

**Model LD-IVT
Ratemeter and Totaliser
Large Digit Display/Controller
Operation and Instruction Manual**

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1 Introduction

General description

This manual contains information for the installation and operation of the LD-IVT rate/total monitor.

The LD-IVT is a general purpose large digit display which will accept inputs of 4-20mA, $\pm 0-20\text{mA}$ $\pm 2.5\text{VDC}$ or $\pm 25\text{VDC}$ or slidewire from 0-1k Ω to 0-1M Ω potentiometer. Refer to function 5.67 for details of totaliser formula and examples. To use the totaliser functions first the rate display must be calibrated. Refer to the "Calibration" chapter for details of rate calibration or scaling. Totaliser reset can be accomplished either via the front **P** button (if available on model being used) or via one of three remote inputs, see the **P.butt** and **RI RP** functions.

Calibration, setpoint and other set up functions are easily achieved by push buttons located on the main circuit board. Four standard inbuilt relays provide alarm on/off control functions. Relays 1 and 2 can be configured for simple on/off control or PI control with a choice of time duration or frequency methods.

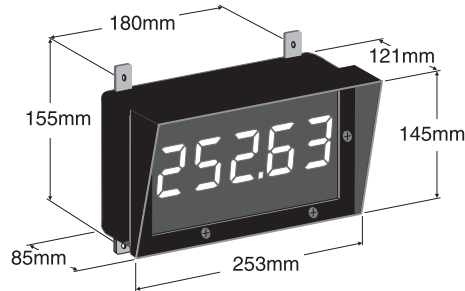
The display can be programmed to follow linear or square root law. Two separate sets of calibration scaling can be entered and the display toggled between these displays via a remote input. Unless otherwise specified at the time of order, your display has been factory set to a standard configuration.

The configuration and calibration is easily changed by the user. Initial changes may require dismantling the instrument to alter PCB links, other changes are made by push button functions. LED models have an inbuilt light sensor which can be used to automatically alter the display brightness to suit ambient light conditions e.g. to avoid glare when in a dark environment.

2 Mechanical installation

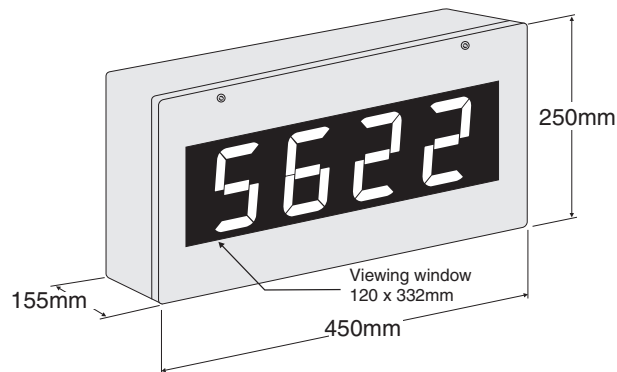
2.1 Standard brightness 38mm, 45mm or 57mm LED and daylight viewable 38mm and 58mm LED

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



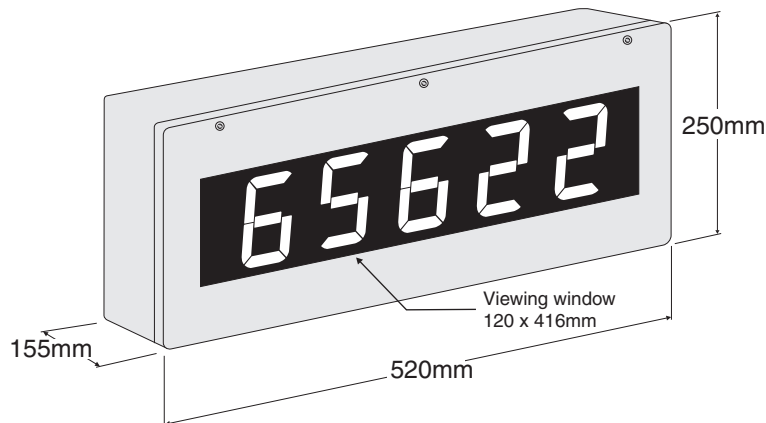
2.2 100mm 4 digit LED or electromagnetic

Weight 10kg (LED), 10.5kg (electromagnetic)



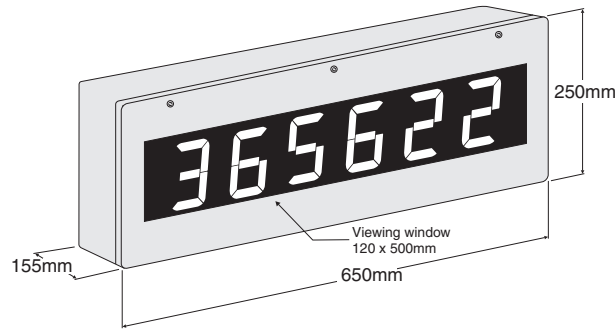
2.3 100mm 5 digit electromagnetic

Weight 12kg.



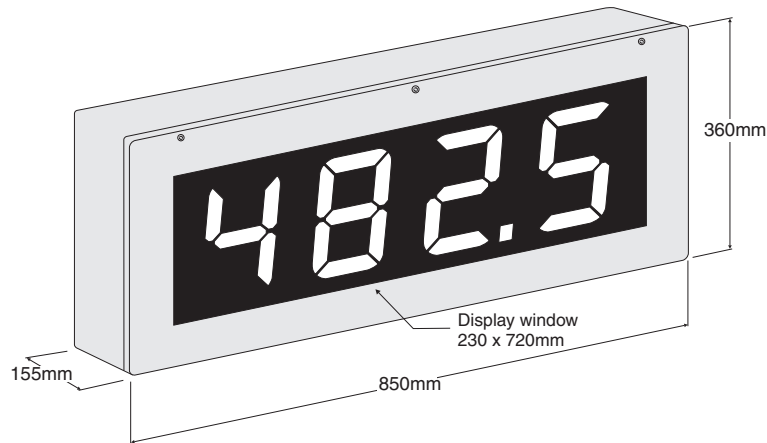
2.4 100mm 6 digit LED or electromagnetic

Weight 13kg (LED), 13.5k (electromagnetic)



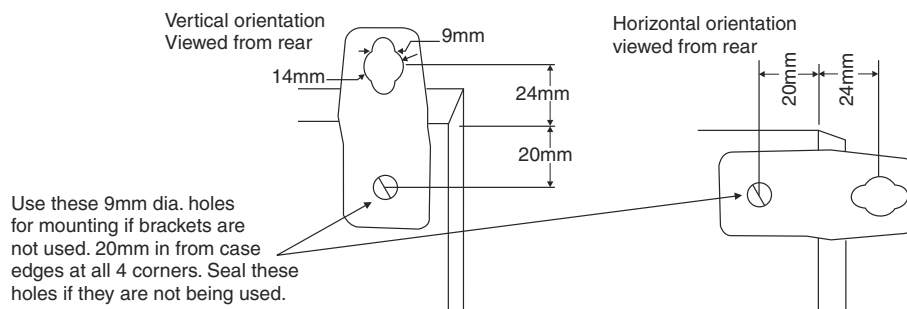
2.5 200mm 4 digit LED

Weight 13kg.



2.6 Mounting brackets

Four mounting brackets and four blind grommets are supplied for use with all metal case large digit displays. Diagrams below illustrate vertical and horizontal installation for mounting brackets. If mounting without the brackets is preferred then the 9mm dia. case holes provided for the brackets can be used as alternative mounting holes. Any rear holes not used for mounting should be sealed.

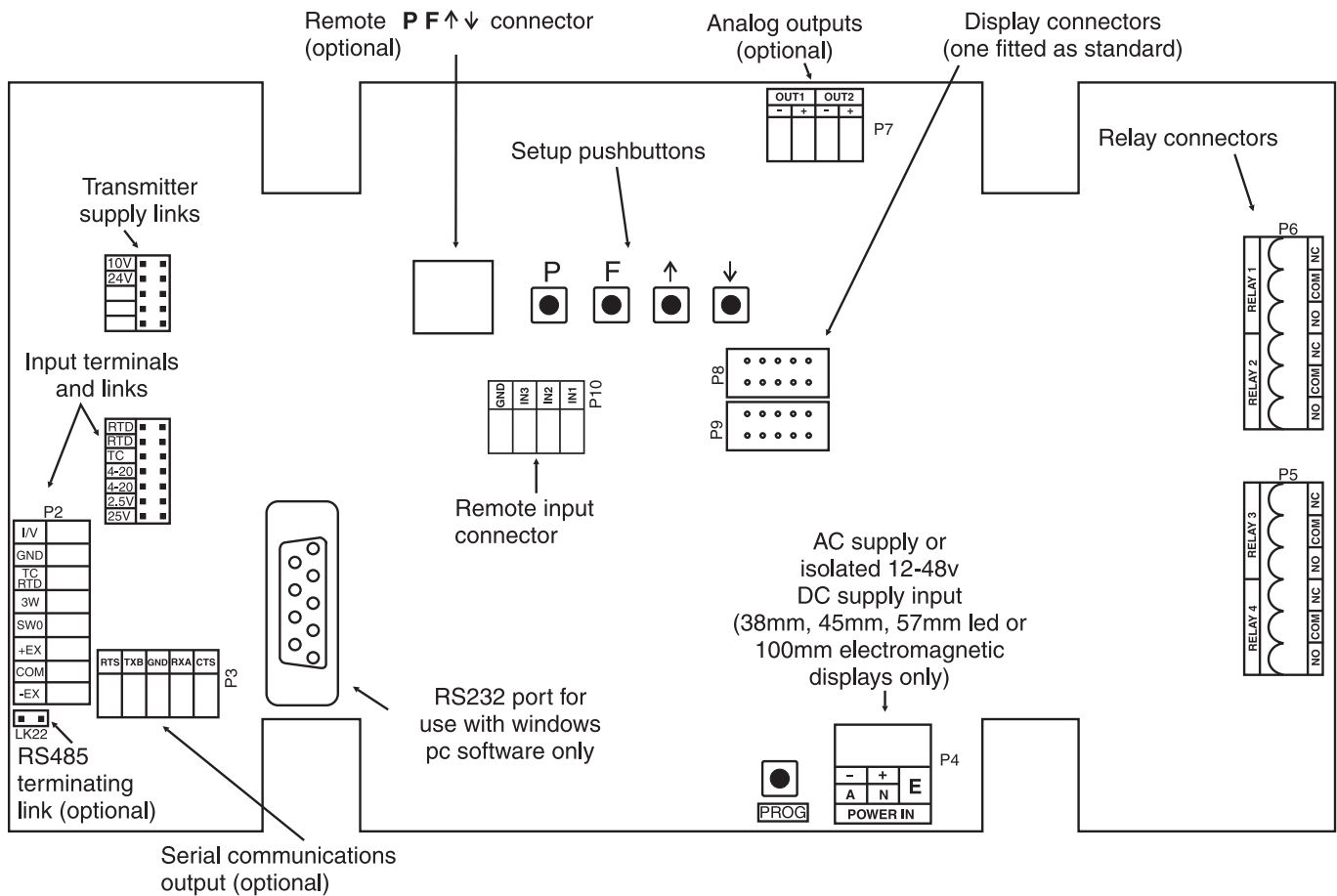


3 Electrical installation

3.1 Electrical installation

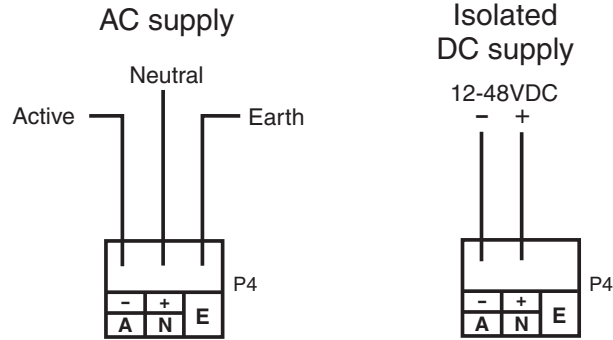
The LD instrument is designed for continuous operation and no power switch is fitted to the unit. It is recommended that an external switch and fuse be provided to allow the unit to be removed for servicing. The terminal blocks are plug in screw type for ease of installation and allow for wires of up to 1.5mm² (2.5mm² for relay, AC or isolated DC supply connections) to be fitted. Connect the wires to the appropriate terminals as indicated below. Refer to other details provided in this manual to confirm proper selection of voltage, polarity and input type before applying power to the instrument. When power is applied the instrument will cycle through a display sequence, indicating the software version and other status information.

