



MM-LN SERIES
MINIATURE TANK LEVEL MONITOR
FOR NON LINEAR TANK APPLICATIONS

OPERATION & INSTRUCTION
MANUAL

DC Current / DC Voltage 50 Point
Lineariser
(Inputs 0-20mA, 4-20mA, 0-100mV,
0-1V, 0-10V & 0-100V)

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1 Introduction

This manual contains information for the installation and operation of the MM-LN lineariser monitor. The MM may be configured to accept inputs of 0 to 20mA, 4 to 20mA, 0-100mV, 0-1V, 0-10V or 0-100VDC.

The MM-LN offers the choice of linear, square root or linearised display.

In lineariser operation up to 50 points may be entered. These points and any function settings and scaling values are stored in EEPROM memory. The lineariser points are stored in a "lineariser table". A written copy of the table should be maintained for reference, a table is provided in Chapter 7 for this purpose. The lineariser table stores the display values for each point and the input values (scaled or otherwise) associated with these display values. Prior to entering values into the table the display must be scaled via a 2 point calibration. Functions **CAL 1** and **CAL 2** can be used for live input display scaling for all input types. For 4-20mA inputs only an alternative scaling method is provided via the **USEF En4** and **USEF En20** functions.

The display may be toggled between "live input" and linearised values via the front  and  pushbuttons (5, 6 & 8 digit LED models) or rear pushbuttons on other models. The display will indicate **LIVE** prior to a live input reading and **LINE** prior to a linearised reading. This feature may be used at any time to check the readings against the lineariser table. Alternatively a remote switch or the front panel  button can be programmed to toggle between the two display types.

The instrument may be calibrated to display the input in engineering units. A standard inbuilt relay provides an alarm/control function, a regulated transmitter supply of 18 VDC is also provided. Optional extra relays, retransmission and ± 12 VDC (24V) transmitter supply/excitation voltage may also be provided. The standard 18VDC transmitter supply must not be used if the optional transmitter supply is used.

Unless otherwise specified at the time of order, your MM has been factory set to a standard configuration. Like all other MM series instruments the configuration and calibration is easily changed by the user. Initial changes may require dismantling the instrument to alter PCB links, other changes are made by push button functions.

Full electrical isolation between power supply, input voltage or current and retransmission output is provided by the MM, thereby eliminating grounding and common voltage problems. This isolation feature makes the MM ideal for interfacing to computers, PLCs and other data acquisition devices.

The versatile MM has various front panel layout options, in some cases the pushbuttons may be located on the front panel as well as the standard rear panel configuration. The MM-LN is available in 4, 5, 6 or 4 digit plus bargraph LED display form or with 4 or 6 digit LCD.

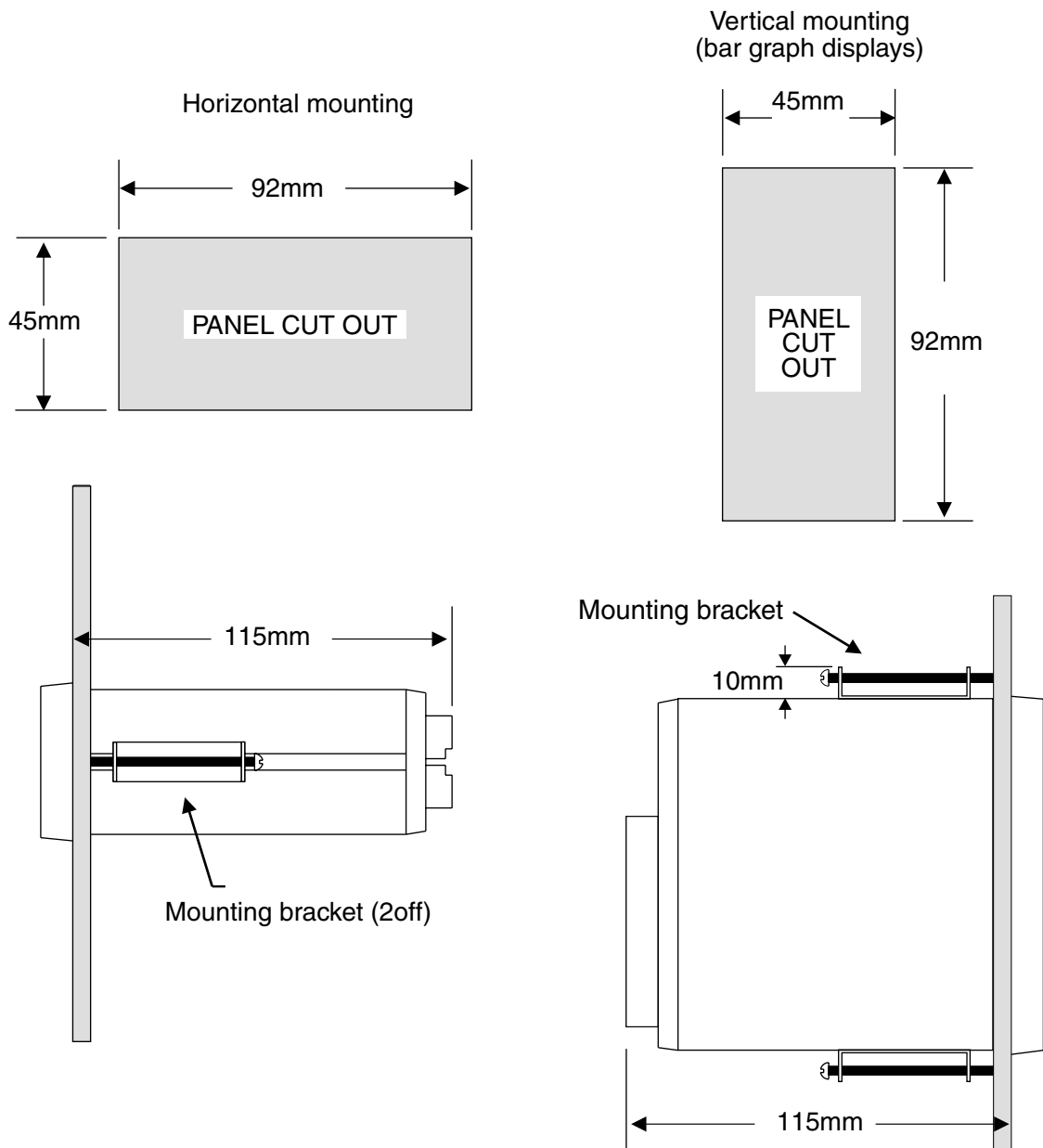
The MM series of Panel Mount Monitors are designed for high reliability in industrial applications. The high brightness LED display provides good visibility, even in areas with high ambient light levels. The high contrast LCD displays provide good visibility and are ideal for battery powered applications.

2 Mechanical Installation

If a choice of mounting sites is available then choose a site as far away as possible from sources of electrical noise such as motors, generators, fluorescent lights, high voltage cables/bus bars etc. An IP65 access cover which may be installed on the panel and surrounds is available as an option to be used when mounting the instrument in damp/dusty positions. A wall mount case is available, as an option, for situations in which panel mounting is either not available or not appropriate. A portable carry case is also available, as an option, for panel mount instruments.

Prepare a panel cut out of 45mm x 92mm +1 mm / -0 mm (see diagram below). Insert the instrument into the cut out from the front of the panel. Then, from the rear of the instrument, fit the two mounting brackets into the recess provided (see diagram below). Whilst holding the bracket in place, tighten the securing screws being careful not to over-tighten, as this may damage the instrument.

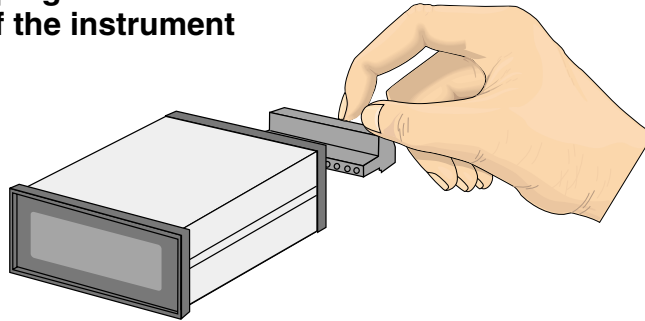
Hint: use the elastic band provided to hold the mounting bracket in place whilst tightening securing screws.



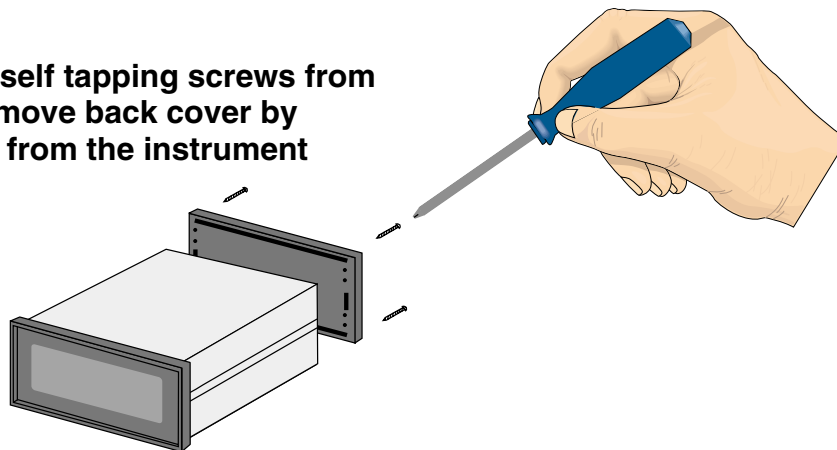
3 Input/Output Configuration

If you need to alter the input or output configuration proceed as follows:

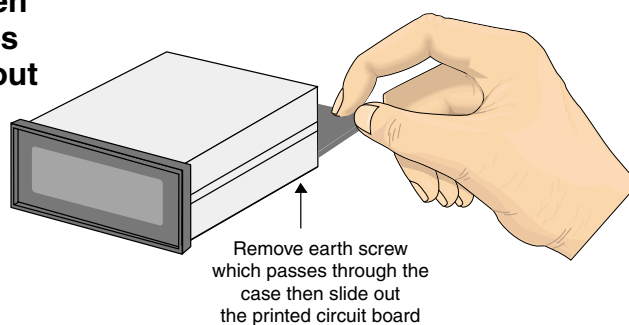
1. Remove the plug in terminals from the rear of the instrument



