Model PM5-SSI
Synchronous Serial Interface
Panel Mount Display/Controller
Operation and Instruction Manual

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1 Introduction

This manual contains information for the installation and operation of the PM5-SSI monitor. The input to this instrument is a Synchronous Serial Interface (SSI) up to 32 bits of binary or Gray code, user selectable. The SSI data transmission is initiated by clock pulses generated by the PM5 monitor. Typical SSI output devices include absolute position encoders and distance measuring equipment. Data transmission distances of up to 1.2km are possible when using SSI data communications.

The display can be scaled in engineering units e.g. "mm" by one of the methods below:

1. By entering values at the **InPut** and **ScAlE** functions (**F.SCALE** mode, see **INPUt CAL OPEr** function), These values work together with the output value from the encoder in a formula used to calculate the required display scaling.
2. By entering the values required at two known points (**U.CAL** mode, see **INPUt CAL OPEr** function). This method also allows the use of a calibration offset.
3. A mode **U.SCALE** may also be seen. This method has not been implemented as yet.

Alarms and relays - 1 relays is fitted as standard an extra 1, 2, 3 or 6 relays are optionally available in certain valid combinations. Using the **AL 1** to **AL 8** functions up to 8 alarms can be set (low and/or high alarms) and each alarm can be allocated to one or more relays. The relays can be set to automatically reset when out of alarm condition or to latch requiring the operator to push the front **F** button (where fitted) to allow the relay to reset when out of alarm condition. The **P** button and/or a remote input can also be programmed to acknowledge a latching alarm thereby allowing it to reset when out of alarm condition. Separate functions (**rLY 1** to **rLY8 AcK**) can be set for the relay itself (separate to the alarm) to require acknowledgement with even with automatic alarm reset and is in an activated condition an acknowledgement will reset the relay even if it is still in an alarm condition. Each alarm can also be programmed to operate on a "timeout" i.e. when a valid signal is not being received the alarm can activate along with any relays allocated to that alarm.

Relay operation - to enable a relay to operate several steps are required, below is a list showing the steps required to enable input 1 to use relay 1 to operate as a high alarm using alarm 1:

- At the **AL Count** function ensure that at least one alarm is enabled.
- At the **AL 1 Hi 9h** function set the required high alarm and ensure that the **AL 1 Lo** function is set to **OFF**.
- Set the **AL 1 HYSt**, **AL 1 tr, P** and **AL 1 rSt** as required.
- At the **AL 1 rLYS** function set **rLY 1** to **On**.
- At the **AL 1 OPEr** function select **Hi .Lo**.
- At the **AL 1 Ch** function select **CH 1**.
- Set **AL 1 LtCh**, **rL 1 rLY** and **rL 1 AcK** functions as required.
- Set the **rL 1 bool** function to **Or**.

1.1 Accessing setup functions

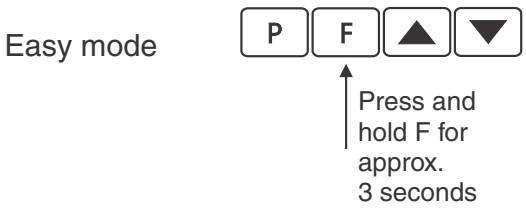
The setup functions allow adjustment of the instruments operation functions. There are five different ways of accessing setup functions. Each mode allows a selection of access levels i.e. allows some choice of which functions are accessible.

As as summary the methods available are:

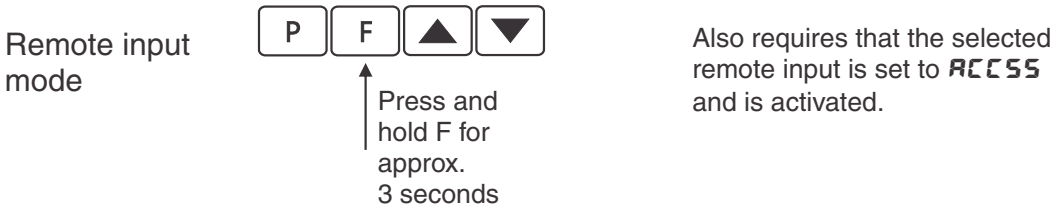
- **Easy mode** - this is the easiest access mode simply requiring the F button to be pressed for 3 seconds. This mode would normally be used to gain access to functions which require frequent adjustment.
- **Remote input mode** - this uses the Easy method of access but also requires the use of a remote input switch.
- **PIN 1 mode** - this method allows a PIN to be set with access via PIN entry.
- **PIN 2 mode** - this method also requires a PIN and would generally be use to allow a higher access level than the first PIN.
- **Super Cal mode** - this method requires a power up procedure and will allow access to all functions.

These modes are explained in more detail below.

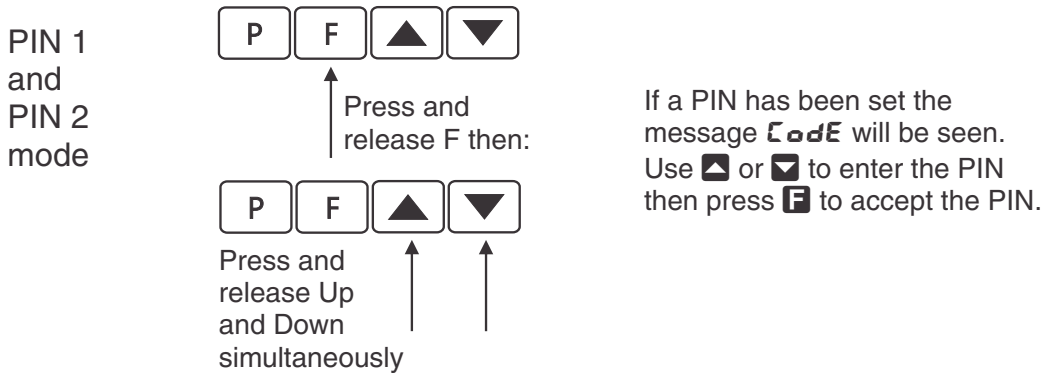
- **Easy mode** - Allows access to the level set by the **EASY LEVEL** function in the **ACCESS** menu. By default the Easy access is set to **NONE** which blocks access to all setup functions. To allow access to functions using this method choose the access level required at the **EASY LEVEL** function.
  The Easy mode simply requires that the F button is held pressed until the message **FUNC** is seen followed by the first function message, this should take approximately 3 seconds. If the message **FUNC End** or no response is seen at this point it means that the access level has been set to **NONE**. The default access for this level is **NONE** so the access level will need to be changed if access via this method is required.



- **Remote input mode** - Allows access to the level set by the **r.i nPut LEVEL** function in the **ACCESS** menu. By default the Remote input access is set to **CAL** level allowing access to all setup functions.
  The remote input mode uses the same access method as the Easy mode but also requires that one of the available remote inputs is set to **ACCSS** and that the selected remote input is activated i.e. shorted to GND. The default access for this level is **NONE** so the access level will need to be changed if access via this method is required.