3.2 Main circuit board layout



3.3 38mm LED, 45mm LED or 57mm LED display power supplies

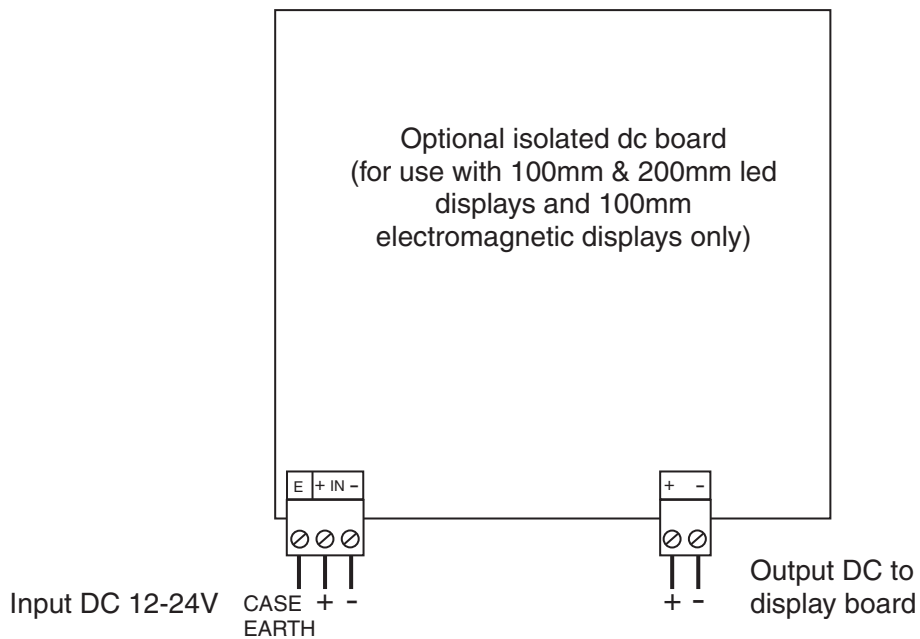
AC power connections use a plug in connector with screw terminals at P4 (2.5mm² max. wire). Isolated DC supplies (12-48VDC) use the same terminals. Note supply type is factory configured.



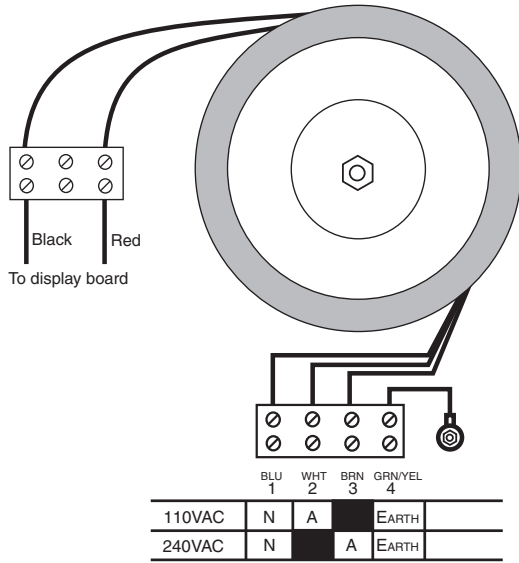
3.4 100mm, 200mm LED and 100mm electromagnetic display power supplies

Isolated DC supplies (12 to 24VDC) connect to the isolated supply pcb on the base board. AC supplies connect to the transformer primary on the base board. The base board is located under the input circuit board, see wiring diagram for AC supplies on the next page.

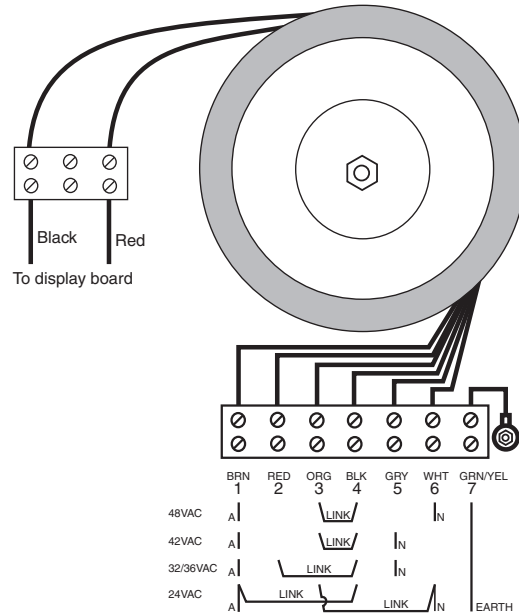
Optional isolated DC supply



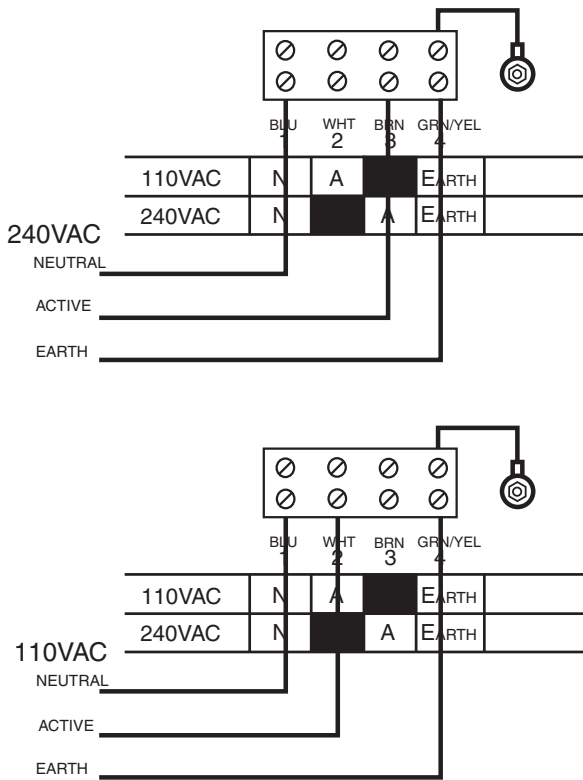
240 & 110VAC supplies.
For 100mm/200mm LED or 100mm
electromagnetic display types only.



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

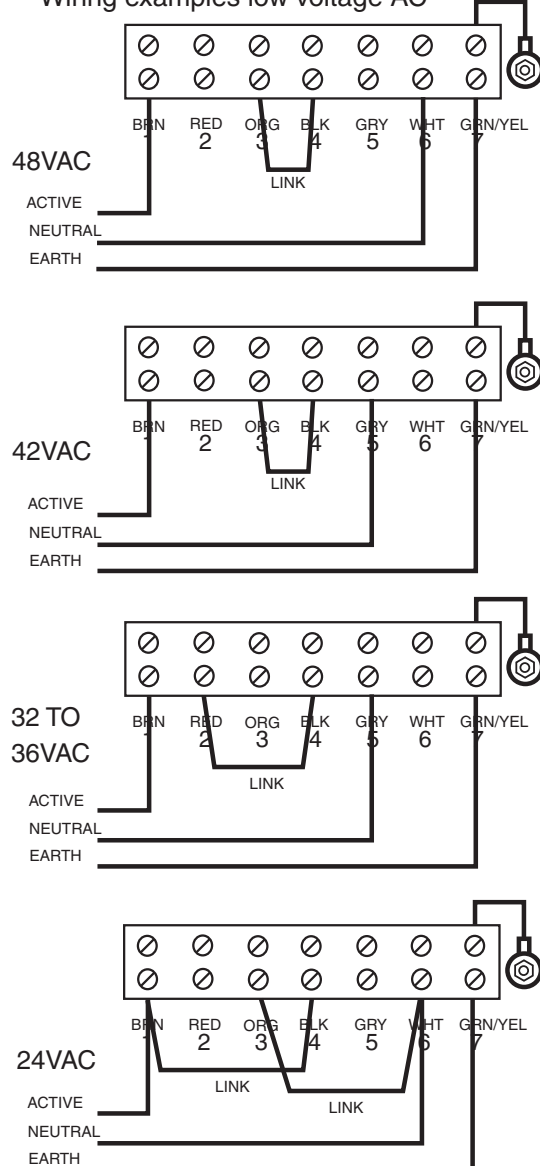


Wiring examples 240VAC & 110VAC



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

Wiring examples low voltage AC



3.5 Input connections and link settings

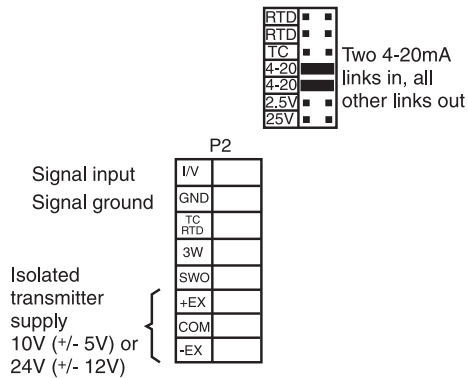
WIRING EXAMPLES 4 to 20mA INPUT

TRANSMITTER SUPPLY LINKS

10VDC (+/- 5V) SUPPLY SELECTED 24VDC (+/- 12V) SUPPLY SELECTED

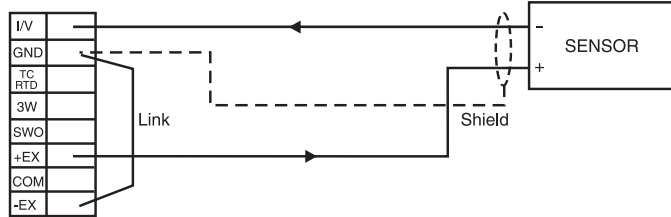


4-20mA INPUT CONNECTOR AND LINKS

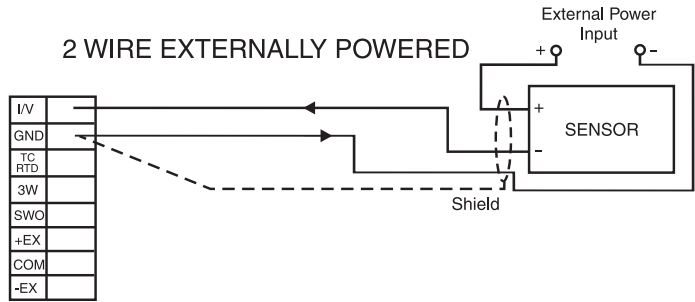


The supplies can be configured as
5, 10, 12 or 24V DC
25mA max. for 5, 12 or 24V
50mA max for 10V

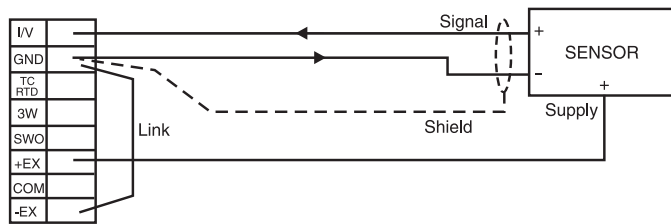
2 WIRE POWERED FROM STANDARD 10V or 24V TRANSMITTER SUPPLY



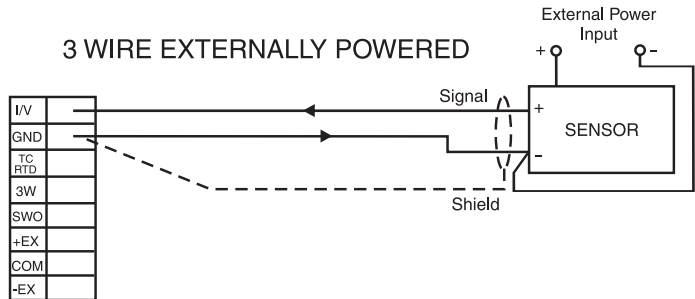
2 WIRE EXTERNALLY POWERED



3 WIRE POWERED FROM STANDARD 10V or 24V TRANSMITTER SUPPLY

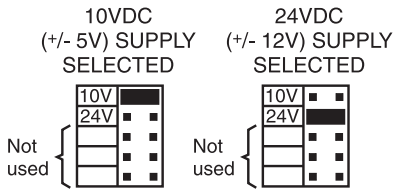


3 WIRE EXTERNALLY POWERED

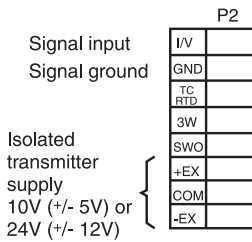
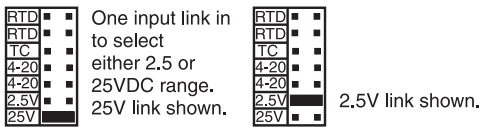