2. Remove 4 x self tapping screws from back cover, remove back cover by pulling it away from the instrument



3. Using a screwdriver, loosen the earth screw which passes through the PCB then slide out the board or boards

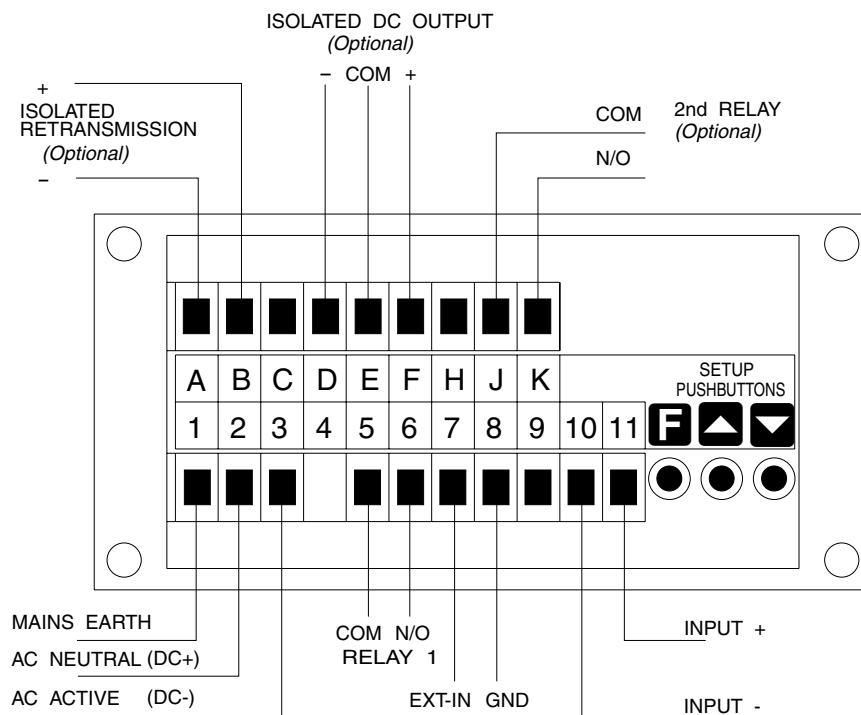


4. Configure the PCB links as required, see appropriate chapter
5. Slide PCB back into the case
6. Re tighten the earth screw which passes through the PCB
7. Refit back cover and fix with the self tapping screws
8. Plug the terminal strips back into the rear of the instrument

4 Electrical Installation

The MM Panel Meter is designed for continuous operation and no power switch is fitted to the unit. It is recommended that an external switch and fuse be provided to allow the unit to be removed for servicing.

The plug in, screw type, terminal blocks allow for wires of up to 2.5mm² to be fitted. Connect the wires to the appropriate terminals as indicated below. Refer to connection details provided in this chapter to confirm proper selection of voltage, polarity and input type before applying power to the instrument. When power is applied to the instrument will cycle through a display sequence indicating the software version and other status information, this indicates that the instrument is functioning. Acknowledgement of correct operation may be obtained by applying an appropriate input to the instrument and observing the reading. The use of screened cable is recommended for signal inputs.



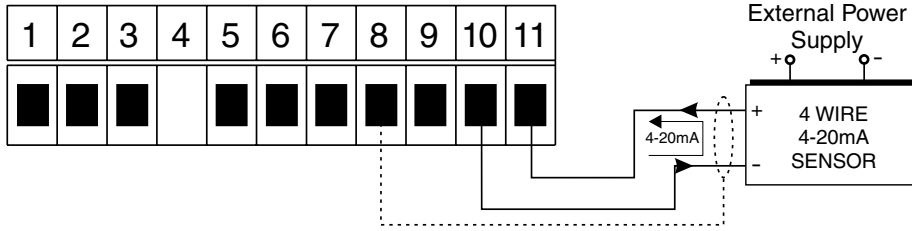
Instrument Rear Panel

1	MAINS EARTH	
2	240VAC NEUTRAL	
3	240VAC ACTIVE	
5	RELAY 1	COM
6	RELAY 1	N/O
7	EXT IN	
8	GROUND	
9	18VDC SUPPLY	
10	INPUT	-
11	INPUT	+
MODEL No: MM-IV-240-4E		SERIAL No:

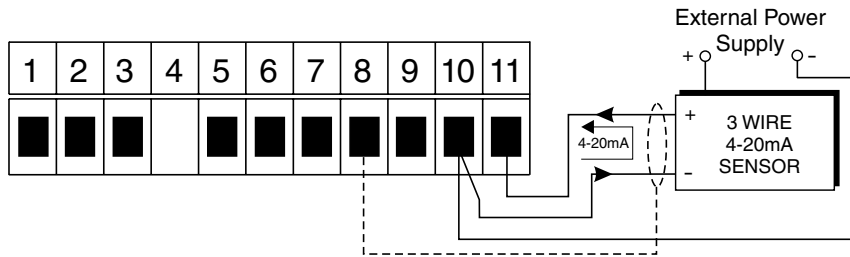
Instrument Data Label (example)

4.1 Connection examples

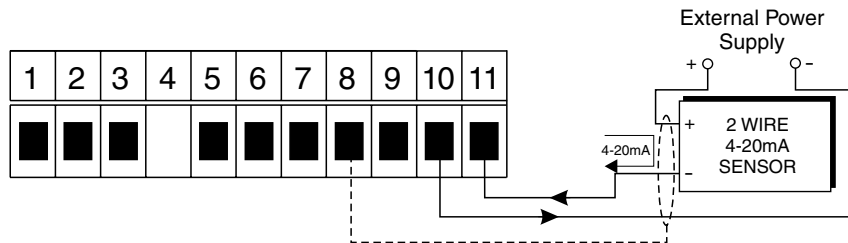
1. 4 wire 4-20mA input - externally powered sensor



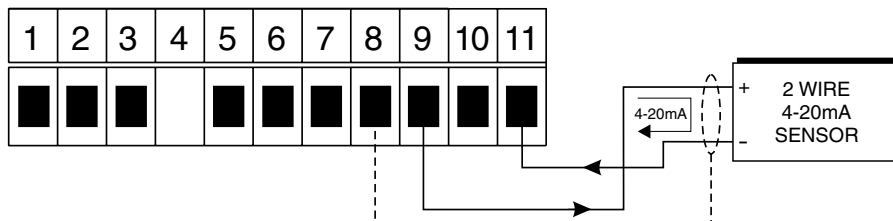
2. 3 wire 4-20mA input - externally powered sensor



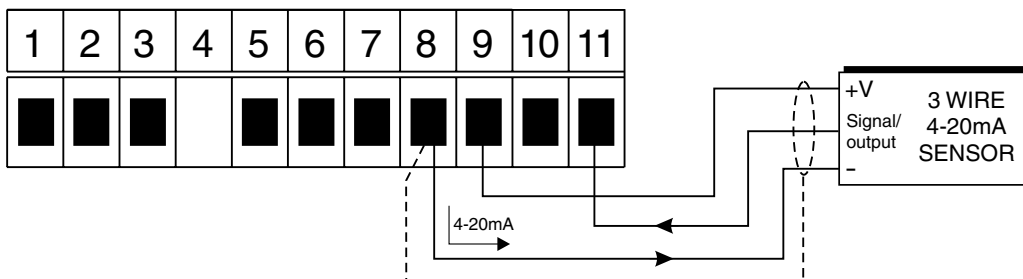
3. 2 wire 4-20mA input - externally powered sensor



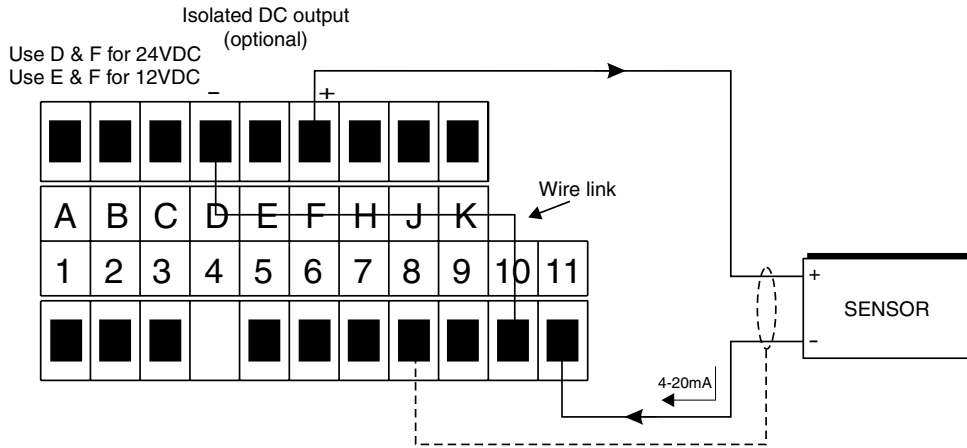
4. 2 wire 4-20mA - powered from MM standard 18VDC (25mA) supply



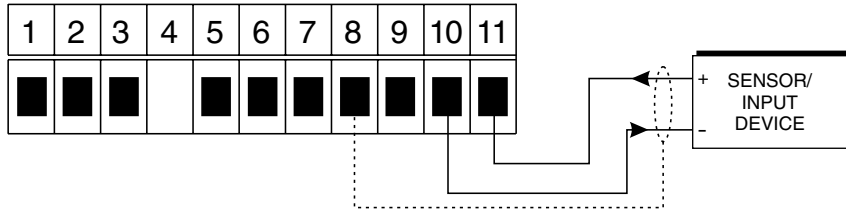
5. 3 wire 4-20mA - powered from MM standard 18VDC (25mA) supply



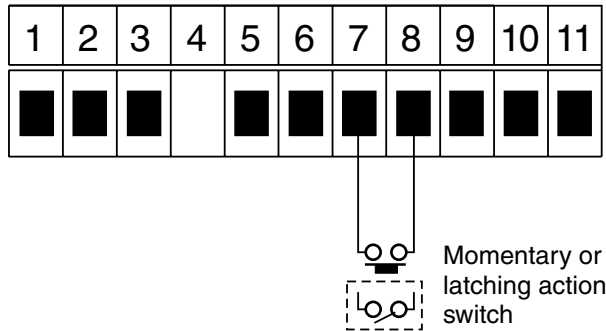
6. 4-20mA input - powered from optional $\pm 12\text{VDC}$ (20mA) MM supply (25mA max.)



