (Hz)} \times \text{rAtE SCLE}}{\text{rAtE InPt}}$
PErd InPt	Period input scale factor - displays and sets the period value to be used with the period scale function value to generate the period display scaling. See examples later in this chapter and the formula below.
PErd SCLE	Period scale factor (only seen when period display selected) - displays and sets the scale factor to be used with the period input setting. To calculate the display value the input frequency and hence the period of this input needs to be known. Scale and input work together to produce a display as follows: Display = $\frac{\text{Input period (seconds)} \times \text{PErd SCLE}}{\text{PErd InPt}}$ Note: the displayed value is also affected by the decimal point and display range settings.

FrEq rnGE	Frequency range - displays and sets the frequency input range. Select LoF 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 4Hz or higher (maximum input frequency is 100kHz). Note that the period display (in both or FrEq modes) will only be accessible when the frequency range is set to LoF and hence the input frequency must not be above 1kHz. Select AUGE for an averaged display. The averaged display allows the input rate to be averaged over a period of seconds set by the AUGE 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.
I nPt Edge	Input edge triggering - displays and sets the input edge on which the instrument will trigger. Select FALL for triggering on a falling edge. Select rI SE for triggering on a rising edge.
dI SP	Period or rate display - when using the low frequency range the user has the option of displaying either the rate of the input or the period of the input. Select rAtE for a rate display in Hz. Select PEr d for a period display (display format is determined by the display range function (dI SP rnGE) and the decimal point setting).
dI SP rnGE	Period display range - Sets the display range when PEr d is chosen as the default display at the dI SP function (FrEq rnGE must also be set to LoF to see this function). The options are 0 .0.0 1 or 0.00.02. The 0 option allows a display in milli seconds. The 0.0 1 option allows a display in minutes and seconds and the 0.00.02 option allows a display in hours.mins.secs. The display units and scaling will now depend on the PEr d dCPt, PEr d I nPt and PEr d SCLE settings e.g. the display can be scaled to give a reading which is ten times the real period if required. Examples below show how a 2Hz input (0.5 sec or 500mS period) is affected by the dI SP rnGE, PEr d dCPt and PEr d SCLE functions. Examples are shown for a 5 digit display type instrument.

dI SP rnGE	PEr d dCPt	PEr d I nPt	PEr d SCLE	Value displayed
0	0	1	1	500
0	0	1	2	1000
0	0	1	10	5000
0	0.003	1	0.00 1	0.500
0.0 1	0.00	1	1.00	500.0
0.00.02	0.00.02	1	0.00.0 1	0.05.00
0.00.02	0.00.02	1	0.0 1.00	5.00.00

With the PEr d I nPt function set to 1000 the display will time in seconds rather than milli seconds. The display can now be made to show hours minutes & seconds. The table below gives some examples.

dI SP rnGE	PEr d dCPt	PEr d I nPt	PEr d SCLE	Actual period	Value displayed
0.00.02	0.00.02	1000	0.00.0 1	1m15s	0.0 1. 15
0.00.02	0.00.02	1000	0.00.0 1	2h12m30s	2. 12.30

t.out SECS	Time out (only seen if LoF is selected under the FREQ rnGE function) - displays and sets the time out in seconds when using the low frequency (LoF) 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 (or -or- if displaying period). 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. 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 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 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
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 are as described in the r.i nP function above. Functions available are: nonE, Hi , Lo or Hi Lo,
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 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 entry to all functions can be made via FUnC mode i.e. CAL mode entry is not required.

SPAC	Setpoint access - sets the FUNC mode access to the alarm relays set points. The following choices are available; A 1 - Allows setpoint access to alarm 1 only. A 1-2 - Allows access to alarms 1 and 2 only. A 1-3 - 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 F.I NP function must be set to SPAC.
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 interface 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 d, SP, Cont, POLL, A.bus or M.bus Allows user to select the RS232/485 interface operation as follows:- d, 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 required. A.bus A special communications mode used with Windows compatible optional PC download software. Refer to the user manual supplied with this optional software. 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

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:

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

Example - **Low frequency input rate display**

A transducer is being used to give one pulse out 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 InPt 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. Enter the setup functions via CAL mode.
2. Step through the functions by pressing and releasing F until the rAtE InPt 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 FFEdrnGE will appear followed by the previous setting.
7. Use the ▲ or ▼ push button to change the setting to LoF.
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 of 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 AUGE SECS function and will therefore show less short term variation in the rate figure. To use the average mode the FFEd rnGE function must be set to AUGE.