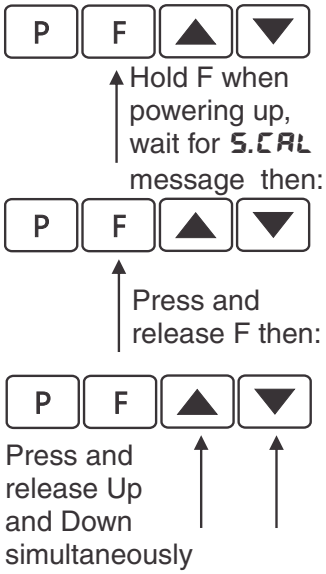
- **PIN 1 mode** - Allows access to the level set by the USr.1 LEVEL function in the ACCESS menu.
  The PIN 1 mode requires the F button is pressed and released then within 2 seconds press the ▲ and ▼ buttons at the same time. The PIN can be set via the USr.1 P1n function in the ACCESS menu. A USr.1 LEVEL setting of 0 disables the PIN which means that there is no need to enter the PIN. If the USr.1 LEVEL function has been set to a number other than nonE then the first function seen when entering via PIN 1 mode will be the function CodE. When this function is seen the PIN value set at the USr.1 P1n function must be entered via the ▲ or ▼ pushbuttons followed by pressing F to accept the PIN before the user can progress to the setup functions.



- **PIN 2 mode** - Allows access to the level set by the USr.2 LEVEL function in the ACCESS menu.
  This method uses the same access method as PIN 1 mode above. A USr.2 P2n setting of 0 disables the PIN. If the USr.1 LEVEL or a USr.2 P2n function has been set to a number other than 0 then the first function seen when entering via PIN 1/PIN2 mode will be the function CodE. When this function is seen the PIN value set at the USr.1 P1n function can be entered for access to the level set at the USr.1 LEVEL function or enter the USr.2 P2n PIN to gain access to the level set at the USr.2 LEVEL function. A correct code will allow access to the functions at the selected level. An incorrect code will result in the FUNC End message being seen indicating that access to setup functions has been refused and the display will return to normal measurement mode.

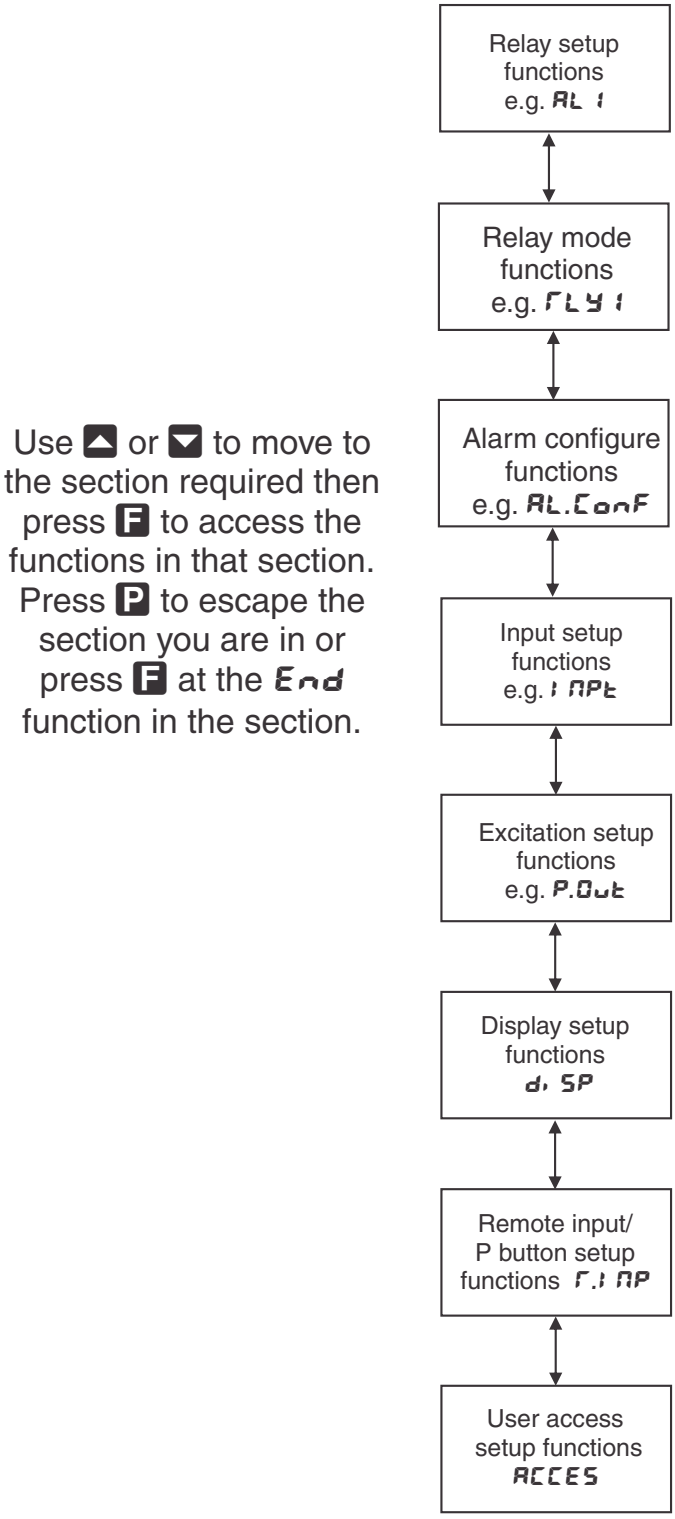
- **Super Cal mode** - This method can be used to gain access to all functions. If a PIN has been set and forgotten use this method to access the PIN functions to check the settings. To access via Super Cal mode with the instrument switched off hold in the F button whilst the instrument powers up. Keep the button pressed until the S.CAL message is seen, you can then release the F button. Next press and release F then within 2 seconds press and release the ▲ and ▼ pushbuttons simultaneously.

Super Cal mode



The setup functions are organised in blocks or sections e.g. all the settings for relay 1 are in the AL 1 section. Once access to setup functions has been gained use the ▲ and ▼ buttons to select the section required then press F to enter this section and again us the ▲ and ▼ buttons to select the required function for alteration and press F to allow alteration of this function.

Typical sections for a basic instrument are illustrated below. In any particular instrument additional sections may appear depending on the part number and any optional outputs fitted.



1.2 Selecting and altering access levels

This subsection details the use "access levels". Access levels can be used to obtain easy access to functions which are regularly required and to limit access to functions which are not required or which restricted access is required. These access level settings can be ignored if no restrictions to access are required and no easy access to selected functions is required.

Each setup function has a default access level allocated to it, for example the relay 1 high alarm function **AL 1h, 9h** is allocated a default level of 2. There is a facility for the user to change the access levels for a limited number of functions to make them either easier to access or harder to access as required, see the **Fn. 1CodE** function.

There are different ways of accessing setup functions, these are explained in the following section. Each mode allows a selection of access levels i.e. allows some choice of which functions are accessible.