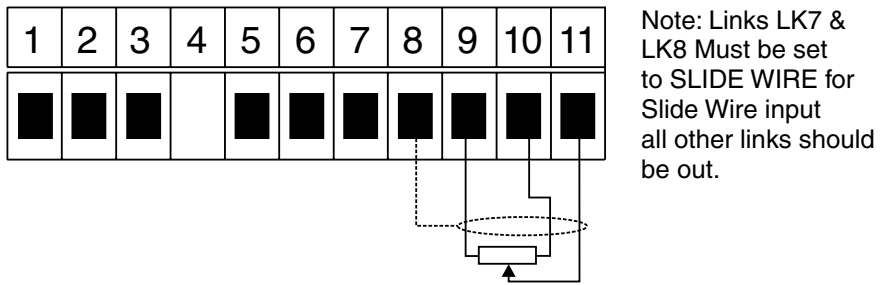
7. DC voltage input



8. Remote input

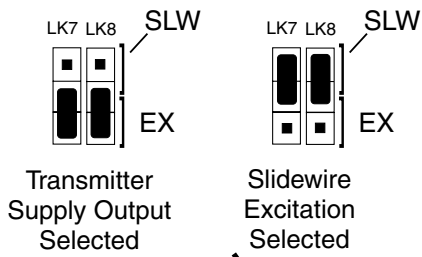


9. Slidewire input

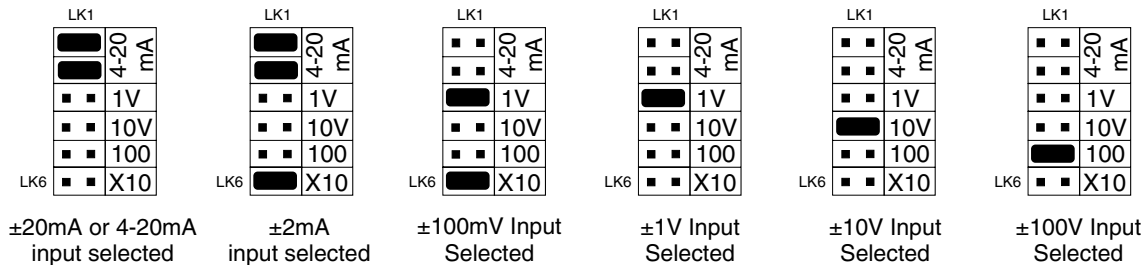
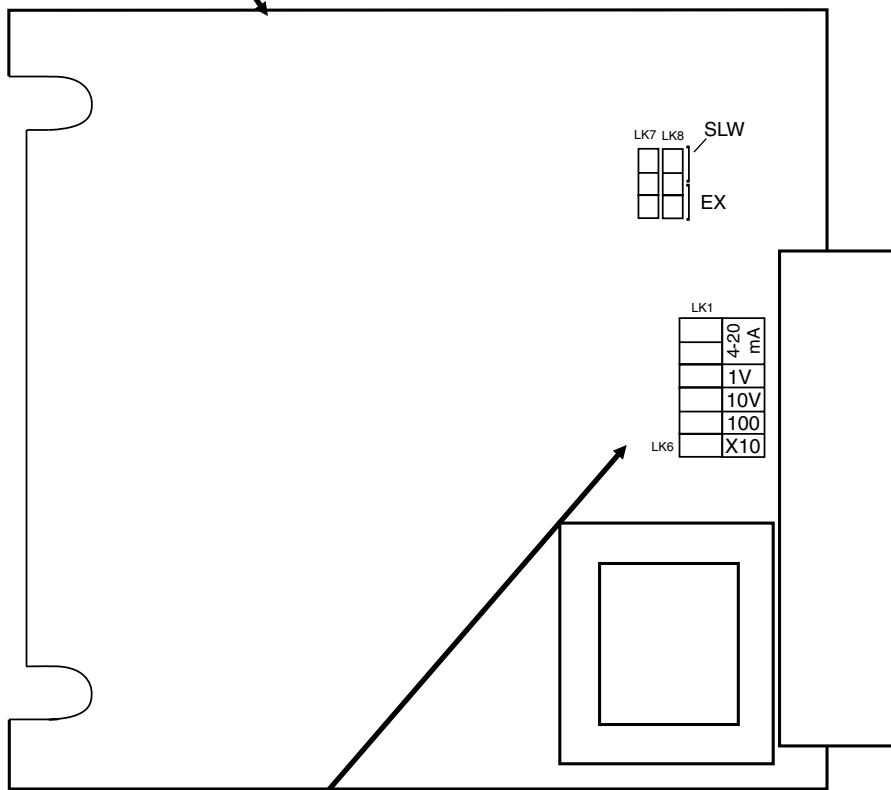


4.2 Selecting the input range

Dismantle the instrument as described in Chapter 3, "Input/output configuration". Insert the links into the appropriate location on the pin header to suit the range required.



Note: All other links should be out when slidewire is selected.



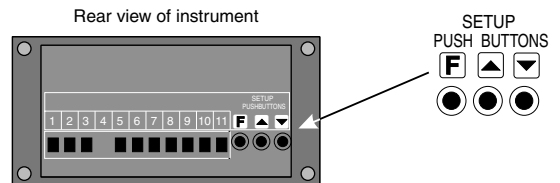
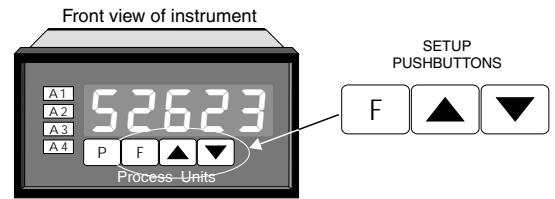
5 Explanation of Functions

The MM 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 located at the rear of the instrument (also at the front on some display options) are used to alter settings. Once **CAL** or **FUNC** mode has been entered you can step through the functions, by pressing and releasing the **F** push button, until the required function is reached. Changes to functions are made by pressing the **▲** or **▼** push button (in some cases both simultaneously) when the required function is reached.



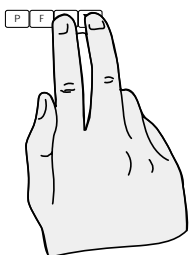
Entering **CAL** Mode



1. Remove power from the instrument. Hold in the **F** button and reapply power. The display will briefly 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.

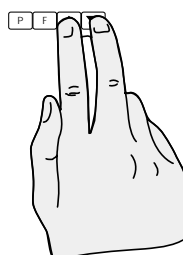
Note: If step 1 above has been completed then the instrument will remain in this **CAL** mode state until power is removed. i.e. there is no need to repeat step 1 when accessing function unless power has been removed.

Entering **FUNC** Mode

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



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



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

The alarm and brightness functions below are accessible via **FUNC** mode.

Note that “x” in the alarm functions is used to indicate any alarm number e.g. if 3 setpoint alarm relays are fitted then **A1Lo**, **A2Lo** and **A3Lo** will all seen as functions on the display.

The MM-LN has an easy alarm access facility which allows access to the alarm setpoints simply by pressing the **F** button at the front or rear of the instrument. 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. The **FUNC** 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 **A1-2** 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.

AxLo (alarm low setpoint)

Displays and sets the 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**. Use **▲** or **▼** to adjust the setpoint value if required. The alarm will activate when the displayed value is lower than the setpoint value. Each relay may be configured with both a low and high setpoint if required, if so the relay will be activated when the display reading moves outside the band set between low and high setpoints.

AxH. (alarm high setpoint)

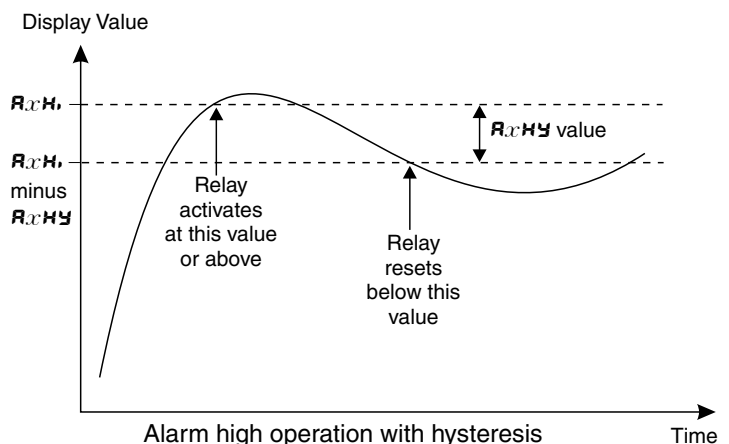
Displays and sets the high setpoint value for the designated alarm relay. The high alarm setpoint may be disabled by pressing the **▲** and **▼** pushbuttons simultaneously. When the alarm is disabled the display will indicate **OFF**. Use **▲** or **▼** to adjust the setpoint value if required. The alarm will activate when the displayed value is higher than the setpoint value. Each relay may be configured with both a low and high setpoint if required, if so the relay will be activated when the display reading moves outside the band set between low and high setpoints.

AxHy (alarm hysteresis [deadband])

Displays and sets the alarm hysteresis limit and is common for both high and low setpoint values. The hysteresis value may be used to prevent too frequent operation of the setpoint relay when the measured value stays close to the setpoint. Without a hysteresis setting (**AxHy** set to zero) the alarm will activate when the display value goes above the alarm setpoint (for high alarm) and will reset when the display value falls below the setpoint, this can result in repeated on/off switching of the relay at around the setpoint value. The hysteresis setting operates as follows:

In the high alarm mode, once the alarm is activated the input must fall below the setpoint value minus the hysteresis value to reset the alarm.

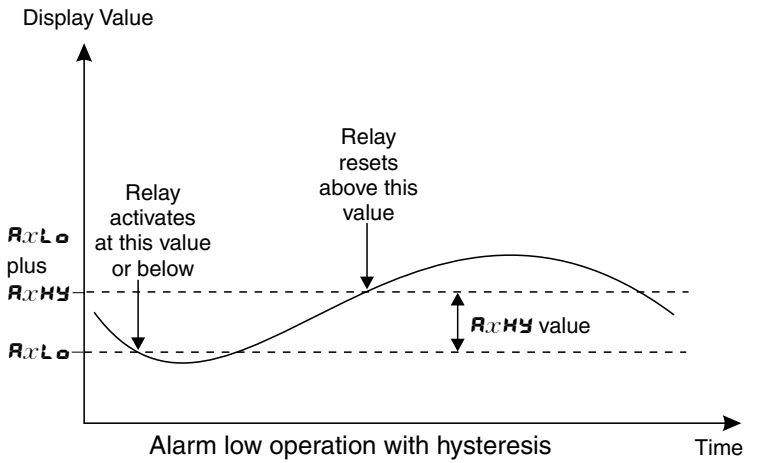
e.g. if **A1H.** is set to **50.0** and **A1HY** is set to **3.0** then the setpoint output relay will activate once the display value goes above **50.0** and will reset when the display value goes below **47.0** (50.0 minus 3.0).