WIRING EXAMPLES DC VOLTS INPUTS

TRANSMITTER SUPPLY LINKS

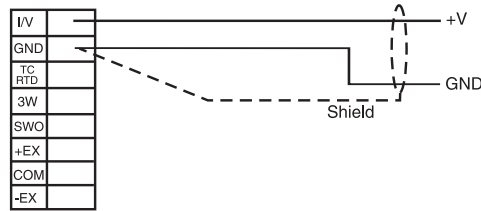


DC VOLTS INPUT CONNECTOR AND LINKS

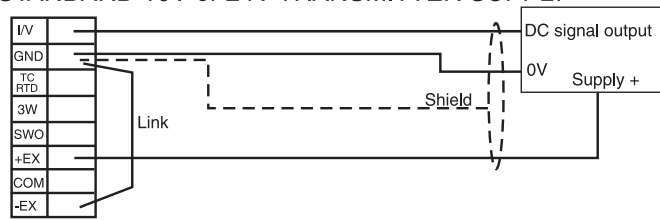


The supplies can be configured as
 5, 10, 12 or 24V DC
 25mA max. for 5, 12 or 24V
 50mA max. for 10V

DIRECT DC VOLTS INPUT

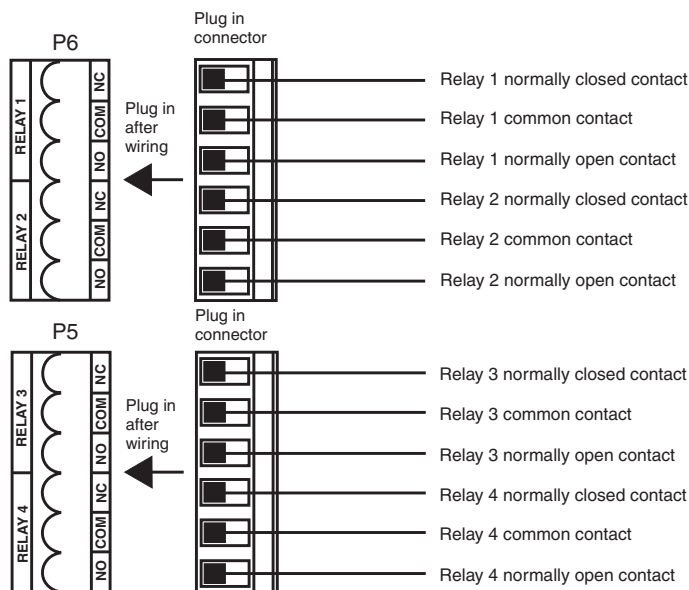


3 WIRE DEVICE POWERED FROM STANDARD 10V or 24V TRANSMITTER SUPPLY



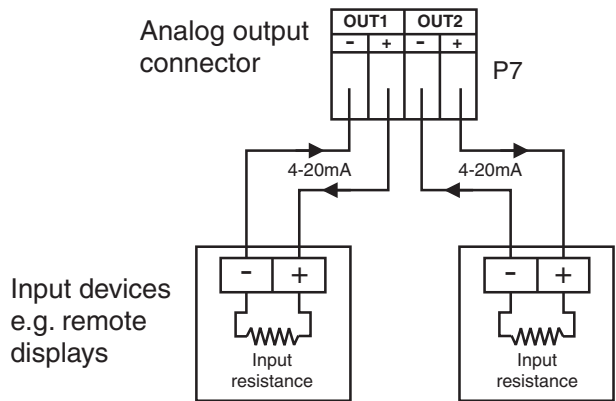
3.6 Relay connections

The LD is supplied with four alarm relays as standard with connections on terminals P5 and P6. The relays are changeover types and are rated at 5A, 240VAC into a resistive load. The relay contacts are voltage free and may be programmed for normally open or normally closed operation. With power removed the relay contacts will be in the normally closed position i.e. shorting between NC and COM.



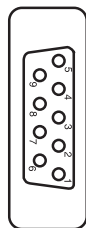
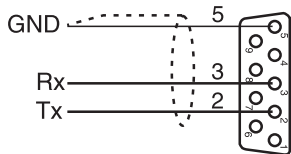
3.7 Optional analog output connections

There are two channels of optional analog outputs. Each output can be individually scaled and is current sourcing i.e. voltage to drive the 4–20mA outputs is provided internally. The outputs should not be connected to another current sourcing device i.e. should not be connected to an external loop supply. The connection diagram below shows connection to passive (current sinking) inputs.



3.8 Standard serial communications connections

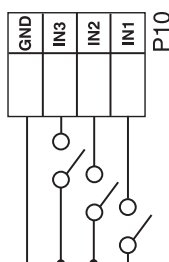
Plug in connector
9 pin male "D" type.
rear terminals shown



RS232 port for use in **R.buS** mode with Windows PC software purchased for use with this instrument or for on site software update only. This port will be disabled if the optional serial communications port fitted. If this port is to be used for **R.buS** communication the **SEF. 1 TYPE** and **SEF. 2 TYPE** functions must be set to **NONE**

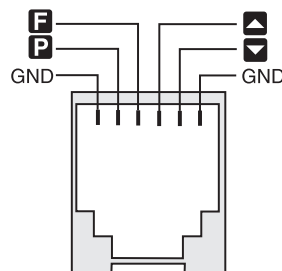
Note: when connecting using Rs232 the Tx line at the display connects to the Rx line at the device it is communicating with. Likewise the Rx line at the display connects to Tx

3.9 Remote input and remote keypad (cable version) connector



REMOTE INPUT
CONNECTOR

IN1, IN2 and IN3 are the remote input switches.
F.1 R1 is used to set the IN1 switch function.
F.1 R2 is used to set the IN2 switch function.
F.1 R3 is used to set the IN3 switch function.
Latching or momentary switches can be used depending on the function selected.



Remote keypad
connector

Optional serial output connections - refer to separate Output Addendum booklet.

4 Function tables - summary of setup functions

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

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

Display	Function	Range	Default	Your record	Ref/Page
A1SP	Relay 1 PI control setpoint	Any display value	0		5.1 / 19
A2SP	Relay 2 PI control setpoint	Any display value	0		5.2 / 19
AxLo	Low setpoint value for designated alarm relay <i>x</i>	Any display value or OFF	OFF	See 4.1	5.3 / 19
AxHi	High setpoint value for designated alarm relay <i>x</i>	Any display value or OFF	OFF	See 4.1	5.4 / 19
AxHY	Hysteresis value for the designated alarm relay <i>x</i> .	0 to 9999	10	See 4.1	5.5 / 20
Axtt	Trip time delay for the designated alarm relay <i>x</i> .	0 to 9999	0	See 4.1	5.6 / 20
Axrt	Reset time delay for the designated alarm relay <i>x</i> .	0 to 9999	0	See 4.1	5.7 / 21
Axn.o or Axn.c	Alarm relay <i>x</i> action to normally open or normally closed	Axn.o or Axn.c	Axn.o	See 4.1	5.8 / 21
AxSP or Axt 1 etc.	Relay operation independent setpoint or trailing setpoint (*Optional)	AxSP or Axt 1 etc.	AxSP	See 4.1	5.9 / 21
brgt AUTO	Automatic display brightness adjustment	on or OFF	OFF		5.10 / 22
brgt	Display brightness level (manually set)	1 to 63	63		5.11 / 22
dULL	Display remote brightness switching	0 to 63	15		5.12 / 22
brgt Hi 9H	Automatic display brightness adjustment - high level	1 to 63	63		5.13 / 23
brgt Lo	Automatic display brightness adjustment - low level	1 to 63	10		5.14 / 23
P.SET	Preset value	Any display value	0		5.15 / 23

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

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

Display	Function	Range	Default	Your record	Ref/Page
A1 OPEF	Relay 1 PI control	A1.AL , A1.LP or A1.FF	A1.AL		5.16 / 24
A2 OPEF	Relay 2 PI control	A2.AL , A2.LP or A2.FF	A2.AL		5.17 / 24
ctrl SPAN	Relay PI control span	1 to any positive value	1		5.18 / 24
A1.P9	Relay 1 PI control proportional gain	-32.767 to 32.767	0.000		5.19 / 24
A2.P9	Relay 2 PI control proportional gain	-32.767 to 32.767	0.000		5.20 / 24
A1.I9	Relay 1 PI control integral gain	-32.767 to 32.767	0.000		5.21 / 25
A2.I9	Relay 2 PI control integral gain	-32.767 to 32.767	0.000		5.22 / 25
A1.LL	Relay 1 PI control integral low limit	0.0 to 100.0	0.0		5.23 / 25
A2.LL	Relay 2 PI control integral low limit	0.0 to 100.0	0.0		5.24 / 25
A1.HH	Relay 1 PI control integral high limit	0.0 to 100.0	0.0		5.25 / 25
A2.HH	Relay 2 PI control integral high limit	0.0 to 100.0	0.0		5.26 / 26
A1.b5	Relay 1 PI control bias	0.0 to 100.0	50.0		5.27 / 26
A2.b5	Relay 2 PI control bias	0.0 to 100.0	50.0		5.28 / 26
A1.dc	Relay 1 PI control minimum off time	0.0 to 100.0	1.0		5.29 / 26
A2.dc	Relay 2 PI control minimum off time	0.0 to 100.0	1.0		5.30 / 26
A1.dr	Relay 1 PI control on time	0.0 to 100.0	0.0		5.31 / 27
A2.dr	Relay 2 PI control on time	0.0 to 100.0	0.0		5.32 / 27
FEC-	Analog output option low display value (*Optional)	Any display value	0		5.33 / 27
FEC+	Analog output option high display value (*Optional)	Any display value	1000		5.34 / 27
FEC- Ch2	Second analog output option low display value (*Optional)	Any display value	0		5.35 / 28
FEC+ Ch2	Second analog output option high display value (*Optional)	Any display value	1000		5.36 / 28

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

drnd	Display rounding	1 to 5000	1		5.37 / 28
dCPt	Decimal point	0, 0.1 etc.	0		5.38 / 28
FLtr	Digital filter	0 to 8	2		5.39 / 29
diSP unit	Display unit	NONE . °C . ° F . ° . C or F	NONE		5.48 / 31
FEC ctrl	Analog output PI control (*Optional)	on or OFF	OFF		5.40 / 29
C.SPN	Analog PI output control span (*Optional)	0 to any positive value	0		5.41 / 29
CP9	Analog PI control proportional gain (*Optional)	-32.767 to 32.767	0.000		5.42 / 29
CP0	Analog PI control proportional offset (*Optional)	0.0 to 100.0	0.0		5.43 / 30
CI9	Analog PI control integral gain (*Optional)	-32.767 to 32.767	0.000		5.44 / 30
CI.L.H	Analog PI control integral high limit (*Optional)	0.0 to 100.0	0.0		5.45 / 30
CI.L.L	Analog PI control integral low limit (*Optional)	0.0 to 100.0	0.0		5.46 / 30
FEC SPAC	Analog PI control setpoint access (*Optional)	on or OFF	OFF		5.47 / 30
CAL 1	First live input calibration scaling point	Any display value	n/a		5.49 / 31
CAL 2	Second live input calibration scaling point	Any display value	n/a		5.50 / 31
CAL OFFst	Calibration offset	Any display value	n/a		5.51 / 31
ZERO RNGE	Zero range limit	Any display value or OFF	OFF		5.52 / 32
CAL ZERO	Zero reference point for ZERO RNGE operation	n/a	n/a		5.53 / 32
USER En4	4mA input scale	Any display value	n/a		5.54 / 32
USER En20	20mA input scale	Any display value	n/a		5.55 / 32
UCAL	Uncalibrate	n/a	n/a		5.56 / 32
Pbut	P button function	NONE . H . . Lo . H . Lo . LRGE . ZERO . P.SET , or CLF.t	NONE		5.57 / 33