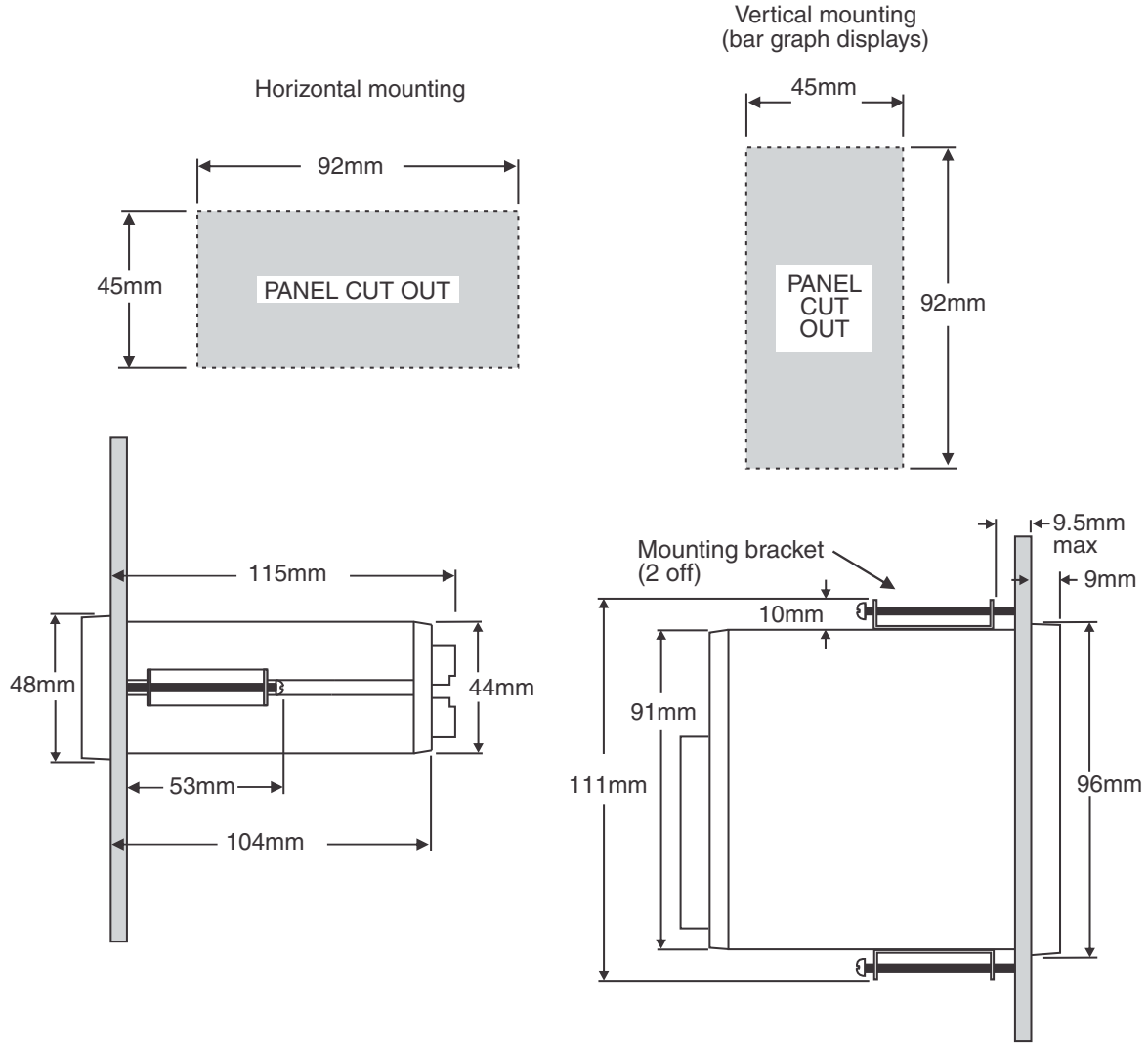
The access levels available are:

None - no access to functions
1 - access to functions allocated to level 1
2 - access to functions allocated to level 2
3 - access to functions allocated to level 3
4 - access to functions allocated to level 4
5 - access to functions allocated to level 5
6 - access to functions allocated to level 6
CAL - access to all normal operation functions

2 Mechanical Installation

Choose a mounting position as far away as possible from sources of electrical noise such as motors, generators, fluorescent lights, high voltage cables/bus bars etc. An IP65 or IP67 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. 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 Electrical installation

3.1 Electrical installation

The PM5 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.

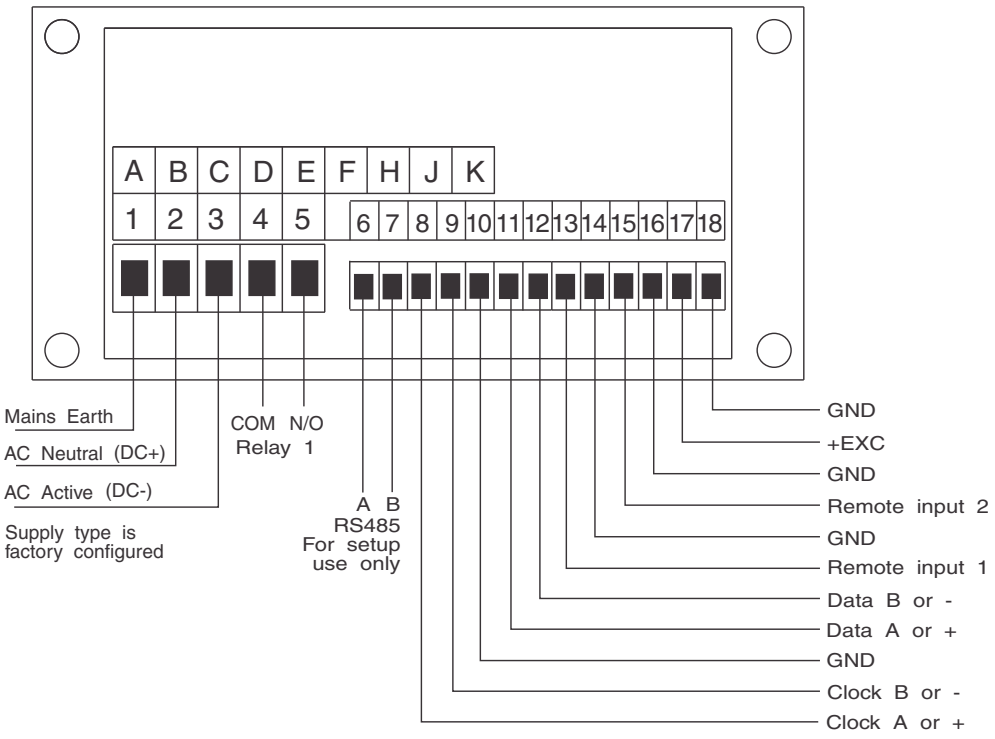
The plug in, screw type, terminal blocks allow for wires of up to 2.5mm^2 to be fitted for power, relays and options and 1mm^2 for sensor and other wiring. Connect the wires to the appropriate terminals as indicated below. Refer to connection details provided in this chapter to confirm proper selection of voltage, polarity and input type before applying power to the instrument.