In the low alarm mode, once the alarm is activated the input must rise above the setpoint value plus the hysteresis value to reset the alarm.

e.g. if **A1Lo** is set to **20.0** and **A1HY** is set to **10.0** then the alarm output relay will activate when the display value falls below **20.0** and will reset when the display value goes above **30.0** (20.0 plus 10.0).

The hysteresis units are expressed in displayed engineering units.



AxTt (alarm trip time)

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 activate, or 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. The trip time is selectable over **0** to **60** seconds.

AxRt (alarm reset time)

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. The reset time is selectable over **0** to **60** seconds.

AxNo or AxNc (alarm x normally open or normally closed)

Displays and sets the setpoint 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.

AxSP, AxT1, AxT2 etc. (relay operation independent setpoint or trailing) - seen only when optional extra relays are fitted. Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when this option is fitted.

Each optional alarm may be programmed to operate with an independent setpoint setting or may be linked (or trailing) to operate at a fixed difference to another relay setpoint. 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 within the Function Setup Mode by selecting, for example, (Alarm 4) **A4SP** = Alarm 4 normal setpoint or **A4T1** = Alarm 4 trailing Alarm 1 or **A4T2** = Alarm 4 trailing Alarm 2 or **A4T3** = 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. For 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). See the trailing alarm table which follows.

Trailing Alarm Table Showing Possible Alarm Assignments			
	A2	A3	A4
A1	A2T1	A3T1	A4T1
A2		A3T2	A4T2
A3			A4T3

b r 9 t (display brightness)

Displays and sets the digital display brightness. The display brightness is selectable from **0** to **15** . where **0** = lowest intensity and **15** = highest intensity. This function is useful for improving the display readability in dark areas or to reduce the power consumption of the instrument.

d u l l (remote display brightness)

Displays and sets the level for remote input brightness switching, see **r . i . n p** function. When the remote input is set to the remote input can be used to switch between the display brightness level set by the **b r 9 t** function and the display brightness set by the **d u l l** 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.

r e c - (recorder/retransmission output low value) - seen only when analog retransmission option fitted. Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when this option is fitted.

Displays and sets the analog retransmission (4-20mA, 0-1V or 0-10V, link selectable) output low value (4mA or 0V) in displayed engineering units. e.g. if it is required to retransmit 4mA when the display indicates **0** then select **0** in this function via the **▲** or **▼** button.

r e c ~ (recorder/retransmission output high value) - seen only when analog retransmission option fitted. Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when this option is fitted.

Displays and sets the analog retransmission (4-20mA, 0-1V or 0-10V, link selectable) output high value (20mA, 1V or 10V) in displayed engineering units. e.g. if it is required to retransmit 20mA when the display indicates **500** then select **500** in this function via the **▲** or **▼** button.

The functions which follow are accessible via **ε R L mode only.**

b A r - (bar graph display low value) - seen only in bargraph display instruments.

Displays and sets the bar graph low value i.e. the value on the 7 segment display at which the bargraph will start to rise. This may be independently set anywhere within the display range of the instrument.

Note: The **b A r ~** and **b A r -** settings are referenced from the 7 segment display readings, not the bargraph scale values. The bargraph scale may be scaled differently to the 7 segment display. For example a bargraph scale could be 0 to 100 yet the 4 digit display could be showing **675.3**. In this example the bargraph scale may be indicating percentage fill of a tank whilst the 7 segment display is indicating litres.

b A r ~ (bargraph display high value) - seen only in bargraph display instruments.

Displays and sets the bar graph high value i.e. the value on the 7 segment display at which the bargraph will reach its maximum indication (all LED's illuminated). May be independently set anywhere within the display range of the instrument.

b A r t y p e (bar graph display operation mode) - seen only in bargraph display instruments.

Allows selection of bargraph operation mode choices are:

b A r - - conventional solid bargraph display i.e. all LED's illuminated when at full scale.

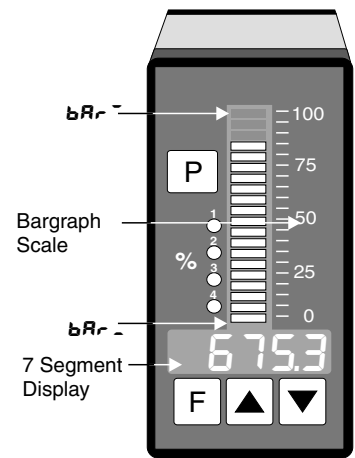
When scaling the display use the **b A r -** and **b A r ~** functions e.g. **b A r - = 0** and **b A r ~ = 100** will give a bargraph with no segments lit at a 7 segment display reading of **0** and all segments lit with a 7 segment display reading of **100**.

S . d o t - single dot display. A single segment will be lit to indicate the input readings position on the scale.

When scaling the display use the **b A r -** and **b A r ~** functions e.g. **b A r - = 0** and **b A r ~ = 100** will give a bargraph with the bottom segment lit at a 7 segment display reading of **0** and the top segment lit with a 7 segment display reading of **100**.

Note: this could also be set up as a centre zero single dot display by entering a negative value and positive value. e.g. **b A r - = - 100** . **b A r ~ = 100** .

d . d o t - double dot display. Two segments will be lit to indicate the input reading position on the scale. The reading should be taken from the middle of the two segments.



When scaling the display use the **bAR₋** and **bAR⁻** functions e.g. **bAR₋ = 0** and **bAR⁻ = 100** will give a bargraph with the bottom two segments lit at a 7 segment display reading of **0** and the top two segments lit with a 7 segment display reading of **100**.

Note: this could also be set up as a centre zero single dot display by entering a negative value and positive value. e.g. **bAR₋ = - 100**, **bAR⁻ = 100**.

C.bAR - centre bar display. The display will be a solid bargraph but will have its zero point in the middle of the display. If the seven segment display value is positive the bargraph will rise. If the seven segment display value is negative then the bargraph will fall.

When scaling the display use the **bAR₋** and **bAR⁻** functions e.g. **bAR₋ = 0** and **bAR⁻ = 100** will give a bargraph with all the bottom half segments lit at a 7 segment display reading of **- 100** and all the top segments lit with a 7 segment display reading of **100**.

d9.OP (digital output mode) - seen only with digital output option. Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when this option is fitted.

Selections available are: **b, n²** (signed binary), **b, n** (unsigned binary), **b.SCL** (scaled binary), **bcd** (binary coded decimal).

d9.OP (digital output polarity) - seen only with digital output option. Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when this option is fitted.

Select either **AL** - active low output or **AH** - active high output.

bcd5trt (BCD - start display position) - seen only with digital output option. Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when this option is fitted.

This function affects BCD mode only and determines the number of digits to skip when outputting from the display. Select from 0 to number of display digits minus 4. e.g. for a 6 digit display you may select 0 to 2, if 2 is selected then the four left most digits will be output.

d, 9₋ (scaled digital output low reading) - seen only with digital output option. Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when this option is fitted.

Accepts any valid display value. Determines the low scaling point for the **b.SCL** mode and has no effect on other modes.



d, 9⁻ (scaled digital output high reading) - seen only with digital output option. Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when this option is fitted.

Accepts any valid display value. Determines the high scaling point for the **b.SCL** mode and has no effect on other modes. For example if **d, 9₋** is set to **0** and **d, 9⁻** is set to **65535** (2^{16}) then the retransmission will not be scaled i.e. a display of **2** will cause a retransmission of 2. If **d, 9⁻** is now changed to **32767** (2^{15}) then a display of **2** will cause a retransmission of 4.



drrd (display rounding)

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. (e.g. if set to **10** the display indication will change in multiples of 10 only).

dLPE (decimal point selection)

With the **tblE** function set to **on** the **dLPE** function sets the number of decimal point places for the **y** values in the table i.e. the linearised display values. The number of decimal point places for the live input **P** values is fixed at 1 decimal point for 4 digit displays and 2 decimal points for all other displays. With **tblE** set to **OFF** the live input can be set to display up to 4 decimal places if the display type allows. By pressing the  or  pushbuttons 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: It is important that the decimal point is chosen before a scaling is completed. Changing the decimal point after a scaling will cause a error in the display value (a factor of 10).

FLtr (digital filter)

Displays and sets the digital filter value. Digital filtering is used for reducing susceptibility to short term interference. The digital filter range is selectable from 0 to 8, where 0 = none and 8 = most filtering. A typical value for the digital filter would be 3. Use  or  to alter if required. Note that at higher filter values the display update time will be increased.

FEE ETR (analog output mode) - seen only when analog output option is fitted. Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when this option is fitted.

This function allows selection of **ON** or **OFF** for PI control output. If set to **OFF** the analog output operates as a retransmission output and uses the functions described in this chapter. If set to **ON** the analog output operates as a PI control output.

CAL 1 (first scaling point for 2 point scaling method)

Note: Two decimal point places (one place for 4 digit displays) will automatically be set for both **CAL 1** and **CAL 2** entries when the **TRBL** function is set to **ON**.