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

r.i NP	Remote input (external input) function	NONE , P.HLd , d.HLd.H. , Lo.H.Lo , ERFE.ZERO , SP.Ac , No.Ac , CAL.S , P.SET.duLL or CLF.t	NONE		5.58 / 33
r.i N2	Remote input (external input) two function	Same as r.i NP	NONE		5.59 / 34
r.i N3	Remote input (external input) three function	Same as r.i NP	NONE		5.60 / 34
ACC5	Access mode	OFF.EASY , NONE or ALL	OFF		5.61 / 35
SPAC	Setpoint access mode	A1.A1-2 etc.	A1		5.62 / 35
SQRt	Square root mode	on or OFF	OFF		5.63 / 35
tot1 dCPEt	Decimal point place for total display	0 , 0.1 etc	0		5.64 / 36
di SP SCALE	Display scaling factor for total	Any display value	1		5.65 / 36
tot1 SECS	Totaliser scaling factor	any display value	60		5.66 / 36
E.SCL	Exponent scaling factor	0 to 9	1		5.67 / 36
tot1 NEG	Negative total select	OFF or on	OFF		5.68 / 37
tot1 WRAP.F	Wrap around operation	ZERO or STOP	ZERO		5.69 / 37
CLF tot1	Clear total	n/a	n/a		5.70 / 38
df1 t di SP	Default display	FAEt or tot1	FAEt		5.71 / 38
A1 , A2 , A3 and A4	Alarm relay operation mode	A1.r.t or A1.tL	A1.r.t	See 4.1	5.72 / 38
rEC or rEC2	Analog or serial operation mode (*Optional)	L.uE.tOEtL , ERFE , P.HLd , d.HLd.H. , Lo or di SP	L.uE		5.73 / 38
Lo di SP	Low overrange visual warning limit value	Any display value or OFF	OFF		5.74 / 40
Hi SH di SP	High overrange visual warning limit value	Any display value or OFF	OFF		5.75 / 40

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

di SP	Display visual warning flashing mode	FLSH or -or-	FLSH		5.76 / 40
SEF. 1 TYPE	Serial communications type (*Optional)	NONE , F232 or F485	NONE		5.77 / 41

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

4.1 Relay table

Record your relay settings in the table below

Display	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7
RxLo							
RxHi							
RxHY							
RxLt							
Rxrt							
Rxn.o or Rxn.c							
R1, R2, R3 and R4							

5 Explanation of functions

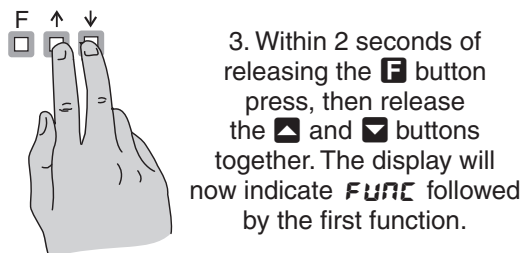
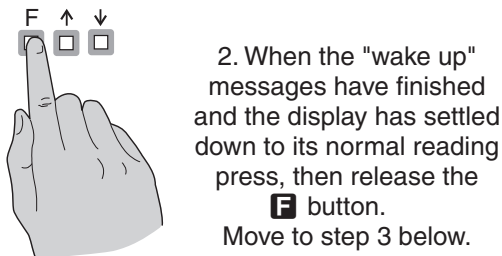
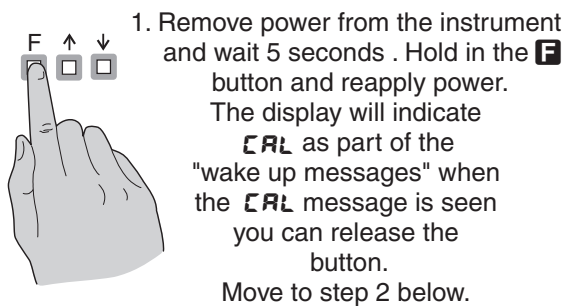
The LD display setup and calibration functions are configured through a push button sequence. The three push buttons located on the input pcb (also at the front on some display options) are used to alter settings. Two basic access modes are available:

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

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

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

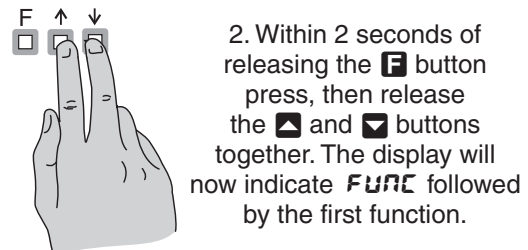
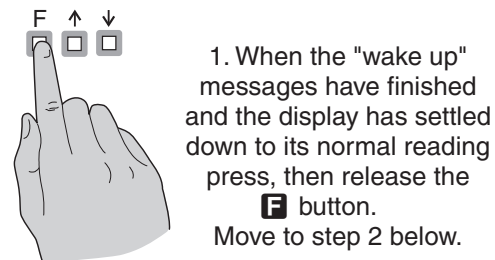
Entering **CAL** Mode



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.

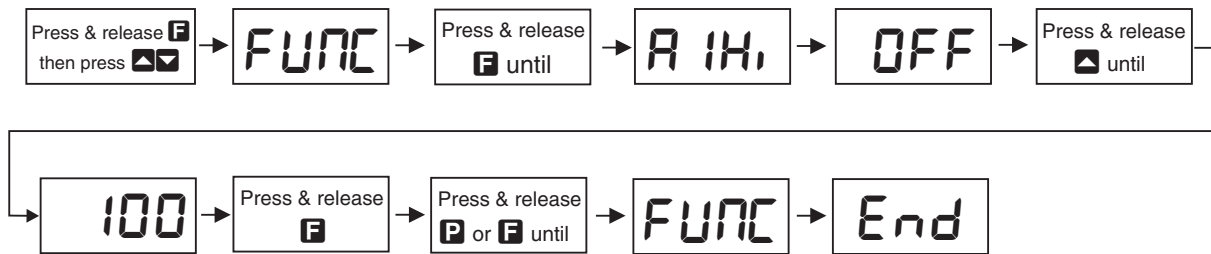


Alternative **CAL** Mode Entry

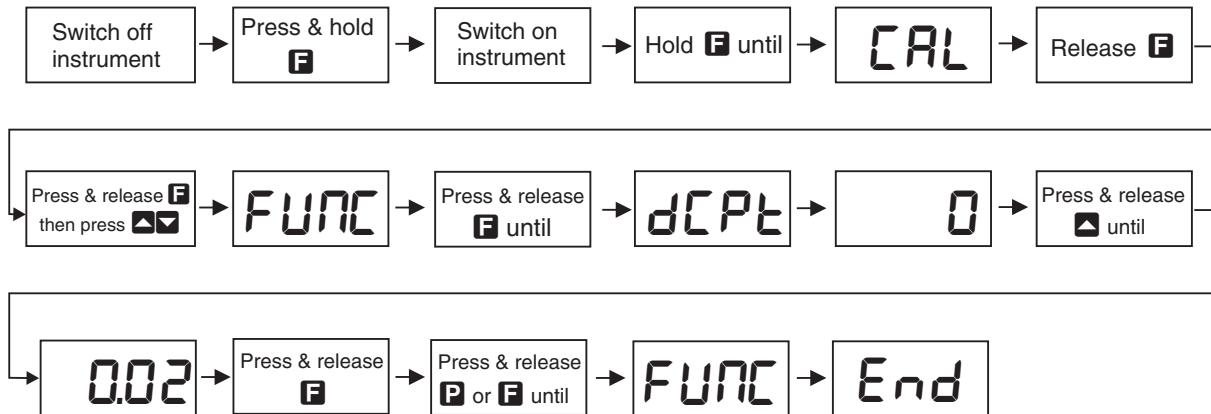
This alternative method allows **CAL** mode entry without the need to remove power:

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.

Example: Entering **FUNC** mode to change alarm 1 high function **A 1H**, from **OFF** to **100**



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



Easy alarm relay adjustment access facility

The display has an easy alarm access facility which allows access to the alarm setpoints simply by pressing the **F** button. The first setpoint will then appear and changes to this setpoint may be made to this setpoint via the **▲** or **▼** buttons. Press the **F** button to accept any changes or to move on to the next setpoint. The instrument must be set in the manner described below to allow the easy access facility to work:

1. A remote input function such as **F.I NP** function must be set to **SPAC** or the **ACCS** function must be set to **ESY**.
2. At least one alarm must have a setpoint, nothing will happen if all the alarm setpoints are set to **OFF**.
3. The **SPAC** function must be set to allow access to the relays required e.g. if set to **A 1-2** then the easy access will work only with alarm relays 1 and 2.
4. The instrument must be in normal measure mode i.e. if the instrument is powered up so that it is in **CAL** mode then the easy access will not function. If in doubt remove power from the instrument, wait for a few seconds then apply power again.
5. If the easy access facility is used then the only way to view or alter any other function settings is to power up via **CAL** mode i.e. there is no entry to **FUNC** mode functions unless the instrument is powered up in **CAL** mode.

Explanation of Functions

5.1 Relay 1 PI control setpoint

Display: **R1.SP**
Range: Any display value
Default Value: **0**

Selects Relay 1 PI control setpoint. This function will not be seen unless the **R1.OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.






5.2 Relay 2 PI control setpoint

Display: **R2.SP**
Range: Any display value
Default Value: **0**

Selects Relay 2 PI control setpoint. This function will not be seen unless the **R2.OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.3 Alarm relay low setpoint

Display: **RxLo**
Range: Any display value or **OFF**
Default Value: **OFF**

Displays and sets the low setpoint value for the designated alarm relay x . Note x will be replaced by the relay number when displayed e.g. **R1Lo** for relay 1. Use this low setpoint function if a relay operation is required when the display value becomes equal to or less than the low setpoint value. To set a low alarm value go to the **RxLo** function and use the  or  push buttons to set the value required then press  to accept this value. The low alarm setpoint may be disabled by pressing the  and  push buttons simultaneously. When the alarm is disabled the display will indicate **OFF**. If the relay is allocated both a low and high setpoint then the relay will activate when the value displayed moves outside the band set by the low and high setpoints. The value at which the relay will reset is controlled by the **RxHy** function.

Example:

If **R1Lo** is set to **10** then relay 1 will activate when the display value is 10 or less.

5.4 Alarm relay high setpoint

Display: **RxH**
Range: Any display value or **OFF**
Default Value: **OFF**

Displays and sets the high setpoint value for the designated alarm relay x . Note x will be replaced by the relay number when displayed e.g. **R1H** for relay 1. Use this high setpoint function if a relay operation is required when the display value becomes equal to or more than the low setpoint

value. To set a high alarm value go to the **RxH** function and use the **▲** or **▼** push buttons to set the value required then press **F** to accept this value. The high alarm setpoint may be disabled by pressing the **▲** and **▼** push buttons simultaneously. When the alarm is disabled the display will indicate **OFF**. If the relay is allocated both a low and high setpoint then the relay will activate when the value displayed moves outside the band set by the low and high setpoints. The value at which the relay will reset is controlled by the **RxHY** function.

Example:

If **R1H** is set to **100** then relay 1 will activate when the display value is **100** or higher.

5.5 Alarm relay hysteresis (deadband)

Display: **RxHY**
Range: **0** to **9999**
Default Value: **10**

Displays and sets the alarm relay hysteresis limit for the designated relay *x*. Note *x* will be replaced by the relay number when displayed e.g. **R1HY** for relay 1. To set a relay hysteresis value go to the **RxHY** function and use the **▲** or **▼** push buttons to set the value required then press **F** to accept this value. The hysteresis value is common to both high and low setpoint values. The hysteresis value may be used to prevent too frequent operation of the relay when the measured value is rising and falling around setpoint value. e.g. if **R1HY** is set to zero the alarm will activate when the display value reaches the alarm setpoint (for high alarm) and will reset when the display value falls below the setpoint, this can result in repeated on/off switching of the relay at around the setpoint value.

