LD-TR
Large Digit Displays
Ratemeter/Totaliser
Operation and Instruction Manual

AMALGAMATED INSTRUMENT CO PTY LTD *ABN: 80 619 963 692*
Unit 5, 28 Leighton Place Hornsby *Telephone: +61 2 9476 2244* *e-mail: sales@aicpl.com.au*
NSW 2077 Australia *Facsimile: +61 2 9476 2902* *Internet: www.aicpl.com.au*

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1 Introduction

General description

This manual contains information for the installation and operation of the the LD-TR Monitor. The instrument may be set to operate as a ratemeter or totaliser or allow toggling between rate and total displays. The **SEt OPEr** function allows selection of one of these three modes. A brief description of each mode is given below. The "Explanation of functions" chapter details functions available for all modes, consult the separate function table for each mode to view the available functions for these modes.

The three modes of operation relevant to this manual selectable at the **SEt OPEr** function are:

1. **totL** - totaliser/counter display. The input pulses are totalised, scaled in engineering units and displayed e.g. Total litres, mm etc. Count up or count down is possible. A total and grand total may be viewed and reset separately. The grand total is a separate total memory which allows storage of all the previous totals.
2. **FrEq** - frequency/rate display. The frequency or rate of the input may be scaled in engineering units and displayed e.g. R.P.M., Bottles/min., Litres/hour etc.. For low frequency inputs (input always below 1kHz) there is an option of displaying either rate or period. For frequencies below 1kHz there is a choice of displaying rate, averaged rate or period each of which are scaleable.
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 (only fitted on certain display options). For low frequency inputs (input always below 1kHz) there is an option of toggling between rate/total or period/total. A total and grand total may be viewed and reset separately.

Selection of operating mode, calibration and scaling are all accomplished by push button operation. "On display" prompts are given for each function to assist in setting up the instrument. Changes to input sensor type may requiring altering PCB links on the main circuit board.

Two inbuilt relays provide alarm/control functions, serial communications (RS232 or RS485) may also be optionally provided.

Unless otherwise specified at the time of order, your LD has been factory set to a standard configuration, see the function table for your selected mode for default settings.

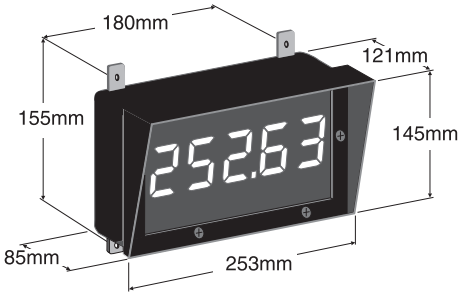
Full electrical isolation between power supply and input signal (not applicable to non isolated DC supply versions) is provided by the LD, thereby eliminating grounding and common voltage problems. This isolation feature makes the LD ideal for interfacing to computers, PLCs and other data acquisition devices.

The LD series of Large Digit Displays are designed for high reliability in industrial applications.

2 Mechanical installation

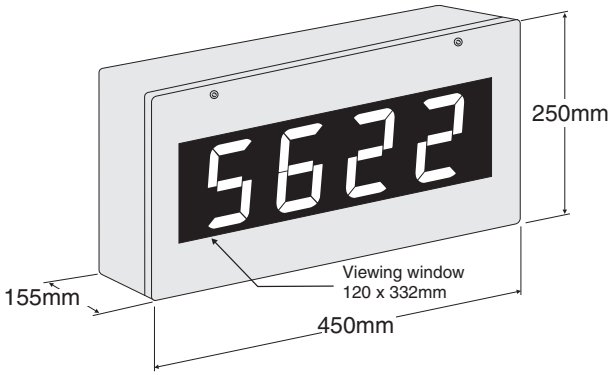
2.1 20mm, 38mm, 45mm, 57mm and 58mm LED

An optional panel mount kit is available for these size displays. Panel cut out size is 240 x 130mm (-0.0mm / +0.5mm). Weight: All types 1.6kg approx.



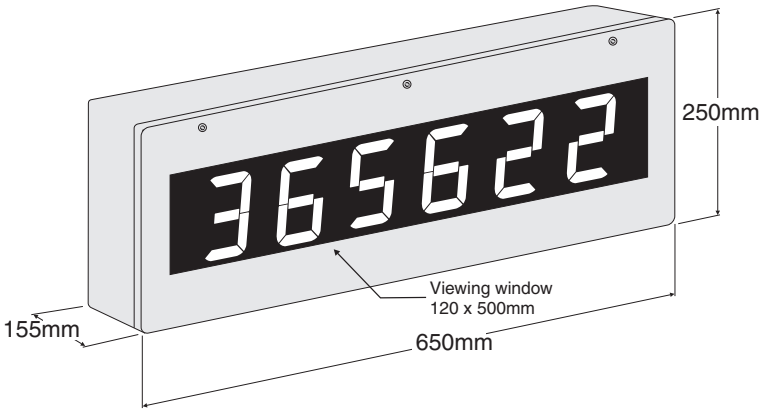
2.2 100mm 4 digit LED

Weight 10kg (LED)



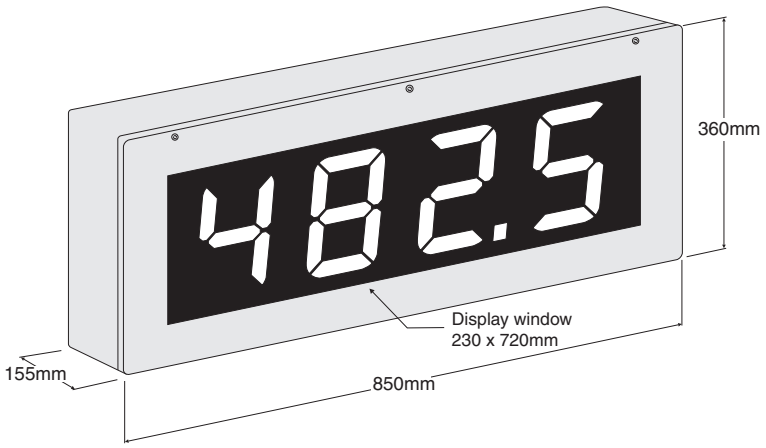
2.3 100mm 6 digit LED

Weight 14kg (LED)



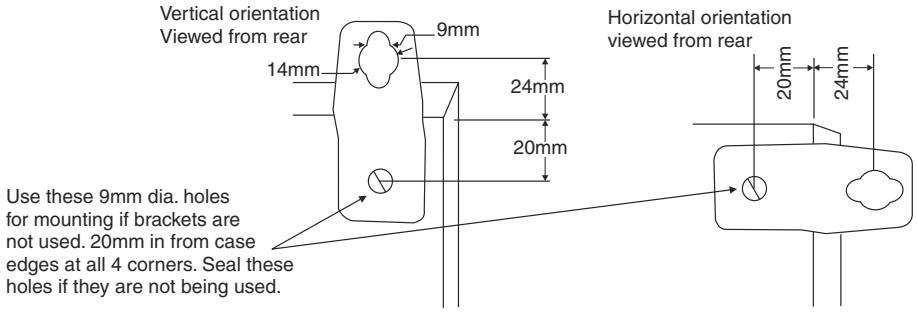
2.4 200mm 4 digit LED

Weight 14kg.



2.5 Cable entry and Mounting brackets

For 20 to 58mm displays no holes are pre drilled. For all 100mm and 200mm displays 3 off 20mm holes are drilled at the bottom of the case, these are fitted with 2 x IP65 grommets and 1 x air vent which allows moisture to exit the case but not enter. Four mounting brackets and four blind grommets are supplied for use with all metal case large digit displays. Diagrams below illustrate vertical and horizontal installation for mounting brackets. If mounting without the brackets is preferred then the 9mm dia. case holes provided for the brackets can be used as alternative mounting holes. Any rear holes not used for mounting should be sealed.

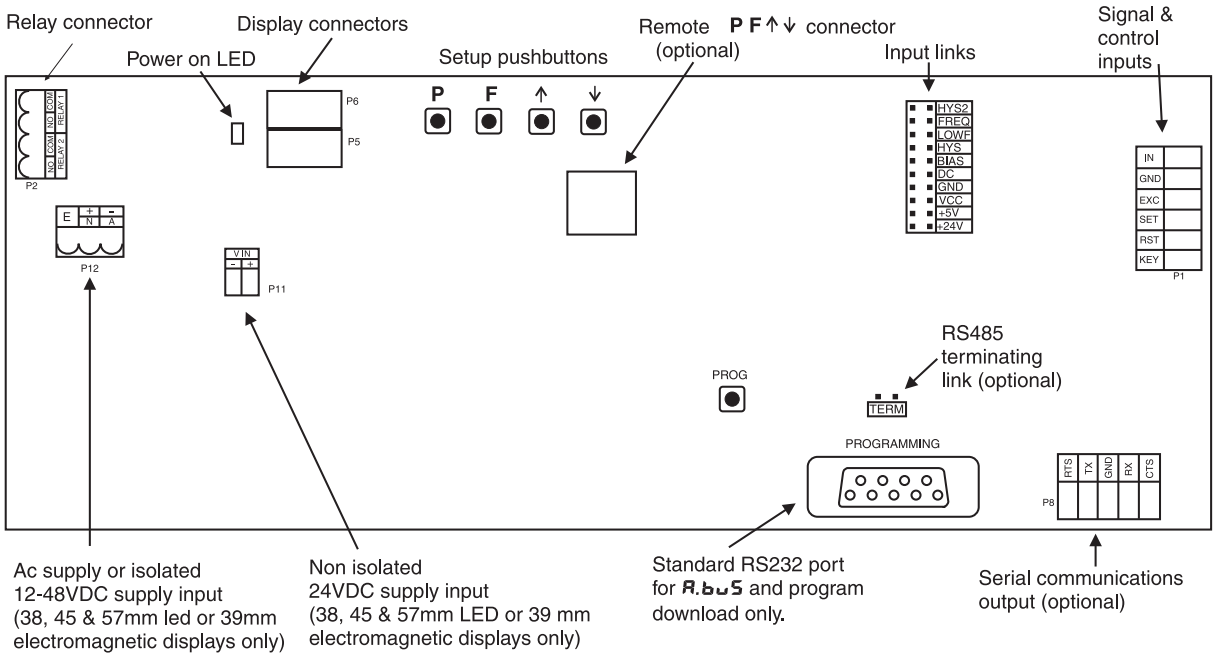


3 Electrical installation

3.1 Electrical installation

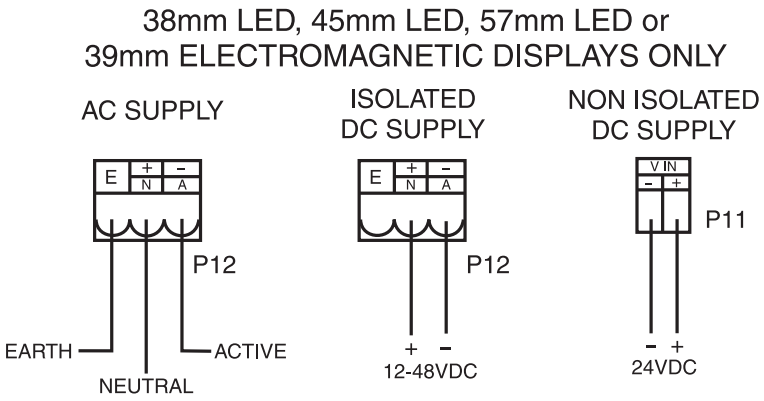
The display is designed for continuous operation and no power switch is fitted to the unit. It is recommended that an external switch and fuse be provided to allow the unit to be removed for servicing. The terminal blocks are plug in screw type for ease of installation and allow for wires of up to 1.5mm^2 (2.5mm^2 for relay, AC or isolated DC supply connections) to be fitted. 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.

3.2 Main circuit board layout



3.3 38, 45, 57 or 58mm LED or 39mm electromagnetic display power supplies

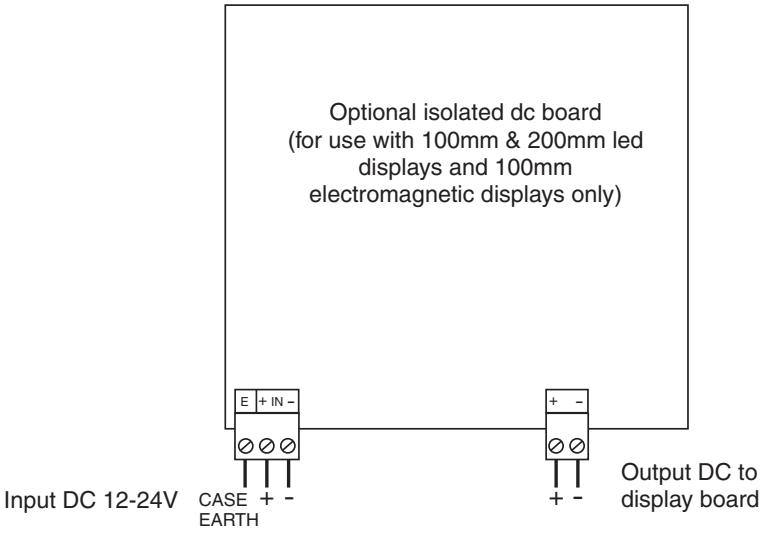
AC power connections use a plug in connector with screw terminals at P12 (2.5mm^2 max. wire). Isolated DC supplies (12-48VDC) use the same terminals. Non isolated DC supplies (24VDC only) may be connected directly to the main circuit board power supply connector via the plug in connector terminals at P11 (1.5mm^2 max. wire diameter). Note supply type is factory configured.



3.4 100mm, 200mm LED and 100mm electromagnetic display power supplies

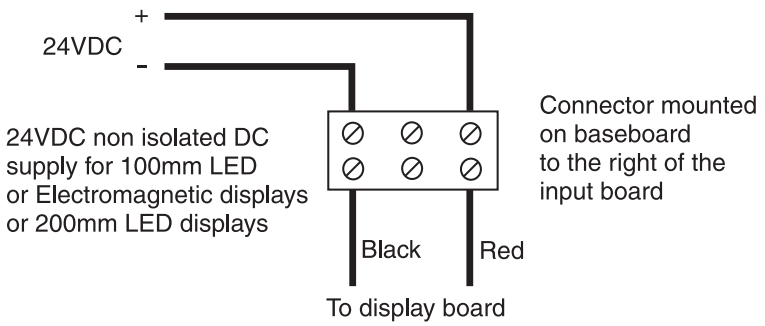
Isolated DC supplies (12 to 24VDC) connect to the isolated supply pcb on the base board. AC supplies connect to the transformer primary on the base board. The base board is located under the input circuit board.

Optional isolated DC supply



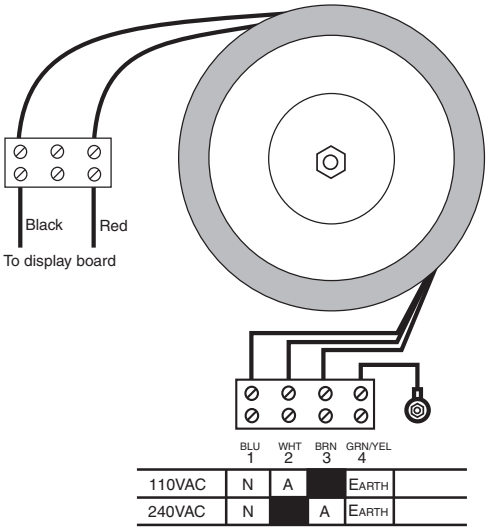
Non isolated DC power supplies

Non isolated DC supplies (24VDC) are wired to a connector on the baseboard as shown below.