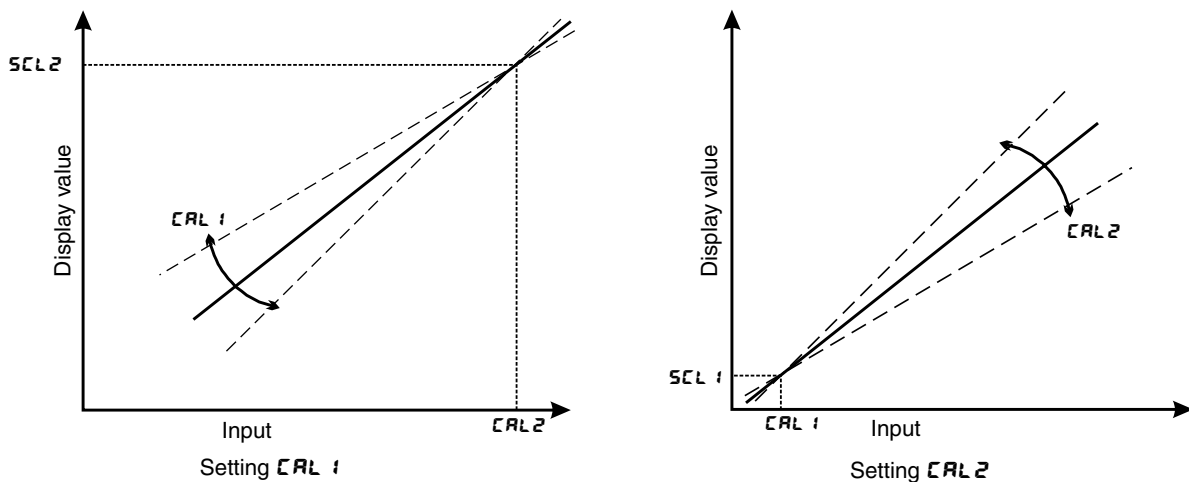
CAL 1 and **CAL 2** are used together to scale the instruments display, values for both must be set when using this scaling method (see also **USER EN 4** and **USER EN 20** functions for an alternative scaling method when using a 4-20mA input). The **CAL 1** function sets the first calibration point for live input calibration. When using this method a signal input must be present at the input terminals. Note: **CAL 1** and **CAL 2** can be set independently i.e. it is not necessary to perform a **CAL 2** operation directly after a **CAL 1**.

The procedure for entering the first scaling point is:

- Ensure that the **TRBL** function is set to **ON** if the lineariser table is to be used. Ensure that an input signal is present at the input terminals, this will normally be at the low end of the signal range e.g. 4mA for a 4-20mA input type.
- At the **CAL 1** function press **▲** and **▼** simultaneously, then release them. The display will indicate 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.
- Press, then release the **F** button. The display will indicate **SCAL 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 **0.00** then ensure **0.00** is selected at **SCAL 1**. Press the **F** button to accept changes or the **P** button to abort the scaling.

CAL 2 (second scaling point for 2 point scaling method)

The second point scaling is performed in exactly the same manner as **CAL 1** except that **SCAL 2** will be seen instead of **SCAL 1**. It is essential that the live input is different in value to the **CAL 1** input e.g. for a 4-20mA input use 20mA as the **CAL 2** live input. Note; it is not essential that 4 and 20mA are used as the live inputs for a 4-20mA scaling but the input values must be significantly different.



CAL OFFSET (calibration offset)

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 OFFSET** function. A "live" reading from the input will be seen, make a note of this reading. Press the **F** button, the message **SCALE** 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 **SCALE** value to 70.

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 OFFSE** 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 **LRGE** operation could be considered.

CAL ZERO (calibration zero)

The calibration zero function is used following a calibration via **CAL 1** and **CAL 2**. A calibration zero operation at this time ensures that the display zero and the **ZERO RANGE** reference zero are at the same point after a calibration. After a calibration the calibration zero 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 **P** 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.

USEF En 4 (4mA input scaling without a live input)

Note: Two decimal point places (one place for 4 digit displays) will automatically be set for both **USEF En 4** and **USEF En 20** entries when the **LRBL** function is set to **on**.

The instrument can be scaled for a 4-20mA input without a live input. This is an alternative method to the **CAL 1** and **CAL 2** method of scaling. To perform the first point (**En 4**) scaling simply press the **▲** and **▼** buttons simultaneously when the **USEF En 4** 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 4mA input.

USEF En 20 (20mA input scaling without a live input)

Used in conjunction with **USEF En 4** described above. The **USEF En 20** function can be used to set the second 4-20mA scaling point i.e. the scale required for a 20mA input. This is an alternative method to the **CAL 1** and **CAL 2** method of scaling. To perform the first point (**En 20**) scaling simply press the **▲** and **▼** buttons simultaneously when the **USEF En 20** 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.

UCAL (uncalibrate)

The uncalibration function sets the instrument back to the factory calibration value. This function is useful as a temporary measure when the input source device/transmitter is replaced and on the spot recalibration is difficult or when a calibrating error exists due to a problem during calibration. To uncalibrate press the **▲** and **▼** buttons simultaneously (note this function will delete the existing calibration and should only be used when necessary). The display will show **CAL CLR** indicating that the calibration is cleared.

P.buE (P button function) - applicable only to 5 , 6 or 8 digit LED models.

The **P** button may be set to operate one of a number of special functions, see **F.1 NP** below for a description of these functions. The **P** button is located at the front of 5, 6, or 8 digit LED models. With some functions, to prevent accidental operation, the **P** button must be held pressed for 2-3 seconds before the function will operate. If both the remote input and **P** button function are operated simultaneously the **P** button will override the remote input. The functions below are as described in the **F.1 NP** function below with the exception of the **UL 9E** function. The **UL 9E** (ullage) function is provided mainly for use in tank level

applications, it allows the **P** button to be used to display the ullage i.e. the difference between the full capacity and the actual level at the time. The full capacity needs to be set at the **FULL CAP** function if the ullage display is required. If this function is chosen when the **P** button is pressed the display will show the message **ULLGE** followed by the ullage value. The display will default back to normal reading after 20 seconds or when the **F** button is pressed.

Functions available are: **NONE**, **H**, **Lo**, **H Lo**, **TAKE**, **ZERO**, **di SP** or **ULLGE**.

7.3 RP (remote input function)

Pins 7 and 8 at the rear of the instrument are the remote input pins. When these pins are short circuited, via a pushbutton or keyswitch the instrument will perform the selected remote input function. A message will flash to indicate which function has been selected when the remote input pins are short circuited. The remote input functions are as follows:

NONE - no remote function required.

P.Hld - peak hold. The display will show the peak value only whilst the remote input pins are short circuited.

d.Hld - display hold. The display value will be held whilst the remote input pins are short circuited.

H - 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 or the power is removed from the instrument then the memory will be reset.

Lo - valley memory. The minimum value stored in memory will be displayed. Otherwise operates in the same manner as the **H** function.

H Lo - toggle between **H** 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. **PH** or **PLo** will flash before each display to give an indication of display type.

TAKE - display tare. Short circuiting the remote input pins momentarily will allow toggling between nett and gross values (shown as **NETT** and **GROSS**). If the remote input is short circuited for approx. 2 seconds the display will be tared and will show zero. The tare will be lost if power is removed.

ZERO - display zero. Zeroes the display in same manner as the tare function except that the zero is not lost when power is removed and the display will zero as soon as the remote input is short circuited.

SP.Ac - setpoint access only. This blocks access to any functions except the alarm setpoint functions unless the remote input pins are short circuited or entry is made via **CAL** mode.

No.Ac - no access. This blocks access to all functions unless the remote input pins are short circuited or entry is made via **CAL** mode.

di SP - Switch to alternate display. When the linearising table is being used it is possible to toggle between the linearised display (the display which uses the table to calculate the display value) and the live input which will be calculated purely from the 2 point values input at **CAL 1** and **CAL 2** or **USER EN4** and **USER EN20**. This feature is useful in that it can provide an easy check of live input against linearised display value i.e. **P** values against **Y** values. The display will indicate **INPE** prior to showing the live input value and **LINE** prior to showing the linearised value. With the remote input terminals open circuit the display will always show the linearised value (if the **TABLE** function is set to **on**). The display will only show the live input value whilst the remote input is short circuited i.e. the contact must remain closed whilst the value is read.

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 **BRIGHT** function and the brightness level set at the **dULL** function.

ACCESS (access mode)

The access mode function **ACCESS** has four possible settings namely **OFF**, **EASY**, **NONE** and **ALL**. If set to **OFF** the mode function has no effect on alarm relay operation. If set to **EASY** the easy alarm access mode will be activated, see details at the beginning of this chapter preceding the **ALLO** function. 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.

SPAC (setpoint access) - seen only 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.

The remote input function (**F.I NP**) must be set to **SPAC** 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.

SQRt (square root) - For use only when **LRbL** function set to **OFF** i.e. not for use with linearised display.

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. 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.

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. For example if, for a 4 - 20mA input, 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. $\sqrt{0.50} \times 1000$ and so on.

FULL CAP (full capacity)

The full capacity function is intended to be used together with the **P** button ullage (**UL 9E**) function to calculate the ullage, typically from a tank filled with liquid. The ullage value displayed will be the full capacity value minus the current value from the lineariser table.

5.1 Lineariser functions

The following five functions are used to set up the lineariser table. The lineariser is of the X,Y type with space for up to 50 points to be programmed and stored. All points are stored in battery backed memory and will be retained when power is removed. Chapter 7 contains a table in which you can make a permanent written record of the points entered.

The X values for each point will actually be indicated as **P** (e.g. **P 1**, **P 2** etc.) since the seven segment display cannot show an X. The **P** values are normally entered either as a percentage of full scale input or as a direct representation of the input signal e.g. for a 4-20mA input you could either enter 4mA = **0.00** and 20mA = **100.00** or 4mA = **4.00** and 20mA = **20.00**. The value entered into the table must correspond with the initial calibration values (**CAL 1** & **CAL 2** or **USER En 4** & **USER En 20**). For example if a 4-20mA input is initially scaled to read from **0.00** to **100.00** then you cannot enter these values as **4.00** to **20.00** in the table (without causing errors in the reading). The number of decimal points available for entering **P** values is 1 decimal place for 4 digit displays or 2 decimal places for 5, 6 or 8 digit displays.

The Y values are indicated as **Y** (e.g. **Y 1**, **Y 2** etc.) . These **Y** values represent the display required for the given **P** value entered. For example if **P 3** = **25.00** and **Y 3** = **1500** then **1500** will be displayed whenever that input is present.

Y values to be entered into the lineariser table must be either calculated or measured via a live input. Refer to the "Example" later in this chapter for an example of creating a lineariser table using live inputs.