The hysteresis setting operates as follows: In the high alarm mode, once the alarm is activated the input must fall below the setpoint value minus the hysteresis value to reset the alarm. e.g. if **R1H** is to **50.0** and **R1HY** is set to **3.0** then the setpoint output relay will activate once the display value goes to **50.0** or above and will reset when the display value goes below **47.0** i.e. at **46.9** or below. In the low alarm mode, once the alarm is activated the input must rise above the setpoint value plus the hysteresis value to reset the alarm. e.g. if **R1Lo** is to **20.0** and **R1HY** is set to **10.0** then the alarm output relay will activate when the display value falls to **20.0** or below and will reset when the display value goes above **30.0** i.e. at **30.1** or above. The hysteresis units are expressed in displayed engineering units.

Example: If **R1H** is set to **100** and **R1HY** is set to **10** then relay 1 will activate when the display value is **100** or higher and will reset at a display value of **89** or lower.

5.6 Alarm relay trip time

Display: **RxTt**
Range: **0** to **9999**
Default Value: **0**

Displays and sets the alarm trip time in seconds. The trip time is common for both alarm high and low setpoint values. The trip time provides a time delay before the alarm relay will activate when an alarm condition is present. The alarm condition must be present continuously for the whole trip time period before the alarm will activate. If the input moves out of alarm condition during this period the timer will reset and the full time delay will be restored. This trip time delay is useful for preventing an alarm trip due to short non critical deviations from setpoint. The trip time is

selectable over **0** to **9999** seconds. To set a trip time value go to the **Ax_tt** function and use the **▲** or **▼** push buttons to set the value required then press **F** to accept this value.

Example: If **A₁t_t** is set to **5** seconds then the display must indicate an alarm value for a full 5 seconds before relay 1 will activate.

5.7 Alarm relay reset time

Display: **Ax_rt**
Range: **0** to **9999**
Default Value: **0**

Displays and sets the alarm reset delay time in seconds. The reset time is common for both alarm high and low setpoint values. With the alarm condition is removed the alarm relay will stay in its alarm condition for the time selected as the reset time. If the input moves back into alarm condition during this period the timer will reset and the full time delay will be restored. The reset time is selectable over **0** to **9999** seconds. To set a reset time value go to the **Ax_rt** function and use the **▲** or **▼** push buttons to set the value required then press **F** to accept this value.

Example: If **A₁r_t** is set to **10** seconds then the resetting of alarm relay 1 will be delayed by 10 seconds.

5.8 Alarm relay normally open/closed

Display: **Ax_{n.o}** or **Ax_{n.c}**
Range: **Ax_{n.o}** or **Ax_{n.c}**
Default Value: **Ax_{n.o}**

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

Example:

If set to **A₁n** alarm relay 1 will be open circuit between the NO and COM terminals when the display is outside alarm condition and will be closed (short circuit across NO and COM terminals) when the display is in alarm condition. The NC and COM terminals will be in the opposite state.

5.9 Alarm relay setpoint or trailing operation

Display: **Ax_{SP}** or **Ax_t i** etc.
Range: **Ax_{SP}** or **Ax_t i** etc.
Default Value: **Ax_{SP}**

Relay operation independent setpoint or trailing setpoint, this function will not be seen unless extra optional relays are fitted. Each alarm relay, except relay 1, may be programmed to operate with an independent setpoint value or may be linked to operate at a fixed difference to another relay setpoint, known as trailing operation. The operation is as follows:

Alarm 1 (**A1**) is always independent. Alarm 2 (**A2**) may be independent or may be linked to Alarm 1. Alarm 3 (**A3**) may be independent or may be linked to Alarm 1 or Alarm 2. Alarm 4 (**A4**) may be independent or may be linked to Alarm 1, Alarm 2 or Alarm 3. The operation of each alarm is selectable by selecting, for example, (Alarm 4) **A4.SP** = Alarm 4 normal setpoint or **A4.t 1** = Alarm 4 trailing Alarm 1 or **A4.t 2** = Alarm 4 trailing Alarm 2 or **A4.t 3** = Alarm 4 trailing Alarm 3. For trailing set points the setpoint value is entered as the difference from the setpoint being trailed. If the trailing setpoint is to operate ahead of the prime setpoint then the value is entered as a positive number and if operating behind the prime setpoint then the value is entered as a negative number.

Example: With Alarm 2 set to trail alarm 1, if **A1H** is set to **1000** and **A2H** is set to **50** then Alarm 1 will activate at **1000** and alarm 2 will activate at **1050** (i.e. 1000 + 50). If Alarm 2 had been set at **-50** then alarm 2 would activate at **950** (i.e. 1000 - 50).

5.10 Automatic display brightness adjustment

Display: **br 9t AUto**
 Range: **on** or **OFF**
 Default Value: **OFF**

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

5.11 Display brightness (manually set)

Display: **br 9t**
 Range: **1** to **63**
 Default Value: **63**

Seen only when **br 9t AUto** is set to **OFF**. Displays and sets the digital display brightness. The display brightness is selectable from **1** to **63**, where **1** = lowest intensity and **63** = highest intensity. This function is useful for improving the display readability in dark areas or to reduce the power consumption of the instrument. See also the **dULL** function 5.12. To set brightness level go to the **br 9t** function and use the **▲** or **▼** push buttons to set the value required then press **F** to accept this value.

5.12 Display remote brightness switching

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

Displays and sets the level for remote input brightness switching, see **r.I NP** function. When a remote input is set to **dULL** the remote input can be used to switch between the display brightness level set by the **br 9t** function 5.11 and the display brightness set by the **dULL** function. The display dull level is selectable from **0** to **63**, where **0** = lowest intensity and **63** = highest

intensity. This function is useful in reducing glare when the display needs to be viewed in both light and dark ambient light levels. To set dull level go to the **dULL** function and use the **▲** or **▼** push buttons to set the value required then press **F** to accept this value.

Example:

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

5.13 Automatic display brightness adjustment - high level

Display: **br9t HI 94**

Range: **1** to **63**

Default Value: **63**

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

5.14 Automatic display brightness adjustment - low level

Display: **br9t Lo**

Range: **1** to **63**

Default Value: **10**

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

5.15 Preset value

Display: **P.SET**

Range: Any display value

Default Value: **0**

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

5.16 Relay 1 PI control

Display: ***R1 OPEF***
Range: ***R1.AL***, ***R1.tP*** or ***R1.FF***
Default Value: ***R1.AL***

Selects Relay 1 PI control mode. Refer to the separate Output Addendum booklet for further details.

5.17 Relay 2 PI control

Display: ***R2 OPEF***
Range: ***R2.AL***, ***R2.tP*** or ***R2.FF***
Default Value: ***R2.AL***

Selects Relay 2 PI control mode. Refer to the separate Output Addendum booklet for further details.

5.18 Relay PI control span

Display: ***ctrl SPAN***
Range: **1** to any positive value
Default Value: **1**

Sets the Relay PI control span value. This setting is common to both relays. This function will not be seen unless the ***R1 OPEF*** or ***R2 OPEF*** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.19 Relay 1 PI control proportional gain

Display: ***R1.PG***
Range: **-32.767** to **32.767**
Default Value: **0.000**

Sets the Relay 1 PI proportional gain value. This function will not be seen unless the ***R1 OPEF*** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.20 Relay 2 PI control proportional gain

Display: ***R2.PG***
Range: **-32.767** to **32.767**
Default Value: **0.000**

Sets the Relay 2 PI proportional gain value. This function will not be seen unless the ***R2 OPEF*** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.21 Relay 1 PI control integral gain

Display: **A 1. I G**
Range: **-32.767 to 32.767**
Default Value: **0.000**

Sets the Relay 1 PI integral gain value. This function will not be seen unless the **A 1 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.22 Relay 2 PI control integral gain

Display: **A 2. I G**
Range: **-32.767 to 32.767**
Default Value: **0.000**

Sets the Relay 2 PI integral gain value. This function will not be seen unless the **A 2 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.23 Relay 1 PI control integral low limit

Display: **A 1. I L**
Range: **0.0 to 100.0**
Default Value: **0.0**

Sets the Relay 1 PI integral low limit value. This function will not be seen unless the **A 1 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.24 Relay 2 PI control integral low limit

Display: **A 2. I L**
Range: **0.0 to 100.0**
Default Value: **0.0**

Sets the Relay 2 PI integral low limit value. This function will not be seen unless the **A 2 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.25 Relay 1 PI control integral high limit

Display: **A 1. I H**
Range: **0.0 to 100.0**
Default Value: **0.0**

Sets the Relay 1 PI integral high limit value. This function will not be seen unless the **A 1 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.26 Relay 2 PI control integral high limit

Display: **R2. IH**
Range: **0.0 to 100.0**
Default Value: **0.0**

Sets the Relay 2 PI integral high limit value. This function will not be seen unless the **R2 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.27 Relay 1 PI control bias

Display: **R1. b5**
Range: **0.0 to 100.0**
Default Value: **50.0**

Sets the Relay 1 PI control bias. This function will not be seen unless the **R1 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.28 Relay 2 PI control bias

Display: **R2. b5**
Range: **0.0 to 100.0**
Default Value: **50.0**

Sets the Relay 2 PI control bias. This function will not be seen unless the **R2 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.29 Relay 1 PI control minimum off time

Display: **R1. dc**
Range: **0.0 to 100.0**
Default Value: **1.0**

Sets the Relay 1 PI proportional bias. This function will not be seen unless the **R1 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.30 Relay 2 PI control minimum off time

Display: **R2. dc**
Range: **0.0 to 100.0**
Default Value: **1.0**

Sets the Relay 2 PI proportional bias. This function will not be seen unless the **R2 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.31 Relay 1 PI control on time

Display: **R1.dr**
Range: **0.0 to 100.0**
Default Value: **0.0**

Sets the Relay 1 PI proportional bias. This function will not be seen unless the **R1 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.32 Relay 2 PI control on time

Display: **R2.dr**
Range: **0.0 to 100.0**
Default Value: **0.0**

Sets the Relay 2 PI proportional bias. This function will not be seen unless the **R2 OPEF** function is set to **on**. Refer to the separate Output Addendum booklet for further details.

5.33 Analog output option low value

Display: **FEC-**
Range: Any display value
Default Value: **0**

Seen only when analog retransmission option fitted. Displays and sets the analog retransmission (4–20mA) output low value (4mA) in displayed engineering units. To set the analog output low value go to the **FEC-** function and use the **▲** or **▼** push buttons to set the required value then press **F** to accept this selection. See also **FEC** function.

Example: If it is required to retransmit 4mA when the display indicates **0** then select **0** in this function using the **▲** or **▼** button.

5.34 Analog output option high value

Display: **FEC~**
Range: Any display value
Default Value: **1000**

Seen only when analog retransmission option fitted. Displays and sets the analog retransmission (4–20mA) output high display value (20mA) in displayed engineering units. To set the analog output high value go to the **FEC~** function and use the **▲** or **▼** push buttons to set the required value then press **F** to accept this selection. See also **FEC** function.

Example: If it is required to retransmit 20mA when the display indicates **50** then select **50** in this function using the **▲** or **▼** button.

5.35 Second analog output option low value

Display: **FEE- CH2**
Range: Any display value
Default Value: **0**

See **FEE-** function 5.33 for description of operation. See also **FEE** function.



5.36 Second analog output option high value

Display: **FEE~ CH2**
Range: Any display value
Default Value: **1000**

See **FEE~** function 5.34 for description of operation. See also **FEE** function.

5.37 Display rounding



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

Displays and sets the display rounding value. This value may be set to 1 - 5000 displayed units. Display rounding is useful for reducing the instrument resolution without loss of accuracy in applications where it is undesirable to display to a fine tolerance. To set the display rounding value go to the **drnd** function and use the  or  push buttons to set the required value then press **F** to accept this selection.

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

5.38 Decimal point

Display: **dCPE**
Range: **0, 0.1** etc.
Default Value: **0**

Displays and sets the decimal point. By pressing the  or  pushbutton at the **dCPE** function the decimal point position may be set. The display will indicate as follows: **0** (no decimal point), **0.1** (1 decimal place), **0.02** (2 decimal places), **0.003** (3 decimal places) and **0.0004** for display with more than 4 digits. Note if the decimal point is altered the display will need to be recalibrated and alarm etc. settings checked.