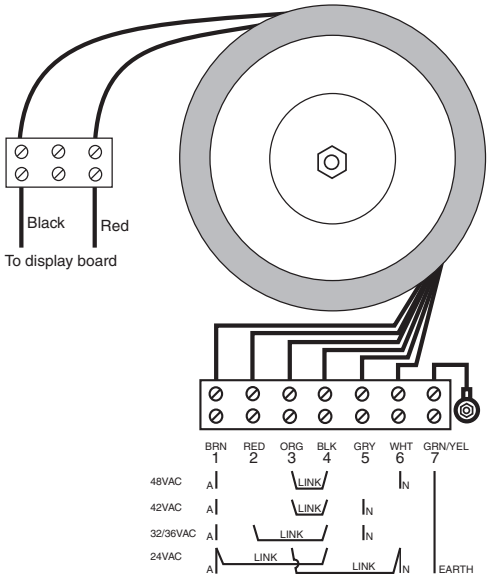


High and low voltage AC supplies

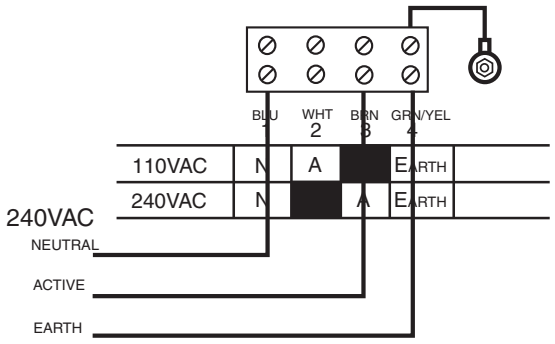
240 & 110VAC supplies.
For 100mm/200mm LED or 100mm electromagnetic display types only.

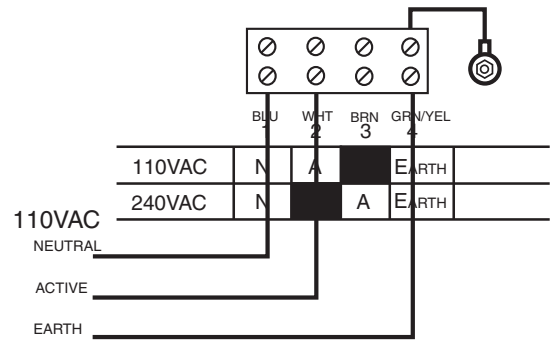


Low voltage AC supplies.
For 100mm/200mm LED or 100mm electromagnetic display types only.



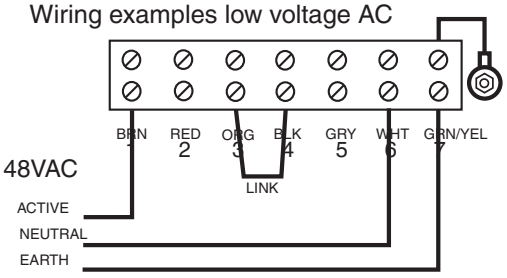
Wiring examples 240VAC & 110VAC

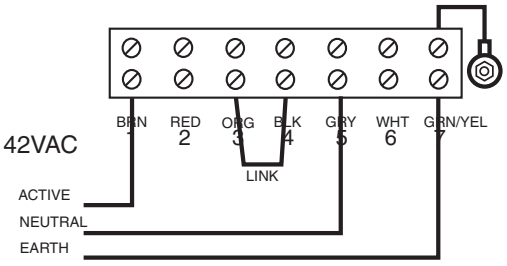


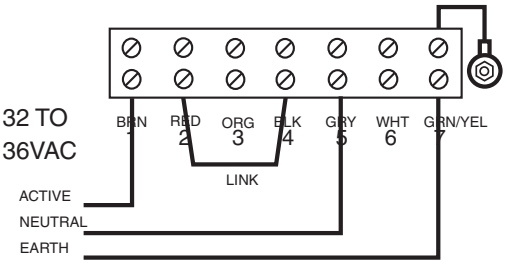


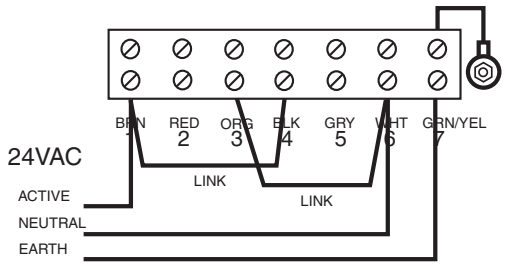
Important note: the 240V & 110V supplies use the same transformer, low voltage instruments use a different transformer. Do not use a low voltage transformer for 240V or 110V or vice versa.

Wiring examples low voltage AC



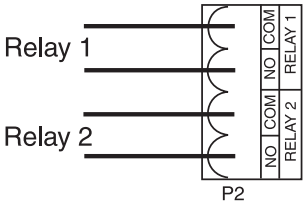






3.5 Relay connections

The display is supplied with two alarm relays as standard with connections on terminal P2. The relays are single pole single throw types and are rated at 5A, 240VAC into a resistive load. The relay contacts are voltage free and may be programmed for normally open or normally closed operation. With power removed the relay contacts will be in open position.



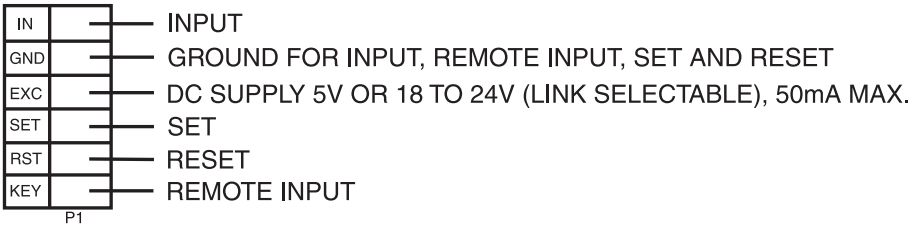
3.6 Input/output connectors

The diagram below shows the input connectors for the LD-TR. The input signal connection is between input (**IN**) and the ground (**GND**) terminals. The ground (**GND**) input is shared with the set (**SET**), reset (**RST**) and remote input (**KEY**) inputs.

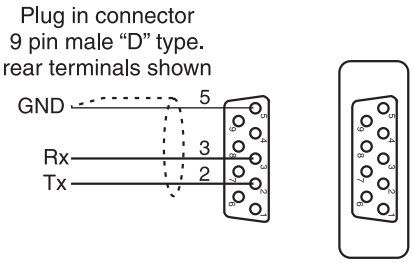
An internal power supply at the **EXC** terminal can be used to be used to give a sensor supply output of either 5VDC regulated or 18 to 24VDC unregulated via links LK 1 or 2. The 18 to 24V unregulated sensor supply is available even if the LD power supply is less than 18V (isolated DC only). When using this output as a transmitter supply ensure that only one link (LK1 or LK2) is in. Maximum current draw is 50mA for both 5V regulated and 18 to 24V unregulated sensor supply. For LD instruments powered from non isolated DC supplies the 5V regulated supply is available but the unregulated supply will be slightly less than the supply voltage. The **SET** input can also be used to control the count direction i.e. count up/count down in both or **totl** modes. This input is used in conjunction with the **SI nP** setting, see the **SI nP** function for these modes for further details.

The reset input (**RST**) is used to reset the totaliser. Either a contact closure (0V) or 5V control voltage can be used to reset the display. For a contact closure or 0V reset the **c.rSt** function must be set to either **Lo** or **LoE**. For 5V control voltage reset the **c.rSt** function must be set to **Hi** or **Hi E**. Note if a control voltage reset is to be used then the totaliser will only accept count inputs when the reset input is short circuit to ground i.e. 0V at the **RST** input.

The remote input (**KEY**) terminal can be used to perform one of the functions chosen at the **F.I nP** function. A contact closure or 0V is required to operate the required remote input function.



3.7 Standard serial communications connections

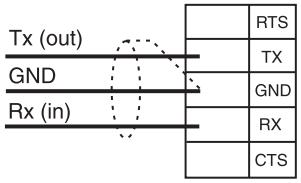


RS232 port for use in **A.bUS** mode with Windows PC software purchased for use with this instrument or for on site software update only. This port will be disabled if the optional serial communications port fitted. If this port is to be used for **A.bUS** communcation the **SEr. 1tYPE** and **SEr.2tYPE** functions must be set to **nONE**

Note: when connecting using Rs232 the Tx line at the display connects to the Rx line at the device it is communicating with. Likewise the Rx line at the display connects to Tx

3.8 Optional serial communications connections

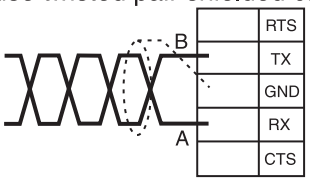
RS232 communications
use 3 core shielded cable



Serial communications is optional, connectors and circuitry will only be fitted if the instrument was ordered with the serial communications option.

Note: when connecting using RS232 the Tx line at the display connects to the Rx line at the device it is communicating with. Likewise the Rx line at the display connects to Tx. When using RS485 connections are A to A and B to B

RS485 communications
use twisted pair shielded cable

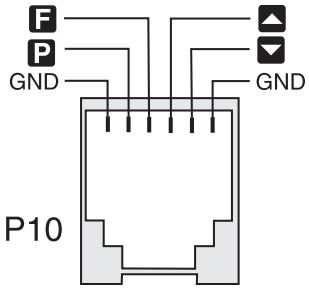


TERM

RS485 terminating link. The link should be in for long cable runs. If multiple instruments are connected insert the link if the display is the first and last unit on the line.

3.9 Optional remote keypad connector

The connector is an RJ12 6P6C type socket



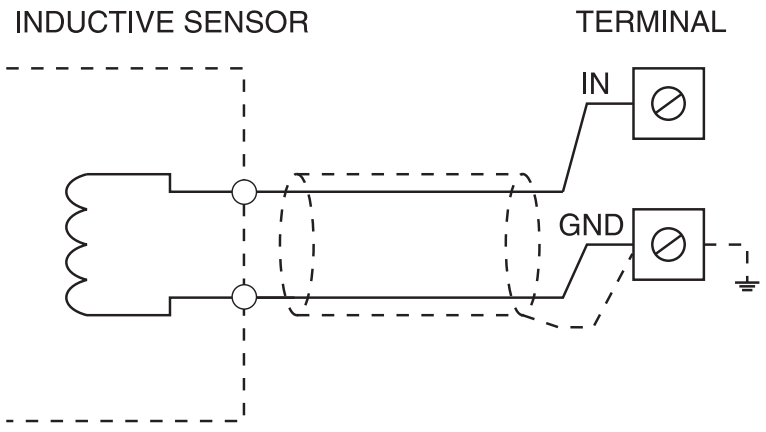
3.10 WS-03102 and Rotapulse wiring and link settings

WS-03102 anemometer and Rotapulse flowmeter are commonly supplied with this model. Wiring and link settings are as shown below:

WS-03102: Wiring - Anemometer WS REF terminal to LD-TR GND terminal and WS SIG terminal to LD-TR IN terminal. Shield to LD-TR GND terminal.
Input link settings: Links in are LK5 (DC), LK8 (LOWF), LK9 (FREQ) all other links are out.
Suggested settings:
FREQ RNGE = **LoF**, **t.out SECS** set as required.
For kph scaling **RATE I NPt** = 30, **RATE SCLE** = 82.0
For m/s scaling **RATE I NPt** = 30, **RATE SCLE** = 22.8

Rotapulse: Colour code: Black - signal + (**IN** terminal), Brown - +24V (**SET** terminal (set to 24V)), Blue - ground (**GND** terminal). Input link settings: Links in are LK1 (24V), LK3 (**VCC**), LK5 (**DC**), LK6 (**BIAS**), LK8 (**HYST**) all other links are out.

3.11 Input connection details and link settings

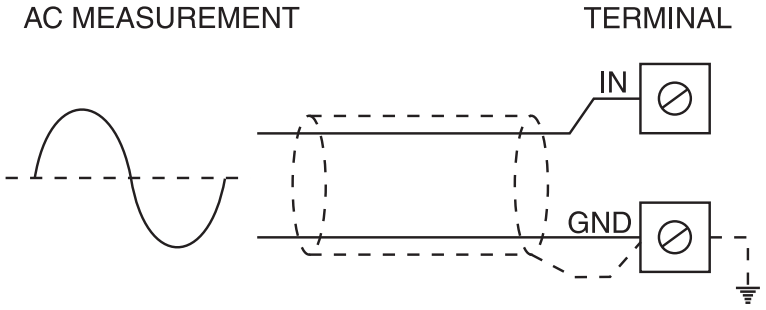


Inductive Sensor (48V RMS Max)

LK1 and LK2 see 3.12

LK3	**VCC**	out
LK4	**GND**	in or out*
LK5	**DC**	in
LK6	**BIAS**	out
LK7	**HYS**	in or out*
LK8	**LOWF**	out
LK9	**FREQ**	in
LK10	**HYS2**	in or out*

* see “Input link settings”

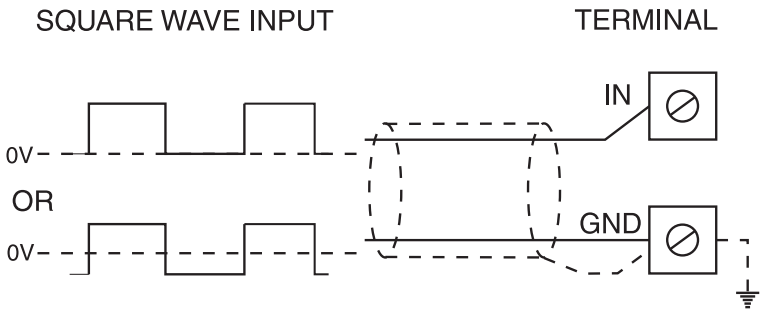


AC Measurement (48V RMS Max)

LK1 and LK2 see 3.12

LK3	**VCC**	out
LK4	**GND**	in or out*
LK5	**DC**	in or out*
LK6	**BIAS**	out
LK7	**HYS**	in or out*
LK8	**LOWF**	out
LK9	**FREQ**	in
LK10	**HYS2**	in or out*

* see “Input link settings”

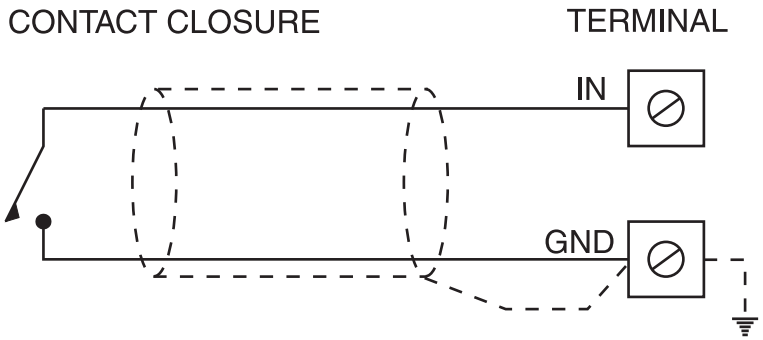


Square wave (48V Max)

LK1 and LK2 see 3.12

LK3	**VCC**	out
LK4	**GND**	in or out*
LK5	**DC**	in
LK6	**BIAS**	in or out*
LK7	**HYS**	in or out*
LK8	**LOWF**	out
LK9	**FREQ**	out
LK10	**HYS2**	in or out*

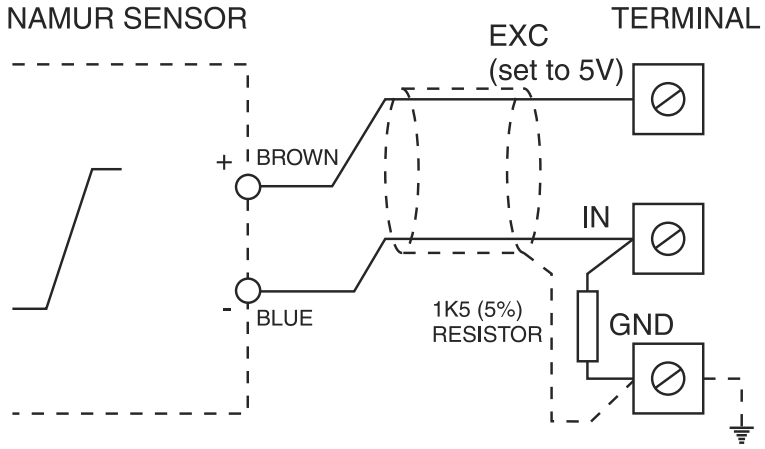
* see “Input link settings”