When power is applied 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.

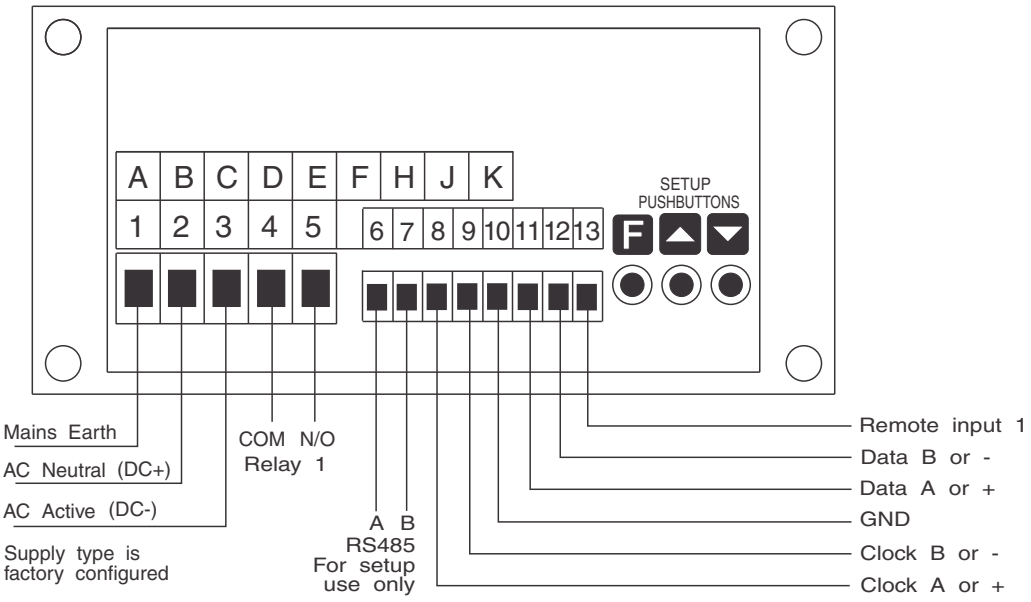
Use twisted pair shielded wire for SSI clock and data connections.

Terminal 17 , if available, can be set for 5V or 12VDC output via the **P.out** function.

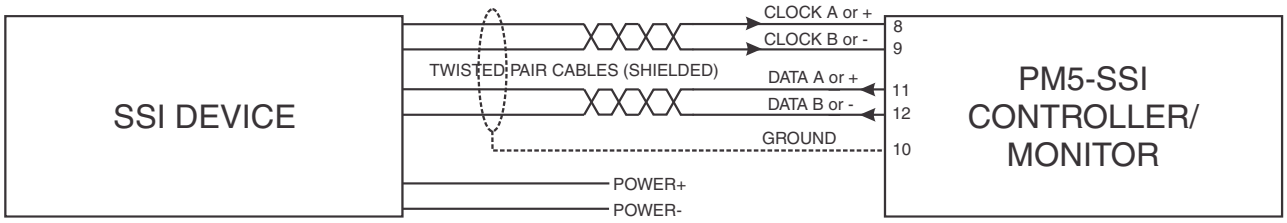
Instrument rear view for instruments with front pushbuttons



Instrument rear view for instruments without front pushbuttons



3.2 Clock and signal connections between sensor and display

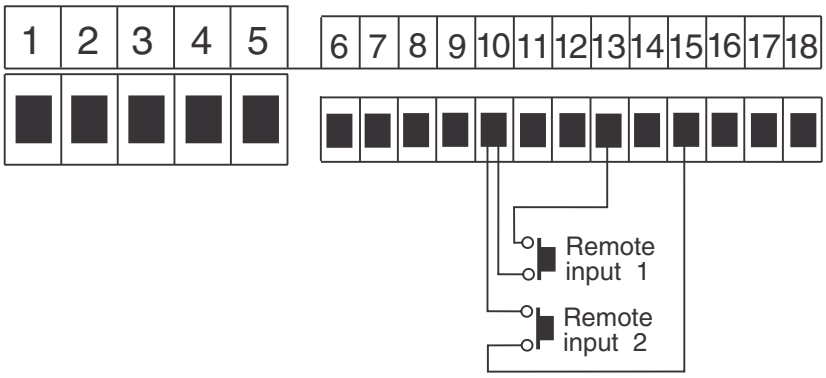


3.3 Relay connections

Relay connections The PM5 is supplied with one alarm relay as standard with connections on terminals 4 and 5, extra relays are optionally available. The relay is a single pole, single throw type and is rated at 5A, 240VAC into a resistive load. The relay contact is voltage free and may be programmed for normally open or normally closed operation.

3.4 Remote input connections

One or two programmable remote input connections are available depending on model purchased. The function of the remote input can be set for software. To operate the remote input connect a voltage free switch or relay (momentary or latching depending on the operation selected) between the remote input terminal and ground. The relay contacts will open when power is removed.



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.

Display messages shown are those which would appear on a 5 digit display, these display messages may in some cases vary slightly for other display types.

Any functions which rely on options being fitted will be denoted by an asterisk *.

Some of the functions shown in the table below require access via Super Cal **S.CAL** mode.

4.1 Alarm relay function table

Display	Function	Range	Default	Your record	Ref/Page
AL 1 to **AL8** **HI SH**	High setpoint value for designated alarm	Any display value or **OFF**	**OFF**	See 4.10	5.1 / 20
AL 1 to **AL8** **LO**	Low setpoint value for designated alarm	Any display value or **OFF**	**OFF**	See 4.10	5.2 / 21
AL 1 to **AL8** **HYST**	Hysteresis value for the designated alarm	**0** to **50000**	**10**	See 4.10	5.3 / 21
AL 1 to **AL8** **tr1 P**	Trip time delay for the designated alarm relay x.	**0** to **5000.0** secs	**0.0**	See 4.10	5.4 / 22
AL 1 to **AL8** **rSt**	Reset time delay for the designated alarm relay x.	**0** to **5000.0** secs	**0.0**	See 4.10	5.5 / 22
AL.ConF **rLYS**	Relay selection **On** or **OFF**	**On** or **OFF**	**OFF**	See 4.10	5.6 / 23
AL 1 to **AL8** **tRAI L**	Alarm trailing or setpoint mode	**SEt.P**, **tL 1**, **tL 2**, **tL 3**, **tL 4**, **tL 5**, **tL 6**, **tL 7**	**SEt.P**	See 4.10	5.7 / 23
AL 1 to **AL8** **OPEr**	Alarm operating mode	**HI .LO**	**HI .LO**	See 4.10	5.8 / 24
AL 1 to **AL8** **Ch**	Alarm relay operation input selection	**CH 1**	**CH 1**	See 4.10	5.9 / 24
AL 1 to **AL8** **LAtch**	Alarm relay latching operation	**Auto** or **LAtch**	**Auto**	See 4.10	5.10 / 24
AL 1 to **AL8** **tout**	Input timeout alarm	**OFF** or **ON**	**OFF**	See 4.10	5.11 / 25