Example - **RPM display**

A proximity sensor 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 rAtE InPt figure and rAtE 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 3 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 of 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 **A 1Lo** this will be seen followed by the previous low alarm setting.

11. Use the ▲ or ▼ push button to change the **A 1Lo** setting to **5 18.5**. Press **F** to accept the change.

12. Press **F**, the function **A 1H** 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 **A 1HY** 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 **A 1n.o**/**A 1n.c** function is seen.

17. Use the ▲ or ▼ push button to change the setting to **A 1n.o** (normally open operation).

18. 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 unit returns to normal measure mode.

Example - **Flow rate display**

See previous examples for detailed steps showing how to alter functions. Flowmeters produce an output frequency proportional to the rate of flow the scaling is calculated using information provided by the manufacturer or from test results. e.g.:

A turbine produces 767 pulses per litre

- to display litres/second set **rAtE 1 nPt** to 767 and **rAtE SCLE** to 1.
- to display litres/minute set **rAtE 1 nPt** to 767 and **rAtE SCLE** to 60.
- to display litres/hour set **rAtE 1 nPt** to 767 and **rAtE SCLE** to 3600.
- to display kilolitres/hour set **rAtE 1 nPt** to 7670 and **rAtE SCLE** to 36.

Example - **Flow rate display from a Rota pulse flowmeter**

In some applications the number of pulses per litre is not known but the number of pulses per metre flow of liquid is given. The number of pulses per litre would then be calculated from the area of the pipe being used. The example below shows how scaling factors can be calculated for this type of application. See also the "Totaliser Explanation of Functions" chapter for examples of total scaling for such a flowmeter.

The "Rota pulse" paddle wheel flow meter (this sensor model is commonly used as an input to the RM4-FX) outputs 45.6 pulses per metre flow of liquid in a pipe. In this example we will assume that the pipe internal diameter is 50mm (25mm or 0.025m radius).

The steps to calculate the scaling of the meter for this example are as follows:

1. Calculate the area of the pipe in square metres:

$Area = \pi \times r^2 = \pi \times 0.025^2 = 0.00196 m^2$

2. Calculate the volume of a 1m length of pipe:

$Volume = Area \times length = 0.00196 \times 1 = 0.00196 m^3$

3. For every 45.6 pulses we therefore have 0.00196 cubic metres of liquid or 1.96 litres of liquid (there are 1000 litres in one cubic metre). For a litres/sec display we could therefore have scaling factors of **rAtE 1 nPt** = 4560 and **rAtE SCLE** = 196.

The table below shows typical scaling factors for this flowmeter.

