LD4-TR

Ratemeter/Totaliser

Large Digit Display

Operation & Instruction Manual

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1 Introduction

This manual contains information for the installation and operation of the LD4-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 three modes of operation 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.

Explanation and examples of the totaliser functions are given in the “Totaliser Explanation of Functions” chapter.

2. FrEq - frequency/rate display.

The frequency or rate of the input may be scaled in engineering units and displayed e.g. 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, average or rolling average rate.

Explanation and examples of the ratemeter functions are given in the “Ratemeter Explanation of Functions” chapter.

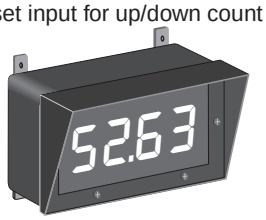
3. both - total/rate display (display may be toggled to either total or rate)

This mode is primarily used when the display is required to toggle between a rate and total display via an external contact closure or via the front panel ⏏ and ⏏ buttons (only fitted on certain display options). For low frequency inputs (input always below 1kHz) there is an option of toggling between rate/total or rate/period. A total and grand total may be viewed and reset separately.

LD4-TR inputs & outputs

Inputs

Programming keypad (on main circuit board)
Power supply 240VAC, 110VAC, 12 to 16VAC, 15 to 24VDC or
optional isolated DC supplies (factory configured)
Signal input pulse input from encoder, switch etc (type set via internal links)
Remote switch input to perform special functions
Key set input for up/down count



Standard outputs

Two alarm relays
Transmitter supply 5VDC or 16VDC unregulated & non isolated (AC powered models only)

Optional outputs

Two extra alarm relays
Serial communications RS232 or RS485 ASCII or Modbus RTU

Selection of operating mode, calibration and scaling are all accomplished by push button operation. “On screen” prompts are given for each function to assist in setting up the instrument. Changes to input sensor type options 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 LD4 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 is provided by the LD4, thereby eliminating grounding and common voltage problems. This isolation feature makes the LD4 ideal for interfacing to computers, PLCs and other data acquisition devices.

The LD4 series of Large Digit Displays are designed for high reliability in industrial applications. The high brightness LED display provides good visibility, even in areas with high ambient light levels.

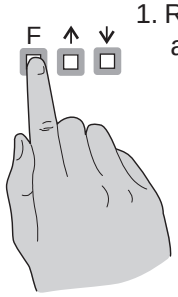
1 .1 Meter setup

The LD4-TR setup and calibration functions are configured through a push button sequence. Two levels of access are provided for setting up and calibrating:-

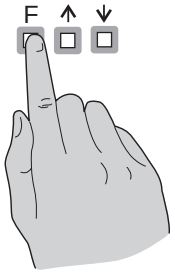
FUNC mode (simple push button sequence) allows access to commonly set up functions such as alarm setpoints. CAL mode (power up sequence plus push button sequence) allows access to all functions including calibration parameters.

The three push buttons are located on the main circuit board, the front cover will need to be removed to gain access to the pushbuttons. 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. Changes to function settings will not be accepted and stored in memory until the F button is pressed to accept the change.

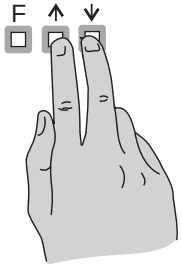
Entering CAL Mode



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.



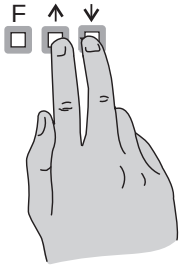
3. Within 2 seconds of releasing the F button press, then release the ▲ and ▼ buttons together. The display will now indicate FUNC followed by the first function.

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.



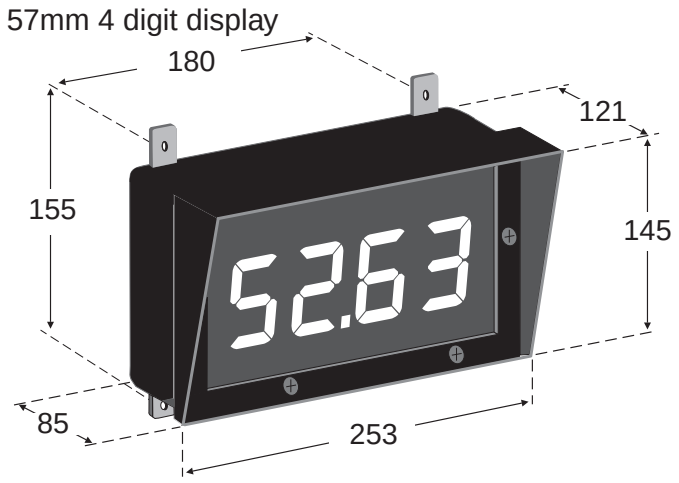
2. Within 2 seconds of releasing the F button press, then release the ▲ and ▼ buttons together. The display will now indicate FUNC followed by the first function.

Alternative CAL Mode Entry

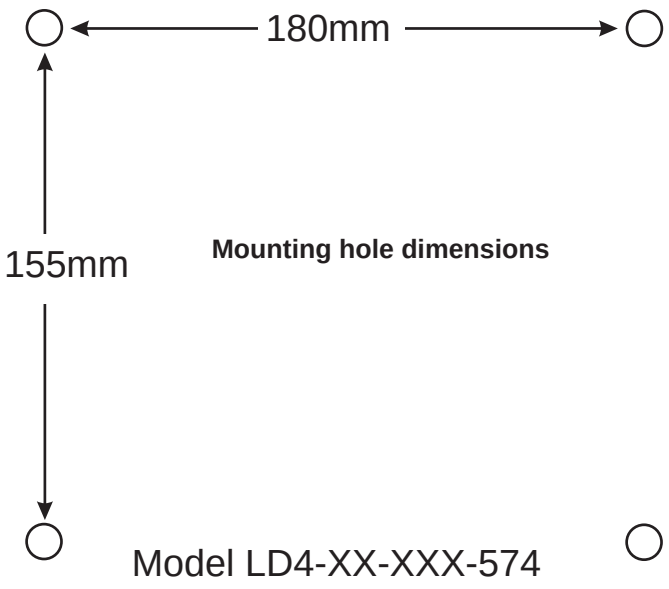
This alternative method allows CAL mode entry without the need to remove power:
1. Enter FUNC mode using the 2 steps above
2. When the first function appears press and hold the P button until you see the message FUNC followed by CAL (the P button will have to be held pressed for approximately 2 seconds)
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.

2 Mechanical Installation

The instruments are designed be wall mounted but an optional panel mount kit is available for the 57mm 4 digit display. See "Electromagnetic displays" appendix if using this type of display.



An optional panel mount kit is available for the 57mm type display. Panel cut out size is 240 x 130mm (-0.0mm/+0.5mm)



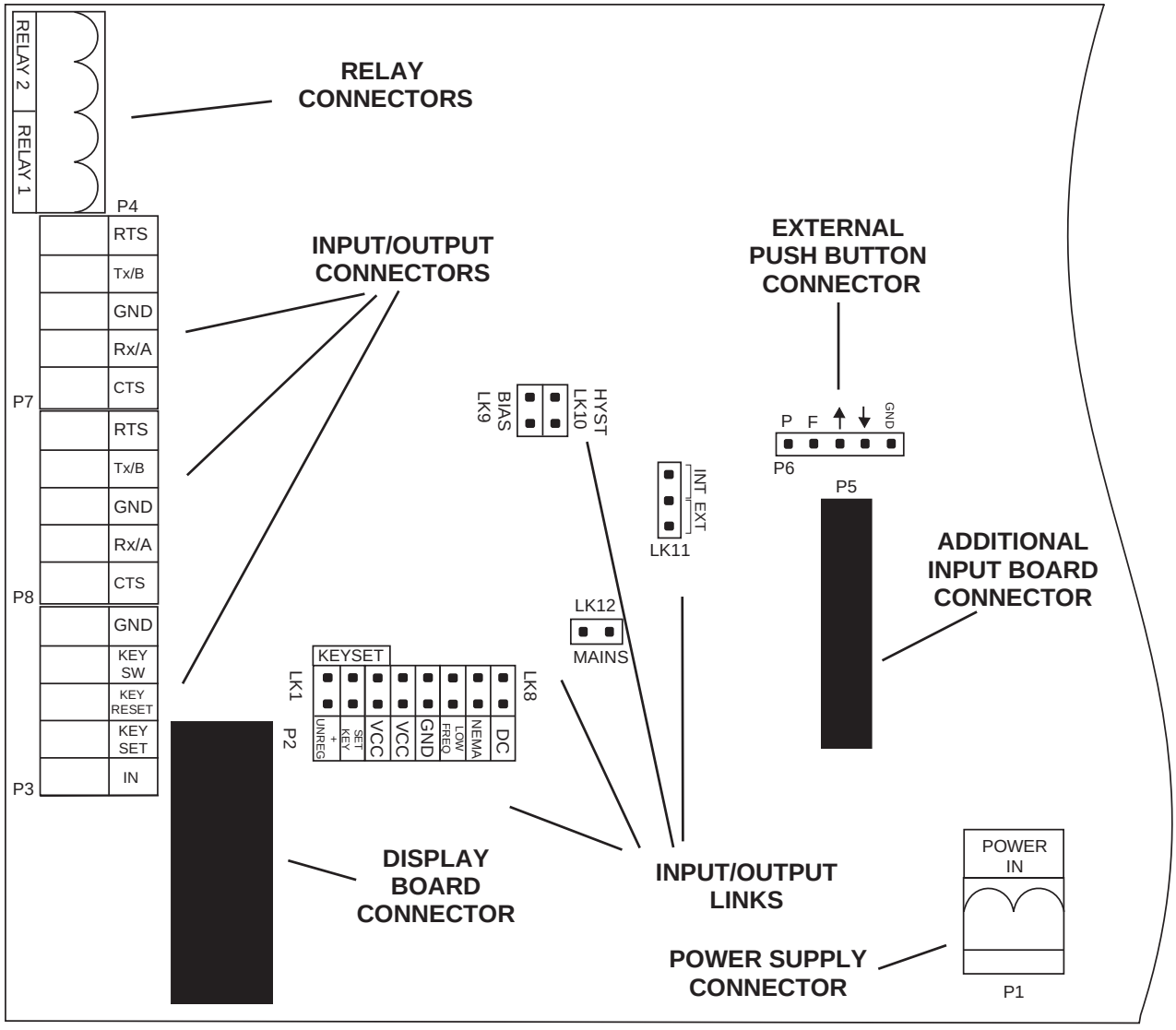
Mounting hole dimensions

3 Electrical Installation

The LD4-TR instrument 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, which are the plug in type for ease of installation, allow for wires of up to 1.5mm^2 (2.5mm^2 for relay and power 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, this indicates that the instrument is functioning.