Switch contact

LK1 and LK2 see 3.12

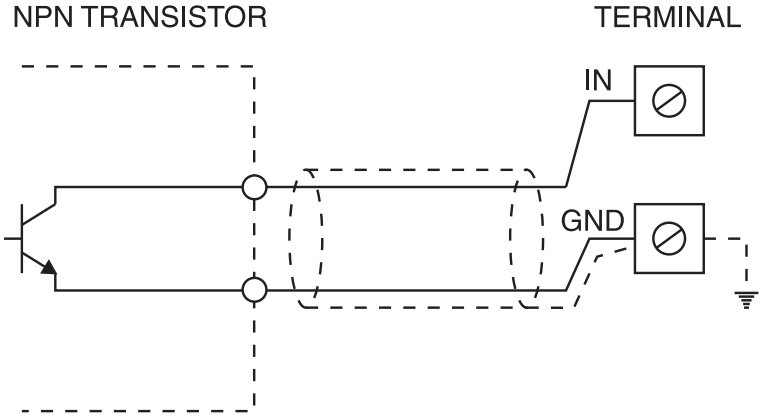
LK3	**VCC**	in
LK4	**GND**	out
LK5	**DC**	in
LK6	**BIAS**	in
LK7	**HYS**	in
LK8	**LOWF**	in
LK9	**FREQ**	out
LK10	**HYS2**	out



Namur sensor

LK1 and LK2 see 3.12

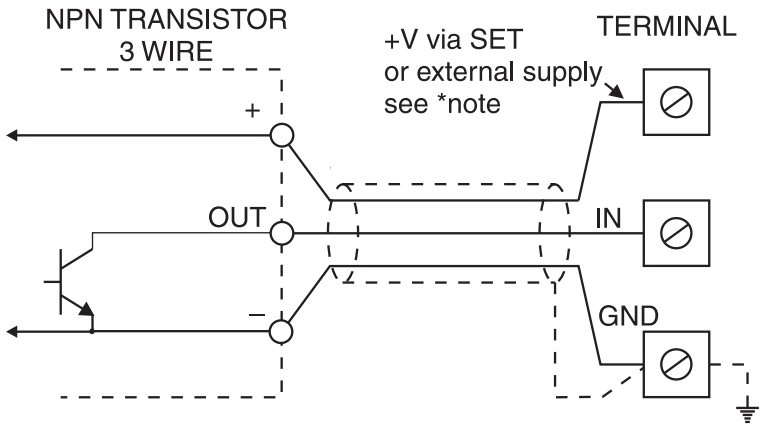
LK3	**VCC**	out
LK4	**GND**	in
LK5	**DC**	in
LK6	**BIAS**	in
LK7	**HYS**	in
LK8	**LOWF**	out
LK9	**FREQ**	out
LK10	**HYS2**	out



2 Wire NPN

LK1 and LK2 see 3.12

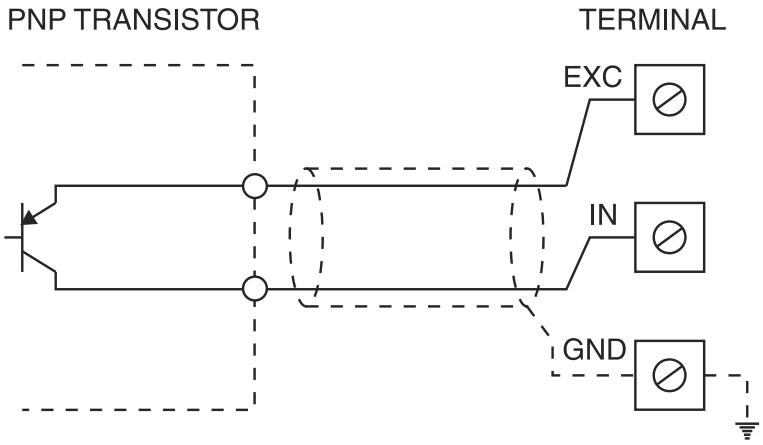
LK3	**VCC**	in
LK4	**GND**	out
LK5	**DC**	in
LK6	**BIAS**	in
LK7	**HYS**	in
LK8	**LOWF**	out
LK9	**FREQ**	out
LK10	**HYS2**	out



3 wire NPN

LK1 and LK2 see 3.12

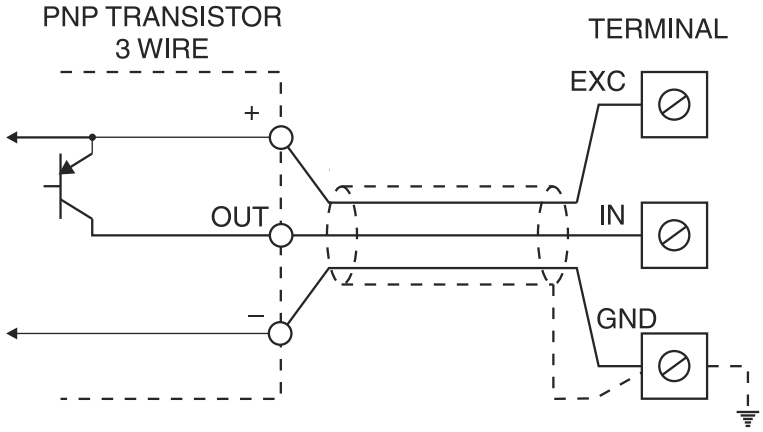
LK3	**VCC**	in
LK4	**GND**	out
LK5	**DC**	in
LK6	**BIAS**	in
LK7	**HYS**	in
LK8	**LOWF**	out
LK9	**FREQ**	out
LK10	**HYS2**	out



2 wire PNP

LK1 and LK2 see 3.12

LK3	**VCC**	out
LK4	**GND**	in
LK5	**DC**	in
LK6	**BIAS**	in
LK7	**HYS**	in
LK8	**LOWF**	out
LK9	**FREQ**	out
LK10	**HYS2**	out



3 wire PNP

LK1 and LK2 see section 3.12

LK3	**VCC**	out
LK4	**GND**	in
LK5	**DC**	in
LK6	**BIAS**	in
LK7	**HYS**	in
LK8	**LOWF**	out
LK9	**FREQ**	out
LK10	**HYS2**	out

3.12 Input link settings

LK1 and LK2. An internal power supply allows the **EXC** input to be used to give a sensor supply output of either 5VDC (LK2) regulated or 18 to 24VDC (LK1) unregulated. When using this output as a sensor supply ensure that only one link (LK1 or LK2) is in.

The **DC** link LK5 should be in for maximum input frequencies of less than 10Hz.

For inputs above 24V both the **VCC** LK3 and **GND** LK4 link should be out.

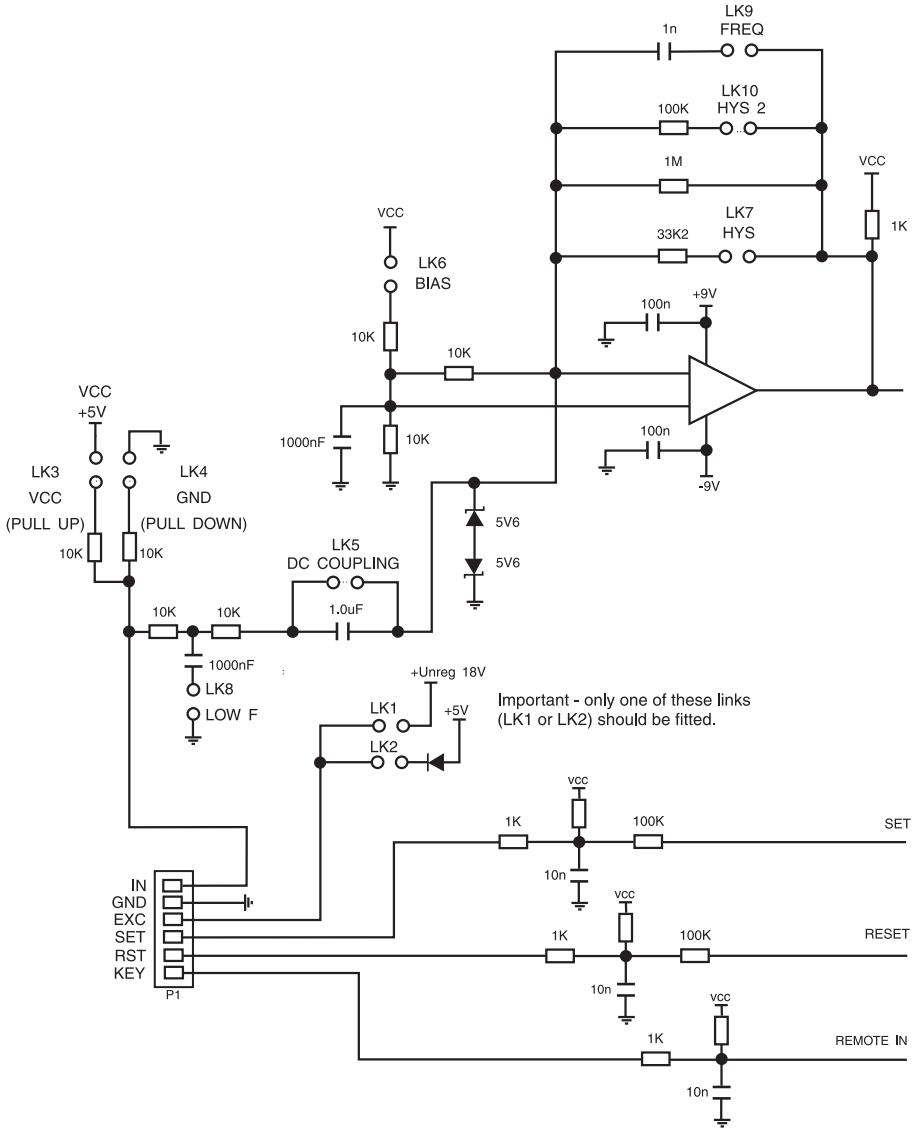
The **BIAS** link LK6 should be in when input signal does not go below 0V.

HYS link LK7 should be in for signals greater than 5V (48VDC or RMS max). **HYS2** link LK10 should be in for signals greater than 1V but less than 5V. Only one hysteresis link should be fitted i.e either LK7 or LK10. For signals lower than 1V both links should be out (100mV minimum signal). Having both links out is not normally recommended since the instrument will be prone to pick up both low signal levels and noise.

The **LOW F** link LK8 is used to provide a low pass filter. When this link is in frequencies above approx. 80Hz will be filtered out and will not appear as an input. This link should be in for contact closure inputs e.g. switches and relays when the maximum input frequency is less than 80Hz. This link can also be left in to filter out high frequency interference for any input type when the maximum input frequency is below 80Hz.

The **FREQ** link LK9 should generally be left out. It can used when the display is having difficulty registering sinewave AC inputs. If at high frequency (above 10kHz) and with input signals above 2VRMS difficulty is found in obtaining a stable display this link can be tried and it may in some circumstances help to stabilise the display.

3.13 Input circuit



4 Function table - for rate/frequecy only display

The function table below shows the functions which will be seen when the **SEt OPEr** function is set to **FrEq**.

Note: the order in which the functions appear on the display may not be exactly as shown below. The availability and order of functions is determined by choice of function settings and options fitted.

Functions in this first table are available in **FUnC** or **CAL** mode

Display	Function	Range	Default	Your record	Ref/Page
A 1Lo	Low setpoint value for alarm relay 1	Any display value or **OFF**	**OFF**		7.8 / 27
A 1H,	High setpoint value for alarm relay 1	Any display value or **OFF**	**OFF**		7.9 / 28
A2Lo	Low setpoint value for alarm relay 2	Any display value or **OFF**	**OFF**		7.10 / 28
A2H,	High setpoint value for alarm relay 2	Any display value or **OFF**	**OFF**		7.11 / 29
A 1HY	Hysteresis value for alarm relay 1	**0** to **9999**	**10**		7.12 / 29
A2HY	Hysteresis value for alarm relay 2	**0** to **9999**	**10**		7.13 / 29
A 1tt	Trip time delay for alarm relay 1	**0** to **999.9**	**0.0**		7.14 / 29
A2tt	Trip time delay for alarm relay 2	**0** to **999.9**	**0.0**		7.15 / 30
A 1rt	Reset time delay for alarm relay 1	**0.0** to **999.9**	**0.0**		7.16 / 30
A2rt	Reset time delay for alarm relay 2	**0.0** to **999.9**	**0.0**		7.17 / 30
A 1n.o or **A 1n.c**	Alarm relay 1 action to normally open or normally closed	**A 1n.o** or **A 1n.c**	**A 1n.o**		7.18 / 30
A2n.o or **A2n.c**	Alarm relay 2 action to normally open or normally closed	**A2n.o** or **A2n.c**	**A2n.o**		7.19 / 30

(*__Optional__)—this function will only be accessible if the relevant option is fitted

Functions in this second table are available only in **CAL** mode or if **ACCS** is set to **ALL**

Display	Function	Range	Default	Your record	Ref/Page
br9t AUto	Automatic display brightness adjustment	**on** or **OFF**	**OFF**		7.21 / 31
br9t	Display brightness level (manually set)	**1** to **63**	**63**		7.22 / 31
dULL	Display remote brightness switching	**0** to **63**	**15**		7.23 / 31
br9t HI 9H	Automatic display brightness adjustment - high level	**1** to **63**	**63**		7.24 / 31
br9t Lo	Automatic display brightness adjustment - low level	**1** to **63**	**10**		7.25 / 32
drnd	Display rounding	**1** to **5000**	**1**		7.26 / 32
FLtr	Digital filter	**0** to **8**	**2**		7.27 / 32
rAtE dCPt	Rate display decimal point selection	**0** to number of display digits minus 1	**0**		7.28 / 32
rAtE 1nPt	Rate input scale factor	Any display value	**1**		7.29 / 32
rAtE SCLE	Rate scale factor	Any display value	**1**		7.30 / 33

(*__Optional__)—this function will only be accessible if the relevant option is fitted

PEr d dCPt	Period display decimal point selection	0, 0.00.02 etc.	0		7.31 / 33
PEr d i nPt	Rate input scale factor	Any display value	1		7.32 / 33
PEr d SCLE	Period scale factor	Any display value	1		7.33 / 33
FrE9 rn9E	Frequency range	LoF. Hi F, AU9E or r.AU9	Hi F		7.39 / 35
FASt UPdt	Fast update	on or OFF	OFF		7.40 / 36
i nPt Ed9E	Input edge	ri SE or FALL	ri SE		7.41 / 36
di SP	Display rate or period	rAtE or PEr d	rAtE		7.42 / 36
di SP rn9E	Period display range	0, 0.0 1, 0.02 or 0.00.02	0		7.43 / 36
tout SECS	Rate display time out	1 or 9999	1		7.44 / 37
AU9E SECS	Average display seconds	1 or 9999	1		7.45 / 37
AU9E cnt	Average display counts	1 or 30	1		7.46 / 37
r.i nP	Remote input function	nonE, P.HLd, d.HLd, Hi , Lo, Hi Lo, 2Er O, SP.Ac, no.Ac, di SP, duLL, 9.rSt or StOP	nonE		7.47 / 37
P.but	P button function	nonE, Hi , Lo, Hi Lo, 2Er O, di SP, FUnC or 9.rSt	nonE		7.48 / 38
ACCS	Access mode	OFF .EASY. nonE or ALL	OFF		7.49 / 38
SPAC	Setpoint access mode	A 1.A 1-2 etc.	A 1		7.50 / 39
Lo di SP	Low overrange visual warning limit value	Any display value or OFF	OFF		7.53 / 39
Hi 9H di SP	High overrange visual warning limit value	Any display value or OFF	OFF		7.54 / 40
di SP	Display visual warning flashing mode	FLSH or -or-	FLSH		7.55 / 40
SEt OPEr	Set display operation	S.Prd, PEr d, FrE9, totL or both	FrE9		7.63 / 42
bAUd rAtE	Baud rate for serial communications (*Optional)	300.600. 1200.2400. 4800.9600. 19.2 or 38.4	9600		7.64 / 42
PrtY	Parity for serial communications (*Optional)	nonE .EUEn or odd	nonE		7.65 / 42
O.Put	Output for serial communications (*Optional)	di SP.Cont. POLL .A.buS or ñ.buS	Cont		7.66 / 42
Addr	Instrument address for serial communications (*Optional)	0 to 31	0		7.67 / 43

(*Optional)—this function will only be accessible if the relevant option is fitted

SEr. 1 tYPE	Serial communications type (*Optional)	nONE, r232 or r485	nONE		7.68 / 43
SEr.2 tYPE	Serial port 2 type (not used)	nONE, r232 or r485	nONE		7.69 / 43

(***Optional**)—this function will only be accessible if the relevant option is fitted

5 Function table - for total only display

The function table below shows the functions which will be seen when the **SEt OPEr** function is set to **totL**.