5.39 Digital filter

Display: **FILTER**
Range: **0** to **8**
Default Value: **2**

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

5.40 Analog output PI control

Display: **FEC ctrl**
Range: **on** or **OFF**
Default Value: **OFF**

Selects analog output PI control mode as on or off. Refer to the separate Output Addendum booklet for further details.

5.41 Analog PI control output span

Display: **C.SPAN**
Range: **0** to any positive value
Default Value: **0**

Sets the analog PI output control span value. Refer to the separate Output Addendum booklet for further details.

5.42 Analog PI control proportional gain

Display: **CPG**
Range: **-32.767** to **32.767**
Default Value: **0.000**

Sets the analog PI proportional gain value. Refer to the separate Output Addendum booklet for further details.

5.43 Analog PI control proportional offset

Display: **CP0**
Range: **0.0 to 100.0**
Default Value: **0.0**

Sets the analog PI proportional offset value. Refer to the separate Output Addendum booklet for further details.

5.44 Analog PI control integral gain

Display: **CI9**
Range: **-32.767 to 32.767**
Default Value: **0.000**

Sets the analog PI integral gain value. Refer to the separate Output Addendum booklet for further details.

5.45 Analog PI control integral high limit

Display: **CI L.H**
Range: **0.0 to 100.0**
Default Value: **0.0**

Sets the analog PI integral high limit value. Refer to the separate Output Addendum booklet for further details.

5.46 Analog PI control integral low limit

Display: **CI L.L**
Range: **0.0 to 100.0**
Default Value: **0.0**

Sets the analog PI integral low limit value. Refer to the separate Output Addendum booklet for further details.

5.47 Analog PI control setpoint access

Display: **FEC SPAC**
Range: **on** or **OFF**
Default Value: **OFF**

Sets the analog PI setpoint access mode. Refer to the separate Output Addendum booklet for further details.

5.48 Display unit

Display: *di SP unit*
Range: *NONE .°C .°F .°C or F*
Default Value: *NONE*

Display unit - When used to measure temperature certain temperature display unit characters can be selected to appear on the display. Choices are:

NONE gives no display units e.g. a display such as **2345**

°C - gives *°C* display unit e.g. **45 °C**

°F - gives *°F* display unit e.g. **90 °F**

° - gives *°* display unit e.g. **123 °**

°C - gives *°C* display unit e.g. **45.2°C**

F - gives *F* display unit e.g. **237F**

Note that if a temperature display is selected the unit will take one or two of the available display digits, this will limit the maximum value which can be displayed. If the number becomes too large to display then an error message *-or-* will appear on the display.

5.49 First calibration scaling point

Display: *CAL 1*
Range: Any display value
Default Value: n/a

First scaling point for 2 point calibration scaling - See "Calibration" chapter, section

5.50 Second calibration scaling point

Display: *CAL 2*
Range: Any display value
Default Value: n/a

Second scaling point for 2 point calibration scaling - See "Calibration" chapter, section

5.51 Calibration offset

Display: *CAL OFFSE*
Range: Any display value
Default Value: n/a

Calibration offset - See section 6.3.

5.52 Zero range

Display: **ZERO RANGE**
Range: Any display value or **OFF**
Default Value: **OFF**

Zero range limit value - see section 6.4.

5.53 Zero reference point for ZERO RANGE operation

Display: **CAL ZERO**
Range: n/a
Default Value: n/a

Zero point calibration for ZERO RANGE function - see section 6.5.

5.54 4mA input scale

Display: **USER En4**
Range: Any display value
Default Value: n/a

4mA input scale value, use only as an alternative to CAL 1 and CAL 2 calibration - See “Calibration” chapter, section 6.2.



5.55 20mA input scale

Display: **USER En20**
Range: Any display value
Default Value: n/a

20mA input scale value, use only as an alternative to CAL 1 and CAL 2 calibration - See “Calibration” chapter, section 6.2.

5.56 Uncalibrate

Display: **UCAL**
Range: n/a
Default Value: n/a

Uncalibrate, resets calibration - required only when a calibration problem occurs and it is necessary to clear the calibration memory. At the UCAL function press the  and  buttons simultaneously. The message CAL CLR should be seen to indicate that the calibration memory has been cleared.

5.57 **P** button function

Display: **PbUt**
Range: **NONE**, **H**, **Lo**, **H**, **Lo**, **tARE**, **ZEFO**, **P.SEt**, or **CLF.t**
Default Value: **NONE**

The **P** button may be set to operate some of functions also available via the remote inputs. See the **r.i NP** function below for details of operation of the available functions. Note: To prevent accidental operation of the **P** button in the **tARE**, **ZEFO**, **P.SEt** and **CLF.t** functions it is necessary to hold the button in for 2 seconds to perform the selected operation.

5.58 Remote input function

Display: **r.i NP**
Range: **NONE**, **P.HLd**, **d.HLd**, **H**, **Lo**, **H**, **Lo**, **tARE**, **ZEFO**, **SP.Ac**, **No.Ac**, **CAL.S**, **P.SEt**, **dULL** or **CLF.t**
Default Value: **NONE**

Remote input function - When remote input terminals 7 and 8 are short circuited, via a switch, relay, keyswitch etc. the instrument will perform the selected remote input function. A message will flash (e.g. **ZEFO** 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 i.e. activating the remote input has no effect.
- **P.HLd** - rate peak hold. The display will show the peak rate value (highest positive value) only whilst the remote input terminals are short circuited i.e. the display value can rise but not fall whilst the input terminals are short circuited. The message **P.HLd** will appear briefly every 8 seconds whilst the input terminals are short circuited to indicate that the peak hold function is active.
- **d.HLd** - rate display hold. The rate display value will be held whilst the remote input terminals are short circuited. The message **d.HLd** will appear briefly every 8 seconds whilst the input terminals are short circuited to indicate that the display hold function is active. The totaliser will still be active and will sample the live input rather than the held input whilst the rate is held i.e. the rate display hold does not affect the totaliser operation.
- **H** - rate peak memory. The rate peak value stored in memory will be displayed if the remote input terminals 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 2 to 3 seconds or the power is removed from the instrument then the memory will be reset.
- **Lo** - rate valley memory. The rate minimum value stored in memory will be displayed. Otherwise operates in the same manner as the **H** function described above.
- **H, Lo** - rate toggle between **H** and **Lo** displays. This function allows the remote input to be used to toggle between rate 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. **PH** or **PLo** will flash before each display to give an indication of display type.
- **tARE** - display tare. Not applicable to this instrument.

- **ZERO** - rate display zero. Zeroes the rate display when the remote input is shorted. The input at the time of the **ZERO** operation will become the new zero point. The zero operation shifts the calibration in the same manner as a calibration offset operation.
- **SP.Ac** - setpoint access only. This mode 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 or if the **ACCESS** function is set to either **EASY** or **ALL**.
- **No.Ac** - no access. This mode blocks access to all functions unless the remote input pins are short circuited or entry is made via **CAL** mode or if the **ACCESS** function is set to **ALL**.
- **CAL.S** - rate calibration select. The remote input can be used to select between rate calibration scaling values. Two sets of calibration values can be entered in the instrument, one set with the remote input open circuit and another set with the remote input short circuit to ground. The remote input can then be used to switch between one set and the other. This feature can be used on all input ranges. For example: With the remote input open circuit a 4-20mA input can be scaled (using **CAL 1** and **CAL 2** or **USER En4** and **USER En20**) to read **0** to **100** over the 4-20mA range. With the remote input short circuit to ground the scaling can be repeated using figures of **0** to **500** for the 4-20mA range. The remote input can be used to switch between ranges. In this example the first scaling could represent a % figure and the second scaling could represent the actual process units (litres, kg, volts etc).
- **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 terminals, between the brightness level set at the **brgt** function and the brightness level set at the **dULL** function.
- **P.SET** - preset. The remote input can be used to force the rate display to the value set at the **P.SET** function.
- **CLF.t** - clear total. This function allows the total to be cleared (reset to zero). The message **CLrd** will appear when this function is operated.

5.59 Remote input two function

Display: **r.1 r2**
 Range: Same as **r.1 rP**
 Default Value: **NONE**

Remote input two function - As per **r.1 rP** function ?? but uses remote input 2.

5.60 Remote input three function

Display: **r.1 r3**
 Range: Same as **r.1 rP**
 Default Value: **NONE**

Remote input three function - As per **r.1 rP** function ?? but uses remote input 3.

5.61 Access mode

Display: **ACCS**
Range: **OFF . EASY . NONE** or **ALL**
Default Value: **OFF**

The access mode function **ACCS** has four possible settings namely **OFF . EASY . NONE** and **ALL**. If set to **OFF** the mode function has no effect on alarm relay operation. If set to **EASY** the “easy alarm access” mode will be activated, see page 18. If set to **NONE** there will be no access to any functions via **FUNC** mode, entry via **CAL** mode must be made to gain access to alarm and calibration functions. If set to **ALL** then access to all functions, including calibration functions, can be gained via **FUNC** mode.

5.62 Setpoint access mode

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

Setpoint access - sets the access via **FUNC** mode and “easy alarm access” mode to the alarm relay setpoints. The following choices are available:

A 1 - Allows setpoint access to alarm 1 only.

A 1-2 - Allows setpoint access to alarms 1 and 2 only.

A 1-3 - Allows setpoint access to alarms 1,2 and 3 etc. up to the maximum number of relays fitted.

The remote input function (**F.I NP**) must be set to **SP.AC** for this function to operate. Note: Only the setpoints which have been given a value will be accessible e.g. if **A 1H** is set to **OFF** then there will be no access to the **A 1H** function when **SPAC** is used.

5.63 Square root mode

Display: **Sqr t**
Range: **on** or **OFF**
Default Value: **OFF**

Square root - selects the square root scaling to **on** or **OFF**. When set to **on** a square root function is applied to the input. When set to **OFF** the calibration is a linear function. When the square root facility is used the scaled displayed value follows the square root of the percentage of the full scale input value. The upper and lower input limits are set as normal as are the values to be displayed at these limits.

Note: It is essential that the display is rescaled, using **CAL 1** and **CAL 2** or **USER EN 4** and **USER EN 20**, whenever the square root function is turned on or off. The **CAL OFFSET** function cannot be used when the **Sqr t** function is set to **on**. **Example:**

For a 4–20mA input if you wish to display 0 at 4mA and 1000 at 20mA the square root function will calculate as follows:

At 20mA (100%) the display will be **1000** i.e. $\sqrt{1} \times 1000$.

At 16mA (75%) the display will be **866** i.e. $\sqrt{0.75} \times 1000$.

At 12mA (50%) the display will be **707** i.e. $\sqrt{0.5} \times 1000$ and so on.

5.64 Decimal point place for total display

Display: **tot: dCPt**

Range: **0, 0.1** etc

Default Value: **0**

Displays and sets the decimal point position for the totaliser display. Choices are **0** (no decimal point), **0.1**, **0.02** etc. up to the number of display digits -1.

5.65 Display scaling factor for total

Display: **d: SP SCL E**

Range: Any display value

Default Value: **1**

Displays and sets the display scaling factor. This factor is used in the formula to calculate the total display (see **E.SCL**). If a negative scale value is selected the total will reduce but this will only occur if the **tot: NEG** function is set to **on**. See below for examples.

5.66 Totaliser scaling factor

Display: **tot: SECS**

Range: any display value

Default Value: **60**

Displays and sets the totaliser scaling factor. The scaling factor can be set anywhere in the range from **0** to the maximum display value. This factor is used in the formula to calculate the total display. This factor is used in the formula to calculate the total display (see **E.SCL**). See below for examples.

5.67 Exponent scaling factor

Display: **E.SCL**

Range: **0** to **9**

Default Value: **1**

Displays and sets the exponent factor for the display. The scaling factor can be set anywhere in the range from **0** to **9**. This factor allows a larger accumulated total by dividing the rate display value down to a smaller number. For example a display in grams can be converted to kilograms by setting **E.SCL** to **3**. The formula used to calculate the accumulated total display from the rate display is as follows:

$$\text{Total} = \text{Previous total} + \left(\frac{\text{Rate display value} \times \mathbf{d: SP SCL E}}{\mathbf{tot: SECS} \times 10^{\mathbf{E.SCL}}} \right) \times T_s$$

Where: T_s is the time since the last sample in seconds.