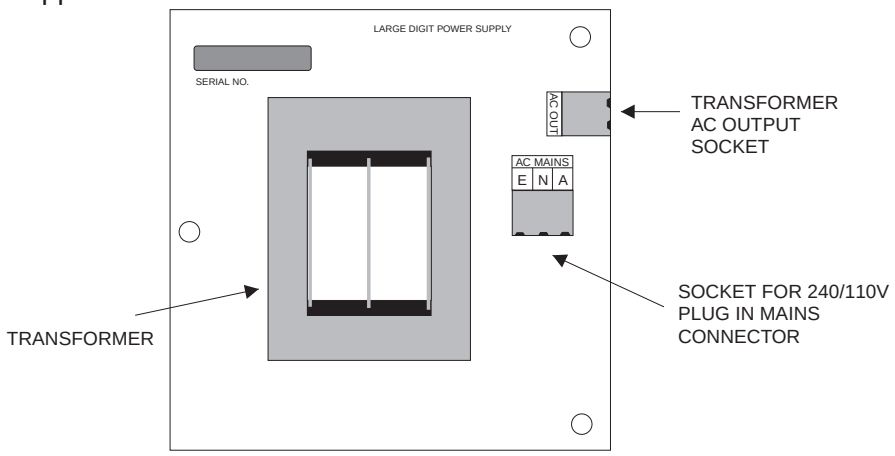
MAIN CIRCUIT BOARD LAYOUT (PARTIAL VIEW)



3 .1 Power supply connections

Mains power connections (240VAC or 110VAC) are made via a plug in terminal with screw connections (display type 574) or via screw terminals mounted to the backplane of the instrument.

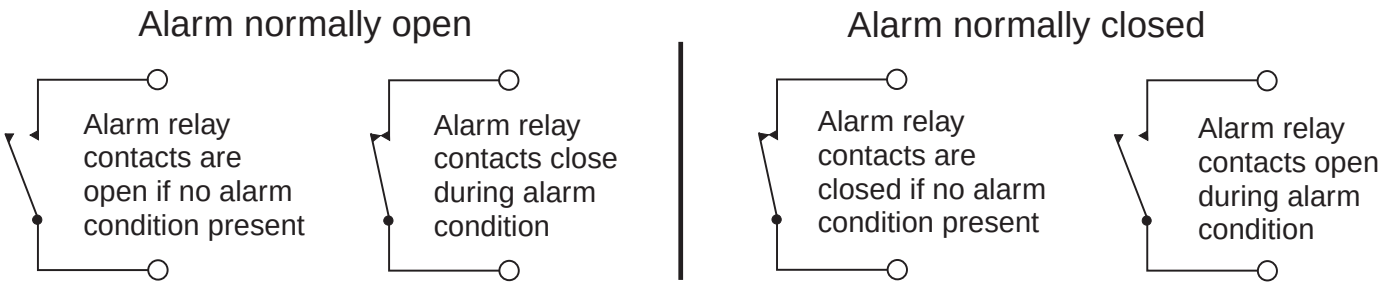
The transformer low voltage AC output goes to the power supply connector P1 on the main circuit board via the lead supplied.



DC supplies may be connected directly to the main circuit board power supply connector via the plug in connector terminals. The positive and negative supplies may be connected either way around.

3 .2 Relay connections

The LD4 is supplied with two alarm relays as standard with connections on P4. The relays are single pole, single throw types and are rated at 5A, 240VAC into a resistive load. The relay contact is voltage free and may be programmed for normally open or normally closed operation.



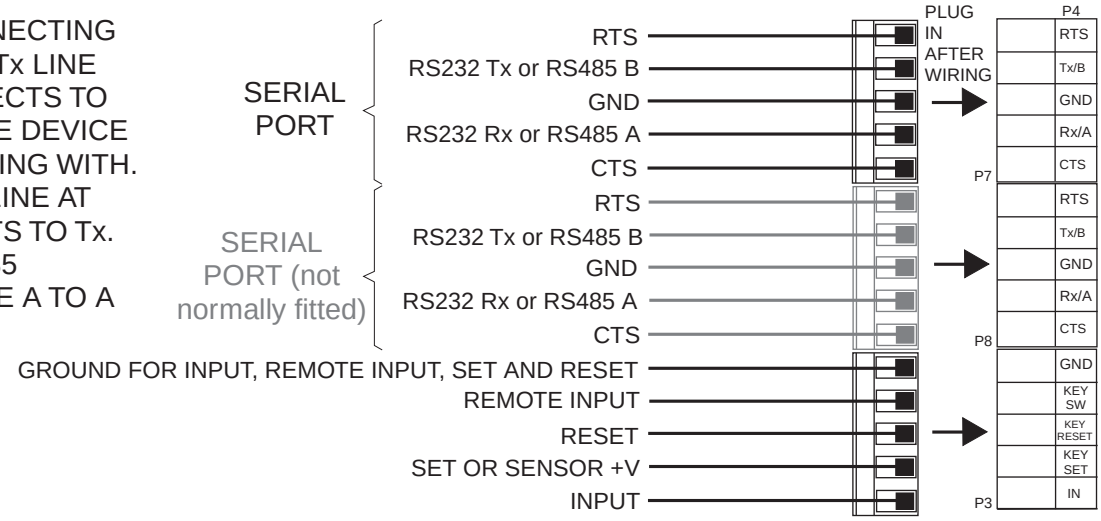
3 .3 Input/output Connectors

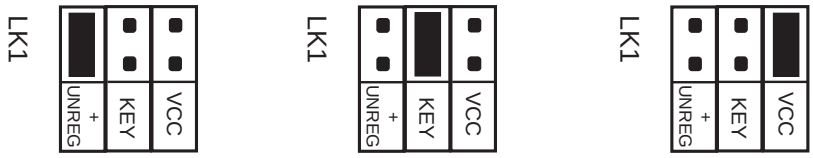
The diagram below shows the input/output connectors for the LD4-TR. The input signal connection is between input and the ground shared with the set, reset and remote input lines.

An internal power supply allows the KEY SET input to be used to give a transmitter supply output of either 5VDC regulated or 16VDC unregulated via links LK 1 or 3. When using this output as a transmitter supply ensure that only one link (LK1 or LK3) is in and that LK2 is out.

The KEY SET input can also be used to control the count direction i.e. count up/count down in **both** or **toti** modes. This input is used in conjunction with the **S.i nP** setting, see the **S.i nP** function for these modes for further details. When used in this mode links LK1 and LK3 must be out and link LK2 must be in. **Note:** Only one of links LK1, 2 or 3 should be in at any time. Damage to the instrument could occur if more than one link is inserted at one time.

NOTE: WHEN CONNECTING USING RS232 THE Tx LINE AT THE LD4 CONNECTS TO THE Rx LINE AT THE DEVICE IT IS COMMUNICATING WITH. LIKEWISE THE Rx LINE AT THE LD4 CONNECTS TO Tx. WHEN USING RS485 CONNECTIONS ARE A TO A AND B TO B





Unregulated DC selected

"SET" key selected

5VDC regulated selected

3 .4 Equflow and Rotapulse wiring and link settings

Equflow and Rotapulse flowmeters are commonly supplied with this model. Note that sensor supplies are available only on AC powered models. Wiring and link settings are as shown below:

Equflow:

Colour code: White - signal + (IN terminal), Brown - +5V (KEY SET terminal), Green and shield - ground (GND terminal).

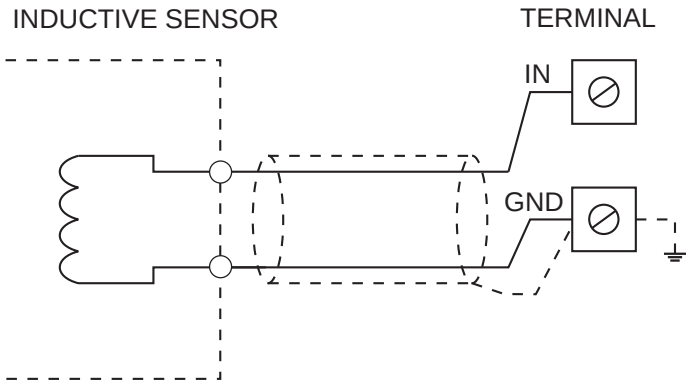
Input link settings: Links in are LK3 (VCC 5V), LK5 (GND), LK9 (BIAS), LK10 (HYST) all other links are out.

Rotapulse:

Colour code: Black - signal + (IN terminal), Brown - +16V (KEY SET terminal), Blue - ground (GND terminal).

Input link settings: Links in are LK1 (UNREG. 16V), LK4 (VCC), LK8 (DC), LK9 (BIAS), LK10 (HYST) all other links are out.

3 .5 Input Connection Details

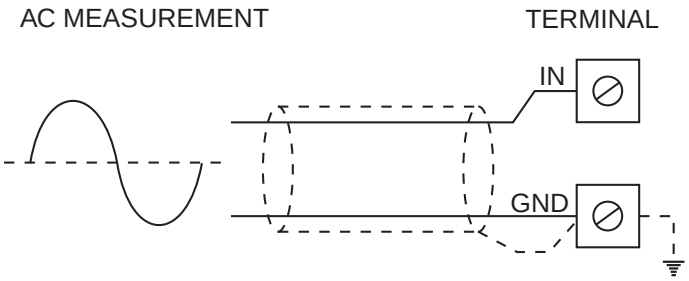


Inductive Sensor (48V RMS Max)

Typical Internal Link Settings

VCC up	Link 4	out
Ground	Link 5	in or out *
Low frequency	Link 6	out
NEMA	Link 7	out
DC couple	Link 8	in
Bias	Link 9	out
Hysteresis	Link 10	in or out *
EXT/INT	Link11	set to EXT

Note: the hysteresis link should be in for signals greater than 2V. Ground link should be out for voltages above 24V RMS.

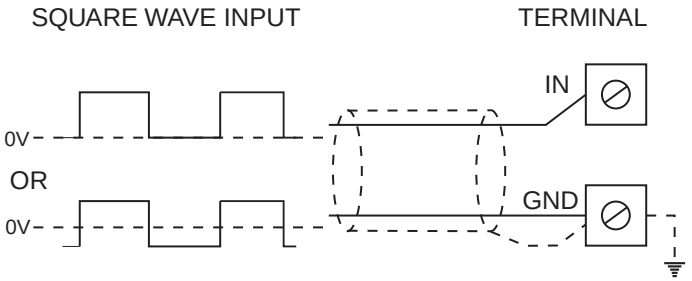


AC Measurement (48V RMS Max)

Typical Internal Link Settings

VCC up	Link 4	out
Ground	Link 5	in or out *
Low frequency	Link 6	out
NEMA	Link 7	out
DC couple	Link 8	in or out *
Bias	Link 9	out
Hysteresis	Link 10	in (or out *)
EXT/INT	Link11	set to EXT

Note: the hysteresis link should be in for signals greater than 2V.
The DC coupling link should be in for frequencies less than 10Hz. Ground link should be out for voltages above 24V RMS.

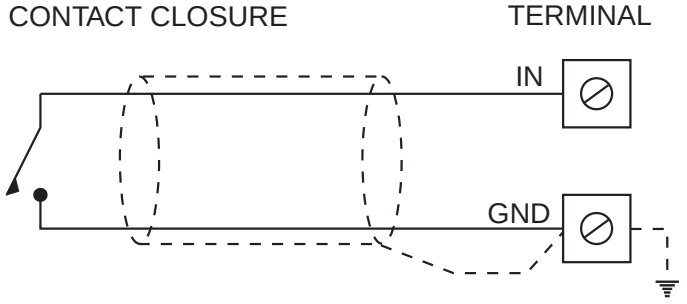


Square Wave (48V Max)

Typical Internal Link Settings

VCC up	Link 4	out
Ground	Link 5	in or out *
Low frequency	Link 6	out
NEMA	Link 7	out
DC couple	Link 8	in
Bias	Link 9	in or out *
Hysteresis	Link 10	in or out *
EXT/INT	Link11	set to EXT

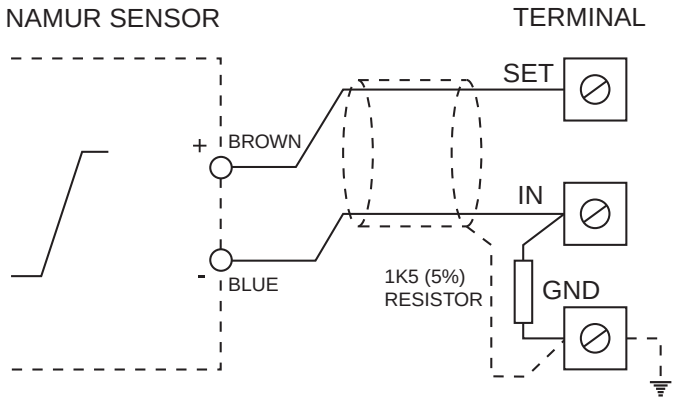
Note: the bias link should be in when input signal does not go below 0V. . . .
The hysteresis link should be in for signals greater than 2V. Ground link should be out for voltages above 24V RMS.