LRbL (lineariser on or off)

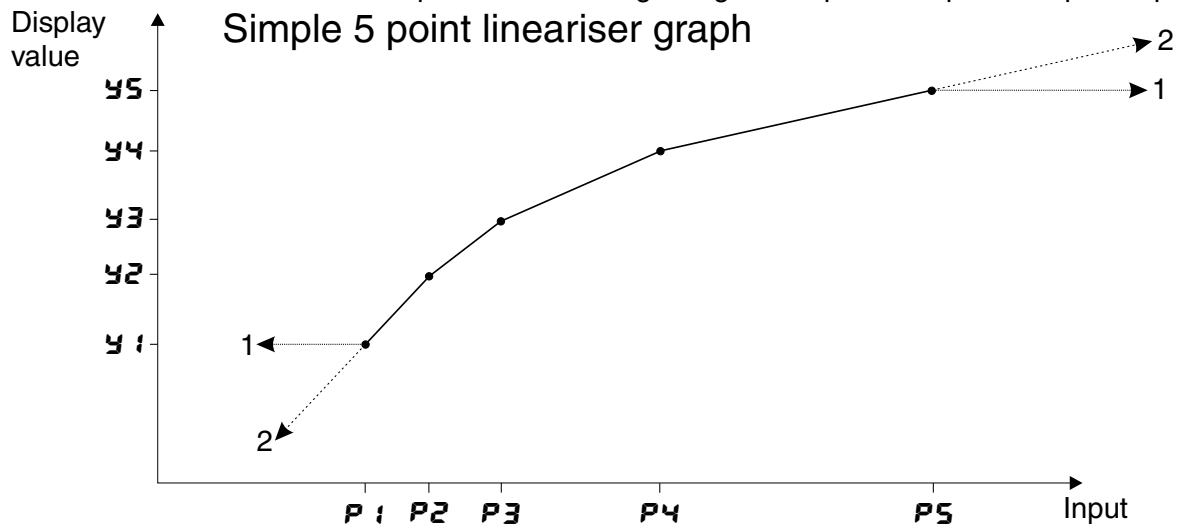
Allows the lineariser to be switched on (**on**) or off (**OFF**). If it is switched off then none of the other lineariser functions will be seen on the display and the instrument will either operate as a linear display using the **CAL 1** & **CAL 2** or **USER En 4** & **USER En 20** scaling values or as a square root law display if the **SQRt** function is set to **on**.

LRbL StOP (mode of operation at points outside the table range)

This function sets the mode in which the instrument will behave when a value is input which is higher than the largest value entered in the table or lower than the smallest value entered in the table. Refer to the graph above.

If set to **ON** then the display value will remain equal to the nearest table entry value. For example if the lowest table entry is made at 8mA and the display indicates **500** at this value then any input lower than 8mA will also cause the display to indicate **500**.

If set to **OFF** then the display value will continue to change when an input outside the table limits in encountered. The instrument will extrapolate the reading using the slope of the previous pair of points.



Arrows labelled "1" show the effect of **ABLSLSTOP** function = **ON**
 Arrows labelled "2" show the effect of **ABLSLSTOP** function = **OFF**

SCALE TAB E (table rounding value)

This function allows a rounding value to be set for **Y** entries. Options provided are 1, 2, 5, 10, 20, 25, 50, 100, 250, 500 or 1000 . For example if the rounding value is set to 25 then the **Y** entries will jump in steps of 25 i.e. 0, 25, 50, 75 etc. (or 0.00, 0.25 etc. depending on decimal place setting). This rounding factor is useful in that it allows the speeding up of entries into the table, it does not cause the final display value to jump in steps. Use the **DRND** function if you wish to cause the final display value to also jump in these steps.

TABLE POINTS (number of table points)

Displays and sets the number of points in the lineariser table. Select the number you require and enter that number of points. If you wish to increase or decrease the number of points then the **TABLE POINTS** value can be changed at a later stage.

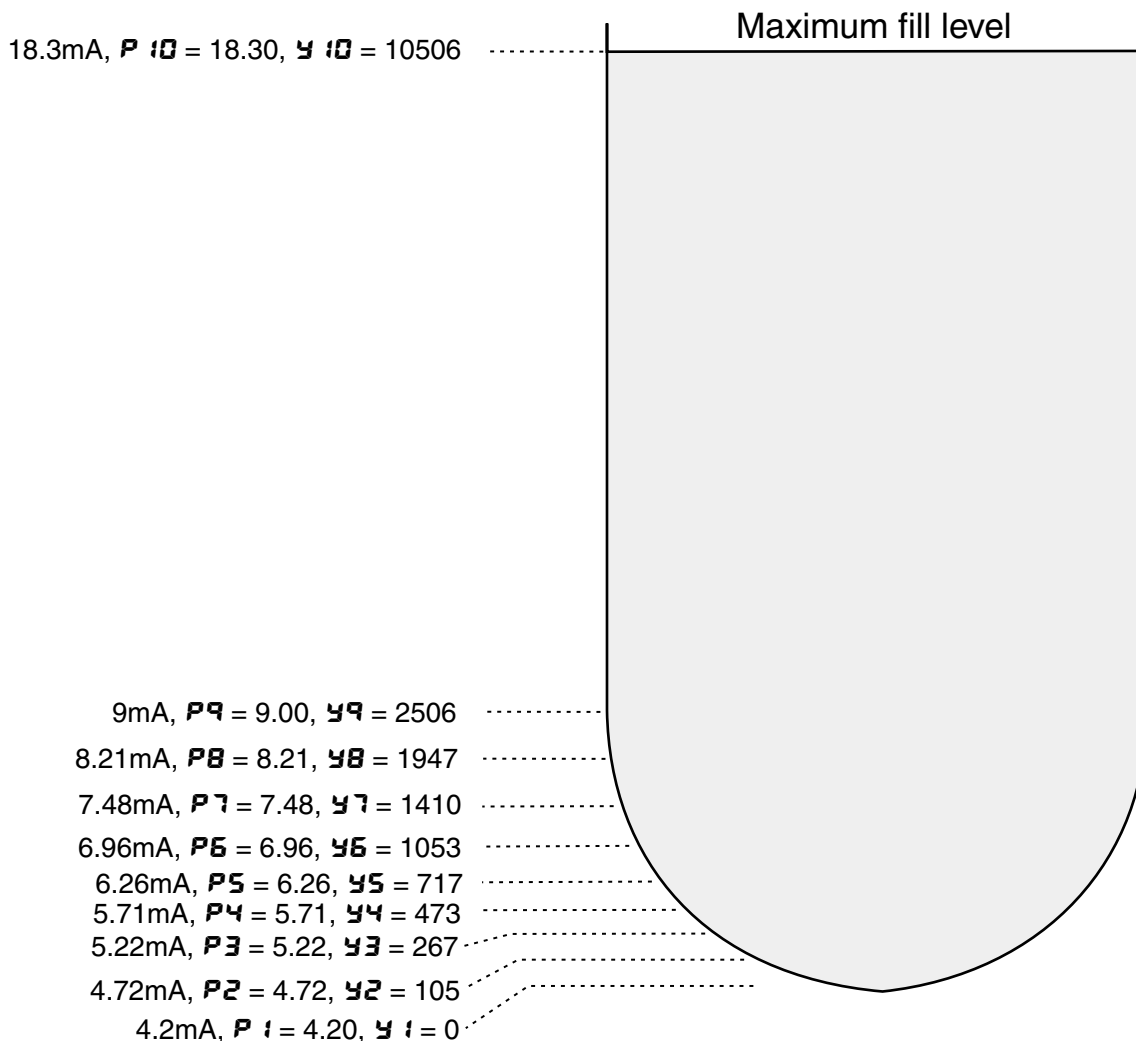
SET TABLE (enter values into the table)

This function allows values to be entered into the lineariser table. Entries to the table do not need to be in any ascending or descending order since the instrument will automatically arrange the points in order at the end of the entry sequence. The procedure for entering points is:

1. Ensure that the correct number of points required has been set in the **TABLE POINTS** function.
2. Complete the lineariser table given in Chapter 7 by calculation or measurement of values.
3. At the **SET TABLE** function press the **▲** and **▼** buttons simultaneously.
4. The display will show **P 1** indicating the first linearising point followed by the first **P** value in memory, use the **▲** or **▼** button to adjust this to the required first input point value.
5. Press the **F** button, the display will indicate **Y 1** followed by the first **Y** value in memory, again use the **▲** or **▼** to make any changes to the value required.
6. Press the **F** button, the display will indicate **P 2** followed by the second **P** value in memory. Repeat the process described in steps 4 and 5 until all points have been entered.

Example

A pressure transmitter with a 4-20mA output is installed near the base of an irregularly shaped tank, see diagram below, which contains a liquid. The transmitter is connected to a MM-LN and 10 linearising points are required to measure the number of litres in the tank. The output from the transmitter will be linear between P9 and P10 since the sides of the tank are straight. Most of the lineariser points are concentrated on the non linear (curved) parts of the tank i.e. the parts of the tank in which the output from the transducer will not be linear.