Table for Rota pulse flowmeter with 45.6 pulses per metre flow.				
Pipe internal diameter	Ratemeter scaling factors.			
	Litres/second	Litres/minute	Litres/hour	m^3/hour
40mm	rAtE I nPt = 4560 rAtE SCLE = 126	rAtE I nPt = 456 rAtE SCLE = 756	rAtE I nPt = 456 rAtE SCLE = 45360	rAtE I nPt = 456 rAtE SCLE = 45
50mm	rAtE I nPt = 4560 rAtE SCLE = 196	rAtE I nPt = 456 rAtE SCLE = 1176	rAtE I nPt = 456 rAtE SCLE = 70560	rAtE I nPt = 456 rAtE SCLE = 71
80mm	rAtE I nPt = 4560 rAtE SCLE = 503	rAtE I nPt = 456 rAtE SCLE = 3018	rAtE I nPt = 456 rAtE SCLE = 181080	rAtE I nPt = 456 rAtE SCLE = 181
100mm	rAtE I nPt = 4560 rAtE SCLE = 785	rAtE I nPt = 456 rAtE SCLE = 4710	rAtE I nPt = 456 rAtE SCLE = 282600	rAtE I nPt = 456 rAtE SCLE = 281
150mm	rAtE I nPt = 456 rAtE SCLE = 177	rAtE I nPt = 456 rAtE SCLE = 10620	rAtE I nPt = 456 rAtE SCLE = 637200	rAtE I nPt = 456 rAtE SCLE = 637
Note that the above examples can be reduced to smaller numbers as long as the ratio between the two numbers are the same e.g. in the case of the Litres/hour scaling for a 150mm pipe the rAtE I nPt = 456 and rAtE SCLE = 637200 can be reduced to rAtE I nPt = 19 and rAtE SCLE = 26550 (both sides divided by 24). This reduction will allow scaling on a 5 digit display whereas the previous scaling required a 6 digit display.				

Example - **period display in rate mode**

If LoF is selected at the FrEq rnGE function then there is an option to display either the period or frequency of the incoming pulses. At the di SP function select the PErd option to display period.

For example a display showing seconds to two decimal places (seconds and hundredths of seconds) is required for the input. The settings required for this display are:

1. PErd dCPt set to 0.02
2. PErd I nPt set to 1000 (one thousand milli seconds i.e. 1 second)
3. PErd SCLE set to 1.00 i.e. every one thousand milli seconds will cause a display of 1.00.
4. FrEq rnGE set to LoF.
5. di SP set to PErd.
6. di SP rnGE set to 0.
7. t.out SECS set to a value higher than the lowest input period e.g. if the lowest input period is going to be 10 seconds the t.out SECS function could be set to 15 seconds.

In the example above the display could be changed to show minutes. seconds & hundredths of seconds by changing the di SP rnGE function to 0.0 1.

4.2 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 i.e. above 99999. Check that the calibration scaling figures are correct.

5 Ratemeter Function Table

Initial display	Meaning of display	Next display	Default Setting	Record Your Settings
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	
rEC_	Analog output 1 low limit	Value in memory	0	
rEC¯	Analog output 1 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	
Functions below are accessible via CAL mode only or if the ACCS function is set to ALL.				
d.OFF SECS	Display auto dimming timer (seconds)	0 to 9999	0	
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 or PErd dCPt	Decimal point setting for rate display or decimal point setting for period depending upon the di SP setting	Value in memory	0	
rAtE inPt or PErd inPt	Rate input setting (Hz) or Period input setting (Secs.) depending upon the di SP setting	Value in memory	1	
rAtE SCLE or PErd SCLE	Rate scale setting or Period scale setting depending upon the di SP setting	Value in memory	1	
FrEq rnGE	Frequency range low, high or average frequency	LoF, HI F or AUGE	Hi F	
FASt UPdt	Fast update mode	on or OFF	OFF	
inPt EdGE	Input edge triggering rising or falling edge	FALL or rISE	rISE	
di SP	Default display for low frequency input (seen only when FrEq rnGE set to LoF)	rAtE or PErd	rAtE	
di SP rnGE	Display range (seen only when di SP set to PErd)	0.0.01 or 0.00.02	0	
t.out SECS	Timeout (seen only when FrEq rnGE set to AUGE or LoF)	1 to 9999	1	
AUGE SECS	Averaging time (seen only when FrEq rnGE set to AUGE)	1 to 9999	1	
r.in P	Remote input	NONE, P.HLd, d.HLd, Hi .Lo, Hi Lo, SP.Ac, no.Ac or dULL	NONE	
P.but	P button operation	NONE, Hi .Lo, Hi or Lo	NONE	
ACCS	Alarm relay access mode	OFF, EASY, NONE or ALL	OFF	
SPAC	Setpoint access	A1, A1-2 etc.	A1	
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	Output, continuous or controlled	Cont. di SP. POLL. A.buS 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
AxLo				
AxHi				
AxHY				
AxEt				
Axrt				
Axn.o or Axn.c				
Ax.SP or Ax.t 1				

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 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)

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.