Switch Contact

Typical Internal Link Settings

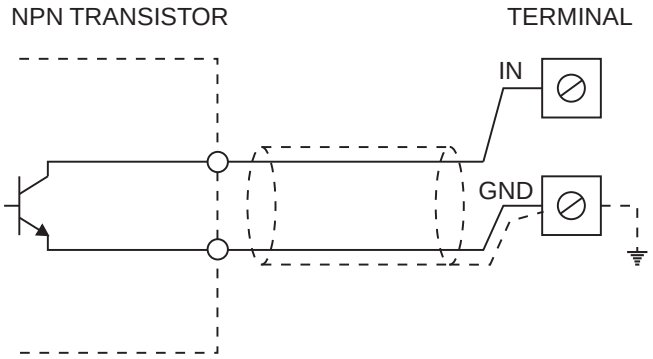
VCC up	Link 4	in
Ground	Link 5	out
Low frequency	Link 6	in
NEMA	Link 7	out
DC couple	Link 8	in
Bias	Link 9	in
Hysteresis	Link 10	in
EXT/INT	Link11	set to EXT



NAMUR Sensor

Typical Internal Link Settings

Supply V+	Link 1	16Volts in
VCC up	Link 4	out
Ground	Link 5	in
Low frequency	Link 6	out
NEMA	Link 7	in
DC couple	Link 8	in
Bias	Link 9	in
Hysteresis	Link 10	in
EXT/INT	Link11	set to EXT

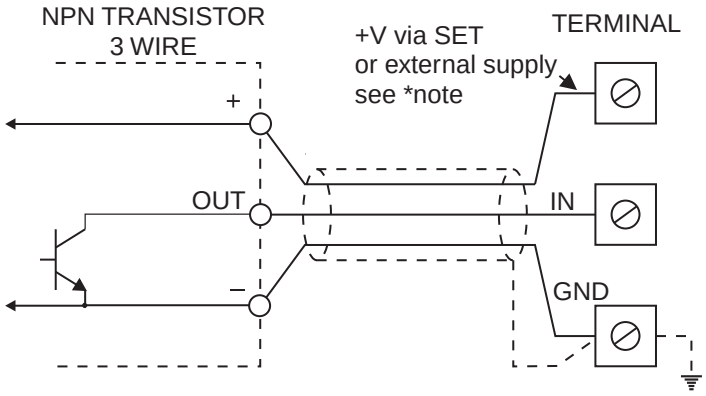


NPN Transistor

Typical Internal Link Settings

VCC up	Link 4	in
Ground	Link 5	out
Low frequency	Link 6	out
NEMA	Link 7	out
DC couple	Link 8	in
Bias	Link 9	in
Hysteresis	Link 10	in
EXT/INT	Link11	set to EXT

Note: The transducer may require an external DC supply. See section 3.3 for internal DC supply link details.

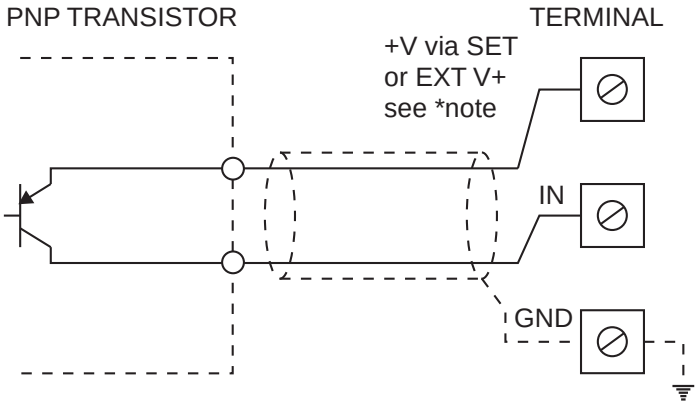


NPN Transistor 3 Wire

Typical Internal Link Settings

VCC up	Link 4	in
Ground	Link 5	out
Low frequency	Link 6	out
NEMA	Link 7	out
DC couple	Link 8	in
Bias	Link 9	in
Hysteresis	Link 10	in
EXT/INT	Link11	set to EXT

Note: The transducer may require an external DC supply.

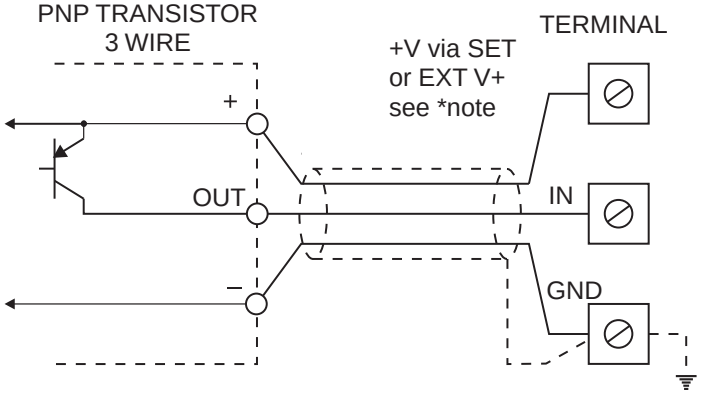


PNP Transistor

Typical Internal Link Settings

VCC up	Link 4	out
Ground	Link 5	in
Low frequency	Link 6	out
NEMA	Link 7	out
DC couple	Link 8	in
Bias	Link 9	in
Hysteresis	Link 10	in
EXT/INT	Link11	set to EXT

Note: The transducer may require an external DC supply. See section 3.3 for internal DC supply link details.



PNP Transistor 3 Wire

Typical Internal Link Settings

VCC up	Link 4	out
Ground	Link 5	in
Low frequency	Link 6	out
NEMA	Link 7	out
DC couple	Link 8	in
Bias	Link 9	in
Hysteresis	Link 10	in
EXT/INT	Link11	set to EXT

Note: The transducer may require an external DC supply. See section 3.3 for internal DC supply link details.

4 Ratemeter Explanation of Functions

Ratemeter/Frequency operation

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

Remember that you will need to enter via CAL or FUNC mode to gain access to functions, the function table for each mode shows which functions require entry via CAL mode. See page 3 for details of how to enter FUNC and CAL modes.

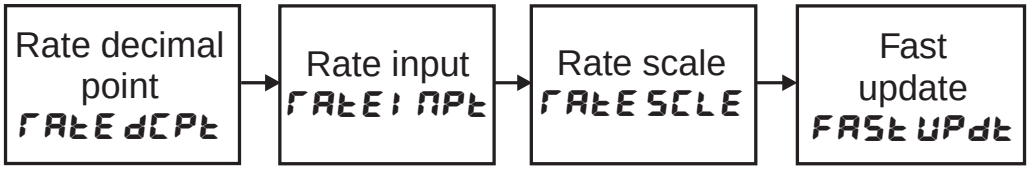
Frequency/rate mode operation modes.

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

1. Rate display, high frequency.

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

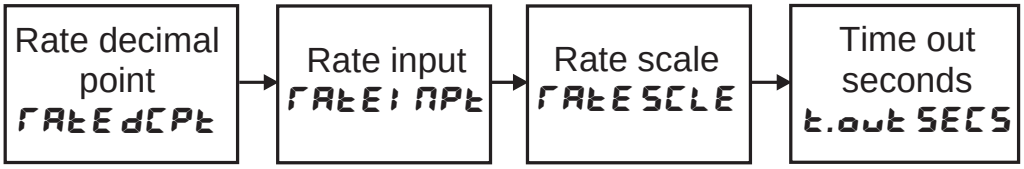
Functions specific to display with FREQ rnGE set to HI F with a rate display



2. Rate display, low frequency.

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

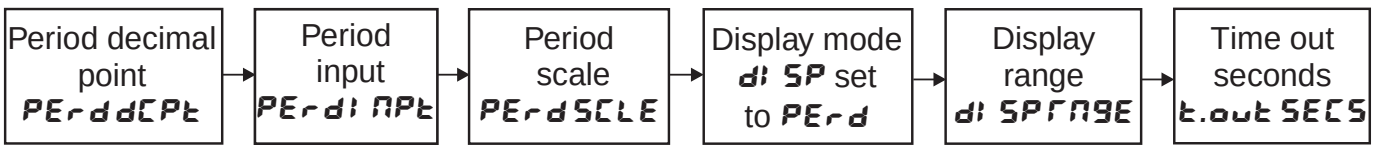
Functions specific to display with FREQ rnGE set to Lo F with a rate display



3. Period display, low frequency.

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

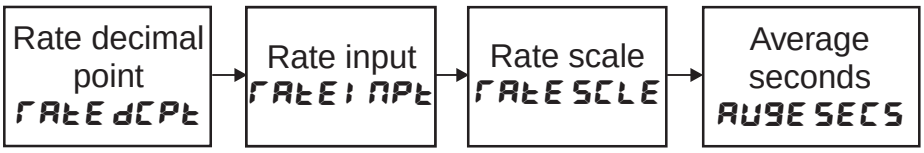
Functions specific to display with FREQ rnGE set to Lo F with a period display



4. Averaged rate display.

With AVGE selected at the FREQ RNGE function the display will average the rate input over the number of seconds selected at the AVGE 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. Note a rolling average R.AVG range is also available - see “Examples” at the end of this chapter.

Functions specific to display with FREQRNGE set to AVGE with a average rate display



Alarm "easy access"

The LD4-TR 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 in order for the easy access to work:

1. Either the ACCS function must be set to EASY or the R.I NP function must be set to SP.AC.

2. At least one alarm must have a setpoint, nothing will happen if all the alarm setpoints are set to OFF.

3. The SP.AC function must be set to allow access to the relays required e.g. if set to A 1-2 then the easy access will work only with alarm relays 1 and 2 even if more relays are fitted.

4. The instrument must be in normal measure mode i.e. if the instrument is powered up so that it is in CAL mode then the easy access will not function. If in doubt then remove power from the instrument, wait for a few seconds then apply power again.

5. If the easy access facility is used then the only way to view or alter any other function settings is to power up via CAL mode i.e. there is no entry to FUNC mode unless the instrument is powered up in CAL mode.

Function	Description
A 1Lo	Alarm 1 low setpoint (value or OFF) - Displays and sets the alarm low setpoint value for the designated alarm relay. The low alarm setpoint may be disabled by pressing the ▲ and ▼ pushbuttons simultaneously. When the alarm is disabled the display will indicate OFF. The alarm relay will trip when the displayed value is less than the AxLo setpoint value. Relays may be configured with both a low and high setpoint, so the relay may be tripped when the reading moves outside the band set between low and high. e.g. if A 1Lo is set to 10.0 and A 1H, is set to 90.0 then the alarm output relay will trip when the display value either goes below 10.0 or goes above 90.0.
A2Lo	Alarm 2 low setpoint (value or OFF) - Displays and sets alarm 2 low setpoint, see A 1Lo for further description.
A 1H,	Alarm 1 high setpoint (value or OFF) - Displays and sets the alarm high setpoint value for the designated alarm relay. The high alarm setpoint may be disabled by pressing the ▲ and ▼ pushbuttons simultaneously. When the alarm is disabled the display will indicate OFF. The alarm relay will trip when the displayed value is greater than the AxH, setpoint value. Relays may be configured with both a low and high setpoint, so the relay may be tripped when the reading moves outside the band set between low and high (see AxLo for example).
A2H,	Alarm 2 high setpoint (value or OFF) - Displays and sets alarm 2 high setpoint, see A 1H, for further description.