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

4.2 Relay function table

Display	Function	Range	Default	Your record	Ref/Page
rLy 1 to rLy 8 rLy	Alarm relay x action to normally open (de-energised) or normally closed (energised)	n.o, n.c	n.o	See 4.10	5.12 / 25
rLy 1 to rLy 8 Ack	Relay acknowledge	OFF or On	OFF	See 4.10	5.13 / 25
rLy 1 to rLy 8 bool	Alarm relay Boolean logic operation	Or, And	Or	See 4.10	5.14 / 26

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

4.3 Relay function table

Display	Function	Range	Default	Your record	Ref/Page
AL.Conf AL Count	Alarm count	0, 1, 2, 3, 4, 5, 6, 7, 8	2	See 4.10	5.15 / 26

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

4.4 Input function tables

Display	Function	Range	Default	Your record	Ref/Page
inPut inPut bitS	SSI input bits	1 to 32	24		5.16 / 26
inPut dAtA bitS	SSI data bits	1 to 32	24		5.17 / 26
inPut SiGn	SSI signed data	OFF or On	OFF		5.18 / 27
inPut CodE	SSI data type	bin, GrAY	bin		5.19 / 27
inPut dP	Display decimal point	0, 0.1, 0.02, 0.003	0		5.20 / 28
inPut d.rnd	Display value rounding	1 to 5000	1		5.21 / 28
inPut FLtr	Digital filter	0, 1, 2, 3, 4, 5, 6, 7, 8	2		5.22 / 28
inPut CAL OPEr	Display scaling method	F.SCALE, U.CAL	F.SCALE		5.23 / 28

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

INPUt INPUt	Input scale value	0 to Maximum display value	1		5.24 / 29
INPUt SCALE	Scale value	Any display value	1		5.25 / 30
INPUt t.OUt	Timeout	OFF or On	On		5.26 / 30
INPUt SLAVE	Slave display	OFF or On	OFF		5.27 / 30
INPUt dUAL rEAd	Dual read	OFF or On	OFF		5.28 / 30
INPUt Un.CAL	Uncalibrate	n/a	n/a		5.29 / 31
INPUt CAL 1	First calibration point	n/a	n/a		5.30 / 31
INPUt CAL 2	Second calibration point	n/a	n/a		5.31 / 31
INPUt SEt ZErO	Set zero	n/a	n/a		5.32 / 31
INPUt OFF- SEt	Display scale offset	n/a	n/a		5.33 / 32
INPUt CLEAr ZErO	Clear zero	n/a	n/a		5.34 / 32

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

4.5 Excitation voltage function tables

Display	Function	Range	Default	Your record	Ref/Page
P.OUt P.OUt	Output voltage selection	5U, 12U	5U		5.35 / 32

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

4.6 Display function table

Display	Function	Range	Default	Your record	Ref/Page
d. SP brgt	Display brightness	1 to 16	16		5.36 / 32
d. SP dull	Dimmed display brighness	0 to 16	2		5.37 / 33

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

4.7 Serial communications functions

Display	Function	Range	Default	Your record	Ref/Page
SEr1 OPEr	Serial operation mode (*__Optional__)	nonE, Cont, Poll, A.buS, dI SP or ñ.buS	nonE		5.38 / 33
SEr1 bAud	Serial baud rate (*__Optional__)	1200, 2400, 4800, 9600, 19.2, 38.4, 57.6, 115.2	9600		5.39 / 34
SEr1 PrtY	Serial parity (*__Optional__)	8NONE, 8 EUEN, 8Odd, 7EUEN, 7Odd	8N		5.40 / 34
SEr1 Un. t Addr	Serial address (*__Optional__)	1 to 127	1		5.41 / 34

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

4.8 P button and remote inputs function table

Display	Function	Range	Default	Your record	Ref/Page
F.1 nP P.but	Front P button operation mode	nONE, P.H. , P.Lo, H. .Lo, AL.Ac, 2ErO	nONE		5.42 / 34
F.1 nP F.1 n. 1	Remote input 1 operation mode	nONE, P.Hol d, d.Hol d, P.H. , P.Lo, H. .Lo, AL.Ac, ACCSS, dull , 2ErO	nONE		5.43 / 35

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

r.1 nP r.1 n.2	Remote input 2 operation mode	nONE, P.Hol d, d.Hol d, P.H, , P.Lo, H, .Lo, AL.Ac, ACCSS, dul l , 2Er0	nONE		5.44 / 36

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

4.9 Access control function table

Display	Function	Range	Default	Your record	Ref/Page
ACCES EASY LEVEL	Easy access mode	NONE, 1, 2, 3, 4, 5, 6, CAL	NONE		5.45 / 36
ACCES r.1 nPut LEVEL	Remote input access mode	NONE, 1, 2, 3, 4, 5, 6, CAL	NONE		5.46 / 36
ACCES USr. 1 P. n	PIN code 1	0 to 50000	0		5.47 / 36
ACCES USr. 1 LEVEL	PIN code 1 access level	NONE, 1, 2, 3, 4, 5, 6, CAL	NONE		5.48 / 37
ACCES USr.2 P. n	PIN code 2	0 to 50000	0		5.49 / 37
ACCES USr.2 LEVEL	PIN code 2 access level	NONE, 1, 2, 3, 4, 5, 6, CAL	NONE		5.50 / 38
ACCES Fn. 1 CodE	User assignable access function 1	0000 to FFFF hex.	0000		5.51 / 38
ACCES Fn. 1 LEVEL	User assignable access 1 level value	dFLt, 1, 2, 3, 4, 5, 6, CAL, S.CAL	dFLt		5.52 / 38
ACCES Fn.2 CodE	User assignable access function 2	0000 to FFFF hex.	0000		5.53 / 38
ACCES Fn.2 LEVEL	User assignable access 2 level value	dFLt, 1, 2, 3, 4, 5, 6, CAL, S.CAL	dFLt		5.54 / 39
ACCES Fn.3 CodE	User assignable access function 3	0000 to FFFF hex.	0000		5.55 / 39
ACCES Fn.3 LEVEL	User assignable access 3 level value	dFLt, 1, 2, 3, 4, 5, 6, CAL, S.CAL	dFLt		5.56 / 39
ACCES Fn.4 CodE	User assignable access function 4	0000 to FFFF hex.	0000		5.57 / 39
ACCES Fn.4 LEVEL	User assignable access 4 level value	dFLt, 1, 2, 3, 4, 5, 6, CAL, S.CAL	dFLt		5.58 / 40

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

4.10 Relay table

Record your relay settings in the table below

Display	Alarm 1	Alarm 2	Alarm 3	Alarm 4	Alarm 5	Alarm 6	Alarm 7	Alarm 8
HI GH								
LO								
HYST								
TRIP								
FST								
FLYS								
TRAIL								
OPER								
CH								
LATCH								
tout								

Record which relays are allocated to which alarms and other relay settings in the table below

Display	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7
Alarm 1							
Alarm 2							
Alarm 3							
Alarm 4							
Alarm 5							
Alarm 6							
Alarm 7							
Alarm 8							
FLY							
ACK							
bool							

5 Explanation of functions

The setup and calibration functions are configured through a push button sequence. The three push buttons located at the front of the instrument are used to alter settings. The access modes available are detailed in section 1.1, starting on page 4.