Note: the order in which the functions appear on the display may not be exactly as shown below. The availability and order of functions is determined by choice of function settings and options fitted.

Functions in this first table are available in **FUNC** or **CAL** mode

Display	Function	Range	Default	Your record	Ref/Page
A 1PS	Relay 1 pass value	Any display value	**OFF**		7.4 / 26
A2PS	Relay 2 pass value	Any display value	**OFF**		7.5 / 27
A 1Pt	Relay 1 pass time	**0.0** to **999.9**	**0.0**		7.6 / 27
A2Pt	Relay 2 pass time	**0.0** to **999.9**	**0.0**		7.7 / 27
A 1Lo	Low setpoint value for alarm relay 1	Any display value or **OFF**	**OFF**		7.8 / 27
A 1H,	High setpoint value for alarm relay 1	Any display value or **OFF**	**OFF**		7.9 / 28
A2Lo	Low setpoint value for alarm relay 2	Any display value or **OFF**	**OFF**		7.10 / 28
A2H,	High setpoint value for alarm relay 2	Any display value or **OFF**	**OFF**		7.11 / 29
A 1HY	Hysteresis value for alarm relay 1	**0** to **9999**	**10**		7.12 / 29
A2HY	Hysteresis value for alarm relay 2	**0** to **9999**	**10**		7.13 / 29
A 1tt	Trip time delay for alarm relay 1	**0** to **999.9**	**0.0**		7.14 / 29
A2tt	Trip time delay for alarm relay 2	**0** to **999.9**	**0.0**		7.15 / 30
A 1rt	Reset time delay for alarm relay 1	**0.0** to **999.9**	**0.0**		7.16 / 30
A2rt	Reset time delay for alarm relay 2	**0.0** to **999.9**	**0.0**		7.17 / 30
A 1n.o or **A 1n.c**	Alarm relay 1 action to normally open or normally closed	**A 1n.o** or **A 1n.c**	**A 1n.o**		7.18 / 30
A2n.o or **A2n.c**	Alarm relay 2 action to normally open or normally closed	**A2n.o** or **A2n.c**	**A2n.o**		7.19 / 30
P.SEt	Preset value	Any display value	**0**		7.20 / 31

(*__Optional__)—this function will only be accessible if the relevant option is fitted

Functions in this second table are available only in **CAL** mode or if **ACCS** is set to **ALL**.

Display	Function	Range	Default	Your record	Ref/Page
br9t AUto	Automatic display brightness adjustment	**on** or **OFF**	**OFF**		7.21 / 31
br9t	Display brightness level (manually set)	**1** to **63**	**63**		7.22 / 31
duLL	Display remote brightness switching	**0** to **63**	**15**		7.23 / 31
br9t HI 9H	Automatic display brightness adjustment - high level	**1** to **63**	**63**		7.24 / 31
br9t Lo	Automatic display brightness adjustment - low level	**1** to **63**	**10**		7.25 / 32
drnd	Display rounding	**1** to **5000**	**1**		7.26 / 32
tOt1 dCPt	Total display decimal point selection	**0** to number of display digits minus 1	**0**		7.34 / 33

(*__Optional__)—this function will only be accessible if the relevant option is fitted

tOtL InPt	Total input scale factor	Any display value	1		7.35 / 34
tOtI SCLE	Total scale factor	Any display value	1		7.36 / 34
trnc	Truncation	on or OFF	OFF		7.37 / 34
G.tot	Grand Total	NONE. For, rEU, POS, NEG or AbS	NONE		7.38 / 34
InPt EdGE	Input edge	rISE or FALL	rISE		7.41 / 36
r.In P	Remote input function	NONE, P.HLd, d.HLd, Hi , Lo, Hi Lo, 2Er0, SP.Ac, no.Ac, di SP, duLL, G.rSt or StOP	NONE		7.47 / 37
P.but	P button function	NONE, Hi , Lo, Hi Lo, 2Er0, di SP, FUNC or G.rSt	NONE		7.48 / 38
ACCS	Access mode	OFF.EASY. NONE or ALL	OFF		7.49 / 38
SPAC	Setpoint access mode	A1.A1-2 etc.	A1		7.50 / 39
A1.rt, A1.tL or A1.PS	Alarm relay 1 operation mode	A1.rt, A1.tL or A1.PS	A1.rt		7.51 / 39
A2.rt, A2.tL or A2.PS	Alarm relay 2 operation mode	A2.rt, A2.tL or A2.PS	A2.rt		7.52 / 39
Lo di SP	Low overrange visual warning limit value	Any display value or OFF	OFF		7.53 / 39
HI GH di SP	High overrange visual warning limit value	Any display value or OFF	OFF		7.54 / 40
di SP	Display visual warning flashing mode	FLSH or -or-	FLSH		7.55 / 40
S.In P	SET terminal input function	Lo or Hi GH	Hi GH		7.56 / 40
c.rSt	Totaliser counter reset value	2Er0 or PSEt	2Er0		7.57 / 40
c.rSt	Totaliser counter reset signal	Lo, LoE, Hi or Hi E	Lo		7.58 / 41
cntr rSt	Totaliser counter reset value	Any display value	0		7.59 / 41
A1Hi rSt	Alarm 1 high reset	on or OFF	OFF		7.60 / 41
P.On rSt	Power on reset	OFF or on	OFF		7.61 / 41
SEt OPEr	Set display operation	S.Prd, PErd, FrEQ, totL or both	FrEQ		7.63 / 42
bAUd rAtE	Baud rate for serial communications (*Optional)	300.600. 1200.2400. 4800.9600. 19.2 or 38.4	9600		7.64 / 42
PrtY	Parity for serial communications (*Optional)	NONE.EUEN or odd	NONE		7.65 / 42

(***Optional**)—this function will only be accessible if the relevant option is fitted

O.Put	Output for serial communications (*Optional)	di SP, Cont, POLL, A.buS or Ā.buS	Cont		7.66 / 42
Addr	Instrument address for serial communications (*Optional)	0 to 31	0		7.67 / 43
SEr. 1 tYPE	Serial communications type (*Optional)	nONE, r232 or r485	nONE		7.68 / 43
SEr.2 tYPE	Serial port 2 type (not used)	nONE, r232 or r485	nONE		7.69 / 43

(***Optional**)—this function will only be accessible if the relevant option is fitted

6 Function table - for both rate and total display

The function table below shows the functions which will be seen when the **SEt OPEr** function is set to **totl** .

Note: the order in which the functions appear on the display may not be exactly as shown below. The availability and order of functions is determined by choice of function settings and options fitted.

Functions in this first table are available in **FUNC** or **CAL** mode

Display	Function	Range	Default	Your record	Ref/Page
A 1PS	Relay 1 pass value	Any display value	**OFF**		7.4 / 26
A 1Pt	Relay 1 pass time	**0.0** to **999.9**	**0.0**		7.6 / 27
A2PS	Relay 2 pass value	Any display value	**OFF**		7.5 / 27
A2Pt	Relay 2 pass time	**0.0** to **999.9**	**0.0**		7.7 / 27
A 1Lo	Low setpoint value for alarm relay 1	Any display value or **OFF**	**OFF**		7.8 / 27
A 1H,	High setpoint value for alarm relay 1	Any display value or **OFF**	**OFF**		7.9 / 28
A2Lo	Low setpoint value for alarm relay 2	Any display value or **OFF**	**OFF**		7.10 / 28
A2H,	High setpoint value for alarm relay 2	Any display value or **OFF**	**OFF**		7.11 / 29
A 1HY	Hysteresis value for alarm relay 1	**0** to **9999**	**10**		7.12 / 29
A2HY	Hysteresis value for alarm relay 2	**0** to **9999**	**10**		7.13 / 29
A 1tt	Trip time delay for alarm relay 1	**0** to **999.9**	**0.0**		7.14 / 29
A2tt	Trip time delay for alarm relay 2	**0** to **999.9**	**0.0**		7.15 / 30
A 1rt	Reset time delay for alarm relay 1	**0.0** to **999.9**	**0.0**		7.16 / 30
A2rt	Reset time delay for alarm relay 2	**0.0** to **999.9**	**0.0**		7.17 / 30
A 1n.o or **A 1n.c**	Alarm relay 1 action to normally open or normally closed	**A 1n.o** or **A 1n.c**	**A 1n.o**		7.18 / 30
A2n.o or **A2n.c**	Alarm relay 2 action to normally open or normally closed	**A2n.o** or **A2n.c**	**A2n.o**		7.19 / 30
P.SEt	Preset value	Any display value	**0**		7.20 / 31

(*__Optional__)—this function will only be accessible if the relevant option is fitted

Functions in this second table are available only in **CAL** mode or if **ACCS** is set to **ALL**

Display	Function	Range	Default	Your record	Ref/Page
br9t AUto	Automatic display brightness adjustment	**on** or **OFF**	**OFF**		7.21 / 31
br9t	Display brightness level (manually set)	**1** to **63**	**63**		7.22 / 31
duLL	Display remote brightness switching	**0** to **63**	**15**		7.23 / 31
br9t HI 9H	Automatic display brightness adjustment - high level	**1** to **63**	**63**		7.24 / 31
br9t Lo	Automatic display brightness adjustment - low level	**1** to **63**	**10**		7.25 / 32
drnd	Display rounding	**1** to **5000**	**1**		7.26 / 32
FLtr	Digital filter	**0** to **8**	**2**		7.27 / 32

(*__Optional__)—this function will only be accessible if the relevant option is fitted

rAtE dCPt	Rate display decimal point selection	0 to number of display digits minus 1	0		7.28 / 32
rAtE InPt	Rate input scale factor	Any display value	1		7.29 / 32
rAtE SCLE	Rate scale factor	Any display value	1		7.30 / 33
PEr d dCPt	Period display decimal point selection	0, 0.00.02 etc.	0		7.31 / 33
PEr d InPt	Rate input scale factor	Any display value	1		7.32 / 33
PEr d SCLE	Period scale factor	Any display value	1		7.33 / 33
tOtl dCPt	Total display decimal point selection	0 to number of display digits minus 1	0		7.34 / 33
tOtL InPt	Total input scale factor	Any display value	1		7.35 / 34
tOtl SCLE	Total scale factor	Any display value	1		7.36 / 34
trnc	Truncation	on or OFF	OFF		7.37 / 34
9.tot	Grand Total	nonE. For, rEU, POS, nEG or AbS	nonE		7.38 / 34
FrEq rnGE	Frequency range	LoF. Hi F, AUGE or r.AUG	Hi F		7.39 / 35
FASt UPdt	Fast update	on or OFF	OFF		7.40 / 36
InPt EdGE	Input edge	rISE or FALL	rISE		7.41 / 36
di SP	Display rate or period	rAtE or PEr d	rAtE		7.42 / 36
di SP rnGE	Period display range	0, 0.0 1, 0.02 or 0.00.02	0		7.43 / 36
tout SECS	Rate display time out	1 or 9999	1		7.44 / 37
AUGE SECS	Average display seconds	1 or 9999	1		7.45 / 37
AUGE cnt	Average display counts	1 or 30	1		7.46 / 37
r.I nP	Remote input function	nonE, P.HLd, d.HLd, Hi , Lo, Hi Lo, 2Er0, SP.Ac, no.Ac, di SP, duLL, 9.rSt or StOP	nonE		7.47 / 37
P.but	P button function	nonE, Hi , Lo, Hi Lo, 2Er0, di SP, FUnC or 9.rSt	nonE		7.48 / 38
ACCS	Access mode	OFF .EASY. nonE or ALL	OFF		7.49 / 38
SPAC	Setpoint access mode	A 1.A 1-2 etc.	A 1		7.50 / 39

(*__Optional__)—this function will only be accessible if the relevant option is fitted

A1.rt, A1.tL or A1.PS	Alarm relay 1 operation mode	A1.rt, A1.tL or A1.PS	A1.rt		7.51 / 39
A2.rt, A2.tL or A2.PS	Alarm relay 2 operation mode	A2.rt, A2.tL or A2.PS	A2.rt		7.52 / 39
Lo dISP	Low overrange visual warning limit value	Any display value or OFF	OFF		7.53 / 39
HI 9H dISP	High overrange visual warning limit value	Any display value or OFF	OFF		7.54 / 40
dISP	Display visual warning flashing mode	FLSH or -or-	FLSH		7.55 / 40
S.InP	SET terminal input function	Lo or hi 9h	hi 9h		7.56 / 40
c.rSt	Totaliser counter reset value	ZErO or PSEt	ZErO		7.57 / 40
c.rSt	Totaliser counter reset signal	Lo, LoE, HI or HI E	Lo		7.58 / 41
cntr rSt	Totaliser counter reset value	Any display value	0		7.59 / 41
A1HI rSt	Alarm 1 high reset	on or OFF	OFF		7.60 / 41
P.On rSt	Power on reset	OFF or on	OFF		7.61 / 41
dFIt dISP	Default display	rAtE, PErd or totl	rAtE		7.62 / 41
SEt OPEr	Set display operation	S.Prd, PErd, FrEq, totL or both	FrEq		7.63 / 42
bAUd rAtE	Baud rate for serial communications (*Optional)	300.600. 1200.2400. 4800.9600. 19.2 or 38.4	9600		7.64 / 42
PrtY	Parity for serial communications (*Optional)	NONE.EVEN or odd	NONE		7.65 / 42
O.Put	Output for serial communications (*Optional)	dISP.Cont. POLL.A.buS or ñ.buS	Cont		7.66 / 42
Addr	Instrument address for serial communications (*Optional)	0 to 31	0		7.67 / 43
SEr.1 tYPE	Serial communications type (*Optional)	NONE.r232 or r485	NONE		7.68 / 43
SEr.2 tYPE	Serial port 2 type (not used)	NONE, r232 or r485	NONE		7.69 / 43

(***Optional**)—this function will only be accessible if the relevant option is fitted

7 Explanation of functions

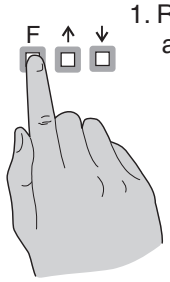
The LD display setup and calibration functions are configured through a push button sequence. The three push buttons located on the input pcb (also at the front on some display options) are used to alter settings. Two basic access modes are available:

FUNC mode (simple push button sequence) allows access to commonly set up functions such as alarm setpoints.

CAL mode (power up sequence plus push button sequence) allows access to all functions including calibration parameters.

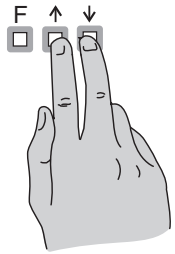
Once **CAL** or **FUNC** mode has been entered you can step through the functions, by pressing and releasing the **F** push button, until the required function is reached. Changes to functions are made by pressing the ▲ or ▼ push button (in some cases both simultaneously) when the required function is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

Entering CAL Mode



1. Remove power from the instrument and wait 5 seconds . 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. Move to step 2 below.

2. When the "wake up" messages have finished and the display has settled down to its normal reading press, then release the **F** button. Move to step 3 below.



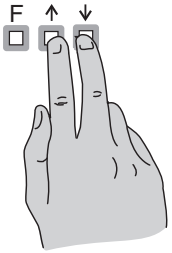
3. Within 2 seconds of releasing the **F** button press, then release the ▲ and ▼ buttons together. The display will now indicate **FUNC** followed by the first function.

Notes: 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. The instrument should show all 8's on power up e.g. **8.8.8.8.** if the instrument does not reset then these numbers will not be seen. Switch off the instrument and allow a longer time delay before powering up again.

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. Move to step 2 below.



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.

Alternative CAL Mode Entry

This alternative method allows **CAL** mode entry without the need to remove power:
1. Enter **FUNC** mode using the 2 steps above
2. When the first function appears press and hold the **P** button until you see the message **FUNC** followed by **CAL** (the **P** button will have to be held pressed for approximately 2 seconds)
3. You should now return to the function you were in but have full access to **CAL** mode functions
Note: when you exit back to live reading the display will remain in **CAL** mode for approximately 4 minutes, after this time you will need to repeat this process to enter **CAL** mode.

The description of functions in this chapter covers the three LD-TR operation modes namely **FREQ** (frequency/rate/period), **totl** (totaliser/counter) and both mode (toggle between rate and total). These modes are selected at the set operation (**SEt OPEr**) function. Individual function tables are given for each mode in the chapters which follow.