Function	Description
A 1HY	Alarm 1 hysteresis [deadband]) (0 to 9999) - this function will not be seen if both the high and low setpoints are set to OFF. Displays and sets the alarm hysteresis limit and is common for both high and low setpoint values. The hysteresis value may be used to prevent too frequent operation of the alarm relay when the measured value stays close to the setpoint. Without a hysteresis setting (AxHY set to zero) the alarm will trip when the display value goes above the alarm setpoint (for high alarm) and will reset when the display value falls below the setpoint, this can result in repeated on/off switching of the relay at around the setpoint value. The hysteresis setting operates as follows: In the high alarm mode, once the alarm is tripped the input must fall below the setpoint value minus the hysteresis value to reset the alarm. e.g. if A 1H, is set to 50.0 and A 1HY is set to 3.0 then the alarm output relay will trip once the display value goes above 50.0 and will reset when the display value goes below 47.0 (50.0 minus 3.0). In the low alarm mode, once the alarm is tripped the input must rise above the setpoint value plus the hysteresis value to reset the alarm. e.g. if A 1Lo is set to 20.0 and A 1HY is set to 10.0 then the alarm output relay will trip when the display value falls below 20.0 and will reset when the display value goes above 30.0 (20.0 plus 10.0). The hysteresis units are expressed in displayed engineering units.
A2HY	Alarm 2 hysteresis (0 to 9999) - Displays and sets alarm 2 hysteresis, see A 1HY for further description.
A 1tt	Alarm 1 trip time (0 to 60 seconds) - this function will not be seen if both the high and low setpoints are set to OFF. Displays and sets the alarm trip time and is common for both alarm high and low setpoint values. The trip time is the delay time before the alarm relay will trip when an alarm condition is present. The alarm condition must be present continuously for the trip time period before the alarm will trip. This function is useful for preventing an alarm trip due to short non critical deviations from setpoint.
A2tt	Alarm 2 trip time (0 to 60 seconds) - Displays and sets alarm 2 trip time, see A 1tt for further description.
A 1rt	Alarm 1 reset time (0 to 60 seconds) - this function will not be seen if both the high and low setpoints are set to OFF. Displays and sets the alarm relay reset time. With the alarm condition is removed the alarm relay will stay in its alarm condition for the time selected as the reset time.
A2rt	Alarm 2 reset time (0 to 60 seconds) - Displays and sets alarm 2 reset time, see A 1rt for further description.
A 1n.o or A 1n.c	Alarm 1 normally open or normally closed - this function will not be seen if both the high and low setpoints are set to OFF. Displays and sets the alarm relay action to normally open (de-energised) or normally closed (energised), when no alarm condition is present. A normally closed alarm is often used to provide a power failure alarm indication. Use the ▲ or ▼ button to choose either normally open or normally closed.
A2n.o or A2n.c	Alarm 2 normally open or normally closed - Displays and sets alarm 2 normally open/normally closed operation, see A 1n.o/A 1n.c for further description.
brgt	Display brightness (1 to 15) - Displays and sets the digital display brightness. The display brightness is selectable from 1 to 15, where 1 = lowest intensity and 15 = highest intensity. This function is useful for reducing glare in low light environments. See also dULL function below.

Function	Description
dull	Remote display brightness (0 to 15) - seen only when r.i np set to dull Displays and sets the level for remote input brightness switching, see r.i np function. When the remote input is set to dull the remote input can be used to switch between the display brightness level set by the br9t function and the display brightness set by the dull function. The display brightness is selectable from 0 to 15, where 0 = lowest intensity and 15 = highest intensity. This function is useful in reducing glare when the display needs to be viewed in both light and dark ambient light levels and may also be used to reduce power consumption.
drnd	Display rounding - Displays and sets the display rounding value. This value may be set from 1- 5000 displayed units (e.g. 0.001 to 5.000 if decimal point set to 3 places). Display rounding is useful for reducing the instrument resolution without loss of accuracy in applications where it is undesirable to display to a fine tolerance. (example: if set to 10 the instruments display will increment in multiples of 10).
FLtr	Digital filter (0 to 8) - Displays and sets the digital filter value. Digital filtering is used for reducing susceptibility to short term interference, interference is normally seen as unwanted display variations from the expected value. The digital filter range is selectable from 0 to 8, where 0 = none and 8 = most filtering. The higher the filter setting the slower the display update. A typical value for the digital filter would be 3.
rAtE dCPt	Rate decimal point selection (0, 0.1, 0.02 etc.) - Displays and sets the decimal point position for the rate display. For example selecting 0 will mean no decimal points (e.g. a display such as 25), 0.1 means 1 decimal point place (e.g. 25.4), 0.02 gives 2 decimal point places (e.g. 25.35) etc. The maximum number of decimal point places is one less than the number of digits on the display e.g. a 4 digit display can have 3 decimal points, a 5 digit display can have 4 decimal points etc. Note: If the number of decimal points is altered then the display scaling figure (rAtE SCLE) will also be affected. Always check the scaling figure following a decimal point change and alter as required.
PErd dCPt	Period decimal point selection - only seen when period display selected. Displays and sets the decimal point for the period display. Note that the decimal point display is tied to the display range (di SP rnGE) function e.g. if the display range function is set to 0.00.02 then the two decimal place setting will show up as 0.00.02 and one decimal place will show as 0.00.1.
rAtE i nPt	Rate input scale factor - Displays and sets the number of input pulses to be used with the rate scale function to generate the display scaling. See examples later in this chapter.
rAtE SCLE	Rate scale factor - Displays and sets the scale factor to be used with the rate input setting. See examples later in this chapter. Scale and input work together as follows: $\text{Display} = \frac{\text{Input frequency (Hz)} \times \text{rAtE SCLE}}{\text{rAtE i nPt}}$
PErd i nPt	Period input scale factor - 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.
PErd SCLE	Period scale factor - only seen when period display selected. Displays and sets the scale factor to be used with the period input setting. To calculate the display value the input frequency and hence the period of this input needs to be known. Scale and input work together to produce a display as follows: $\text{Display} = \frac{\text{Input period (seconds)} \times \text{PErd SCLE}}{\text{PErd i nPt}}$ Note: the displayed value is also affected by the decimal point and display range settings.

Function	Description
FrEq rnGE	Frequency range (LoF, Hi F. AUGE or r.AUG) - Displays and sets the frequency input range, see section 4.1 for examples of the use of each of these modes. Select LoF if the input frequency is likely to be lower than 4Hz and not greater than 1kHz. See also the t.out SECS function which is used when LoF is selected. 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. 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.
FASt UPdt	Fast update (on or OFF) - seen only when FrEq rnGE set to Hi F. With FASt UPdt set to OFF the relay and analog retransmission updates will take place approximately twice per second. With FASt UPdt set to on the relay and analog retransmission updates will take place approximately six times per second.
inPt EdGE	Input edge triggering (rising or FALL) - Displays and sets the input edge on which the instrument will trigger. Select FALL for triggering on a falling edge. Select rising for triggering on a rising edge.
di SP	Period or rate display - When using the low frequency range the user has the option of displaying either the rate of the input or the period of the input. Select rAtE for a rate display in Hz. Select Perd for a period display (display format is determined by the display range function (di SP rnGE) and the decimal point setting).
di SP rnGE	Period display range - Sets the display range when Perd is chosen as the default display at the di SP function (FrEqrnGE must also be set to LoF to see this function). The options are 0, 0.0 1 or 0.00.02. The 0 option allows a display in milli seconds. The 0.0 1 option allows a display in minutes and seconds and the 0.00.02 option allows a display in hours.mins.secs. The display units and scaling will now depend on the Perd dCPt, Perd inPt and Perd 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, PerddCPt and Perd SCLE functions. Examples are shown for a 5 digit display type instrument.

di SP rnGE	Perd dCPt	Perd inPt	Perd SCLE	Value displayed
0	0	1	1	500
0	0	1	2	1000
0	0	1	10	5000
0	0.003	1	0.00 1	0.500
0.0 1	0.00	1	1.00	500.0
0.00.02	0.00.02	1	0.00.0 1	0.05.00

<table>
<tr><th>Function</th><th>Description</th></tr>
<tr><td>di SP rnGE
cont.</td><td>With the PEr di nPt function set to 1000 the display will time in seconds rather than milli seconds. The display can now be made to show hours minutes & seconds. The table below gives some examples.
<table>
<tr><th>d, SP rnGE</th><th>PEr d dCPt</th><th>PEr d i nPt</th><th>PEr d SCLE</th><th>Actual period</th><th>Value displayed</th></tr>
<tr><td>0.00.02</td><td>0.00.02</td><td>1000</td><td>0.00.0 i</td><td>1 min 15 sec</td><td>0.0 i. 15</td></tr>
<tr><td>0.00.02</td><td>0.00.02</td><td>1000</td><td>0.00.0 i</td><td>2 hours, 12 minutes 30 seconds</td><td>2. 12.30</td></tr>
</table></td></tr>
<tr><td>t.out SECS</td><td>Time out (i to 9999 seconds) - only seen if LoF is selected at the FrEq rnGE function.
Displays and sets the time out in seconds when using the low frequency (LoF) range. The timeout allows very low frequency inputs to be used without the display reverting to zero between samples. If no input pulses are received the display hold the previous display value for the time out period. If a pulse is received during this time the display will update. If no pulses are received or the input period exceeds the time out value set then the display will indicate 0 (or -or- if displaying period).</td></tr>
<tr><td>AUGE SECS</td><td>Average seconds (i to 9999 seconds) - only seen if AUGE or r.AUG is selected at the FrEq rnGE function.
Displays and sets the number of seconds over which the rate should be averaged when using the low frequency (LoF) range. The rate display will not update until the end of the average seconds time. This function allows the user to select a display update rate most suitable for applications in which the rate input may be irregular.</td></tr>
<tr><td>AUGE cnt</td><td>Average count (i to 30 seconds) - only seen if r.AUG is selected at the FrEq rnGE function. Sets the number of time periods 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.</td></tr>
<tr><td>r.i nP</td><td>Remote input function - Terminals labelled KEY SW 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. PHi or PLo will flash before each display to give an indication of display type.
2Er0 - zero the display. The total will be zeroed when the remote input is short circuited.
SP.AC - setpoint access only. This blocks access to any functions except the alarm setpoint functions unless the remote input pins are short circuited or entry is made via CAL mode.
no.AC - no access. This blocks access to all functions unless the remote input pins are short circuited or entry is made via CAL mode.</td></tr>
</table>