Examples: Example 1 - The instrument is connected to a flow meter and the rate is scaled to show litres per minute (L/m). The total display is required in Megga Litres (ML). For a flow

indication of 500 L/m the total should increase by 500 litres or 0.0005ML in 1 minute. In the formula the rate display will be 500, there is no display scaling factor (**DISP SCALE**) so enter this as **!**, the totaliser scaling factor (**TOTL SECS**) will be 60 (seconds) since we are measuring in litres per minute and Ts will be 60 (seconds) if we wish to see the total after 1minute. Since we are measuring in megga litres (Litres x 106), the **E.SCL** value will be 6.

$$\text{Total} = \text{Previous total} + \left(\frac{500 \times 1}{60 \times 10^6} \right) \times 60$$

$$\text{Total} = \text{Previous total} + 0.0005 \text{ (ML)}$$

Example 2 - Rate of fill measured is to be in m3/hr (cubic metres per hour). It is found that the total fill in one hour equals 1.22 times the rate indication, this will be the **DISP SCALE** factor. **TOTL SECS** will be 3600 (seconds i.e. 1 hour in seconds), **E.SCL** will be 0 since both rate and total are in cubic metres. For this example we will examine the increase in total after 2 hours (7200 seconds). A rate of 35.8 m3/hr we would expect an increase in the total of 87.352 m3 in 2 hours (35.8 x 1.22 x 2).

$$\text{Total} = \text{Previous total} + \left(\frac{35.8 \times 1.22}{3600 \times 10^0} \right) \times 7200$$

$$\text{Total} = \text{Previous total} + 87.352 \text{ (Cubic Metres)}$$

5.68 Negative total select

Display: **TOTL NEG**
 Range: **OFF** or **ON**
 Default Value: **OFF**

Displays and sets whether negative totals are allowed or not. When set to OFF negative totals are not allowed and the total will not increase when the rate input is negative. Set to on to allow negative totals.

5.69 Wrap around operation

Display: **TOTL WRAP.F**
 Range: **ZERO** or **STOP**
 Default Value: **ZERO**

Displays and sets the totaliser wrap around operation for displays at full scale. If **STOP** is selected the display will halt at its maximum or minimum display value. If **ZERO** is selected then the display will wrap around to zero i.e. will reset itself and start again at zero.

5.70 Clear total

Display: **CLF tot**
Range: n/a
Default Value: n/a

Allows the totaliser value to be cleared via the setup pushbuttons located at the rear of the instrument. To clear the totaliser press **▲** and **▼** simultaneously at this function. The message **CLrd** will be seen to confirm that the totaliser memory has been cleared. Alternatively the **P** button or a remote input can be used to clear the total. If a remote switch is to be used the **PI RP** function must be set to **CLF.t**. If the **P** button is to be used to clear the total the **P.but** function must be set to **CLF.t**.

5.71 Default display

Display: **dFl t dl SP**
Range: **RAE** or **tot**
Default Value: **RAE**

The default display may be set to total (**tot**) or rate (**RAE**). The instrument will automatically revert to its default display. The **▲** or **▼** button can be used to change from the default to the alternate display and the instrument will then return to the default display after a period of around 20 seconds.

5.72 Alarm relay operation mode

Display: **A1.A2.A3** and **A4**
Range: **A1.r** or **A1.t**
Default Value: **A1.r**

Alarm relay operation mode for relays 1, 2, 3 and 4. The following choices are available for alarm operation mode:

A1.r - Relay 1 will operate from the value on the rate display (**A2.r** for relay 2 etc.)

A1.t - Relay 1 will operate from the value on the totaliser display (**A2.t** for relay 2 etc.)

5.73 Analog or serial operation mode

Display: **rEC** or **rEC2**
Range: **L, uE .totL .tAFE .PHLd .d.HLd .H, .Lo** or **dl SP**
Default Value: **L, uE**

This section describes the operation modes available for the retransmission options **rEC** (analog retransmission) operation mode or **rEC2** (second analog retransmission). Note that the **rEC** function will not be seen if analog output 1 operation has been set for PI control operation at the **rEC ctrl** function. The following choices are available:

L, UE - live input mode. The retransmission will follow the electrical input and will not necessarily follow the 7 segment display. For example if the remote input is set for peak hold operation then when the remote input is closed the 7 segment display will only show the peak value but the retransmission will be free to change to follow the electrical input. Note that the **L, UE** mode does not follow the electrical input if a remote input or **P** button **ZERO** operation has been undertaken. This is due to the fact that the **ZERO** operation shifts the display calibration.

LOEL - total mode. The retransmission will follow the total value.

LAPE - tare mode. The retransmission value will tare (fall to zero) along with 7 segment display when the remote input tare function is operated. If the remote input toggles the 7 segment display to show gross (**GFOS**) then the 7 segment display will change to show the gross value but the retransmission will not respond (see **L, UE** for alternative operation).

P.HLD - peak hold mode. The 7 segment display and retransmission value will indicate the peak value only whilst the peak value function is operated via a contact closure on the remote input i.e. the 7 segment display and retransmission can rise but not fall whilst the remote input switch is closed. When the remote input switch is opened the retransmission value will remain fixed i.e. it will not rise or fall, although the 7 segment display value will be free to alter. This peak retransmission output can be cleared by closing the remote input switch for another operation or by removing power from the instrument. Note: In this mode the retransmission will show a zero reading until the remote input is operated for the first time after switch on.

d.HLD - display hold mode. The 7 segment display and retransmission value will be held whilst the remote input display hold switch is closed. When the switch is opened the retransmission value will remain fixed at the held value although the 7 segment display value will be free to alter. The held retransmission output can be cleared by closing the remote input switch for another operation or by removing power from the instrument. Note: In this mode the bargraph will show a zero reading until the remote input is operated for the first time after switch on.



H - peak (max.) memory mode. With the peak remote input switch open the retransmission will indicate the peak value in memory i.e. the retransmission output can rise but not fall. The retransmission output can be reset by clearing the memory. The memory may be cleared either by closing the remote input switch for approximately 2 seconds or by removing power to the instrument.

Lo - valley (min.) memory mode. With the valley remote input switch open the retransmission will indicate the valley (min.) value in memory i.e. the retransmission output can fall but not rise. The retransmission output can be reset by clearing the memory. The memory may be cleared either by closing the remote input switch for approximately 2 seconds or by removing power to the instrument.

d: SP - display mode. The retransmission output will follow whatever value is on the 7 segment display. For example if the remote input is set to **LAPE** then the 7 segment and retransmission output will indicate the tared value and both will also be changed if the remote input toggles the displays between **NEEL** and **GFOS**. If the **FEC** had been set to **LAPE** then the retransmission output would not respond to the **GFOS** toggle.



5.74 Low overrange visual warning limit value

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

Low overrange limit value - the display can be set to show an overrange message if the display value falls below the *Lo di SP* setting. For example if *Lo di SP* is set to *50* then once the display reading falls below *50* the message *-or-* will flash on and off or the display value will flash on and off instead of the normal display units (see *di SP* function 5.76). 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.

5.75 High overrange visual warning limit value

Display: *Hi 9H di SP*
Range: Any display value or *OFF*
Default Value: *OFF*

High overrange limit value - the display can be set to show an overrange message if the display value rises above the *Hi 9H di SP* setting. For example if *Hi 9H di SP* is set to *1000* then once the display reading rises above *1000* the message *-or-* will flash on and off or the display value will flash on and off instead of the normal display units (see *di SP* function 5.76). This message can be used to alert operators to the presence of an input which is above the high limit. If this function is not required it should be set to *OFF* by pressing the  and  buttons simultaneously at this function.

5.76 Display visual warning flashing mode

Display: *di SP*
Range: *FLSH* or *-or-*
Default Value: *FLSH*

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

5.77 Serial communications type

Display: **SEF. 1 TYPE**
Range: **NONE, F232** or **F485**
Default Value: **NONE**

Selects the serial output communications type from: **NONE** for no serial output, **F232** for RS232 output or **F485** for RS485 output. Note that the serial output is optional and factory configured with the hardware for one particular type of output i.e. if fitted with RS232 hardware then both the **SEF. 1 TYPE** and the hardware must be changed to convert to RS485.

5.78 Error messages

- **SPAN Err** - calibration span error. Live inputs used at **CAL 1** and **CAL 2** too close in value. Recalibrate using inputs further apart in value. If you are certain that the inputs are far enough apart but still see the **SPAN Err** message then ignore the message and continue with the two point calibration. At the end of the calibration check to see if the display calibration is correct and if not recalibrate again.
- **ZERO RANGE Err** - zero range error. Caused by an attempt to zero the display outside the allowed range. See **ZERO RANGE** function.
- **NO ACCS** or **NO SP.AC** - these message indicate that access has been blocked via **FUNC** mode to all functions or to functions other than alarm relay setpoints. Access can be blocked by the **F: 01**, **F: 02**, **F: 03** or **ACCS** functions. Check these functions and alter them if required. If the **F: 01**, **F: 02** or **F: 03** has been used to block access then the appropriate remote input can be used to override the block. Entry via **CAL** mode can also be used to access all functions since **CAL** mode overrides the blocking functions.
- Unstable display - if the display is not stable the usual cause is either that the input signal is unstable or that the calibration scaling was incorrectly attempted. If the calibration scaling was unsuccessful then uncalibrating the display at the **UCAL** function should return the display to stable readings but the previous calibration scaling values will be lost. If the display is still not stable after uncalibrating then check the input for stability and electrical noise.
- Display shows - - - - this message indicates that the input signal is higher than the range selected. e.g. for an input set for 0-2.5V the - - - - message will be seen if the input signal goes much higher than 2.5V. Display shows -or- this message indicates either that the number is too big to display e.g. above 9999 on a 4 digit display or that the **di SP** function has been set to -or- and either the **Lo di SP** or **Hi 9H di SP** function limits have been exceeded.
- Display value flashes on and off - this indicates that the **di SP** function has been set to **FLSH** and either the **Lo di SP** or **Hi 9H di SP** function limits have been exceeded.

6 Calibration

The instrument can be calibrated via a two point live input calibration method using functions **CAL 1** and **CAL 2**. For 4-20mA inputs only an alternative method allows display scaling without live inputs using the **USER En4** and **USER En20** functions. An offset calibration scaling adjustment using the **CAL OFFSt** function is available which allows the scaling to be adjusted by a fixed amount over the entire scale. Each of these methods and other calibration scaling function are described in this chapter.

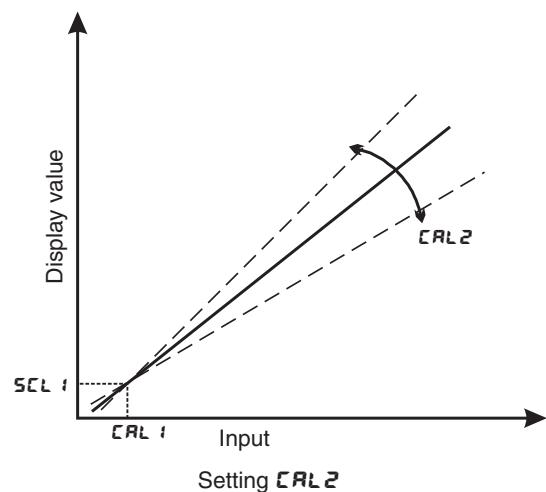
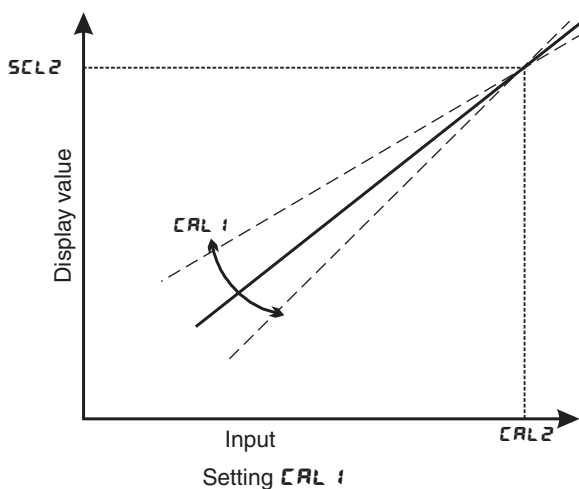
In order to gain access to the calibration functions you must be in **CAL** mode, refer to Chapter 5 page 17 which shows the method of entering **CAL** mode.