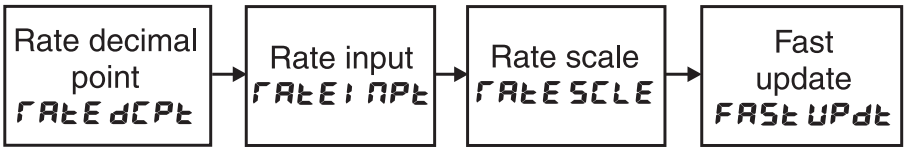
7.1 Ratemeter/Frequency or Period or Average operation

Frequency/rate/period mode operation modes. This mode is chosen by selecting FrEq at the SEt OPEr function. When in FrEq mode certain functions which relate only to totl or both modes will not be seen. The ratemeter (FrEq) 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 FrEqrnGE function the instrument acts as a general purpose frequency/ ratemeter/tachometer. If a very low frequency (below approx. 4Hz) inputs may be encountered then Lo F mode should be selected. If Hi F is 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.

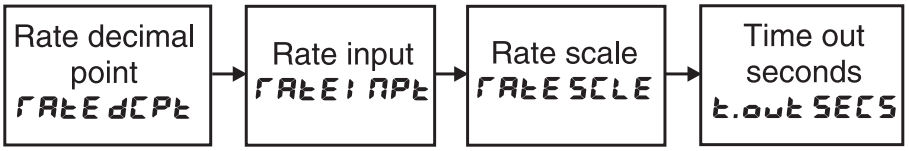
Functions specific to display with FrEqrnGE set to Hi F with a rate display



2. Rate display, low frequency

If Lo F is selected at the FrEqrnGE 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 is accomplished by allowing the user to set a "time out" value - see the tout SECS function 7.44.

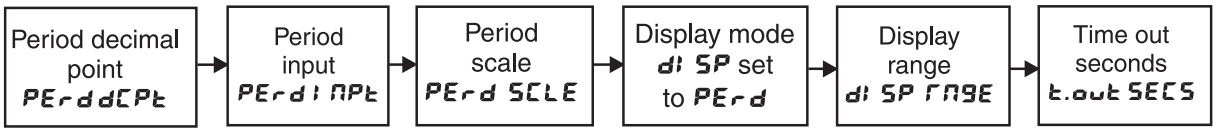
Functions specific to display with FrEqrnGE set to Lo F with a rate display



3. Period display, low frequency

With Lo F selected at the FrEqrnGE function the user has the option of either displaying the rate (rAtE) or period (PErd) of the input (chosen via the di SP 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.

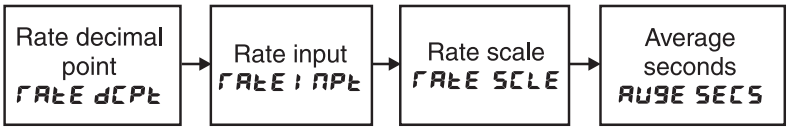
Functions specific to display with FrEqrnGE set to Lo F with a period display



4. Averaged rate display

With AUGE selected at the FrEqrnGE 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. A special "rolling averaged" mode is also selectable (r.AUG) - see FrEqrnGE function 7.39.

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



7.2 Totaliser functions

This mode is chosen by selecting **totl** at the **SEt OPEr** function. When in **totl** mode certain functions which relate only to **FrEq** or both modes will not be seen. The totaliser mode allows the instrument to be used as a single input counter/totaliser with the count direction (up/down count) being programmable or controlled via an external switch input. A grand total or accumulated total memory (**g.tot** function) provides a separately viewable and resettable total memory. An alarm relay operation unique to the total mode operation is the "pass" mode operation e.g. **A 1tl** /**A 1.PS** function. This operation mode allows the selected relay to operate for a programmable time every time the total passes a programmable value, see **A 1PS**, **A2PS**, **A 1Pt** and **A2Pt** functions.

7.3 Both mode functions

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. The ▲ and ▼ buttons can be used to toggle between total and rate (or period) displays. Alternatively a remote input contact closure can be used across terminals **GND** and **KEY**. If these terminals are to be used to toggle between displays then the remote input function **r1 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.

Easy alarm relay adjustment access facility

The display has an easy alarm access facility which allows access to the alarm setpoints 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. A remote input function such as **r.1 nP** function must be set to **SPAC** or the **ACCS** function must be set to **EASY**.
2. At least one alarm must have a setpoint, nothing will happen if all the alarm setpoints are set to **OFF**.
3. The **SPAC** 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.
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 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 functions unless the instrument is powered up in **CAL** mode.

Explanation of Functions

7.4 Relay 1 pass value

Display:	**A 1PS**
Range:	Any display value
Default Value:	**OFF**

Alarm relay 1 pass value - only seen when **SEt OPEr** is set to **totl** mode and if **A 1PS** selected at the **A 1PS**/**A 1tL** function. Displays and sets the alarm pass value. The alarm relay will activate at multiples of the pass value e.g. if **A 1PS** is set to **50** then relay 1 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 1Pt** function which follows. The pass value may be set anywhere in the display range of the instrument, positive or negative. The pass value can be set to **OFF** (disabled) by pressing the ▲ and ▼ buttons together.

7.5 Relay 2 pass value

Display: A2PS
Range: Any display value
Default Value: OFF

Alarm relay 2 pass value, operates in the same manner as the A 1PS function. See A 1PS for description.

7.6 Relay 1 pass time

Display: A 1Pt
Range: 0.0 to 999.9
Default Value: 0.0

Alarm relay 1 pass time - only seen when SEt OPEr is set to toti or both mode and if A 1PS selected at the A 1PS/A 1tL function. Note: on electromagnetic displays the decimal point needs to be taken into account e.g. 10.0 seconds may appear as 100 on an electromagnetic display with no decimal point positioned. Displays and sets the alarm relay 1 pass time in seconds and 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 value. e.g. if set to 2.0 with a A 1PS 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 LD 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.

7.7 Relay 2 pass time

Display: A2Pt
Range: 0.0 to 999.9
Default Value: 0.0

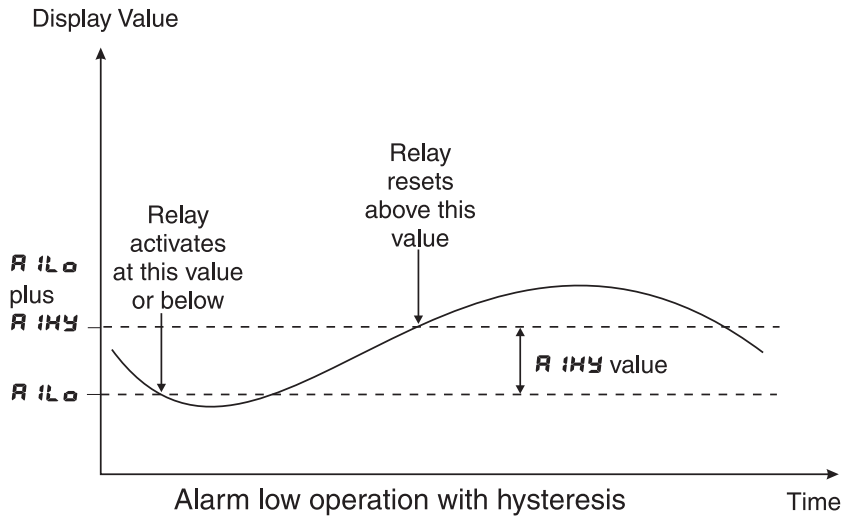
Alarm relay 2 pass time, operates in the same manner as the A 1Pt function. See A 1Pt for description.

7.8 Alarm relay 1 low setpoint

Display: A 1Lo
Range: Any display value or OFF
Default Value: OFF

Displays and sets the low setpoint value for alarm relay 1. Use this low setpoint function if a relay operation is required when the display value becomes equal to or less than the low setpoint value. To set a low alarm value go to the A 1Lo function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value. The low alarm setpoint may be disabled by pressing the ▲ and ▼ push buttons simultaneously. When the alarm is disabled the display will indicate OFF. If the relay is allocated both a low and high setpoint then the relay will activate when the value displayed moves outside the band set by the low and high setpoints. The value at which the relay will reset is controlled by the A 1HY function.

Example:
If A 1Lo is set to 10 then relay 1 will activate when the display value is 10 or less.

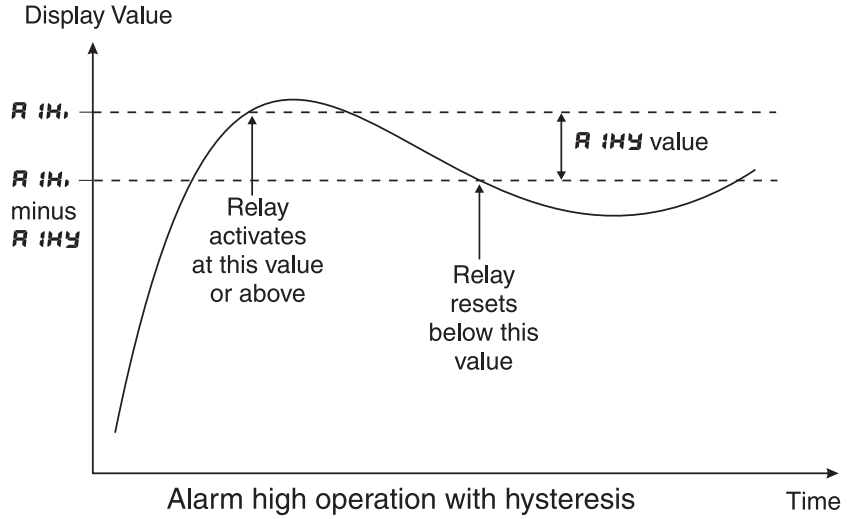


7.9 Alarm relay 1 high setpoint

Display: A 1H,
Range: Any display value or OFF
Default Value: OFF

Displays and sets the high setpoint value for alarm relay 1. Use this high setpoint function if a relay operation is required when the display value becomes equal to or more than the low setpoint value. To set a high alarm value go to the A 1H, function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value. The high alarm setpoint may be disabled by pressing the ▲ and ▼ push buttons simultaneously. When the alarm is disabled the display will indicate OFF. If the relay is allocated both a low and high setpoint then the relay will activate when the value displayed moves outside the band set by the low and high setpoints. The value at which the relay will reset is controlled by the A 1HY function.

Example:
If A 1H, is set to 100 then relay 1 will activate when the display value is 100 or higher.



7.10 Alarm relay 2 low setpoint

Display: A2Lo
Range: Any display value or OFF
Default Value: OFF

Displays and sets the low setpoint value for alarm relay 2 which operates in the same manner as the A 1Lo function. See A 1Lo function for further description.

7.11 Alarm relay 2 high setpoint

Display: A2H,
Range: Any display value or OFF
Default Value: OFF

Displays and sets the high setpoint value for alarm relay 2 which operates in the same manner as the A 1H, function. See A 1H, function for further description.

7.12 Alarm relay 1 hysteresis (deadband)

Display: A 1HY
Range: 0 to 9999
Default Value: 10

Displays and sets the alarm relay hysteresis limit for relay 1. To set a relay hysteresis value go to the A 1HY function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value. The hysteresis value is common to both high and low setpoint values. The hysteresis value may be used to prevent too frequent operation of the relay when the measured value is rising and falling around setpoint value. e.g. if A 1HY is set to zero the alarm will activate when the display value reaches 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 1H, is to 50.0 and A 1HY is set to 3.0 then the setpoint output relay will activate once the display value goes to 50.0 or above and will reset when the display value goes below 47.0 i.e. at 46.9 or below. 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 to 20.0 and A 1HY is set to 10.0 then the alarm output relay will activate when the display value falls to 20.0 or below and will reset when the display value goes above 30.0 i.e at 30.1 or above. The hysteresis units are expressed in displayed engineering units.

Example:
If A 1H, is set to 100 and A 1HY is set to 10 then relay 1 will activate when the display value is 100 or higher and will reset at a display value of 89 or lower.

7.13 Alarm relay 2 hysteresis (deadband)

Display: A2HY
Range: 0 to 9999
Default Value: 10

Displays and sets the alarm relay hysteresis limit for relay 2 which operates in the same manner as the A 1HY function. See A 1HY function for further description.

7.14 Alarm relay 1 trip time

Display: A 1tt
Range: 0 to 999.9
Default Value: 0.0

Displays and sets the alarm trip time in seconds and tenths of seconds. The trip time is common for both alarm high and low setpoint values. The trip time provides a time delay before the alarm relay will activate when an alarm condition is present. The alarm condition must be present continuously for the whole trip time period before the alarm will activate. If the input moves out of alarm condition during this period the timer will reset and the full time delay will be restored. This trip time delay is useful for preventing an alarm trip due to short non critical deviations from setpoint. The trip time is selectable over 0.0 to 999.9 seconds. To set a trip time value go to the A 1tt function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value.

Example:
If A 1tt is set to 5.0 seconds then the display must indicate an alarm value for a full 5 seconds before relay 1 will activate.

7.15 Alarm relay 2 trip time

Display: A2tt
Range: 0 to 999.9
Default Value: 0.0

Displays and sets the alarm trip time in seconds and tenths of seconds for relay 2 and operates in the same manner as the A 1tt function. See A 1tt for further description.

7.16 Alarm relay 1 reset time

Display: A 1rt
Range: 0.0 to 999.9
Default Value: 0.0

Displays and sets the alarm reset delay time in seconds and tenths of seconds. The reset time is common for both alarm high and low setpoint values. With the alarm condition is removed the alarm relay will stay in its alarm condition for the time selected as the reset time. If the input moves back into alarm condition during this period the timer will reset and the full time delay will be restored. The reset time is selectable over 0.0 to 999.9 seconds. To set a reset time value go to the A*x*rt function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value.

Example:
If A 1rt is set to 10.0 seconds then the resetting of alarm relay 1 will be delayed by 10 seconds.

7.17 Alarm relay 2 reset time

Display: A2rt
Range: 0.0 to 999.9
Default Value: 0.0

Displays and sets the alarm reset time in seconds and tenths of seconds for relay 2 and operates in the same manner as A 1rt function. See A 1rt for further description.

7.18 Alarm relay 1 normally open/closed

Display: A 1n.o or A 1n.c
Range: A 1n.o or A 1n.c
Default Value: A 1n.o

Displays and sets the setpoint alarm relay 1 action to normally open (de-energised) or normally closed (energised), when no alarm condition is present. Since the relay will always open when power is removed a normally closed alarm is often used to provide a power failure alarm indication. To set the alarm alarm for normally open or closed go to the A 1n.o or A 1n.c function and use the ▲ or ▼ push buttons to set the required operation then press F to accept this selection.

Example:
If set to A 1n.o alarm relay 1 will be open circuit when the display is outside alarm condition and will be closed (short circuit across terminals) when the display is in alarm condition.

7.19 Alarm relay 2 normally open/closed

Display: A2n.o or A2n.c
Range: A2n.o or A2n.c
Default Value: A2n.o

Displays and sets the setpoint alarm relay 2 action to normally open (de-energised) or normally closed (energised) and operates in the same manner as the A 1n.o or A 1n.c function. See A 1n.o or A 1n.c for further description.

7.20 Preset value

Display: P.SEt
Range: Any display value
Default Value: 0

A preset value can be entered at this function, for totaliser operation only. If a remote input (r.i nP function) or P button (P.but function) is programmed to P.SEt then operation of the remote input or P button will cause the display to change to the preset value. Any change in input from this point will cause a variation above or below the preset value. To set preset value go to the P.SEt function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value. **Example:**
With a display showing a value of 50 at a given input if the P.SEt function is set to 70 and the remote function is set to P.SEt then once the remote input is activated the same input will now have a display value of 70.

7.21 Automatic display brightness adjustment

Display: br9t AUto
Range: on or OFF
Default Value: OFF

Automatic display brightness adjustment. Not applicable unless the optional light sensor is fitted. The automatic brightness adjustment uses the optional light sensor to gauge the required brightness level for the environment. The high and low brightness limits are set at the br9t HI 9H and br9t Lo functions described below. If the light sensor is not fitted this function should be set to OFF.