Function	Description
r.i nP cont.	di SP - display toggle. With SEt OPEr 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 br9t function and the brightness level set at the duLL function. 9.rSt - grand total reset. This mode allows the remote input to be used as a reset input for the grand total seen in the totl and both modes.
P.but	P button function - The P button may be set to operate 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. Functions available are: nonE, Hi , Lo, Hi Lo, 2Er0 , di SP .FUnC or 9rSt. The FUnC function is used only in totalising and can be used to adjust the preset value. When set to FUnC the message PSEt 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. The 2Er0, FUnC and 9.rSt functions are applicable only to totaliser operation.
ACCS	Access mode (OFF, EASY, nonE or ALL) - If set to OFF the mode function has no effect or alarm relay operation. If set to EASY the "easy alarm access" mode will be in operation, see page 13. If set to nonE there will be no access to any functions via FUnC mode, entry via CAL mode must be made to gain access to alarm functions. This function provides an alternative to using the r.i nP function for easy access or no access mode thereby allowing the remote input to be programmed for an alternative use. If set to ALL then access to all functions can be made via FUnC mode i.e. there is no need to enter via CAL mode.
SPAC	Setpoint access (A 1 or A 1-2) - Sets the access to the alarm relay set points. The following choices are available: A 1 - Allows setpoint access to alarm 1 only. A 1-2 - Allows access to alarms 1 and 2 only. For this function to operate the remote input function must be set to SP.AC.
Lo di SP	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 rate display reading falls below 50 the message -or- or the display value (see di SP function) will flash instead of the normal display units. 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.
Hi 9H di SP	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 rate display reading rises above 1000 the message -or- or the display value (see di SP function) will flash instead of the normal display units. 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.
di SP	Display overrange warning flashing mode (FLSH or -or-) - This function is used in conjunction with the Lo and Hi 9H di SP functions. The di SP function can be set to FLSH or -or-. If the value set at the Lo or Hi 9H di SP function is exceeded and the di SP function is set to FLSH then the display value will flash on for approximately one second and off for approximately one second as a warning. If the value set at the Lo or Hi 9H di SP function is exceeded and the di SP function is set to -or- then the -or- message will flash on for approximately one second and off for approximately one second as a 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.

Function	Description
SEt OPEr	Set operating mode - Displays and sets the selected operating mode, e.g. select tOtI for totaliser operation. See the dedicated chapter in this manual for description of the required operating mode. Options are: S.Prd - Not applicable to this manual PErd - Not applicable to this manual both - Frequency and total measurement - allows toggling between rate and total display. totL - Total measurement FrEq - Frequency/rate measurement
SEr.I tYPE	Serial communications type - Select either nonE for no communications, r232 for RS232 communications or r485 for RS485 communications.
bAud	Set baud rate - Select from 300. 600. 1200. 2400. 4800. 9600. 19.2 or 38.4.
PrtY	Set parity - Select parity check to either nonE, EUEn or odd.
O.Put	Set RS232/485 interface mode - Select di SP, Cont or POLL Allows user to select the RS232/485 interface operation as follows:- di SP Sends image data from the display without conversion to ASCII. Cont Sends ASCII form of display data every time display is updated. POLL Controlled by computer or PLC as host. Host sends command via RS232/485 and instrument responds as required.
Addr	Set unit address for polled (POLL) mode (0 to 31) - Allows several units to operate on the same RS485 interface reporting on different areas etc. The host computer or PLC may poll each unit in turn supplying the appropriate address. The unit address ranges from 0 to 31 (DEC) but is offset by 32 (DEC) to avoid clashing with ASCII special function characters (such as <STX> and <CR>). Therefore 32 (DEC) or 20 (HEX) is address 0, 42 (DEC) or 2A (HEX) addresses unit 10.

Returning to the normal measure mode

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

4 .1 Examples

Rate display examples

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

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

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 I nPt value will be 1 and the rAtE SCLE value will be 60 i.e. 1 bottle per second = 60 bottles per minute. The procedure is as follows:

1. Follow the procedure shown on page 3 to enter the setup functions via CAL mode.
2. Step through the functions by pressing and releasing F until the rAtE I nPt function is seen.
3. Use the ▲ or ▼ push button to change the setting to 1.
4. Press F, the function rAtE SCLE will appear followed by the previous input value.
5. Use the ▲ or ▼ push button to change the setting to 60.
6. Press F, the function FrEq rnGE will appear followed by the previous input value.
7. Use the ▲ or ▼ push button to change the setting to Lo F.
8. Step through the functions by pressing and releasing F until the t.out SECS function is seen.

9. Use the ▲ or ▼ push button to change the setting to a value greater than 5 seconds e.g. **8**.

10. Press **F** to accept the change then either press **P** to exit or continue pressing and releasing **F** until the **FUNC End** message is seen and the unit returns to normal measure mode.

Example - averaged rate display

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

Example - rolling averaged rate display

The rolling averaged rate display uses both the averaging rate (set by **AVGE SECS**) and the average count (set **AVGE Cnt**). For example if the with the **FREQ RNGE** function set to **r.AVG** (rolling average), the **AVGE SECS** function set to **300** (300 seconds or 5 minutes) and the **AVGE 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.

Example - RPM display

A proximity sensor connected to a flywheel produces 20 pulses per revolution. The LD4 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 3 to enter the setup functions via **CAL** mode.

2. Step through the functions by pressing and releasing **F** until the **rAtE dCPt** function is seen.

3. Use the ▲ or ▼ push button to change the setting to **0.1.**

4. Press **F**, the function **rAtE INPt** will appear followed by the previous input value.

5. Use the ▲ or ▼ push button to alter the previous input value to the new input value of **1**.

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

7. Use the ▲ or ▼ push button to alter the previous scale value to the new scale value of **3.0**.

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

9. Follow the procedure shown on page 3 to enter the setup functions via **FUNC** mode.

10. The first function is **A1Lo** this will be seen followed by the previous low alarm setting.

11. Use the ▲or ▼ push button to change the **A1Lo** setting to **518.5**. Press **F** to accept the change.

12. Press **F**, the function **A1Hi** will appear followed by the setpoint value.

13. Use the ▲ or ▼ push button to alter the previous setpoint value to the new setpoint value of **600.0**.

14. Press **F**, the function **A1HY** will appear followed by the previous hysteresis value.

15. Use the ▲ or ▼ push button to alter the previous hysteresis value to the new hysteresis value of **20.0**.

16. Step through the functions by pressing and releasing **F** until the **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 or 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 to produce an output frequency proportional to the rate of flow.The scaling is calculated using information provided by the manufacturer or from test results. e.g.:

A turbine produces 767 pulses per litre

- to display litres/second set rAtE I nPt 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. See also the “Totaliser Explanation of Functions” chapter for examples of total scaling for such a flowmeter.

The “Rota pulse” paddle wheel flow meter (this sensor model is commonly used as an input to the LD4-TR) 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 .

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

Example - period display in rate mode.

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

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

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

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

Example - wind speed display in rate mode.

Model WS30 wind speed sensor sends 1250 pulses per kilometer.
To display in kilometers per hour the settings required are:

PErdI nPt = 125
PErdSCLE = 360

To display in metres per second:

PErdI nPt = 125
PErdSCLE = 100

Model WS03002 wind speed sensor outputs a sine wave with 30Hz being equivalent to 22.8m/S or 82km/h.
To display in metres per second:

PErdI nPt = 300
PErdSCLE = 228

To display in kilometres per hour:

PErdI nPt = 30
PErdSCLE = 82

5 Ratemeter Function Table

Initial display	Meaning of display	Next display	Default Setting	Record Your Settings
A1Lo	Alarm 1 low setpoint value	Setpoint value or OFF	OFF	
A1Hi	Alarm 1 high setpoint value	Setpoint value or OFF	OFF	
A2Lo	Alarm 2 low setpoint value	Setpoint value or OFF	OFF	
A2Hi	Alarm 2 high setpoint value	Setpoint value or OFF	OFF	
A1HY	Alarm 1 hysteresis	Hysteresis value in measured units	10	
A2HY	Alarm 2 hysteresis	Hysteresis value in measured units	10	
A1tt	Alarm 2 trip time	No of seconds before relay trips	0	
A2tt	Alarm 2 trip time	No of seconds before relay trips	0	
A1rt	Alarm 1 reset time	No of seconds before relay resets	0	
A2rt	Alarm 2 reset time	No of seconds before relay resets	0	
A1no or A1nc	Alarm 1 action N/O or N/C	A1no or A1nc	A1no	
A2no or A2nc	Alarm 2 action N/O or N/C	A2no or A1nc	A2no	
brgt	Digital display brightness	1 to 15 (15 = highest brightness)	15	
dull	Remote input brightness control	0 to 15 (15 = highest brightness)	0	
Functions below are accessible via CAL mode only				
drnd	Display rounding selects resolution	Value in memory	1	
FLtr	Digital filter range 0 to 8	0 to 8 (8 = most filtering)	2	
rAtE dCPt or PErd dCPt	Decimal point setting for rate display or decimal point setting for period depending upon the di SP setting	Value in memory	0	
rAtE inPt or PErd inPt	Rate input setting (Hz) or Period input setting (Secs.), see di SP setting	Value in memory	1	
rAtE SCLE or PErd SCLE	Rate scale setting or Period scale setting, see di SP setting	Value in memory	1	
FrEq rnGE	Frequency range low or high frequency	LoF, HiF, AUGE or r.AUG	HiF	
FASt UPdt	Fast update mode	on or OFF	OFF	
inPt EdGE	Input edge triggering rising or falling edge	FALL or rISE	rISE	
di SP	Default display for low frequency input (seen if FrEq rnGE set to LoF)	rAtE or PErd	rAtE	
di SP rnGE	Display range (seen if di SP set to PErd)	0.0.0 1 or 0.00.02	0	
t.out SECS	Timeout (seen only when FrEqrnGE set to AUGE or LoF)	1 to 9999	0	
AUGE SECS	Averaging time, seconds (seen if FrEq rnGE set to AUGE or r.AUG)	1 to 9999	0	
AUGE cnt	Average count (seen if FrEq rnGE set to r.AUG)	1 to 30	1	
r.inP	Remote input	nonE, P.HLd, d.HLd, Hi .Lo, Hi Lo, 2Er0, SP.Ac, no.Ac, di SP, dull or 9.rSt	nonE	
P.but	P button operation	nonE, Hi .Lo, Hi Lo, 2Er0, di SP, FUnC or 9.rSt	nonE	
ACCS	Alarm relay access mode	OFF, EASY, nonE or ALL	OFF	
SPAC	Setpoint access	A1, A1-2 etc.	A1	
Lo di SP	Display low overrange	Limit value or OFF	OFF	
Hi gH di SP	Display high overrange	Limit value or OFF	OFF	
di SP	Overrange display warning flashing mode	FLSH or -or-	FLSH	
SEt OPEr	Set operating mode	S.Prd, PErd, both, totl or FrEq	FrEq	
SEr.i tYPE	Serial communications type	nonE, r232 or r485	nonE	
bAUd rAtE	Baud rate	300, 600, 1200, 2400, 4800, 9600, 19.2 or 38.4	9600	
PrtY	Parity select	nonE, EVEn or Odd	nonE	
O.Put	Output, continuous or controlled	POLL, Cont or di SP	POLL	
Addr	Set unit address for POLL mode	0 to 31	0	

Note: Functions shown shaded will be seen only when those options are fitted.

6 Totaliser Explanation of Functions

Totaliser functions

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

Remember that you will need to enter via CAL or FUNC mode to gain access to functions, the function table for each mode shows which functions require entry via CAL mode. See page 3 for details of how to enter FUNC and CAL modes.