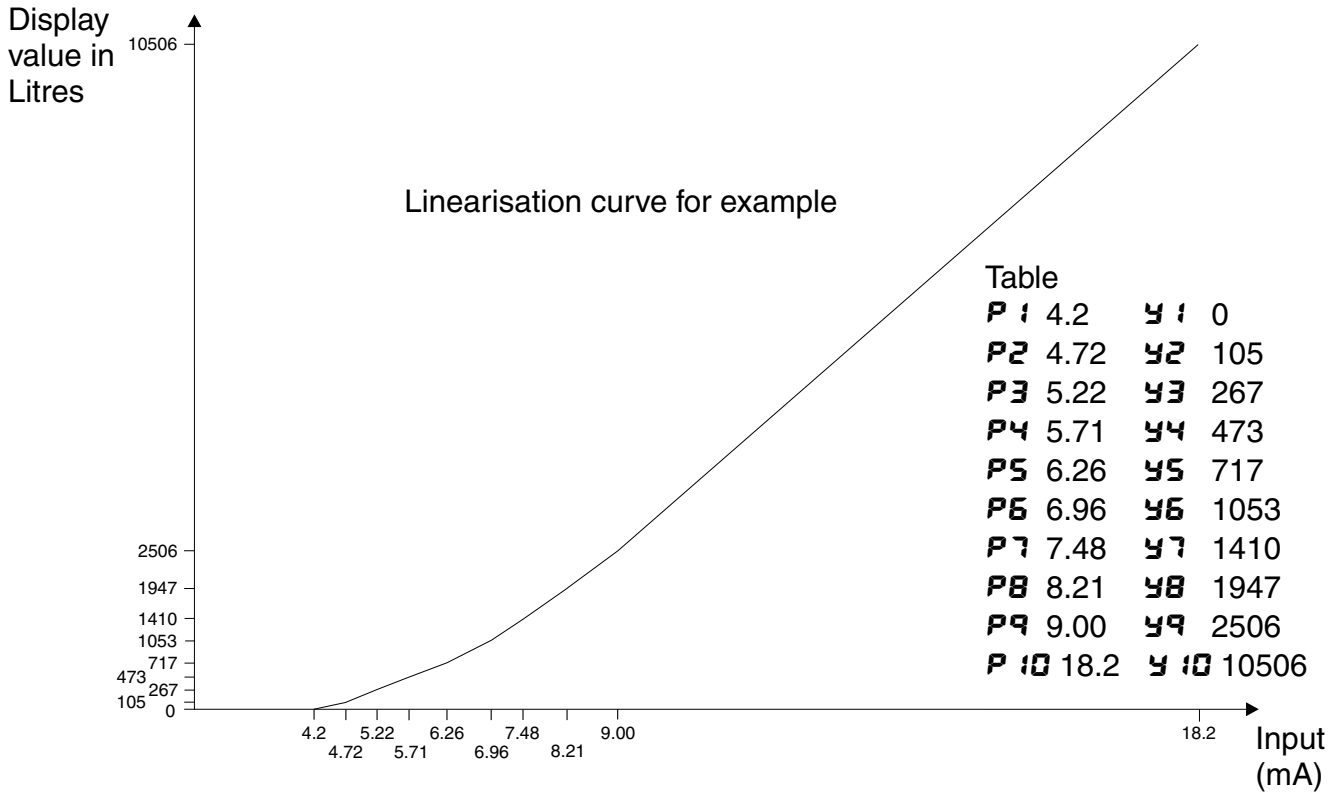


The procedure used is as follows, steps a. to n.:

- All general functions are set as required i.e. display rounding etc.
- Set the **LRBL** function to **on**. The **SRt** function should be set to **OFF**.
- Use **CAL 1 & CAL 2** or **USER En4 & USER En20** to scale the MM to show 4mA= **4.00**, 20mA= **20.00**.
- The tank is emptied and the transmitter is connected to the display, the tank will need to be gradually filled whilst the lineariser table (Chapter 7) record is completed. Note that the reverse process is equally valid i.e. starting with a full tank and gradually emptying it.
- The first reading is taken from the display (4.20 in this case) with the tank virtually empty this represents a reading of zero litres. The lineariser table is filled in for the first point, **P 1 = 4.20**, **Y 1 = 0**.
- The tank is now gradually filled and a flowmeter is used to measure the number of litres entering the tank. The panel meter reading will change as the tank is filled.
- The second reading is taken from the display (4.72 in this case), at this point 105 litres had been added to the tank. The lineariser table is filled in for the second point, **P 2 = 4.72**, **Y 2 = 105**.
- Repeat the filling procedure until all 10 points are recorded, the results in this example are shown in the example diagram and table.
- The figures from the written table record now need to be transferred to the instruments lineariser table memory. Set the **LRBL** function to **on** and the **LRBL Pnt5** function to **10**.
- At the **SET LRBL** function press the **▲** and **▼** button simultaneously. The display will show **P 1** followed by a number, use the **▲** or **▼** button to change this number to **4.20**.
- Press, then release, the **▢** button. The display will indicate **Y 1** followed by a number. Use the **▲** or **▼** button to change this to **0**.
- Press, then release, the **▢** button. The display will indicate **P 2** followed by a number. Use the **▲** or **▼** button to change this to **4.72**.
- Repeat the process until all the **P** and **Y** values have been entered.

Continue pressing, then releasing, the **▢** button until the **End** message is seen and the display

returns to measurement mode.



5.2 Alarm, bargraph and retransmission operation modes

The following describes the output modes for alarm, bargraph, analog, serial and digital retransmission. The serial output (RS232 or RS485) can alternatively be controlled via polling commands, see the “RS232/RS485 Commands” appendix for details. Retransmission and extra alarm relays are optional outputs. The following commands only apply if the option is fitted to the instrument. Refer to the separate “MM Panel Meter Optional Output Addendum” booklet supplied when optional outputs are fitted.

R1, R2 etc. (Alarm relay operation mode for relays 1, 2 etc.)

The following choices are available for alarm operation mode:

LIVE - live input mode. The alarm relay operation will always follow the electrical input at that time irrespective of the 7 segment display value. e.g. assume the remote input is set to **LIVE** and **R1** is set to **100**. If the instrument is tared at a display reading of **30** then the alarm will now activate at a display reading of **70**.

TARE - tare mode. The alarm relay operation will follow the tare function. e.g. in the example above (**d: SP**) if **R1** is set to **TARE** then the alarm would activate at a display reading of **100** (the setpoint value) rather than **70**.

PHLD - peak hold mode. If the peak hold mode is used and the remote input is set to peak hold then once the peak display goes above any alarm high setpoint the alarm relay will activate and will not de-activate until the peak hold is released and the display value falls below the setpoint value.

d.HLD - display hold mode. If the display hold mode is used and the remote input is set to display hold then the alarm relay will be held in its present state (activated or de-activated) until the display hold is released and the display is free to change.

H - peak (max.) memory mode. If the peak memory mode is used and the remote input is set to peak memory then the alarm will be activated if the peak memory value is above the high setpoint value. The alarm will not de-activate until the memory is reset.

Lo - valley (min.) memory mode. If the valley memory mode is used and the remote input is set to valley memory then the alarm relay will be activated if the valley memory value is below the low setpoint value. The alarm will not de-activate until the memory is reset.

d: SP - display mode. If the live display mode is used then the alarms will operate purely on the display value at the time i.e. if the display is showing above high setpoint or below the low setpoint value then the alarm relay will activate. For example if the remote input were set to peak memory and **R1** were set to live display mode then, unless the display is actually showing the peak memory value (i.e. the remote input has just been activated), the alarm relay is free to operate from the changing display value i.e. the memory does not have to be reset to clear an alarm condition.

bARF (bargraph operation mode) - applicable only to bargraph displays.

The following choices are available for bargraph operation mode:

L, UE - live input mode. The bargraph will respond to the electrical input only and will not necessarily follow the 7 segment display value. 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 bargraph will be free to move up and down to follow the electrical input.

tARFE - tare mode. The bargraph 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 (**9F05**) then the 7 segment display will change to show the gross value but the bargraph will not respond (see **L, UE** for alternative operation).

P.HLD - peak hold mode. The bargraph (and 7 segment display) will indicate the peak value only whilst the peak value function is operated via a contact closure on the remote input i.e. the bargraph & 7 segment display can rise but not fall whilst the remote input switch is closed. When the remote input switch is opened the bargraph 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 bargraph reading 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.

d.HLD - display hold mode. The bargraph (and 7 segment display) value will be held whilst the remote input display hold switch is closed. When the switch is opened the bargraph value will remain fixed at the held value although the 7 segment display value will be free to alter. The held bargraph reading 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 will indicate the peak value in memory i.e. the bargraph can rise but not fall. The bargraph 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.

L - valley (min.) memory mode. With the valley remote input switch open the bargraph will indicate the valley (min.) value in memory i.e. the bargraph can fall but not rise. The bargraph 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 bargraph display will follow whatever value is on the 7 segment display. For example if the remote input is set to **tARFE** then the 7 segment and bargraph will indicate the tared value and both will also be changed if the remote input toggles the displays between **NEEE** and **9F05**. If the **bARF** function had been set to **tARFE** then the bargraph would not respond to the **9F05** toggle.

FEC (analog retransmission operation mode) and d.GOP (digital output retransmission) and SEFL (serial retransmission). Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when optional outputs are fitted.

The following choices are available for analog, digital or serial retransmission operation mode:

L, UE - live input mode. The retransmission will follow the electrical input and will not necessarily follow the 7 segment or bargraph 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.

tARFE - 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 (**9F05**) 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_i - 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.

L_o - 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_i 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 **BARFE** 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 **NEEE** and **9F05**. If the **FECE** or **d90P** function had been set to **BARFE** then the retransmission output would not respond to the **9F05** toggle.

5.3 Display warning functions

L_o d_i SP (low overrange limit value)

The display can be set to show an overrange message if the display value falls below the **L_o d_i SP** setting. For example if **L_o d_i SP** is set to **50** then once the display reading falls below **50** the message **-or-** or the display value (see **d_i 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.

H_i 9H d_i SP (high overrange limit value)

The display can be set to show an overrange message if the display value rises above the **H_i 9H d_i SP** setting. For example if **H_i 9H d_i SP** is set to **1000** then once the display reading rises above **1000** the message **-or-** or the display value (see **d_i 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**.

d_i SP (display overrange warning flashing mode)

This function is used in conjunction with the **L_o** and **H_i 9H d_i SP** functions. The **d_i SP** function can be set to **FLASH** or **-or-**. If the value set at the **L_o** or **H_i 9H d_i SP** function is exceeded and the **d_i SP** function is set to **FLASH** 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 **L_o** or **H_i 9H d_i SP** function is exceeded and the **d_i 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.

5.4 Serial output functions

The functions which follow are only seen if the serial output option is fitted. Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when optional outputs are fitted.

baud (set baud rate) - seen only with serial output option.

Select from **300 . 600 . 1200 . 2400 . 4800 . 9600 . 19.2** or **38.4**.

Prty (set parity) - seen only with serial output option.

Select parity check to either **NONE**, **EVEN** or **odd**.

Q.Pnt (set serial interface mode) - seen only with serial output option.

Select **d_i SP**, **Cont**, **POLL**, **R.buS** or **~.buS**

Allows user to select the serial interface operation as follows:-

d_i 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.

R.buS Required setting when using the optional Windows compatible download software.

~.buS Modbus RTU protocol.

Addr (set unit address for **POLL**, **R.bu5** & **r.bu5** modes (0 to 31)) - seen only with serial output option.

Allows several units to operate on the same RS485 interface reporting on different areas etc. The host computer or PLC may poll each unit in turn supplying the appropriate address.

The unit address ranges from 0 to 31 (DEC) but is offset by 32 (DEC) to avoid clashing with ASCII special function characters (such as <STX> and <CR>). Therefore 32 (DEC) or 20 (HEX) is address 0, 42 (DEC) or 2A (HEX) addresses unit 10.

SEFL - (serial retransmission mode)

Applies only when **OpUt** function set to **Cont**. Refer to **FEE** function on previous page for function description.

Returning to normal measure mode

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

5.5 Error messages

The following contains some of the error messages which may be encountered when setting up the instrument.