7.22 Display brightness (manually set)

Display: br9t
Range: 1 to 63
Default Value: 63

Seen only when br9t AUto is set to OFF. Displays and sets the digital display brightness. The display brightness is selectable from 1 to 63, where 1 = lowest intensity and 63 = highest intensity. This function is useful for improving the display readability in dark areas or to reduce the power consumption of the instrument. See also the dULL function 7.23. To set brightness level go to the br9t function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value.

7.23 Display remote brightness switching

Display: dULL
Range: 0 to 63
Default Value: 15

Displays and sets the level for remote input brightness switching, see r.i nP function. When a remote input is set to dULL the remote input can be used to switch between the display brightness level set by the br9t function 7.22 and the display brightness set by the dULL function. The display dull level is selectable from 0 to 63, where 0 = lowest intensity and 63 = highest intensity. This function is useful in reducing glare when the display needs to be viewed in both light and dark ambient light levels. To set dull level go to the dULL function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value.

Example:
With dULL set to 15 and br9t set to 63 and the r.i nP function set to dULL the display brightness will change from the 63 level to 15 when a switch connected to the remote input terminals is activated.

7.24 Automatic display brightness adjustment - high level

Display: br9t HI 9H
Range: 1 to 63
Default Value: 63

Automatic brightness high level - seen only when br9t AUto is set to on. The high brightness level sets the maximum brightness which the automatic brightness control can achieve with 63 being the highest intensity.

7.25 Automatic display brightness adjustment - low level

Display: brgt Lo
Range: 1 to 63
Default Value: 10

Automatic brightness low level - seen only when brgt AUto is set to on. The high brightness level sets the minimum brightness which the automatic brightness control can achieve with 63 being the highest intensity.

7.26 Display rounding

Display: drnd
Range: 1 to 5000
Default Value: 1

Displays and sets the display rounding value. This value may be set to 1 - 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. To set the display rounding value go to the drnd function and use the ▲ or ▼ push buttons to set the required value then press F to accept this selection.

Example: If set to 10 the display values will change in multiples of 10 only i.e. display moves from 10 to 20 to 30 etc.

7.27 Digital filter

Display: FLtr
Range: 0 to 8
Default Value: 2

Displays and sets the digital filter value. Digital filtering uses a weighted average method of determining the display value and is used for reducing display value variation due to short term interference. The digital filter range is selectable from 0 to 8, where 0 = none and 8 = most filtering. Use ▲ or ▼ at the FLtr function to alter the filter level if required. Note that the higher the filter setting the longer the display may take to reach its final value when the input is changed, similarly the relay operation and any output options will be slowed down when the filter setting is increased. To set the digital filter value go to the FLtr function and use the ▲ or ▼ push buttons to set the required value then press F to accept this selection.

7.28 Rate display decimal point selection

Display: rAtE dCPt
Range: 0 to number of display digits minus 1
Default Value: 0

Rate decimal point selection - only seen when FrEq or both mode selected. Note: electromagnetic displays require the decimal point to be mechanically fixed in position, the decimal point functions are included for use with serial communications rather than display purposes. 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. 2.4), 0.02 gives 2 decimal point places (e.g. 2.35) 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 6 digit display can have 5 decimal points 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.

7.29 Rate input scale factor

Display: rAtE InPt
Range: Any display value
Default Value: 1

Rate input scale factor - only seen when FrEq or both mode selected. 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 and formula below.

7.30 Rate scale factor

Display: rAtE SCLE
Range: Any display value
Default Value: 1

Rate scale factor - only seen when FrEq or both mode selected. 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:

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

Note: if either the rate input or rate scale factor are set to 0 the scaling will be 1:1 i.e. a 1Hz input will give a display of 1 i.e. it is assumed that there are no scaling factors.
Example: If an encoder sensing revolutions of a shaft puts out 20 pulses per revolution a rAtE I nPt of 20 and a rAtE SCLE of 60 will give a display in RPM. Note as the display value is calculated from the ratio between rAtE I nPt and rAtE SCLE settings of rAtE I nPt = 1 and rAtE SCLE = 3 will give the same result.

7.31 Period display decimal point selection

Display: PEr d dCPt
Range: 0, 0.00.02 etc.
Default Value: 0

Period decimal point selection - only seen when di SP function is set to PEr d. Note: electromagnetic displays require the decimal point to be mechanically fixed in position, the decimal point functions are included for use with serial communications rather than display purposes. 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.

7.32 Period input scale factor

Display: PEr d I nPt
Range: Any display value
Default Value: 1

Period input scale factor - only seen when di SP function is set to PEr d. Displays and sets the number of time period to be used with the period scale function to generate the display scaling. See examples later in this chapter and formula below.

7.33 Period scale factor

Display: PEr d SCLE
Range: Any display value
Default Value: 1

Period scale factor - only seen when di SP function is set to PEr d. 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:

$$\text{Display} = \frac{\text{Input period (seconds)} \times \text{PEr dSCLE}}{\text{PEr d I nPt}}$$

Note: the displayed value is also affected by the decimal point and display range settings.

7.34 Total display decimal point selection

Display: tOt I dCPt
Range: 0 to number of display digits minus 1
Default Value: 0

Total decimal point selection - only seen when tOt I or both mode selected. Note: electromagnetic displays

require the decimal point to be mechanically fixed in position, the decimal point functions are included for use with serial communications rather than display purposes. Displays and sets the decimal point position for the total 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. **2.4**), **0.02** gives 2 decimal point places (e.g. **2.35**) 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 6 digit display can have 5 decimal points etc. Note: If the number of decimal points is altered then the display scaling figure (**totl SCLE**) will also be affected. Always check the scaling figure following a decimal point change and alter as required.

7.35 Total input scale factor

Display: **tOtL I nPt**
Range: Any display value
Default Value: **1**

Total input scale factor - only seen when **tOtI** or **both** mode selected. 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 and the formula below.

7.36 Total scale factor

Display: **tOtI SCLE**
Range: Any display value
Default Value: **1**

Total scale factor - only seen when **tOtI** or **both** mode selected. Displays and sets the scale factor to be used with the total input setting. Scale and input work together to produce a display as follows:

$$New\,total \;=\; Old\,total \;+\; \left(\frac{Input\,pulses\,counted \;\times\; Total\,Scale}{Total\,Input}\right)$$

7.37 Truncation

Display: **trnc**
Range: **on** or **OFF**
Default Value: **OFF**

Totaliser truncation - only seen when **totL** or **both** mode selected. When set to **OFF** the display will round up to the nearest total value. When set to on the display will not round up. For example with **totL I nPt** set to **10** and **totL SCLE** set to **1** (i.e. 10 pulses for 1 count) and with the display just reset to zero if truncation is **OFF** then after 6 input pulses the display will round up to show **1**. With truncation set to **on** the display will not show **1** until the full 10 input pulses have been received.

7.38 Grand total

Display: **G.tot**
Range: **nONE**. **For**, **rEU**, **POS**, **nEG** or **AbS**
Default Value: **nONE**

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**, **totI** or **Gtot** to indicate what the following total display is showing. To reset the grand total the remote input must be set to **GrSt**, see the **rI nP** function. Six modes of grand total display are provided namely:

nONE - no grand total display
For - Forward
rEU - Reverse
POS - Positive
nEG - Negative
AbS - Absolute

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.

These modes allow a choice of how the grand total will be displayed. The total may be switched between up and down count via the "SET" input and the SI NP function. Ensure that the "SET" link is in before attempting to use this input to change count direction. The following table illustrates each mode of operation.

7.39 Frequency range

Display: FrEq rnGE
Range: LoF, Hi F, AUGE or r.AUG
Default Value: Hi F

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 3Hz 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 pulses.

Select r.AUG for a "rolling averaged" display (note the filter FLtr function is not available when this mode is selected). The rolling average allows the frequency/rate reading to be averaged over a period set by the AUGE SECS function but this average is taken over a programmable number of counts set at the AUGE Cnt function. For example if the with the FrEqrnGE function set to r.AUG (rolling average), the AUGE SECS function set to 300 (300 seconds or 5 minutes) and the AUGE Cnt (average count) function set to 12 the display will be averaged and updated every 5 minutes with each new update showing not the average of the last 5 minutes but the average of the last 12 x 5 minute (1 hour) time periods.

For this example starting with a zero display a steady input scaled to read 1200 per hour would read 100 after the first 5 minutes, 200 after the second 5 minutes etc. up to 1200 after 1 hour (12 x 5 minutes). Beyond this time the display will update every 5 minutes showing the average over the last 12 x 5 minute time periods. The rate will be zeroed when the display is switched off of if the input stops for a sufficient time to allow the rate to fall to zero.

7.40 Fast update

Display: FAST UPdt
Range: on or OFF
Default Value: OFF

Seen only when SEt OPEr is set to FrEq and FrEq rnGE set to HI F. With FAST UPdt set to OFF the relay updates will take place approximately twice per second. With FAST UPdt set to on the relay updates will take place approximately six times per second.

7.41 Input edge

Display: I nPt EdGE
Range: rI SE or FALL
Default Value: rI SE

Displays and sets the pulse input edge on which triggering will occur. If set to rI SE then the rising edge of the input pulse will trigger the input. If set to FALL then the falling edge of the input pulse will trigger the input. This function can be useful if one of the edges provides a better switching input than the other e.g. if there is a long rise time in the pulse input but a sharp fall time then select FALL as this will give a more definite pulse transition.

7.42 Display rate or period

Display: dI SP
Range: rAtE or PEr d
Default Value: rAtE

Period or rate display - This function is only seen when the FrEq rnGE function is set to LoF. When using the LoF 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).

7.43 Period display range

Display: dI SP rnGE
Range: 0, 0.0 1, 0.02 or 0.00.02
Default Value: 0

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). Note: on electromagnetic display types the decimal point position must be mechanically fixed.

The 0 option allows a display in 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 (5 and 6 digit displays only). The 0.02 option is available only on 4 digit displays.

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 6 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	0.00.0 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	0.50.00

With the PERd1 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 and seconds. The table below gives some examples.

d1 SP rnGE	PERd dCPt	PERd1 nPt	PERd SCLE	Actual Period	Value displayed
0.00.02	0.00.02	1000	0.00.01	1m 15sec	0.01.15
0.00.02	0.00.02	1000	0.00.01	2h 12m 30sec	2.12.30

7.44 Rate display time out

Display: tout SECS
Range: 1 or 9999
Default Value: 1

Only seen if LoF is selected under the FrEQrnGE 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 holds 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 if displaying rate or -or- if displaying period.

7.45 Average display seconds

Display: AUGE SECS
Range: 1 or 9999
Default Value: 1

Only seen if AUGE or r.AUG is selected under the FrEQrnGE 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.

7.46 Average display counts

Display: AUGE cnt
Range: 1 or 30
Default Value: 1

Only seen if r.AUG is selected at the FrEQrnGE function. Sets the number of time periods counted over which the rolling average display will be calculated. For example if the AUGE SECS is set to 60 and the AUGE cnt is set to 10 then the rolling average displayed will be the average of the last ten 60 second averaged periods.

7.47 Remote input function

Display: r.1 nP
Range: nonE, P.HLd, d.HLd, Hi , Lo, Hi Lo, 2Er0, SP.Ac, no.Ac, d1 SP, duLL, 9.rSt or StOP
Default Value: nonE

Terminals labelled KEY and GND are the remote input terminals. When these terminals 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. **P Hi** or **P Lo** will flash before each display to give an indication of display type. If the short circuit is held for 1 to 2 seconds then the memory will be cleared.

ZERO - zero the display. The total will be reset when the remote input is short circuited. If the **c.rSt** function is set to **ZERO** then the display will zero when reset. If the **c.rSt** function is set to **P.SEt** then the display will go to the preset value when reset. This function is not applicable to rate or period displays.

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. With the **SEt OPEr** function set to both this function will cause the display to toggle from the default display to the alternate display when the remote input pins are short circuited i.e allows toggling between the rate and total display. When the alternate display is being viewed a message will flash every 8 seconds to indicate that the alternate display is being shown e.g. if rate is the alternate display the message **rAtE** will be seen momentarily once every 8 seconds whilst the display is showing rate.

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. Not applicable to electromagnetic displays.

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.

StOP - totiser inhibit - the total display value will be held and any input pulses ignored whilst the remote input is short circuited. Not applicable to rate display.

7.48 P button function

Display: **P.but**
Range: **none**, **Hi** , **Lo**, **Hi Lo**, **ZERO**, **di SP**, **FUNC** or **G.rSt**
Default Value: **none**

The P button may be set to operate one chosen special function. This button is located on the main circuit board (remote pushbuttons optionally available). 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 available functions, except for **FUNC**, are as described in the **r.I np** function above. The **FUNC** function is used only in totalising and can be used to adjust the preset value. When set to **FUNC** the message **P.SEt** will appear when the P button is pressed. The operator can then adjust the preset via the ▲ or ▼ button, F is then pressed to accept the change. A message **End** will be seen when the new preset value is accepted. When the total is next reset the display will reset to the new preset value if the **c.rSt** function is set to **P.SEt**.

7.49 Access mode

Display: **ACCS**
Range: **OFF**,**EASY**,**none** or **ALL**
Default Value: **OFF**

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 page 26. 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 and calibration functions. If set to **ALL** then access to all functions, including calibration functions, can be gained via **FUNC** mode.

7.50 Setpoint access mode

Display: **SPAC**
Range: **A 1**,**A 1-2** etc.
Default Value: **A 1**

Setpoint access - sets the access via **FUNC** mode and "easy alarm access" mode to the alarm relay setpoints. The following choices are available:
A 1 - Allows setpoint access to alarm 1 only.
A 1-2 - Allows setpoint access to alarms 1 and 2 only.
A 1-3 - Allows setpoint access to alarms 1,2 and 3 etc. up to the maximum number of relays fitted.
The remote input function (**r.1 nP**) must be set to **SP.AC** for this function to operate. Note: Only the setpoints which have been given a value will be accessible e.g. if **A 1H,** is set to **OFF** then there will be no access to the **A 1H,** function when **SPAC** is used.

7.51 Alarm relay 1 operation mode

Display: **A 1.rt**, **A 1.tL** or **A 1.PS**
Range: **A 1.rt**, **A 1.tL** or **A 1.PS**
Default Value: **A 1.rt**

This function is used to set the operation mode for relay 1. Choices available depend on the **SEt OPEr** function setting. With **SEt OPEr** set to **both** mode alarm relay 1 can be set to operate as either a standard setpoint relay operating from rate when **A 1.rt** is selected or total when **A 1.tL** is selected or as a totliser "pass value" relay when **A 1.PS** is selected. In **totL** mode **A 1.tL** or **A 1.PS** may be selected. In **FrEq** mode this function will not appear.

With **A 1.rt** or **A 1.tL** selected relay 1 will operate from the high and/or low setpoints (**A 1H,** and **A 1Lo**) and values for hysteresis, trip time, reset time, normally open/normally closed operation and setpoint or trailing alarms can also be set. The pass functions **A 1PS** and **A 1Pt** will not be seen if the **A 1.tL** or **A 1.rt** mode is selected. With **A 1.PS** selected relay 1 will operate on a pass value i.e. it will operate on multiples of the **A 1PS** value set. The setpoint functions **A 1Lo**, **A 1H,** , **A 1HY**, **A 1tt**, **A 1rt**, **A 1SP**/**A 1tL** will not be seen if the **A 1PS** mode is selected.

7.52 Alarm relay 2 operation mode

Display: **A2.rt**, **A2.tL** or **A2.PS**
Range: **A2.rt**, **A2.tL** or **A2.PS**
Default Value: **A2.rt**

Operates in the same manner as **A 1.rt**, **A 1.tL** or **A 1.PS** but sets the operation mode for relay 2. Refer to the **A 1.rt**, **A 1.tL** or **A 1.PS** function for further description.

7.53 Low overrange visual warning limit value

Display: **Lo di SP**
Range: Any display value or **OFF**
Default Value: **OFF**

Low overrange limit value - the display can be set to show an overrange message if the display value falls below the **Lo di SP** setting. For example if **Lo di SP** is set to **50** then once the display reading falls below **50** the message **-or-** will flash on and off or the display value will flash on and off instead of the normal display units (see **di SP** function 7.55). This message can be used to alert operators to the presence of an input which is below the low limit. If this function is not required it should be set to **OFF** by pressing the ▲ and ▼ buttons simultaneously at this function.