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

Function	Description
A 1PS	Alarm 1 pass value (value or OFF) - only seen if A 1.PS selected at the A 1.PS/A 1.tL function. Displays and sets the alarm pass value (see A 1.PS/A 1.tL function). The alarm relay will activate at multiples of the pass value e.g. if A 1PS is set to 50 then the relay will activate at a total display value of 50, 100, 150 etc. The time for which the relay remains activated at each pass value is set via the A 1Pt function which follows. The pass value may be set anywhere in the display range of the instrument. The pass value can be set to OFF (disabled) by pressing the ▲ and ▼ buttons together.
A2PS	Alarm 2 pass value (value or OFF) - only seen if A2.PS selected at the A2.PS/A2.tL function. See A 1PS above for a description of operation.
A 1Pt	Alarm 1 pass time (0.0 to 999.9 seconds) - only seen if A 1.PS selected at the A 1.PS/A 1.tL function. Displays and sets the alarm pass time in seconds & tenths of seconds within the range 0.0 to 999.9 seconds. The value set is the time for which the relay will remain energised when activated at a pass 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 LD4 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.
A 1Pt	Alarm 2 pass time - only seen if A2.PS selected at the A2.PS/A2.tL function. See A 1Pt above for a description of operation.
tOt1 dCPt	Totaliser decimal point selection - Displays and sets the decimal point position for the totaliser display. For example selecting 0 will mean no decimal points (e.g. 25), 0. 1 means 1 decimal point place (e.g. 25.4), 0.02 gives 2 decimal point places (e.g. 25.35) etc. The maximum number of decimal point places is one less than the number of digits on the display e.g. a 4 digit display can have 3 decimal points, a 5 digit display can have 4 decimal points etc. Note: If the number of decimal point is altered then the display scaling figure (tot1 SCLE) will also be affected. Always check the scaling figure following a decimal point change and alter as required.
tOt1 1 nPt	Totaliser input pulse count - Displays and sets the number of input pulses to be used with the total scale function to generate the display scaling. See examples which follow.
tOt1 SCLE	Totaliser scale factor - Displays and sets the scale factor for totaliser. Scale and input work together as follows: New Total = Old Total + $\frac{\text{Input pulses counted x tOt1 SCLE}}{\text{tOt1 1 nPt}}$

<table>
<tr><th>Function</th><th>Description</th></tr>
<tr><td>G.tot</td><td>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, totl or G.tot to indicate what the following total display is showing. To reset the grand total the remote input must be set to G.rSt, see the r.1 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
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 S.1 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.
<table>
<tr><th>Grand Total Mode</th><th>Up Count</th><th>Down Count</th></tr>
<tr><td>nonE</td><td>No effect</td><td>No effect</td></tr>
<tr><td>For</td><td>The grand total will increase with each up count input pulse. The grand total can show positive and negative totals.</td><td>The grand total will decrease with each down count input pulse. The grand total can show positive and negative totals.</td></tr>
<tr><td>rEU</td><td>The grand total will decrease with each up count input pulse. The grand total can show both positive and negative totals.</td><td>The grand total will increase with each down count input pulse. The grand total can show both positive and negative totals.</td></tr>
<tr><td>POS</td><td>The grand total will increase with each up count input pulse. The grand total display cannot go negative.</td><td>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.</td></tr>
<tr><td>nEG</td><td>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.</td><td>The grand total will increase with each down count input pulse. The grand total display cannot go negative.</td></tr>
<tr><td>Abs</td><td>The grand total will increase with any input pulse whether up or down count. The grand total display cannot go negative.</td><td>The grand total will increase with any input pulse whether up or down count. The grand total display cannot go negative.</td></tr>
</table></td></tr>
<tr><td>i nPt
EdgE</td><td>Input edge triggering - Displays and sets the input edge on which the instrument will trigger. Select FALL for triggering on a falling edge. Select rI SE for triggering on a rising edge.</td></tr>
<tr><td>A 1.tL
A 1.PS</td><td>Alarm relay 1 operation mode - Alarm relay 1 can be set to operate as either a standard setpoint relay when A 1.tL is selected or as a “pass value” relay when A 1.PS is selected.
With A 1.tL selected the relay will operate from the high and/or low setpoints (A 1H, and A 1Lo). 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 1.PS and A 1.Pt will not be seen in if the A 1.tL mode is selected.
With A 1.PS selected the relay will operate on a pass value i.e. it will operate on multiples of the A 1.PS value set (the first function described in this chapter). See A 1.PS and A 1.tL for further description of operation. The setpoint functions A 1Lo, A 1H, , A 1HY, A 1tt, A 1rt, A 1SP/A 1tL will not be seen if the A 1.PS mode is selected.</td></tr>
</table>

<table>
<tr><th>Function</th><th>Description</th></tr>
<tr><td>A2.tL
A2.PS</td><td>Alarm relay 1 operation mode - Alarm relay 2 setpoint or pass mode operation - see A 1.tL/A 1.PS above for description.</td></tr>
<tr><td>P.SEt</td><td>Preset value - This function displays and sets the preset value which the total count can be reset to. For example, if the LD4 is set to count down from a preset value then the P.SEt function sets this value. See also c.rSt function which sets the reset mode.</td></tr>
<tr><td>SPAC</td><td>Setpoint access - only seen if more than 1 relay fitted.
Sets the access to the alarm relay set points. The following choices are available: A 1 - Allows setpoint access to alarm 1 only. A 1-2 - Allows access to alarms 1 and 2 only. A 1-3 allows access to alarms 1,2 and 3 etc. up to the maximum number of relays fitted. For this function to operate the remote input function must be set to SP.AC.</td></tr>
<tr><td>S.I nP</td><td>SET terminal input - Sets, in conjunction with the KEY SET terminal input, the count up/down operation of the totaliser, ensure that the KEY link (LK2) is in and that LK1 & 3 are out. The S.I nP function and the KEY SET terminal input connection may be used in one of the modes shown in the table below.
<table>
<tr><th>S.I nP setting</th><th>SET (KEY SET TERMINAL)</th><th>Operation mode</th></tr>
<tr><td>Lo</td><td>Open i.e. no connection to KEY SET terminal</td><td>Count down</td></tr>
<tr><td>Lo</td><td>Closed i.e. KEY SET terminal shorted to GND</td><td>Count up</td></tr>
<tr><td>Hi 9H</td><td>Open i.e. no connection to KEY SET terminal</td><td>Count up</td></tr>
<tr><td>Hi 9H</td><td>Closed i.e. KEY SET terminal shorted to GND</td><td>Count down</td></tr>
</table></td></tr>
<tr><td>Lo
dI SP</td><td>Low overrange limit value - Not applicable to totaliser operation.</td></tr>
<tr><td>HI 9H
dI SP</td><td>High overrange limit value - Not applicable to totaliser operation.</td></tr>
<tr><td>dI SP</td><td>Display overrange warning flashing mode - Not applicable to totaliser operation.</td></tr>
<tr><td>c.rSt</td><td>Counter reset value - The reset terminal can be programmed to cause the display to reset to either zero or the selected preset value. Choose either 2ErO or P.SEt to select the required operation.</td></tr>
<tr><td>c.rSt</td><td>Counter reset mode - Allows selection of reset level or edge to force a counter reset. If set to LO a low input level or closed switch on the reset line will force a reset. If set to HI a high input level or open switch on the reset line will force a reset. If set to LOE then a falling edge or switch closure on the reset line will force a reset. If set to HI E then a rising edge or switch opening on the reset line will force a reset.</td></tr>
<tr><td>cntr
rSt</td><td>Counter reset value - 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 2ErO then when the display value reaches 99 the next input pulse will cause the instrument to automatically reset to 0.</td></tr>
<tr><td>A 1H,
rSt</td><td>Alarm 1 high reset operation) (on or 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 (A 1.tL) then when the display value reaches the value set at A 1H, the relay will operate momentarily (the duration of the relay pulse can be extended via the A 1rt function if required).
If the alarm mode is set to pass (A 1.PS) then the display will reset when the display value reaches the pass value (set at A 1PS) and the relay will activate and will remain activated for the time set at the A 1Pt function.</td></tr>
</table>

Returning to the normal measure mode

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

6 .1 Examples

Flow Totalising

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 - A turbine 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 3 to enter the setup functions via CAL mode.
2. Step through the functions by pressing and releasing F until the tot1 dCPt function is seen followed by the previous decimal point setting.
3. Use the ▲ or ▼ push button to change the tot1 dCPt setting to 0.1. Press F to accept the change.
4. Step through the functions by pressing and releasing F until the tot1 1 nPt function followed by the previous input value is seen.
5. Use the ▲ or ▼ push button to alter the previous input value to the new input value of 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 or continue pressing and releasing F until the FUNC End message is seen and the display returns to normal measurement mode.

Example - A Rota pulse paddle wheel flowmeter (this sensor model is commonly used as an input to the LD4-TR) gives 45.6 pulses per metre flow of liquid. The flowmeter is places in a 100mm pipe. The LD4 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 3 to enter the setup functions via CAL mode.
2. Step through the functions by pressing and releasing F until the A 1H, function is seen followed by the previous high alarm setting.
3. Use the ▲ or ▼ push button to change the A 1H, 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 1 nPt 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.

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.

$$Area = \pi r^2 = \pi \; x \; 0.05^2 = 0.00785 \; m^2$$

The volume of a 1 metre length is: $Volume = area \; x \; length = 0.00785 \; x \; 1 = 0.00785 \; m^3$

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

$Litres \; per \; metre \; length = volume \; x \; 1000 = 0.00785 \; x \; 1000 = 7.85 \; Litres$

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 of 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:-

Pipe diameter	Litres	Kilolitres or cubic metres
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

Examples - Item counting

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

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 3 to enter the setup functions via CAL mode.
2. Step through the functions by pressing and releasing F until the tot1 dCPt function is seen followed by the previous decimal point setting.
3. Use the ▲ or ▼ push button to change the tot1 dCPt setting to 0.003. Press F to accept the change.
4. Step through the functions by pressing and releasing F until the tot1 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 or 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 LD4 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 3 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 1n.o/A 1n.c function is seen.
5. Use the ▲ or ▼ push button to change the setting to A 1n.c (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 S.I 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 c.rSt function followed by the previous reset value is seen.
15. Use the ▲ or ▼ push button to change the setting to P.SEt. This will force the instrument display to revert to the preset value whenever the display is reset.
16.Use the ▲ or ▼ push button to alter the previous scale value to the new scale value of 1.
17. Press F to accept the change then either press P to exit or continue pressing and releasing F until the FUNC End message is seen and the display returns to normal measurement mode.