SPAN Err - scaling span error. This message indicates that the live inputs used in **CAL 1** and **CAL 2** were either identical or too close together. Recalibrate ensuring that the live input used at **CAL 1** is significantly different to that used at **CAL 2**.


CAL FAIL - scaling failure. This message indicates that the instrument has not accepted the live inputs used during a **CAL 1** and **CAL 2** scaling operation. Try recalibrating again ensuring that the inputs used are correct for the input range and input link settings chosen, you may find that the input links have been set to a different range. If you have checked the inputs and find that the **CAL FAIL** message is still appearing then perform a **UCAL** operation prior to the **CAL 1** and **CAL 2** operation.

COP FAIL - this message indicates that the instrument power has been interrupted, usually due a spike on the power supply or signal input lines. The instrument will show this error message and then reset itself i.e. the "wake up" display messages will be seen after the **COP FAIL** message. Check the power supply and input lines for spikes, usually caused by something with a large inductance (e.g. solenoid, motor etc.) on the same supply circuit switching on or off. It may be necessary to suppress the interference at the source and/or place the MM on a different supply line. Screened cables are recommended for the signal input lines, the screen should be grounded at the MM end only.

- - - - the bars across the screen indicate that the instrument is seeing an input which is out of its range. e.g. if the input links are set to 0-1V and the signal input is much greater than 1V then this error message will be seen. Check the input signal and input links.

-or- this message indicates that the display is "overrange" i.e. it is being asked to display a number larger than its display range. e.g. larger than **9999** for a 4 digit instrument. Check that the input signal is within the input range chosen by the link settings. Check also that the scaling values given are correct e.g. if, for a 0-1V input on a 4 digit instrument, the instrument was scaled using 0V = **0** and 0.4V = **8000**, then an input of 0.5V or above will cause the error message to be seen.

6 Function Table

Initial display	Meaning of display	Next display	Default Setting	Record Your Settings
RxLo	Alarm low setpoint value	Setpoint value or OFF	OFF	See following table
RxHi	Alarm high setpoint value	Setpoint value or OFF	OFF	See following table
RxHY	Alarm hysteresis	Hysteresis value in measured units	1	See following table
RxTt	Alarm trip time	No of seconds before relay trips	0	See following table
Rxrt	Alarm reset time	Reset time in seconds	0	See following table
Rxn.o or Rxn.c	Alarm action N/O or N/C	Rxn.o or Rxn.c	R In.o	See following table
Rx.SP or Rx.t!	Setpoint or trailing alarm	Rx.SP or Rx.t!	Rx.SP	See following table
brgt	Display brightness	1 to 15	15	
dULL	Remote display brightness switching	0 to 15	1	
rEE-	Recorder output low limit	Value in memory	0	
rEE+	Recorder output high limit	Value in memory	1000	
Functions below are accessible only via CAL mode.				
br-	Bar graph low reading	Value in memory	0	
br+	Bar graph high reading	Value in memory	1000	
br tYPE	Bargraph operation mode	br .S.dot.d.dot or C.br	br	
d9OP	Digital output mode	bcd.b.SCL.b.n or b.n2	b.n2	
d9.OP	Digital retransmission output polarity	ALo or RH,	ALo	
bcd Start	BCD retransmission start value	Value in memory	0	
di 9-	Scaled digital output low reading	Value in memory	0	
di 9+	Scaled digital output high reading	Value in memory	1000	
drnd	Display rounding selects resolution	1 to 5000	1	
dCPt	Display decimal point	Decimal point position (e.g. 0.0. 10.02 etc.)	0	
FLtr	Digital filter range 0 to 8	0 to 8 (8 =most filtering)	3	
FECtrl	Analog output control	on or OFF	OFF	
CAL 1	First scaling point	Live reading	n/a	
CAL 2	Second scaling point	Live reading	n/a	
CAL OFSt	Calibration offset	Live reading	n/a	
ZEFO RANGE	Zero range	Limit value or OFF	1000	
CAL ZEFO	Calibration zero	Value in memory	n/a	
USEF En4	4mA input scaling	Value in memory	0	
USEF En20	20mA input scaling	Value in memory	1000	
UCAL	Uncalibrate	CAL CLR	n/a	
P.but	 button function (5, 6 or digit LED displays only)	NONE.H, .Lo.H, Lo.tAFE, ZEFO.di SP or UL9E	NONE	
F.I NP	Remote input function	NONE.PHLd.dHLd.H, .Lo.H, Lo.tAFE.ZEFO.SP.Rc.No.Rc.di SP or duLL	NONE	

ACCS	Access mode	OFF, EASY, NONE or ALL	OFF	
SPAC	Setpoint access	R 1, R 1-2 etc.	R 1	
SQRt	Square root operation	OFF or on	OFF	
FULL CAP	Full capacity for ullage reading	Value	0	
tAbL	Lineariser on/off	on or OFF	OFF	
tAbL StOP	Operation mode at table limits	on or OFF	OFF	
SCALE tbi E	Scaling (rounding) factor for lineariser Y values	1, 2, 5, 10, 20, 25, 50, 100, 250, 500 or 1000	1	
tAbL PntS	Number of points for lineariser	2 to 50	2	
SEt tAbL	Enter points into lineariser table	P 1	n/a	
Rx	Alarm 2 etc. operation mode	L, uE, tARtE, P, H, Ld, d, H, Ld, H, Lo or di SP	L, uE	
bARt	Bargraph operation mode	L, uE, tARtE, P, H, Ld, d, H, Ld, H, Lo or di SP	L, uE	
rEC	Analog retransmission mode	L, uE, tARtE, P, H, Ld, d, H, Ld, H, Lo or di SP	L, uE	
d90P	Digital retransmission mode	L, uE, tARtE, P, H, Ld, d, H, Ld, H, Lo or di SP	L, uE	
Lo di SP	Display low overrange	Limit value or OFF	OFF	
Hi SH di SP	Display high overrange	Limit value or OFF	OFF	
di SP	Overrange display warning flashing mode	FLSH or -or-	FLSH	
bAUD rARtE	Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19.2 or 38.4	9600	
Prty	Parity	NONE, EVEN or Odd	NONE	
OPut	Output Mode	d, SP, Cont, POLL, R, bus or n, bus	Cont	
Addr	Address	Value in memory	0	
SEFL	Serial retransmission mode	L, uE, tARtE, P, H, Ld, d, H, Ld, H, Lo, di SP or H, Lo	L, uE	

Note: Functions shown shaded on this table will be displayed, only when those particular options are fitted. Refer to the separate "MM Panel Meter Optional Output Addendum" booklet supplied when these options are fitted.

Settings for relays - record settings here				
	A1	A2	A3	A4
RxLo				
RxH,				
RxHY				
Rxtt				
Rxrt				
Rxn.o or Rxn.c				
Rx.SP or Rx.t 1	n/a			
Rx				

7 Lineariser table

Lineariser Table							
Complete and retain for reference							
P Value		Y Value (Value to be displayed)		P Value		Y Value (Value to be displayed)	
P 1		Y 1		P26		Y26	
P2		Y2		P27		Y27	
P3		Y3		P28		Y28	
P4		Y4		P29		Y29	
P5		Y5		P30		Y30	
P6		Y6		P31		Y31	
P7		Y7		P32		Y32	
P8		Y8		P33		Y33	
P9		Y9		P34		Y34	
P 10		Y 10		P35		Y35	
P 11		Y 11		P36		Y36	
P 12		Y 12		P37		Y37	
P 13		Y 13		P38		Y38	
P 14		Y 14		P39		Y39	
P 15		Y 15		P40		Y40	
P 16		Y 16		P41		Y41	
P 17		Y 17		P42		Y42	
P 18		Y 18		P43		Y43	
P 19		Y 19		P44		Y44	
P20		Y20		P45		Y45	
P21		Y21		P46		Y46	
P22		Y22		P47		Y47	
P23		Y23		P48		Y48	
P24		Y24		P49		Y49	
P25		Y25		P50		Y50	

8 Specifications

8.1 Technical Specifications

Input Types:	Link selectable 0-20mA, 4 to 20mA or DC Volts 0-100mV, 0-1V, 0-10V, 0-100V
Impedance:	80Ω (4 to 20mA) & 1MΩ on DC Voltage
ADC Resolution:	1 in 20,000
Lineariser table:	Selectable from 2 to 50 points (X,Y type)
Accuracy:	0.1% when calibrated
Sample Rate:	4 per sec
Conversion Method:	Dual Slope ADC
Microprocessor:	MC68HC11 CMOS
Ambient Temperature:	LED -10 to 60°C, LCD -10 to 50°C
Humidity:	5 to 95% non condensing
Display:	LED Models: 4 digit 20mm, 5 digit 14.2mm + status LEDs + 4 way keypad. 6 digit 14.2mm + 4 way keypad, 8 digit 10mm + 4 way keypad LED Bar Graph 20 segment bar + 5 digit 7.6mm LCD Models: 4 digit 12.7mm, 6 digit 12.7mm
Power Supply: (factory configured)	AC 240V, 110V or 24V 50/60Hz or DC isolated wide range 12 to 48V. Special supply types 32VAC, 48VAC 50/60Hz or DC isolated 50 to 110V also available. Note: supply type is factory configured.
Power Consumption:	AC supply 4 VA max, DC supply, (depends on display type & options)
Output (standard):	1 x relay, Form A, rated 5A resistive 18VDC regulated transmitter supply, 25mA maximum
Relay Action:	Programmable N.O. or N.C.

8.2 Output Options

Extra Relay:	Same specs as Relay 1 (up to 3 extra relays)
Analog Retransmission:	4 to 20mA, 0 to 1V or 0 to 10V link selectable 4 to 20mA can drive into 1kΩ load maximum.
Digital Retransmission	BCD/Binary (isolated).
Serial Communications:	RS232 or RS485
DC Voltage Output:	Isolated ±12V(24V) standard, ±5V(10V) link selectable 25mA maximum.

8.3 Physical Characteristics

Bezel Size:	DIN 48mm x 96mm x 10mm
Case Size:	44mm x 91mm x 120mm behind face of panel
Panel Cut Out:	45mm x 92mm +1mm &- 0mm
Connections:	Plug in screw terminals (max 2.5mm wire)
Weight:	400 gms Basic model, 450 gms with option card

9 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.

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written consent of the manufacturer.

This product is designed and manufactured in Australia.



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