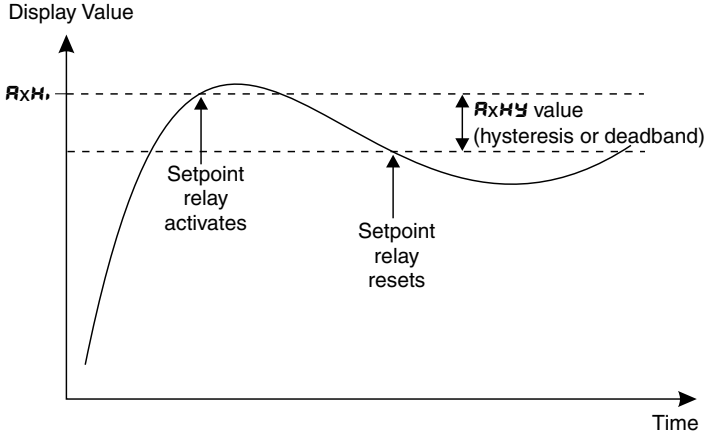
Alarm hysteresis (AxHY)

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).

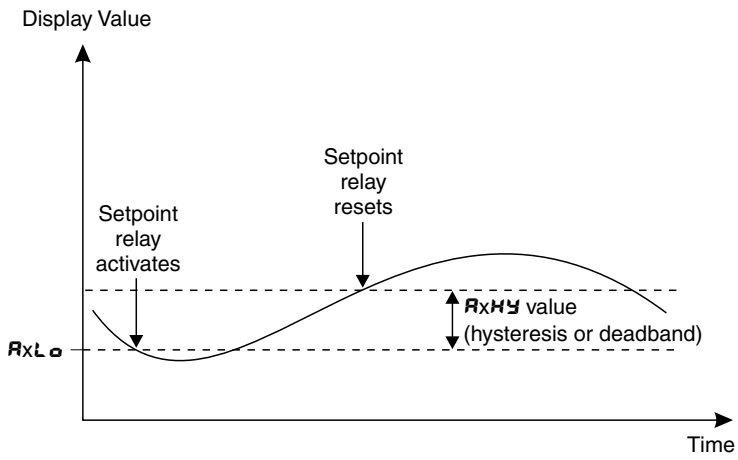
In the low alarm mode, once the alarm is activated the input must rise above the



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 (RxtE)

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 (Rxrt)

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 (Rxno/nc)

Each alarm may be programmed to operate as a normally open (N/O e.g. R1 no) or normally closed (N/C e.g. R2nc) 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.

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 R2.SP is selected then alarm 2 will act as an independent relay. If R2.t 1 is selected then the alarm 2 relay will trail alarm 1 relay. With R2.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

	R2	R3	R4
R 1	R2.t 1	R3.t 1	R4.t 1
R2		R3.t2	R4.t2
R3			R4.t3

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 ACCS function must be set to EASY or the F.I nP function must be set to SP.AC. If the ACCS function is used the remote input function F.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 100Ωresistor 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.

7 Specifications

7 .1 Technical Specifications

Rate input:	Input type is link selectable internal pull up resistor, internal pull down resistor biassed input, DC couple and added hysteresis. Voltage level link selectable 100mV DC or RMS min., 48VDC or RMS max.
Ratemeter functions:	Scaleable rate, averaged rate or period display.
Accuracy:	For period measurement 0.01% ±10uS
Impedance:	10KΩ
Max input rate:	100kHz
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 5V or 24VDC unregulated transmitter supply (common ground) rated at 25mA, available on both AC and DC powered models.

7 .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, Available as 12 bit single channel, 16 bit single channel or dual channel 12 bit.
Serial communications:	RS232, RS485 or RS422 factory configured
Transmitter supply:	Isolated & regulated. Link selectable12VDC (50mA max) or 24VDC (25mA max)

7 .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

8 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.