6.1 Live signal input calibration

CAL 1 and **CAL 2** - The functions **CAL 1** and **CAL 2** are used together to scale the instruments display, values for both **CAL 1** and **CAL 2** must be set when using this scaling method. The **CAL 1** function sets the first calibration point for live input calibration. When using this method different signals inputs must be present at the input terminals for **CAL 1** and **CAL 2**. Note: **CAL 1** and **CAL 2** can be set independently.

The procedure for entering the first scaling point **CAL 1** is as follows:

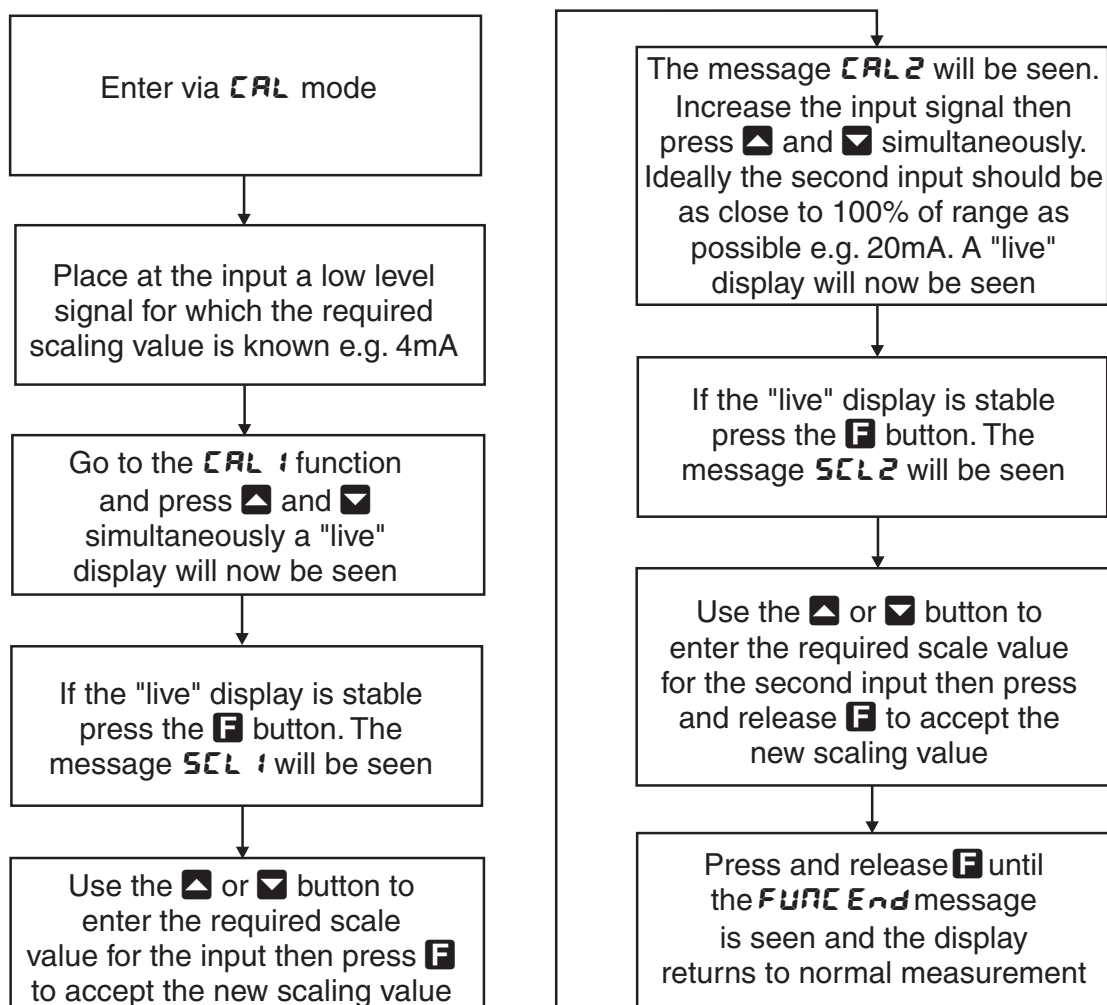
- a. Ensure that an input signal is present at the input terminals, this will usually be at the low end of the signal range e.g. 4mA for a 4-20mA input.
- b. At the **CAL 1** function press **▲** and **▼** simultaneously then release them. The display will show the live input value. Do not be concerned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



The procedure for entering the second scaling point **CAL2** is as follows:

- a. Ensure that an input signal is present at the input terminals, this will usually be at the high end of the signal range e.g. 20mA for a 4-20mA input. The change in input signal from the **CAL1** input must be at least 10% of the input range full scale.
- b. At the **CAL2** function press **▲** and **▼** simultaneously then release them. The display will show the live input value. Do not be concerned at this stage if the live input display value is not what is required. It is important that the live input value seen is a steady value, if not then the input needs to be investigated before proceeding with the scaling.
- c. Press then release the **F** button. The display will indicate **SCL2** followed by a value. Use the **▲** or **▼** button to change this value to the required display value at this input. e.g. if 20mA was input and the required display at 20mA was **500** then ensure **500** is entered at **SCL2**. Press the **F** button to accept changes or the **P** button to abort the scaling. If the scaling has been accepted the **CAL End** message should be seen.

Example - Flow chart showing scaling using two live inputs



Note: If the "live" display at any scaling point is not stable then check the input signal for stability.

6.2 Alternative 4-20mA scaling

USER En4 - 4mA input scaling without a live input - this calibration method can be used with 4-20mA inputs only. The instrument can be scaled for a 4-20mA input without a live input i.e. this is an alternative method to the **CAL 1** and **CAL 2** method of scaling. To perform the first point (**En4**) scaling simply press the **▲** and **▼** buttons simultaneously when the **USER En4** function is displayed. The display will now indicate a value. Use the **▲** or **▼** button to change this value to the display value required for a 4mA input. Press the **F** button to accept changes or the **P** button to abort the scaling. If the scaling has been accepted the **CAL End** message should be seen.

USER En20 - 20mA input scaling without a live input - this calibration method can be used with 4-20mA inputs only. To perform the second point (**En20**) scaling simply press the **▲** and **▼** buttons simultaneously when the **USER En20** function has been reached. The display will now indicate a value. Use the **▲** or **▼** button to change this value to the display value required for a 20mA input. Press the **F** button to accept changes or the **P** button to abort the scaling. If the scaling has been accepted the **CAL End** message should be seen.

Note: the **USER En4** and **USER En20** method relies on the accuracy of the signal input. If the sensor output is found to have an offset use the **CAL OFSt** function to correct for the offset. If the slope of the sensor output is not correct then **CAL 1** and **CAL 2** methods will have to be used.

6.3 Offset calibration

CAL OFSt - Calibration offset - the calibration offset is a single point adjustment which can be used to alter the calibration scaling values across the entire measuring range without affecting the calibration slope. This method can be used instead of performing a two point calibration when a constant measurement error is found to exist across the entire range. To perform a calibration offset press the **▲** and **▼** buttons simultaneously at the **CAL OFSt** function. A “live” reading from the input will be seen, make a note of this reading. Press the **F** button, the message **SCLE** will now be seen followed by the last scale value in memory. Use the **▲** or **▼** button to adjust the scale value to the required display value for that input. For example if the “live” input reading was **50** and the required display value for this input was **70** then adjust the **SCLE** value to **70**. Press the **F** button to accept changes or the **P** button to abort the scaling. If the scaling has been accepted the message **OFSt End** should be seen. If the **ZERO RANGE Err** message is seen refer to the **ZERO RANGE** and **CAL ZERO** functions.

6.4 Zero range

ZERO RANGE - Zero Range - the zero range function allows a limit value to be set (in engineering units) above which the display will not zero i.e. if a zero operation is attempted via the **P** button, remote input or set zero function when the display value is greater than the zero range setting the display will refuse to zero and give a **ZERO RANGE Err** message (note that the **CAL OFSt** function is also affected by the **ZERO RANGE** setting). For example if the zero range setting is **10** the instrument will only respond to a zero operation if the display reading at the time is between **- 10** and **10**. If the zero range function is not required it can be set to **OFF** by pressing the **▲** and **▼** buttons simultaneously at this function. When switched off the instrument can be zeroed no matter what the display value. Note that the instrument keeps track of the value being zeroed at each operation, when the total amount zeroed from repeated operations becomes greater than the zero range value the instrument will reject the zero operation and a **ZERO RANGE Err** message will

be seen. To allow a zero operation beyond this point either the **ZERO RANGE** function value will need to be raised or a new zero reference point introduced via the **CAL ZERO** function. If repeated zero operations are required the **ZERO RANGE** function should be set to **OFF** or alternatively the **LARGE** operation could be considered.

6.5 Zero range zero calibration

CAL ZERO - Zero range zero calibration - a **CAL ZERO** zero operation can be used to ensure that the display zero and the **ZERO RANGE** reference zero are at the same point after a calibration. After a calibration the **CAL ZERO** operation can also be used to select a zero point other than the display zero as the reference for the **ZERO RANGE** function. For example if the **CAL ZERO** operation is carried out with a display reading of **500** and a **ZERO RANGE** reading of **10** the zero range function will allow the display to zero only if the current display reading is between **490** and **510**. To perform a calibration zero press the **▲** and **▼** buttons simultaneously at the **CAL ZERO** function, a live reading will be seen, press the **F** button, the message **CAL ZERO End** should now be seen indicating that the instrument has accepted the zero point. Although the display reading will not change as a result of the calibration zero the input value on the display at the time of the operation will be the new zero reference point for the **ZERO RANGE** function.

6.6 Uncalibration

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

7 Specifications

7.1 Technical specifications

Input types:	Link selectable $\pm 20\text{mA}$, 4 to 20mA or DC Volts $\pm 2.5\text{V}$ or $\pm 25\text{V}$ or slidewire 0-1k Ω to 0-1M Ω potentiometer
Input impedance:	64 Ω nominal for 4 to 20mA/ $\pm 20\text{mA}$ range and 1M Ω on DC voltage ranges. 4-20mA/ $\pm 20\text{mA}$ input uses a self healing 30mA poly fuse for input protection, input impedance quoted includes poly fuse resistance.
Memory:	Battery backed totaliser memory
Accuracy:	Better than 0.1% when calibrated
Sample rate:	5 samples per second
ADC Resolution:	1 in 32,000
Conversion Method:	Sigma delta
Microprocessor:	HC68HC11F CMOS
Ambient temperature:	LED -10 to 60° C
Humidity:	5 to 95% non condensing
Power supply:	100 and 200mm LED and 100mm electromagnetic: AC 240 or 110V selectable, 50/60Hz or AC 48/42/32/24 selectable, 50/60Hz or DC isolated wide range 12 to 24V. 38mm, 45mm or 57mm LED: AC 240 or 110V 50/60Hz or DC 12 to 48V isolated Supply type is factory configured
Output (standard):	4 x relays, Form C, rated 5A resistive. Programmable N.O. or N.C. Relays 1 and 2 can alternatively be set for PI control (frequency or pulse width)

7.2 Optional outputs

Dual analog:	Dual isolated 4-20mA analog outputs. Output 1 can be set for retransmission or PI control. Output 2 is retransmission only.
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7.3 Physical characteristics

Refer to “Mechanical installation”, chapter 2 page 4 for size and weight specifications.

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 au authorised representative of the manufacturing company.

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

When returning the product for service or repair a full description of the fault and the mode of operation used when the product failed must be given. In any event the manufacturer has no other obligation or liability beyond replacement or repair of this product.

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

This document is the property of the instrument manufacturer and may not be reproduced in whole or part without the written consent of the manufacturer.

This product is designed and manufactured in Australia.