Display messages shown are those which would appear on a 6 digit display, these display messages may in some cases vary slightly for other display types.

Explanation of Functions

5.1 Alarm relay high setpoint

Section:	AL 1 to AL 8
Display:	Hi SH
Range:	Any display value or OFF
Default Value:	OFF
Default Access Level	2
Function number	4000 to 4007

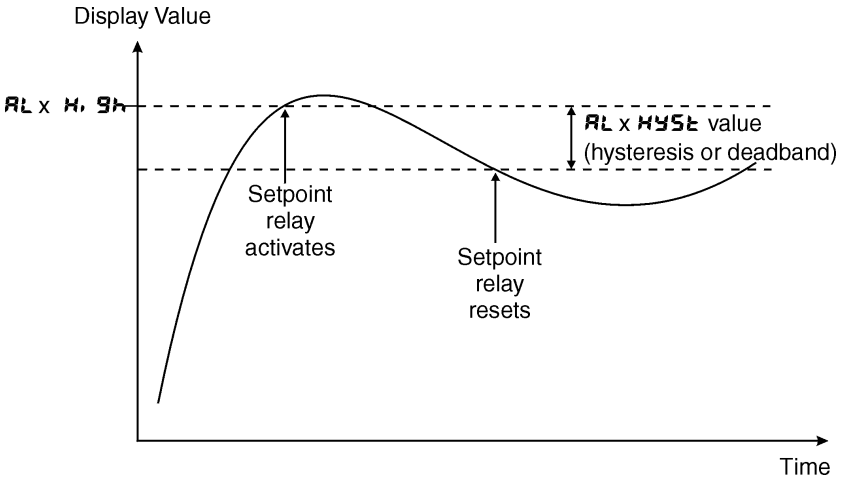
Displays and sets the high setpoint value for the designated alarm. Use this high setpoint function if an alarm operation is required when the display value becomes equal to or greater than the required setpoint value.

To set the high alarm value go to the Hi SH function, press F and when you see a digit of the value flash use the ▲ or ▼ push buttons to set the required value then press F to accept this selection. 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 alarm is allocated both a low and high setpoint then the alarm will activate when the value displayed moves outside the band set by the low and high setpoints. The value at which the alarm will reset is controlled by the HYSt function.

Overlapping alarms - if the Hi SH value is set lower than the Lo value then the alarm will activate in the band between the two values.

If the display has annunciator leds for the alarm then the annunciator will initially flash in alarm condition, if the alarm is acknowledged by pressing the F button the annunciator will be solidly lit until the display moves out of alarm condition.

Example:
If Hi SH under AL 1 is set to 100 then alarm 1 will activate when the display value is 100 or higher. Any relay allocated to this alarm will also activate.



5.2 Alarm relay low setpoint

Section:	AL 1 to AL 8
Display:	Lo
Range:	Any display value or OFF
Default Value:	OFF
Default Access Level	2
Function number	40 10 to 40 17

Displays and sets the low setpoint value for the designated alarm.

Use this low setpoint function if a relay operation is required when the display value becomes equal to or less than the required setpoint value.

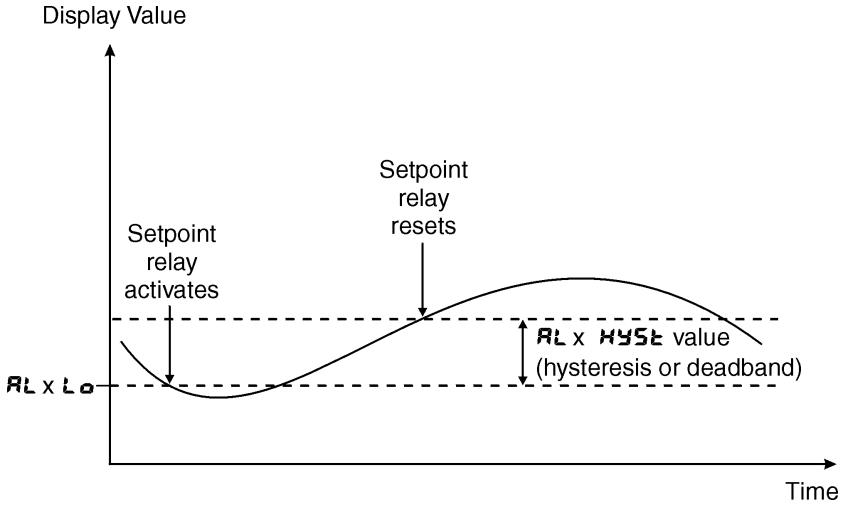
To set the low alarm value press F and when you see a digit of the value flash use the ▲ or ▼ push buttons to set the required value then press F to accept this selection.

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 alarm is allocated both a low and high setpoint then the alarm will activate when the value displayed moves outside the band set by the low and high setpoints. The value at which the alarm will reset is controlled by the Hysteresis function.

If the display has annunciator leds for the alarm then the annunciator will initially flash in alarm condition, if the alarm is acknowledged by pressing the F button the annunciator will be solidly lit until the display moves out of alarm condition.

Overlapping alarms - if the Hi 9h value is set lower than the Lo value then the alarm will activate in the band between the two values.

Example:
If Lo under AL 1 is set to 10 then relay 1 will activate when the display value is 10 or less. Any relay allocated to this alarm will also activate



5.3 Alarm hysteresis (deadband)

Section:	AL 1 to AL 8
Display:	HYSt
Range:	0 to 50000
Default Value:	10
Default Access Level	3
Function number	4020 to 4027

Displays and sets the alarm hysteresis limit for the designated alarm. To set a alarm hysteresis value go

to the 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 alarm and associated relays when the measured value is rising and falling around setpoint value. e.g. if HYST under AL 1 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 relays 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 Hi SP under AL 1 is to 50.0 and HYST is set to 3.0 then the setpoint alarm 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 Lo is to 20.0 and HYST is set to 10.0 then the alarm 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.

To set the hysteresis value go to the HYST function, press F and when you see a digit of the value flash use the ▲ or ▼ push buttons to set the required value then press F to accept this selection. The hysteresis units are expressed in displayed engineering units.

Example: If Hi SP is set to 100 and HYST is set to 10 then alarm 1 will activate when the display value is 100 or higher and will reset at a display value of 89 or lower.

5.4 Alarm relay trip time

Section:	AL 1 to AL 8
Display:	trIP
Range:	0 to 5000.0 secs
Default Value:	0.0
Default Access Level	3
Function number	4040 to 4047

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 50000 seconds.

To set the trip time value go to the trIP function, press F and when you see a digit of the value flash use the ▲ or ▼ push buttons to set the required value then press F to accept this selection.

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

5.5 Alarm relay reset time

Section:	AL 1 to AL 8
Display:	rSt
Range:	0 to 5000.0 secs
Default Value:	0.0
Default Access Level	3
Function number	4050 to 4057

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 50000 seconds.