7.54 High overrange visual warning limit value

Display: HI 9H dI SP
Range: Any display value or OFF
Default Value: OFF

High overrange limit value - the display can be set to show an overrange message if the display value rises above the HI 9H dI SP setting. For example if HI 9H dI SP is set to 1000 then once the display reading rises above 1000 the message -or- will flash on and off or the display value will flash on and off instead of the normal display units (see dI SP function 7.55). This message can be used to alert operators to the presence of an input which is above the high limit. If this function is not required it should be set to OFF by pressing the ▲ and ▼ buttons simultaneously at this function.

7.55 Display visual warning flashing mode

Display: dI SP
Range: FLSH or -or-
Default Value: FLSH

Display overrange warning flashing mode - this function is used in conjunction with the Lo dI SP and HI 9H dI SP functions. The dI SP function can be set to FLSH or -or-. If the display warning value set at the Lo dI SP or HI 9H dI SP function is exceeded and the dI SP function is set to FLSH then the display value will flash on and off every second as a visual warning. If the display warning value set at the Lo dI SP or HI 9H dI SP function is exceeded and the dI SP function is set to -or- then the -or- message will flash on and off once a second as a visual warning. The warning flashes will cease and the normal display value will be seen when the value displayed is higher than the low limit and lower than the high limit.

7.56 SET terminal input function

Display: S.I nP
Range: Lo or hI 9h
Default Value: hI 9h

Sets, in conjunction with the SET terminal input, the count up/down operation of the totaliser. The totaliser may be made to count up or count down via this function and if required made to toggle between up and down count mode using an external contact closure between SET and GND terminals. The S.I nP function and the SET terminal input connection may be used in one of the modes shown in the table below.

S.I nP Setting	SET terminal	Operation mode
Lo	Open i.e. no connection to SET terminal	Count down
Lo	Closed i.e. SET terminal shorted to GND terminal	Count up
hI 9h	Open i.e. not connection to SET terminal	Count up
hI 9h	Closed i.e. SET terminal shorted to GND terminal	Count down

7.57 Totaliser counter reset value

Display: c.rSt
Range: ZERO or PSEt
Default Value: ZERO

The reset terminal operation can be programmed to cause the display to reset to either zero or the selected preset value. Choose either ZERO or PSEt to select the required operation. PSEt is most commonly selected when the display is required to count down (S.I nP set to Lo) from a preset value.

7.58 Totaliser counter reset signal

Display: c.rSt
Range: Lo, LoE, Hi or Hi E
Default Value: Lo

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 terminal will force a reset, the display will continuously reset whilst the input is low. If set to Hi a high input level or open switch on the reset terminal will force a reset, the display will continuously reset whilst the reset line is high. If set to LoE then a falling edge or switch closure on the reset terminal will force a reset. If set to Hi E then a rising edge or switch opening on the reset terminal will force a reset.

7.59 Totaliser counter reset value

Display: cntr rSt
Range: Any display value
Default Value: 0

The counter reset value function allows a number to be set at which the display will automatically reset. The automatic counter reset function can be disabled by setting the function to 0. This function is only applicable to upward counting applications i.e. the total is increasing. For example if cntr rSt is set to 100 and c.rSt is set to 2Er0 then when the display value reaches 99 the next input pulse will cause the instrument to automatically reset to 0. If the cntr rSt function is set to 0 then the display will not automatically reset and when the count has gone below the display limit the overrange warning message -or- will be seen. The only way to clear the overrange message is to reset the display.

7.60 Alarm 1 high reset

Display: A1Hi rSt
Range: on or OFF
Default Value: OFF

Applies to relay 1 only. The alarm 1 high reset function allows the alarm operation to also cause an automatic total display reset. If the alarm mode is set to total (A1tL) then when the display value reaches the value set at A1Hi the relay will operate momentarily (the duration of the relay pulse can be extended via the A1rt function if required). If the alarm mode is set to pass (A1PS) then the display will reset when the display value reaches the pass value (set at A1PS) and the relay will activate and will remain activated for the time set at the A1Pt function.

7.61 Power on reset

Display: P.On rSt
Range: OFF or on
Default Value: OFF

This function is seen only when the SEt OPEr function is set to either totL or both. The power on reset function when set to on will cause the total value in memory to be reset each time the display is powered up. The reset will cause the display to either go to zero or to the preset value depending on the setting of the c.rSt function. If this function is set to OFF then the power up will have no effect on the total. No matter what the setting the display can still be reset in the usual manner via the reset input or remote input or P button 2Er0 functions.

7.62 Default display

Display: dFlt dISP
Range: rAtE, PErd or totl
Default Value: rAtE

Seen only in both mode. Sets the display default to either total or rate (or period if dISP is set to PErd). The display will always revert to the default display on power up but can be forced to the alternate display via the P

button or remote input (see **P.but** and **F.1 nP** functions). If the alternate display is being viewed an identifier will flash briefly every 8 seconds approx. e.g. if the rate is the default display and the display is now toggled to show total the message **totl** will flash briefly every 8 seconds.

7.63 Set display operation

Display: **SEt OPEr**
Range: **S.Prd**, **PErd**, **FrEq**, **totL** or **both**
Default Value: **FrEq**

Displays and sets the selected operating mode, e.g. select **totL** for totaliser operation. Options are:

S.Prd - Not applicable to this instruction manual

PErd - Not applicable to this instruction manual

both - Frequency and total - allows toggling between rate and total display

totL - Total/counter display

FrEq - Frequency/rate display

7.64 Baud rate for optional serial communications

Display: **bAUd rAtE**
Range: **300**.**600**. **1200**.**2400**.**4800**.**9600**. **19.2** or **38.4**
Default Value: **9600**

Set baud rate - seen only with serial output option. Select from **300**.**600**. **1200**.**2400**.**4800**.**9600**. **19.2** or **38.4** baud. Refer to Chapter 8, page 49 .

7.65 Parity for optional serial communications

Display: **PrtY**
Range: **nonE**.**EUEn** or **odd**
Default Value: **nonE**

Set parity - seen only with serial output option. Select parity check to either **nonE**, **EUEn** or **odd**. Refer to Chapter 8, page 49 .

7.66 Output mode for optional serial communications

Display: **O.Put**
Range: **di SP**.**Cont**.**POLL**.**A.buS** or **ñ.buS**
Default Value: **Cont**

Set serial interface mode - seen only with serial output option. Refer to Chapter 8, page 49 . Allows user to select the serial interface operation as follows:

di SP - sends image data from the display without conversion to ASCII.
Cont - sends ASCII form of display data at a rate typically 90% of the sample rate.
POLL - controlled by computer or PLC as host. Host sends command via RS232/485 and instrument responds as requested.
A.buS - is a special communications mode used with Windows compatible optional PC download software. Refer to the user manual supplied with this optional software.
ñ.buS - Modbus RTU protocol.

7.67 Instrument address for optional serial communications

Display: Addr
Range: 0 to 31
Default Value: 0

Set unit address for polled (POLL) mode (0 to 31)) - seen only with serial output option. 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) is address 10. Refer to Chapter 8, page 49 .

7.68 Serial communications type

Display: SER. 1 TYPE
Range: NONE ,r232 or r485
Default Value: NONE

Selects the serial output communications type from: NONE for no serial output, r232 for RS232 output or r485 for RS485 output. Note that the serial output is optional and factory configured with the hardware for one particular type of output i.e. if fitted with RS232 hardware then both the SER. 1 TYPE and the hardware must be changed to convert to RS485.

7.69 Serial port 2 type

Display: SER.2 TYPE
Range: NONE, r232 or r485
Default Value: NONE

Not applicable to this instrument, leave setting at NONE.

7.70 Returning to normal measure mode

When the calibration has been completed it is advisable to return the instrument to the normal mode (where calibration functions are less likely to be tampered with). To return to normal mode, turn off power to the instrument, wait a few seconds and then restore power.

7.71 Ratemeter setup 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:

$$Display = \frac{Input\ frequency\,(Hz) \times Rate\ Scale}{Rate\ Input}$$

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 1 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 24 to enter the setup functions via CAL mode.
2. Step through the functions by pressing and releasing F until the rATE 1 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 FREQ RNGE will appear followed by the previous input value.
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 FREQ RNGE function must be set to AUGE. **Example - RPM display**

A proximity sensor connected to a flywheel produces 20 pulses per revolution. The instrument 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 24 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 24 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 A1no/A1nc function is seen.
17. Use the ▲ or ▼ push button to change the setting to A1no (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/minute set RATE INPt to 767 and RATE SCLE to 60.

- to display litres/hour set rAtE i nPt to 767 and rAtE SCLE to 3600.
- to display kilolitres/hour set rAtE i 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. The "Rota pulse" paddle wheel flow meter (this sensor model is commonly used as an input to this display) 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:
2. Calculate the volume of a 1m length of pipe:
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 i nPt = 4560 and rAtE SCLE = 196.

The table which follows shows typical scaling factors for this.

Note that the examples can be reduced to smaller numbers if 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.

	Ratemeter Scaling Factors			
Int. Dia.	Litres/second	Litres/minute	Litres/hour	m^3/hour
25mm	rAtE i nPt=4560 rAtE SCLE=49	rAtE i nPt= 456 rAtE SCLE=295	rAtE i nPt=456 rAtE SCLE= 17640	rAtE i nPt=45600 rAtE SCLE= 1764
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= 18 1080	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

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:

- PErd dCPt set to 0.02
- PErd i nPt set to 1000 (one thousand milli seconds i.e. 1 second)
- PErd SCLE set to 1.00 i.e. every one thousand milli seconds will cause a display of 1.00
- FrEq rnGE set to LoF
- di SP set to PErd
- di SP rnGE set to 0
- 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 and hundredths of seconds by changing the di SP rnGE function to 0.0 1.

7.72 Totaliser setup examples

Example - Flow totalising

Flow meters 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 - Flowmeter totalising

A flowmeter produces 56 pulses per litre. The display us required to show total litres with 1 decimal point place. The procedure is as follows.

1. Follow the procedure shown on page 24 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 0.1. Press F to accept the change.
4. Step through the functions by pressing and releasing F until the tot1 1nPt 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 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 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 - Rotapulse totalising

Example - A Rota pulse paddle wheel flowmeter (this sensor model is commonly used as an input to the rateme-ter/totaliser) gives 45.6 pulses per metre flow of liquid. The flowmeter is places in a 100mm pipe. The LD is required to display kilolitres to 3 decimal places. An alarm relay closure is required when a total of 53.000 kilolitres is reached.

1. Follow the procedure shown on page 24 to enter the setup functions via CAL mode.
2. Step through the functions by pressing and releasing F until the A1Hi function is seen followed by the previous high alarm setting.
3. Use the ▲ or ▼ push button to change the A1Hi setting to 53.000. Press F to accept the change. Note: we will not deal with this here but in practice you will also need to consider alarm hysteresis, trip time, reset time and normally open/normally closed operation of this relay, refer to the explanations earlier chapter for further details.
4. Step through the functions by pressing and releasing F until the tot1 dCPt function is seen followed by the previous decimal point setting.
5. Use the ▲ or ▼ push button to change the tot1 dCPt setting to 0.003. Press F to accept the change.
6. Step through the functions by pressing and releasing F until the tot1 1nPt function followed by the previous input value is seen.
7. Use the ▲ or ▼ push button to alter the previous input value to the new input value of 1000. See calculation below.
8. Press F, the function tot1 SCLE will appear followed by the previous scale value.
9. Use the ▲ or ▼ push button to alter the previous scale value to the new scale value of 0.172. See calculation below.
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 display returns to normal measurement mode. Calculating the input and scaling figures for the above Rota pulse example. We know that there are 45.6 pulses per meter flow of liquid and that the pipe is 100mm (0.1 metres) in diameter (0.05 metre radius). From the pipe diameter we can work out the area in metres squared and the volume in metres cubed of a 1 metre section. From the volume we can find the number of litres in the 1 metre section and hence the number of kilolitres in this section. We will then know that 45.6 pulses represents this number of kilolitres and hence we can work out the display scaling factors.

The volume of a 1 metre length is: Since there are 1000 litres in one cubic meter we can find the number of litres in this one metre length of pipe:

If there are 7.85 litres per metre length and there are 45.6 pulses per metre length then each pulse represents 0.172 litres (from 7.85 divided by 45.6) or 0.000172 kilolitres. If we had enough decimal point places we could use a **tot1 1nPt** factor or 1 and a **tot1 SCLE** factor of **0.000172** to give a display in kilolitres. Since we require 3 decimal places only then multiplying both figures by 1000 will give the same scaling result and figures of: **tot1 1nPt** = **1000** and **tot1 SCLE** = **0.172**. It is the ratio between **tot1 1nPt** and **tot1 SCLE** which determines the scaling factor and so there are many input and scale figures which are equally valid e.g. **tot1 1nPt** = **100000** and **tot1 SCLE** = **17.2** would give the same display scaling as would **tot1 1nPt** = **5814** and **tot1 SCLE** = **1**. The table below shows Rota pulse scaling figures for typical pipe diameters:-

	Totaliser Scaling Factors	
Internal Diameter	Litres	Kilolitres or m^3
25mm	**tot1 1nPt**=92896 **tot1 SCLE**= 1000	**tot1 1nPt**= 92896 **tot1 SCLE**= 1
40mm	**tot1 1nPt**=36287 **tot1 SCLE**= 1000	**tot1 1nPt**= 36287 **tot1 SCLE**= 1
50mm	**tot1 1nPt**=23224 **tot1 SCLE**= 1000	**tot1 1nPt** =23224 **tot1 SCLE**= 1
80mm	**tot1 1nPt**=9072 **tot1 SCLE**= 1000	**tot1 1nPt**= 9072 **tot1 SCLE**= 1
100mm	**tot1 1nPt**=5806 **tot1 SCLE**= 1000	**tot1 1nPt**= 5806 **tot1 SCLE**= 1
150mm	**tot1 1nPt**=2580 **tot1 SCLE**= 1000	**tot1 1nPt**= 2580 **tot1 SCLE**= 1

Example - Up counting

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 24 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 1nPt** 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 of continue pressing and releasing **F** until the **FUNC** End message is seen and the display returns to normal measurement mode.

Example - Down counting

A proximity sensor is counting objects on a conveyor belt. When 2000 objects have passed the LD is to force its internal relay to open which will be used to de-activate a solenoid and halt the conveyor. The display is required to count down from the preset value of 2000 to zero. The input and scale factors in this case will both be 1 since the display is simply counting objects. Other settings needed in this example are some alarm settings, the preset value, the SET input mode and the counter reset value.

1. Follow the procedure shown on page 24 to enter the setup functions via **CAL** mode.
2. The first function is **A 1Lo** this will be seen followed by the previous low alarm setting.
3. Use the ▲ or ▼ push button to change the **A 1Lo** setting to **0**. Press **F** to accept the change.
4. Step through the functions by pressing and releasing **F** until the **A 1no**/**A 1nC** function is seen.

5. Use the ▲ or ▼ push button to change the setting to **A inc** (normally closed operation).
6. Step through the functions by pressing and releasing **F** until the **totl inPt** function followed by the previous input value is seen.
7. Use the ▲ or ▼ push button to alter the previous input value to the new input value of 1.
8. Press **F**, the function **totl SCLE** will appear followed by the previous scale value.
9. Use the ▲ or ▼ push button to alter the previous scale value to the new scale value of 1.
10. Step through the functions by pressing and releasing **F** until the **PSEt** function is seen followed by the previous preset value. Note: If the display has a front panel **P** button then the function of this button can be programmed to allow fast access to the preset value without needing to enter **CAL** mode. This facility can be useful if the preset value is likely to be changed regularly.
11. Use the ▲ or ▼ push button to change the setting to **2000**.
12. Step through the functions by pressing and releasing **F** until the **SI nP** function followed by the previous SET input mode is seen.
13. Use the ▲ or ▼ push button to change the setting to **Lo**. This will force the instrument to count down.
14. Step through the functions by pressing and releasing **F** until the first **crSt** function followed by the previous reset value is seen.
15. Use the ▲ or ▼ push button to change the setting to **PSEt**. This will force the instrument display to revert to the preset value whenever the display is reset.
16. 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.

8 Serial communication option

Serial communications is optional and the required circuitry will only be fitted if the instrument was ordered with this option.