7 Totaliser Function Table

Initial display	Meaning of display	Next display	Default Setting	Record Your Settings
A1PS	Alarm 1 pass value	Pass value or OFF	OFF	
A2PS	Alarm 2 pass value	Pass value or OFF	OFF	
A1Pt	Alarm 1 pass time	Time in seconds	0.0	
A2Pt	Alarm 2 pass time	Time in seconds	0.0	
A1Lo	Alarm 1 low setpoint value	Setpoint value or OFF	OFF	
A1Hi	Alarm 1 high setpoint value	Setpoint value or OFF	OFF	
A2Lo	Alarm 2 low setpoint value	Setpoint value or OFF	OFF	
A2Hi	Alarm 2 high setpoint value	Setpoint value or OFF	OFF	
A1HY	Alarm 1 hysteresis	Hysteresis value in measured units	10	
A2HY	Alarm 2 hysteresis	Hysteresis value in measured units	10	
A1tt	Alarm 2 trip time	No of seconds before relay trips	0	
A2tt	Alarm 2 trip time	No of seconds before relay trips	0	
A1rt	Alarm 1 reset time	No of seconds before relay resets	0	
A2rt	Alarm 2 reset time	No of seconds before relay resets	0	
A1no or A1nc	Alarm 1 action N/O or N/C	A1no or A1nc	A1no	
A2no or A2nc	Alarm 2 action N/O or N/C	A2no or A1nc	A2no	
brgt	Digital display brightness	0 to 15 (15 = highest brightness)	15	
dull	Remote input brightness control	0 to 15 (15 = highest brightness)	0	
Functions below are accessible via CAL mode only.				
totl dCPt	Decimal point setting for totaliser display	Value in memory	0	
totl 1nPt	Totaliser input setting see “Totaliser Operation” Chapter	Value in memory	1	
totl SCLE	Totaliser scale setting	Value in memory	1	
G.tot	Grand total operating mode	NONE, For, FEU, POS, NEG or Abs	NONE	
1nPt Edge	Input edge triggering rising or falling edge	FALL or RISE	RISE	
r.1nP	Remote input	NONE, P.HLd, d.HLd, Hi, Lo, Hi Lo, ZERO, SP.Ac, No.Ac, di SP, dull or G.rSt	NONE	
P.but	P button operation	NONE, Hi, Lo, Hi Lo, ZERO, di SP, FUNC or G.rSt	NONE	
ACCS	Alarm relay access mode	OFF, EASY, NONE or ALL	OFF	
SPAC	Setpoint access	A1, A1-2 etc.	A1	
A1.tL/A1.PS	Alarm 2 operation mode total or pass	A1.tl or A1.PS	A1.rt	
A2.tL/A2.PS	Alarm 2 operation mode total or pass	A2.tl or A2.PS	A2.rt	
PSEt	Preset value	Value in memory	0	
S.1nP	SET terminal low or high input operation	Lo or Hi GH	Hi GH	
Lo di SP	Display low overrange	Limit value or OFF	OFF	
Hi GH di SP	Display high overrange	Limit value or OFF	OFF	
di SP	Overrange display warning flashing mode (only valid for FrEG operation)	FLSH or -or-	FLSH	
c.rSt	Reset value zero or preset	ZERO or P.SEt	ZERO	
c.rSt	Reset mode	Lo, Hi, LoE or Hi E	Lo	
cntr rSt	Reset value	Value in memory	0	
A1Hi rSt	Alarm 1 high reset	on or OFF	OFF	
SEt OPEr	Set operating mode	S.Prd, PErd, both, totL or FrEG	FrEG	
SEr.1 tYPE	Serial communications type	NONE, r232 or r485	NONE	
bAUd rAtE	Baud rate.	300, 600, 1200, 2400, 4800, 9600, 19.2 or 38.4	9600	
PrtY	Parity select	NONE, EUEN or Odd	NONE	
O.Put	Output, continuous or controlled	POLL, Cont or di SP	POLL	
Addr	Set unit address for POLL mode	0 to 31	0	

Note: Functions shown shaded will be seen only when those options are fitted.

8 Both Mode

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

The ▲ and ▼ buttons can be used to toggle between totaliser and ratemeter displays. Alternatively a remote input contact closure can be used across terminals GND and KEY SW. If these terminals are to be used to toggle between displays then the remote input function **r.i nP** must be set to **di SP**.

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

8.1 Both Mode Function Table

Initial display	Meaning of display	Next display	Default Setting	Record Your Settings
A 1PS	Alarm 1 pass value	Pass value or **OFF**	**OFF**	
A2PS	Alarm 2 pass value	Pass value or **OFF**	**OFF**	
A 1Pt	Alarm 1 pass time	Time in seconds	**0.0**	
A2Pt	Alarm 2 pass time	Time in seconds	**0.0**	
A 1Lo	Alarm 1 low setpoint value	Setpoint value or **OFF**	**OFF**	
A 1H,	Alarm 1 high setpoint value	Setpoint value or **OFF**	**OFF**	
A2Lo	Alarm 2 low setpoint value	Setpoint value or **OFF**	**OFF**	
A2H,	Alarm 2 high setpoint value	Setpoint value or **OFF**	**OFF**	
A 1HY	Alarm 1 hysteresis	Hysteresis value in measured units	**10**	
A2HY	Alarm 2 hysteresis	Hysteresis value in measured units	**10**	
A 1tt	Alarm 2 trip time	No of seconds before relay trips	**0**	
A2tt	Alarm 2 trip time	No of seconds before relay trips	**0**	
A 1rt	Alarm 1 reset time	No of seconds before relay resets	**0**	
A2rt	Alarm 2 reset time	No of seconds before relay resets	**0**	
A 1n.o or **A 1n.c**	Alarm 1 action N/O or N/C	**A 1n.o** or **A 1n.c**	**A 1n.o**	
A2n.o or **A2n.c**	Alarm 2 action N/O or N/C	**A2n.o** or **A 1n.c**	**A2n.o**	
brgt	Digital display brightness	**0** to **15** (**15** = highest brightness)	**15**	
dull	Remote input brightness control	**0** to **15** (**15** = highest brightness)	**0**	
Functions below are accessible only via CAL mode				
drnd	Display rounding selects resolution	Value in memory	**1**	
FLtr	Digital filter range 0 to 8	**0** to **8** (**8** = most filtering)	**2**	
rAtE dCPt or **PErd dCPt**	Decimal point setting for rate display or decimal point setting for period depending upon the **di SP** setting	Value in memory	**0**	
rAtE 1 nPt or **PErd 1 nPt**	Rate input setting (Hz) or Period input setting depending upon the **di SP** setting	Value in memory	**1**	
rAtE SCLE or **PErd SCLE**	Rate scale setting or Period scale setting depending upon the **di SP** setting	Value in memory	**1**	
tot1 dCPt	Decimal point setting for totaliser display	Value in memory	**0**	
tot1 1 nPt	Totaliser input setting	Value in memory	**1**	
tot1 SCLE	Totaliser scale setting	Value in memory	**1**	
g.tot	Grand total operating mode	**nonE**,**For**,**rEU**,**POS**,**nEg** or **Abs**	**nonE**	
FrEq rnGE	Frequency range low, high, average or rolling average	**H, F**,**LoF**,**AUGE** or **r.AUg**	**H, F**	
FASt UPdt	Fast update mode	**on** or **OFF**	**OFF**	
1 nPt EdGE	Input edge triggering rising or falling edge	**FALL** or **r1 SE**	**r1 SE**	
di SP	Default display for low frequency input (seen only when **FrEq rnGE** set to **LoF**)	**rAtE** or **PErd**	**rAtE**	

Initial display	Meaning of display	Next display	Default Setting	Record Your Settings
dISP rnGE	Display range (seen only when dISP set to PErd)	0.0.0 1 or 0.00.02	0	
t.out SECS	Timeout (seen only when FrEQ rnGE set to AUGE, r.AUG or LoF)	Value in memory	0	
AUGE SECS	Averaging time (seen only when FrEQrnGE set to AUGE or r.AUG)	Value in memory	0	
AUGE Cnt	Rolling average count (seen only when FrEQrnGE set to r.AUG)	1 to 30	1	
r.I nP	Remote input	nonE, P.HLd, d.HLd, HI .Lo, HI Lo, 2Er0, SP.Ac, no.Ac, dISP.dULL or 9.rSt	nonE	
P.but	P button operation	nonE, HI .Lo, HI Lo, 2Er0, dISP. FUnC or 9.rSt	nonE	
ACCS	Alarm relay access mode	OFF, EASY, nonE or ALL	OFF	
SPAC	Setpoint access	A1, A1-2 etc.	A1	
A1.rt/A1.tL/ A1.PS	Alarm 1 operation mode rate, total or pass	A1.rt, A1.t! or A1.PS	A1.rt	
A2.rt/A2.tL/ A2.PS	Alarm 2 operation mode rate, total or pass	A2.rt, A2.t! or A2.PS	A2.rt	
PSEt	Preset value	Value in memory	0	
S.I nP	SET terminal operation	Lo or HI 9h	HI 9h	
Lo dISP	Display low overrange	Limit value or OFF	OFF	
HI 9H dISP	Display high overrange	Limit value or OFF	OFF	
dISP	Overrange display warning flashing mode	FLSH or -or-	FLSH	
c.rSt	Reset value	2Er0 or P.SEt	2Er0	
c.rSt	Reset mode	Lo, HI , LoE or HI E	Lo	
cntrrSt	Counter reset value	Value in memory	0	
A1HI rSt	Alarm 1 high reset	on or OFF	OFF	
dFLt dISP	Default display rate, total or period, total depending upon the dISP setting.	rAtE.tot! or PErd.tot!	rAtE	
SEt OPEr	Set operating mode	S.Prd.PEr d.both.tot! or FrEQ	FrEQ	
SEr.I tYPE	Serial communications type	nonE.r232 or r485	nonE	
bAUd rAtE	Baud rate	300.600. 1200.2400.4800. 9600. 19.2 or 38.4	9600	
PrtY	Parity select	nonE.EUEn or Odd	nonE	
O.Put	Output, continuous or controlled	POLL.Cont or dISP	POLL	
Addr	Set unit address for POLL mode	0 to 31	0	

Note: Functions shown shaded will be seen only when those options are fitted.

9 Specifications

9 .1 Technical Specifications

Count/Rate input:	Link selectable internal pull up resistor, internal pull down resistor, biassed input, DC input and 2V added hysteresis. 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 (switch selectable or programmable for up or down)
Ratemeter functions:	Max 100kHz, Min determined by **t.out SECS** function setting
Accuracy:	Better than 0.01% for rate indication (0.01% ±10uS for period)
Impedance:	10kΩ
Max count rate:	100kHz
Memory retention:	Battery backed totaliser memory
Display reset:	Remote reset via “RESET” input (contact closure to ground or 5VDC maximum)
Microprocessor:	MC68HC11 CMOS
Ambient temperature:	-10 to 60°C
Humidity:	5 to 95% non condensing
Power supply:	AC 240V,110V 50/60Hz or DC 15 to 24V non isolated or DC 12V, 24V or 48V isolated 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, consult supplier (depends voltage & options)
Transducer excitation:	+5V or +16V

9 .2 Options

Serial communications:	RS232 or RS485 serial communications. The rate/total update rate for serial communications is twice per second with **FASt UPdt** set to **OFF** or approx. twenty per second with **FASt UPdt** set to **on**.

Physical characteristics

Model LD4-X-X-574	Case size (mm) = 255 x 145 x 125 Weight: = 1.3 kgs Mounting hole locations (mm) = 180(w) x 55(h)

8 Guarantee and Service

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

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

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

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

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

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

This product is designed and manufactured in Australia.

Appendix - RS232/RS485 Commands

Serial communications option

Refer to “Electrical Installation” chapter for general information on electrical connections. External connections to the board are via plug in connectors with screw terminals these terminals allow for wires up to 1.5mm^2 to be fitted. Use twisted pair overall screened cable for RS485 and 3 core overall screened cable for RS232.

Ensure that the appropriate link is selected for RS232 or RS485. If RS232 is selected chip U1 should be in and chip U2 should be out. If RS485 is selected chip U1 should be out and chip U2 should be in. The RS485 terminating resistor link should be in if the LD4 is the first or last unit in a RS485 chain.

RS232/485 Operation and Commands

The RS232/485 interface is user selectable. The modes of operation available are as follows:-

d, SP - Image Display Mode:

In image display mode the display value is sent via RS232/485 as raw data in the following format:

<ESC> IXYYYY

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.

The most common usage would be to provide output for 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, Bit 7 is decimal point etc.