To set the reset time value go to the rSt function, press F and when you see a digit of the value flash use the ▲ or ▼ push buttons to set the required value then press F to accept this selection.

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

5.6 Relay selection

Section:	AL.ConF
Display:	rLyS
Range:	On or OFF
Default Value:	OFF
Default Access Level	4
Function number	4330 to 4337

Allows a relay to be allocated to an alarm. For example if a high alarm value has been selected at the AL 1H, 9hfunction this alarm could be allocated to relay 3 by selecting rLy3 On at this function. Press the F button to enter this function then use the ▲ or ▼ pushbuttons to choose the required relay then press the F button to toggle to On or OFF as required.

5.7 Alarm trailing or setpoint mode

Section:	AL 1 to AL 8
Display:	trAIL
Range:	SEt.P, tL 1, tL 2, tL 3, tL 4, tL 5, tL 6, tL 7
Default Value:	SEt.P
Default Access Level	4
Function number	4060 to 4067

This function will not only be seen for alarms 2 and higher. Each alarm, except alarm 1, may be programmed to operate with an independent setpoint value (SEt.P selected) or may be linked to operate at a fixed difference to another alarm setpoint, known as trailing operation. The operation is as follows:

- Relay 1 (AL 1) is always independent.
- Relay 2 (AL2) may be independent or may be linked to alarm 1 (tL 1).
- Relay 3 (AL3) may be independent or may be linked to alarm 1 (tL 1) or alarm 2 (tL2).
- Relay 4 (AL4) may be independent or may be linked to alarm 1 (tL 1), alarm 2 (tL2) or alarm 3 (tL3).
- Relay 5 (AL5) may be independent or may be linked to alarm 1 (tL 1), alarm 2 (tL2), alarm 3 (tL3) or alarm 4 (tL4).
- Relay 6 (AL6) may be independent or may be linked to alarm 1 (tL 1), alarm 2 (tL2), alarm 3 (tL3), alarm 4 (tL4) or alarm 5 (tL5).
- Relay 7 (AL7) may be independent or may be linked to alarm 1 (tL 1), alarm 2 (tL2), alarm 3 (tL3), alarm 4 (tL4), alarm 5 (tL5) or alarm 6 (tL6).

The operation of each alarm is selectable by selecting, for example, (Alarm 4) AL4 SEt.P = Alarm 4 normal setpoint or AL4 tL 1 = Alarm 4 trailing alarm 1 or AL4 tL2 = Alarm 4 trailing alarm 2 or AL4 tL3 = 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 1 - High alarm: With alarm 2 set to trail alarm 1, if **AL 1 Hi 9h** is set to **1000** and **AL2 Hi 9h** 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) or above.

Example 2 - Low alarm: With alarm 2 set to trail alarm 1, if **AL 1 Lo** is set to **600** and **AL2 Lo** is set to **200** then alarm 1 will activate at **600** and alarm 2 will activate at **800** (i.e. 600 + 200). If alarm 2 had been set at **-200** then alarm 2 would activate at **400** (i.e. 600 – 200) or below.

5.8 Alarm operating mode

Section:	**AL 1** to **AL 8**
Display:	**OPEr**
Range:	**Hi .Lo**
Default Value:	**Hi .Lo**
Default Access Level	**4**
Function number	**4 160** to **4 167**

Sets the operating mode for the selected alarm, at this point the only choice is for normal on/off switching using high and/or low setpoints. The relay can also be activated by a timeout in the data string.

5.9 Alarm relay operation input selection

Section:	**AL 1** to **AL 8**
Display:	**Ch**
Range:	**CH 1**
Default Value:	**CH 1**
Default Access Level	**4**
Function number	**4070** to **4077**

Sets the input from which the selected alarm relay will operate. At present the only choice is **CH 1** i.e. relay operates from value of channel 1 (for this software version only 1 channel is available)

5.10 Alarm relay latching operation

Section:	**AL 1** to **AL 8**
Display:	**LAtch**
Range:	**Auto** or **LAtch**
Default Value:	**Auto**
Default Access Level	**4**
Function number	**4 170** to **4 177**

Allows selection of alarm latching operation. If set to **Auto** the alarm and associated relays will not latch i.e. they will automatically reset when the display moves out of alarm condition. If set to **LAtch** the alarm will latch and will not reset until the display value is out of alarm condition and either the **F** button is pressed to clear the latch condition or if power is removed. If the **F** button is pressed whilst still in alarm condition the alarm will automatically reset once the display goes out of alarm condition. The relay hysteresis, trip time and reset time settings still apply to latching relays.

In latching mode the alarm annunciator (5 digit display type only) will flash when the display goes into alarm condition. If the display goes out of alarm condition without being acknowledged the flashing period will change to give a longer “off” time. If the alarm is acknowledged by pressing the **F** button then the

annunciator will change from flashing to solidly lit. Once the alarm has been acknowledged the alarm will be free to reset once the display value moves out of alarm condition.

5.11 Input timeout alarm

Section:	AL 1 to AL 8
Display:	t.out
Range:	OFF or On
Default Value:	OFF
Default Access Level	4
Function number	4 1d0 to 4 1d7

When this function is set to On it allows the selected alarm to be used to give visual t.out message warning and, if required, an alarm activation (along with a relay activation if a relay has been allocated to the alarm) if the input signal fails i.e. the display does not recognise the signal as a valid value. Note that this can be used in addition to the high and low setpoints. If an alarm activation is required then the required alarm t.out function must be set to On and a relay chosen for that alarm. e.g. AL4 t.out set to On and a relay must be selected at the AL4 rLY5 function.

5.12 Alarm relay normally open/closed

Section:	rLY 1 to rLY8
Display:	rLY
Range:	n.o, n.c
Default Value:	n.o
Default Access Level	4
Function number	4030 to 4037

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 open when power is removed a normally closed alarm is often used to provide a power failure alarm indication. To set the alarm relay for normally open or closed go to the rLY 1 to rLY8 rLY function and use the ▲ or ▼ push buttons to set the required operation then press F to accept this selection. **Example:**
If set to A 1n.o alarm relay 1 will be open circuit when the display is outside alarm condition and will be closed (short circuit across COM and N/O terminals) when the display is in alarm condition.

5.13 Relay acknowledge

Section:	rLY 1 to rLY8
Display:	Ac K
Range:	OFF or On
Default Value:	OFF
Default Access Level	4
Function number	4320 to 4327

If the Ac K is set to On the operator can acknowledge the alarm whilst still in alarm condition allowing the relay to reset straight away. This is not affected by the alarm being set to either latching or auto reset mode. The acknowledge can be made by pressing the front F button, if available. The front P button and/or a remote input can also be programmed to be used in acknowledging the alarm.

5.14 Alarm relay Boolean logic operation

Section:	rLY 1 to rLY8
Display:	bool
Range:	Or, And
Default Value:	Or
Default Access Level	4
Function number	43 10 to 43 17

This function allows a Boolean logic AND (**And**) or OR (**Or**) function to be applied to alarms. If two or more alarms use the same relay and that relay is set to operate as an OR operation then this effectively puts the alarms in parallel. If two or more alarms use the same relay that relay is set to operate on an AND operation then this effectively puts the alarms in series.