8.1 Serial operation and commands

The operation mode for serial communication is set by the **O.Put** function, the following choices are available:
nonE - No serial communication

di SP - Image display mode.
In image display mode the display value is sent via RS232/RS485 as raw data in the format <ESC> IXYYYY where:

Where: $< ESC >$ is the ESCAPE character (27 Dec, 1B Hex)
I is the character "I" (73 Dec, 49 Hex)
X is the number of image bytes in ASCII (31 to 38 Hex)
YYYY is the raw, 8 bit display data.

This information is output every display update (approx. 4 times per second - depending upon baud rate). The number of image bytes sent depends on the number of display digits present. This mode is suitable only when the receiving unit is produced by the same manufacturer as the LD. The most common usage would be to provide a large digit display for wide area viewing which just mimics the smaller display on the measuring instrument. The large digit displays automatically detect the image mode data and display the correct value accordingly. The data is in seven segment display image i.e. Bit 0 is segment A, Bit 1 is segment B etc.

cont - Continuous mode.
In this mode the display value is continually sent via the RS232/485 interface in ASCII format with 8 data bits + 1 stop bit. Data will be updated at approximately 90% of the display sample rate. The format for this output is: $< STX > XYYYY < CR >$

Where: $< STX >$ is start of text character (2 Dec, 02 Hex)
X SPACE (32 Dec, 20 Hex) indicates a positive value or
X "-" (45 Dec, 2D Hex) indicates a negative value.
$YYYY$ is the display value in ASCII.
$< CR >$ is a Carriage Return (13 Dec, 0D Hex).

e.g.: If the display is showing 123456 then the instrument will send "02 31 32 33 34 35 36 0D" (HEX) to the host. In **both** mode the rate value is sent first followed by a comma followed by the total value followed by a comma followed by the grand total value. In **totL** mode the total is sent first followed by a comma followed by the grand total value. Note that the grand total value will not be included in the above if the **9.tot** function is set to **nonE**.

POLL Host controlled transmit mode, see section 8.2.

A.bus Special communication mode for use with optional Windows compatible software, refer to the "Download Software User Guide" booklet supplied with this optional software.

M.bus Modbus RTU operation, see section 8.3

8.2 POLL mode commands

This mode requires a host computer. PLC or other device to poll the instrument to obtain display or other information or reset various setpoint parameters. Special communications software such as a terminal program is required when using **POLL** mode. Data is in ASCII format with 8 data bits + 1 stop bit. When polling the instrument it is essential that the command characters are sent with less than a 10mS delay between them. This normally means that each command line must be sent as a whole string e.g. a command such as $< STX > PA < CR >$ is sent as one string rather than $< STX >$ on one line followed by P etc. If testing using a "terminal" program or other software this is normally achieved by allocating a command string to a function key. Whenever the function key is operated the whole string is sent. The format used is ASCII (8 data bits + 1 stop bit) so, for instance, if address 1 is used then the string $< STX > PA < CR >$ must be put into the terminal program as: ∧BP!∧M where:

	∧B	is the ASCII character for $< STX >$ (2 Dec, 02 Hex)
	P	is the command line to transmit the primary display value (80 Dec. 50 Hex)
	!	is the ASCII character for address 1 (33 Dec of 21 Hex)
	∧M is the ASCII character for $< CR >$ (13 Dec. 0D Hex)	

Typical formats for the host command is as follows:-

$< ST > CA < CR >$ (Standard read etc.)
$< STX > CA < CR > N < CR > XYYYY$ (Set Value Command)

Where:	$< STX >$	is Start of Text Character (2 Dec, 02 Hex, ∧B ASCII)
	C	is the command character (see following commands)
	A	is the unit address (Range: 32 to 63 Dec, 20 to 3F Hex, "SPACE" to ? ASCII the address is offset by 32 Dec, 20 Hex)
	$< CR >$	is Carriage Return (13 Dec, 0D Hex, ∧M ASCII)
	N	is the setpoint number in ASCII e.g.: 1 for alarm 1 etc.
	X	SPACE for positive and "-" for negative
	$YYYY$	is the setpoint value in ASCII

The POLL commands available and instrument responses are as follows:

Transmit primary display value: $< STX > PA < CR >$
e.g. ∧BP!∧M using a terminal program (address 1). Instructs unit to return the primary display value. The primary display value is the rate/frequency value. Format of returned data is: $< ACK > PAXYYYY < CR >$

Where:	$< ACK >$	is ASCII Acknowledge (6 Dec, 06 Hex)
	P	echo command received "P" (80 Dec, 50 Hex)
	A	is the responding units address (offset by 32 Dec e.g. "!" is address 1)
	X	SPACE for positive and "-" for negative
	$YYYY$	is the display value in ASCII
	$< CR >$	is a Carriage Return (13 Dec, 0D Hex)

Transmit secondary display value: $< STX > SA < CR >$
e.g. ∧BS!∧M using a terminal program (address 1). Instructs unit to return the secondary display value. The secondary display value is the total value, the grand total is not available via serial download. Format of returned data is: $< ACK > SAXYYYY < CR >$

Where:	$< ACK >$	is Acknowledge (6 Dec, 06 Hex)
	S	echo command received "S" (83 Dec, 53 Hex)
	A	is the responding units address (offset by 32 Dec e.g. "!" is address 1)
	X	SPACE for positive and "-" for negative
	$YYYY$	is the display value in ASCII
	$< CR >$	is a Carriage Return (13 Dec, 0D Hex)

Transmit instrument model and software version: $< STX > IA < CR >$ e.g. ∧BI!∧M using a terminal program (address 1). Instructs unit to return the instrument model and software version.
Format of returned data is: $< ACK > IACCX.X < CR >$

Where:	$< ACK >$	is Acknowledge (6 Dec, 06 Hex, ∧F ASCII)
	I	echo command received "I" (73 Dec, 49 Hex)
	A	is the responding units address (offset by 32 Dec e.g. "!" is address 1)
	CC	a 2 character identifier e.g. LC means loadcell input
	$X.X$	is the software version number e.g. 4.6
	$< CR >$	is a Carriage Return (13 Dec, 0D Hex, ∧M ASCII)

Invalid command: If the command received from the host is invalid the unit will return the following: $< ACK >$ $?A < CR >$, where:

Where:	$< ACK >$	is Acknowledge (6 Dec, 06 Hex, ∧F ASCII)
	?	echo command received "?" (63 Dec, 3F Hex)
	A	is the responding units address (offset by 32 Dec e.g. "!" is address 1)
	$< CR >$	is a Carriage Return (13 Dec, 0D Hex, ∧M ASCII)

8.3 Modbus operation

When using Modbus RTU communications the instrument must be set up electrically for RS232 or RS485 communications and the **O.Put** function must be set to **rtbuS**. The maximum recommended baud rate for Modbus operation is 9600. The following functions are available:

Modbus Function 1 - Read coil status

Reads the ON/OFF status of the relay coils. Broadcast is not supported. Relays 1 and 2 are addressed as 0 and 1. Logic 1 = ON, Logic 0 = OFF. To read the coil status a query is sent to the instrument, the instrument then responds to the query. An example of a query to read coils 1 and 2 from the LD at address 3 is given below.

Field name	**Example(Hex)**
Unit address	03
Function	01
Starting address Hi	00
Starting address Lo	00
Number of points Hi	00
Number of points Lo	02
Error check (LRC or CRC)	–

An example of a response is given below:

Field name	**Example(Hex)**
Unit address	03
Function	01
Byte count	01
Data (coils 2 to 1)	01
Error check (LRC or CRC)	–

The status of the relay coils is shown in the Data 01 (hex) or binary 01. Relay 1 is indicated by the least significant binary bit. The status of the relays is therefore:

Relay 2 - OFF, Relay 1 - ON

Function 3 - Read holding registers

This function reads the binary contents of the holding registers in the LD being addressed. The value for this function is stored as a 32 but two's compliment number, 2 registers per channel are used. Note; a value of 1,000,000 represents a positive overrange and -200,000 a negative overrange. Registers 1 to 2 hold the display value, registers 3 to 4 the valley memory (lowest reading in memory), registers 5 to 6 the peak memory (highest reading in memory), registers 7 to 8 the display hold value. Registers 9 to 12 hold the alarm high values for relays 1 to 2. Note a value of 0X8000 means that the relay is set to OFF and has no high value. Registers 17 to 20 hold the alarm low values for relays 1 to 2. Note a value of 0X8000 means that the relay is set to OFF and has no low value. Register 25 represents the decimal point settings for the display. An example of a query to read holding registers 1 to 4 from the LD at address 5 is given below.

Field name	**Example(Hex)**
Unit address	05
Function	03
Starting address Hi	00
Starting address Lo	00
Number of points Hi	00
Number of points Lo	04
Error check (LRC or CRC)	–

An example of a response is given below:

Field name	Example(Hex)
Unit address	05
Function	03
Byte count	06
Data Hi(register 1)	00
Data Lo(register 1)	33
Data Hi(register 2)	00
Data Lo(register 2)	33
Data Hi(register 3)	00
Data Lo(register 3)	17
Data Hi(register 3)	02
Data Lo(register 3)	34
Error check (LRC or CRC)	–

The contents of register 1 is 33 (hex) or 51 (decimal), register 2 is 33 (hex) or 51 (decimal), register 3 is 17(hex) or 23(decimal), the contents of register 4 is 234(hex) or 564(dec).

The above table would be transmitted as 05 03 00 00 00 0 XX XX where:
05 is the unit address (set at the LD **Addr** function)
03 is the function number (function 3)
00 00 is the starting address of zero. Note addresses 0 to 7 correspond to registers 1 to 8.
00 04 is the number of points required (08 hex.)
XX XX is the error check (the actual number will be generated by the modbus program)

An example of the entire message transmitted and received in this example is:
tx: 05 03 00 00 00 04 XX XX
rx: 05 03 08 00 00 00 33 00 00 00 33 00 00 00 17 00 00 02 34 XX XX
The data received (rx:) is interpreted as follows:
05 is the address of the LD-TR
03 denotes function 3
10 is the byte count (10 hex., 16 decimal) i.e. 16 bytes at 4 bytes per set of data
00 00 00 33 is the rate value 33 hex., 51 decimal (requires 4 bytes i.e. 2 registers)
00 00 00 33 is the same rate value again
00 00 00 17 is the total value (17 hex., 23 decimal)
00 00 02 34 is the grand total value (234 hex., 564 decimal)
XX XX is the error check (the actual number will be generated by the modbus program)

Register table for LD-TR displays using Modbus RTU function 3

Address	Register	Description
0X00	1	Rate display value high word
0X01	2	Rate display value low word
0X02	3	Rate display value high word repeated
0X03	4	Rate display value low word repeated
0X04	5	Total display value high word
0X05	6	Total display value low word
0X06	7	Grand total display value high word
0X07	8	Grand total display value low word
0X08	9	Relay 1 high setpoint high word
0X09	10	Relay 1 high setpoint low word
0X0A	11	Relay 2 high setpoint high word
0X0B	12	Relay 2 high setpoint low word
0X0C	13	Relay 3 high setpoint high word
0X10	17	Relay 1 low setpoint high word
0X11	18	Relay 1 low setpoint low word
0X12	19	Relay 2 low setpoint high word
0X13	20	Relay 2 low setpoint low word

8.4 ASCII Code Conversion Listing

ASCII for control characters is shown in brackets. e.g. STX may in some cases be entered as ∧B.

ASCII char.	Decimal	Hex	ASCII char.	Decimal	Hex	ASCII char.	Decimal	Hex
NUL (∧@)	00	00	+	43	2B	V	86	56
SOH (∧A)	01	01	,	44	2C	W	87	57
STX (∧B)	02	02	-	45	2D	X	88	58
ETX (∧C)	03	03	.	46	2E	Y	89	59
EOT (∧D)	04	04	/	47	2F	Z	90	5A
ENQ (∧E)	05	05	0	48	30	[	91	5B
ACK (∧F)	06	06	1	49	31	\	92	5C
BEL (∧G)	07	07	2	50	32	]	93	5D
BS (∧H)	08	08	3	51	33	∧	94	5E
HT (∧I)	09	09	4	52	34	_	95	5F
LF (∧J)	10	0A	5	53	35	‘	96	60
VT (∧K)	11	0B	6	54	36	a	97	61
FF (∧L)	12	0C	7	55	37	b	98	62
CR (∧M)	13	0D	8	56	38	c	99	63
SO (∧N)	14	0E	9	57	39	d	100	64
SI (∧O)	15	0F	:	58	3A	e	101	65
DLE (∧P)	16	10	;	59	3B	f	102	66
DC1 (∧Q)	17	11	<	60	3C	g	103	67
DC2 (∧R)	18	12	=	61	3D	h	104	68
DC3 (∧S)	19	13	>	62	3E	i	105	69
DC4 (∧T)	20	14	?	63	3F	j	106	6A
NAK (∧U)	21	15	@	64	40	k	107	6B
SYN (∧V)	22	16	A	65	41	l	108	6C
ETB (∧W)	23	17	B	66	42	m	109	6D
CAN (∧X)	24	18	C	67	43	n	110	6E
EM (∧Y)	25	19	D	68	44	o	111	6F
SUB (∧Z)	26	1A	E	69	45	p	112	70
ESC (∧[)	27	1B	F	70	46	q	113	71
FS (∧\)	28	1C	G	71	47	r	114	72
GS (∧∧)	29	1D	H	72	48	s	115	73
RS (∧)	30	1E	I	73	49	t	116	74
US (∧_)	31	1F	J	74	4A	u	117	75
SP ( )	32	20	K	75	4B	v	118	76
!	33	21	L	76	4C	w	119	77
”	34	22	M	77	4D	x	120	78
#	35	23	N	78	4E	y	121	79
$	36	24	O	79	4F	z	122	7A
%	37	25	P	80	50	{	123	7B
&	38	26	Q	81	51	|	124	7C
’	39	27	R	82	52	}	125	7D
(	40	28	S	83	53	~	126	7E
)	41	29	T	84	54	DEL	127	7F
*	42	2A	U	85	55			

9 Technical specifications

Display:	6 digit 38mm red LED or 5 digit 45mm red LED or 4 digit 57mm red LED or 4 or 6 digit 100mm red LED or 4, 5 or 6 digit 100mm yellow electromagnetic type or 4 digit 200mm red LED type Count/Rate
Input:	Link selectable to suit most sensor types. For inductive, AC and square wave inputs the maximum input voltage is 48VDC or RMS with appropriate link settings
Totaliser Functions:	Up or down counter
Ratemeter Functions:	Selectable as rate/frequency or period or average or rolling average display Max 100kHz, Min determined by **tout SECS** function setting Period display is only available when low frequency range is selected i.e. less than 1kHz input
Impedance:	10kΩ
Memory Retention:	Battery backed totaliser memory
Display Reset:	Remote reset via "RST" input (contact closure to ground or 5VDC maximum)
Microprocessor:	MC68HC11 CMOS
Ambient Temperature:	-10 to 60^{o}C
Humidity:	5 to 95% non condensing
Power Supply:	100mm and 200mm LED and 100mm electromagnetic displays: AC 240/110V selectable 50/60Hz or AC 48/42/32/24V selectable 50/60Hz or DC 12 to 24V isolated or DC 30 to 48V isolated or 24VDC non isolated. 38mm or 45mm or 57mm LED or 39mm electro magnetic displays: AC 240V or110V 50/60Hz or DC 12 to 48V isolated or DC 24V (±10%) non isolated Note: Supply type is factory configured
Outputs:	2 x Setpoint relays, form A, rated 5A at 240VAC
Power Consumption:	AC supply 15 VA max DC supply: 38 and 45mm LED standard brightness displays typically 100mA at 24V, peak 200m 38mm LED high contrast display typically 150mA at 24V, peak 800mA 57mm LED display typically 250mA at 24V, peak 500mA 58mm LED high contrast display typically 150mA at 24V, peak 800mA 100mm LED displays typically 300mA at 24V, peak 2A 39mm electromagnetic typically 150mA at 24V, peak 1A 100mm electromagnetic typically 1A at 24V, peak 4A Sensor
DC output supply:	Regulated 5VDC or unregulated 18 to 24VDC (link selectable) @ 50mA max. Note: for instruments powered from non isolated DC the 18 to 24V unregulated supply will be slightly less than the power supply voltage.

Physical characteristics - see chapter 2

10 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 au 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.