Cont - Continuous Transmit Mode (ASCII):

In this mode the display value is continually sent via the RS232/485 interface every display update (approx. 4 times per second depending on the baud rate). The format for this is as follows:-

<STX> XYYYY<CR>

Where:<STX> is start of text character (2 Dec, 02 Hex)
X SPACE (32 Dec, 20 Hex) for a positive value.
X ‘-’ (45 Dec, 2D Hex) for a negative value.
YYYY is the display value in ASCII (length depends on number of display digits).
<CR> is a Carriage Return (13 Dec, 0D Hex)

e.g.: If the display is showing 123456 then the instrument will send
‘02 20 31 32 33 34 35 36 0D’ (HEX) to the host.

UPdt - Update Mode (see “Real Time Clock Operation” chapter)

POLL - Host Controlled Transmit Mode (ASCII):

This mode requires a host computer or PLC to poll the instrument to obtain display or other information or reset various setpoint parameters. The format for the host command is as follows:-

<STX>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)
C is the command character (see list below)
A is the unit address (Range: 32 to 63 Dec,
20 to 3F Hex - address is offset by 32 Dec, 20 Hex)
<CR> is Carriage Return (13 Dec, 0D Hex)
N is the setpoint number in ASCII
e.g.: 31 Hex would be 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>

Instructs unit to return the primary display value. The primary value is the main reading on a certain instrument such as pH on a LD4pH meter or Thermocouple temperature on a LD4TC. Format of returned data is:-

<ACK>PAXYYYY<CR>

Where: <ACK> is Acknowledge (6 Dec, 06 Hex)
P echo command received 'P' (80 Dec, 50 Hex)
A is the responding unit's address
X SPACE for positive and '-' for negative
YYYY is the display value in ASCII
<CR> is a Carriage Return (13 Dec, 0D Hex)

The number of display characters returned depends on the number of display digits present. If the decimal point is non zero then it will be sent in the appropriate place as '.' (46 Dec, 2E Hex).

Transmit Secondary Display Value: <STX>SA<CR>

Instructs unit to return the secondary display value. For example the secondary value would be Solution Temperature on a LD4PH or Cold Junction Temperature on a LD4TC. 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 unit's address
X is SPACE for positive and '-' for negative
YYYY is the display value in ASCII
<CR> is a Carriage Return (13 Dec, 0D Hex)

The number of display characters returned depends on the number of display digits present. If the decimal point is non zero then it will be sent in the appropriate place as '.' (46 Dec, 2E Hex).

If the instrument does not have a secondary display then the command will be echoed back with no display value (i.e.: <ACK>SA<CR>).

Transmit Special Function Value: <STX>K**A**<CR>

Instructs unit to return the special function value (if enabled). Will return the Display Hold, Peak Hold, Valley High, Valley Low or Tare value depending upon which is selected. Format of returned data is:-

<ACK>KAXYYYY<CR>

Where: <ACK> is Acknowledge (6 Dec, 06 Hex)
K echo command received 'K' (75 Dec, 4B Hex)
A is the responding unit's address
X is SPACE for positive and '-' for negative
YYYY is the display value in ASCII
<CR> is a Carriage Return (13 Dec, 0D Hex)

The number of display characters returned depends on the number of display digits present. If the decimal point is non zero then it will be sent in the appropriate place as '.' (46 Dec, 2E Hex).

If special functions are not active then the invalid command message will be returned (refer Invalid Command later).

Reset Special Function Value: <STX>RA<CR>

Instructs the unit to reset the special function value (if applicable). Will reset the stored value for Peak Hold, Valley High and Valley Low. Format of returned data is:

<ACK>RA<CR>

Where: <ACK> is Acknowledge (6 Dec, 06 Hex)
R echo command received 'R' (82 Dec, 52 Hex)
A is the responding unit's address
<CR> is a Carriage Return (13 Dec, 0D Hex)

If special functions are not active then the invalid command message will be returned (refer Invalid Command later).

Read Low Alarm Setpoint: <STX>LA<CR>N<CR>

Instructs unit to return value of low alarm setpoint. Format of returned data is:

<ACK>LANXYYYY<CR>

Where: <ACK> is Acknowledge (6 Dec, 06 Hex)
L echo command received 'L' (76 Dec, 4C Hex)
A is the responding unit's address
N is the setpoint number in ASCII
e.g.: 31 Hex would be alarm 1 etc.
X is SPACE for positive and '-' for negative
YYYY is the setpoint value in ASCII
<CR> is a Carriage Return (13 Dec, 0D Hex)

If setpoint number specified is not present the return string will have the setpoint number set to zero (i.e.: <ACK>LA0).

Read High Alarm Setpoint: <STX>HA<CR>N<CR>

Instructs unit to return value of high alarm setpoint. Format of returned data is:

<ACK>HANXYYYY<CR>

Where: <ACK> is Acknowledge (6 Dec, 06 Hex)
H echo command received 'H' (72 Dec, 48 Hex)
A is the responding unit's address
N is the setpoint number in ASCII
e.g.: 31 Hex would be alarm 1 etc.
X is SPACE for positive and '-' for negative
YYYY is the setpoint value in ASCII
<CR> is a Carriage Return (13 Dec, 0D Hex)

If setpoint number specified is not present the return string will have the setpoint number set to zero (i.e.: <ACK>HA0).

Set Low Alarm Setpoint: <STX>lA<CR>N<CR>XYYYY<CR>

Instructs unit to change value of low alarm setpoint. Format of returned data is:-

<ACK>lANXYYYY<CR>

Where: <ACK> is Acknowledge (6 Dec, 06 Hex)
l echo command received 'l' (108 Dec, 6C Hex)
A is the responding unit's address
N is the setpoint number in ASCII
e.g.: 31 Hex would be alarm 1 etc.
X is SPACE for positive and '-' for negative
YYYY is the setpoint value in ASCII
<CR> is a Carriage Return (13 Dec, 0D Hex)

If setpoint number specified is not present the return string will have the setpoint number set to zero (i.e.: <ACK>lA0XYYYY).

Set High Alarm Setpoint: <STX>hA<CR>N<CR>XYYYY<CR>

Instructs unit to change value of high alarm setpoint. Format of returned data is:-

<ACK>hANXYYYY<CR>

Where: <ACK> is Acknowledge (6 Dec, 06 Hex)
h echo command received 'h' (104 Dec, 68 Hex)
A is the responding unit's address
N is the setpoint number in ASCII
e.g.: 31 Hex would be alarm 1 etc.
X is SPACE for positive and '-' for negative
YYYY is the setpoint value in ASCII
<CR> is a Carriage Return (13 Dec, 0D Hex)

If setpoint number specified is not present the return string will have the setpoint number set to zero (i.e.: <ACK>hA0XYYYY).

Tare Using Current Display Value: <STX>TA<CR>

Instructs the unit to tare the instrument using the current display value (if tare has been selected in special functions mode). Format of returned data is:-

<ACK>TA<CR>

Where: <ACK> is Acknowledge (6 Dec, 06 Hex)
T is echo command received 'T' (84 Dec, 54 Hex)
A is the responding unit's address
<CR> is a Carriage Return (13 Dec, 0D Hex)

If tare is not valid then the invalid command message will be returned (refer Invalid Command later).

Transmit Instrument Model and Version: <STX>IA<CR>

Instructs unit to return the model and version number of the instrument. Format of returned data is:-

<ACK>IACCX.X<CR>

Where: <ACK> is Acknowledge (6 Dec, 06 Hex)
I is echo command received 'I' (73 Dec, 49 Hex)
A is the responding unit's address
CC a 2 character model identifier (e.g.: TC - thermocouple)
X.X is the version number (e.g.: '0.1')
<CR> is a Carriage Return (13 Dec, 0D Hex)

Invalid Command

If the command received from the host is not valid then the unit will return the following:-

<ACK>?A<CR>

Where: <ACK> is Acknowledge (6 Dec, 06 Hex)
? is the character '?' (63 Dec, 3F Hex)
A is the responding unit's address
<CR> is a Carriage Return (13 Dec, 0D Hex)

If the address received from the host does not match the units address then the unit will not respond at all.

Other commands may be added to suit the particular configuration of each instrument. Value read commands will have the same format as the Transmit Primary Value command. Set Value commands will have the same format as the Set Low Alarm Setpoint command etc.

SEr. 1 - Output mode for serial port 1

Displays and sets the output mode for serial port 1. Options are:

nonE - no serial input/output

r232 - RS232 serial input/output

r485 - RS485 serial input/output

I 20 - 20mA serial current loop

Where a serial input/output is being used the option must be set to correspond to the input/output hardware fitted. e.g. if the instrument was ordered with an RS232 output then **SEr. 1** (and/or **SEr.2**) must be set to **r232.**

SEr.2 - Output mode for serial port 2

Displays and sets the output mode for serial port 2. Options are as per **SEr. 1.**

Host Timing Requirements for RS485 Operation:

RS485 operation requires the host to switch the RS485 transceiver to transmit before a command is sent. The instrument is capable or replying after 1 to 2 milliseconds. Therefore the host should switch the RS485 transceiver back to receive mode within 0.5 milliseconds after the last character of the command has been sent to ensure correct operation.

ASCII Char.	Dec	Hex	ASCII Char.	Dec	Hex
NUL (^@)	000	00	@	64	40
SOH (^A)	001	01	A	65	41
STX (^B)	002	02	B	66	42
ETX (^C)	003	03	C	67	43
EOT (^D)	004	04	D	68	44
ENQ (^E)	005	05	E	69	45
ACK (^F)	006	06	F	70	46
BEL (^G)	007	07	G	71	47
BS (^H)	008	08	H	72	48
HT (^I)	009	09	I	73	49
LF (^J)	010	0A	J	74	4A
VT (^K)	011	0B	K	75	4B
FF (^L)	012	0C	L	76	4C
CR (^M)	013	0D	M	77	4D
SO (^N)	014	0E	N	78	4E
SI (^O)	015	OF	O	79	4F
DLE (^P)	016	10	P	80	50
DC1 (^Q)	017	11	Q	81	51
DC2 (^R)	018	12	R	82	52
DC3 (^S)	019	13	S	83	53
DC4 (^T)	020	14	T	84	54
NAK (^U)	021	15	U	85	55
SYN (^V)	022	16	V	86	56
ETB (^W)	023	17	W	87	57
CAN (^X)	024	18	X	88	58
EM (^Y)	025	19	Y	89	59
SUB (^Z)	026	1A	Z	90	5A
ESC (^[)	027	1B	[	91	5B
FS (^\)	028	1C	\	92	5C
GS (^^)	029	1D	]	93	5D
RS (^)	030	1E	^	94	5E
US (^_)	031	1F	_	95	5F
SP ( )	032	20	‘	96	60
!	033	21	a	97	61
“	034	22	b	98	62
#	035	23	c	99	63
$	036	24	d	100	64
%	037	25	e	101	65
&	038	26	f	102	66
‘	039	27	g	103	67
(	040	28	h	104	68
)	041	29		105	69
*	042	2A	j	106	6A
+	043	2B	k	107	6B
,	044	2C	l	108	6C
-	045	2D	m	109	6D
.	046	2E	n	110	6E
/	047	2F	o	111	6F
0	048	30	p	112	70
1	049	31	q	113	71
2	050	32	r	114	72
3	051	33	s	115	73
4	052	34	t	116	74
5	053	35	u	117	75
6	054	36	v	118	76
7	055	37	w	119	77
8	056	38	x	120	78
9	057	39	y	121	79
:	058	3A	z	122	7A
;	059	3B	{	123	7B
<	060	3C	|	124	7C
=	061	3D	}	125	7D
>	062	3E	~	126	7E
?	063	3F	DEL	127	7F