Examples: 1. If alarms 1, 2 and 3 all use relay 1 and relay 1 is set for **Or** operation then relay 1 will activate if the display value for the selected channels for these alarms causes either alarm 1 or alarm 2 or alarm 3 to go into alarm condition. i.e. relay 1 will activate if any of the alarms is in alarm condition.

2. If alarms 1, 2 and 3 all use relay 1 and relay 1 is set for **And** operation then relay 1 will activate if the display value for the selected channels for these alarms causes alarm 1 and alarm 2 and alarm 3 to go into alarm condition. i.e. all 3 alarms must be in alarm condition for relay 1 to activate.

5.15 Alarm count

Section:	AL.ConF
Display:	AL Count
Range:	0, 1, 2, 3, 4, 5, 6, 7, 8
Default Value:	2
Default Access Level	4
Function number	437d

Allows the setting of the number of alarms to be used. Once the number has been set to alarm parameters and the relays to be used for each alarm can be set in the **AL 1** to **AL 8** section.

5.16 SSI input bits

Section:	InPUt
Display:	InPUt bitS
Range:	1 to 32
Default Value:	24
Default Access Level	CAL
Function number	49E6

This function allows selection of number of bits for the SSI input i.e. the number of bits which are used to transmit the position data. See also **dAtA bitS** which follows.

5.17 SSI data bits

Section:	InPUt
Display:	dAtA bitS
Range:	1 to 32
Default Value:	24
Default Access Level	CAL
Function number	49E2

This function allows selection of total number of data bits for the SSI input e.g. a 32 bit encoder may

have 24 bits of position data and 8 bits of other data which is not used in the actual display value. It is important that the correct value is entered for both the **INPUT bITS** and **dATA bITS** since this allows the display to detect if a genuine message is being received.

5.18 SSI signed data

Section:	**INPUT**
Display:	**SIGN**
Range:	**OFF** or **ON**
Default Value:	**OFF**
Default Access Level	**CAL**
Function number	**49E3**

Displays and sets the sign bit enabling. With the **SI GN** function set to **on** the data is interpreted as a twos compliment signed number, masked to the number of bits set by the **INPUT bITS** function. See the **INPUT bITS** function above for the effect of the **SI GN** setting on the values displayed for a given number of input bits.

The table which follows gives some examples of the effect of **INPt**, **SCLE**, **SSI bITS** and **SI GN** settings.

INPt	SCLE	SSI bITS	SI GN	Viewable display range
1	1	12	OFF	0 to 4095
1	-1	12	OFF	0 to -4095
1	1	12	on	-2048 to 2047
1	-1	12	on	-2047 to 2048
1	2	12	OFF	0 to 8191
2	1	12	OFF	0 to 2047
1	1	13	OFF	0 to 8191
1	1	14	OFF	0 to 16383
1	1	20	OFF	0 to 1048575
1	1.00	20	OFF	0 to 1048.58
8192	1000	12	OFF	0 to 500

5.19 SSI data type

Section:	**INPUT**
Display:	**CodE**
Range:	**bIn**, **GrAY**
Default Value:	**bIn**
Default Access Level	**CAL**
Function number	**49E4**

The input data type can be set to **bIn** for binary or to **GrAY** for gray code SSI to match the output type from the sensor.

5.20 Display decimal point

Section:	INPUT
Display:	dP
Range:	0, 0.1, 0.02, 0.003
Default Value:	0
Default Access Level	4
Function number	4100

This function sets the number of decimal points to be displayed.

5.21 Display value rounding

Section:	INPUT
Display:	d.rnd
Range:	1 to 5000
Default Value:	1
Default Access Level	4
Function number	4360

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.
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.

5.22 Digital filter

Section:	INPUT
Display:	FLtr
Range:	0, 1, 2, 3, 4, 5, 6, 7, 8
Default Value:	2
Default Access Level	4
Function number	43C0

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. 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 filter go to the FLtr function, press F and when you see a digit of the value flash use the ▲ or ▼ push buttons to set the required value then press F to accept this selection.

5.23 Display scaling method

Section:	INPUT
Display:	CAL OPEr
Range:	F.SCALE, U.CAL
Default Value:	F.SCALE
Default Access Level	CAL
Function number	49E5

Displays and sets the method to be used to scale the display. Choices are:

- **F.SCL** - this method uses the **INPUT** and **SCALE** functions to scale the display.
  If the relevant details of the encoder and display requirements are known the easiest way to find the **INPUT** and **SCALE** values is to use the maximum output value from the encoder as the **INPUT** value and the display value for this maximum output value as the **SCALE** value. For example a 16 bit encoder has an output of 0 to 65535. If you wish this to display 0 to 1500 over the full range of the encoder then set the **INPUT** value to 65535 and the **SCALE** value to 1500.

  The display value is calculated in the following manner:

$$\text{Display value} = \frac{\text{Value sent from encoder} \times \textbf{SCLE}}{\textbf{INPt}}$$

  Example: A 12 bit SSI encoder will give an output in the range 0 to 4095 (if only positive values are used). The display is to be scaled to show 0.0 to 359.9 over this 12 bit range. With 1 decimal point the **INPt** value could be set to **4095** and the **SCLE** value set to **359.9** to achieve this i.e. at one quarter output from the encoder (i.e. 1024) the display value is calculated from:

$$\text{Display value} = \frac{1024 \times 359.9}{4095}$$

  i.e. Display value = 90.0

- **U.CAL**

  This method allows selection of two point live input calibration and allows scaling without the need to calculate the required scaling from the SSI encoder/sensor data.

  The **CAL 1** and **CAL2** functions described below can then be used to scale the display. If required the **OFFSEt** function can be used to make an adjustment to add or subtract an offset value across the display range. The **CAL 1**, **CAL2** will only be seen if the **CAL OPEr** function is set to **U.SCL**.

  Setting the first calibration point To scale the display using this method get the encoder output to a known position and go to the **CAL 1** function. Press **F** then press ▲ to toggle to **YES** and press the **F** button again. The display will show a value based on the previous scaling. Press **F** and the display will show the message **SCLE CAL 1** followed by a value. Use the ▲ or ▼ pushbutton to set this to the value required for this first position then press **F** button. The display should show **CAL End** indicating that the first calibration point has been accepted.

  Setting the second calibration point Get the encoder output to a second known position and go to the **CAL2** function. Press **F** then press ▲ to toggle to **YES** and press the **F** button again. The display will show a value based on the previous scaling. Press **F** and the display will show the message **SCLE CAL2** followed by a value. Use the ▲ or ▼ pushbutton to set this to the value required for this first position then press **F** . The display should show **CAL End** indicating that the first calibration point has been accepted.

5.24 Input scale value

Section:	**INPUt**
Display:	**INPUt**
Range:	**0** to Maximum display value
Default Value:	**1**
Default Access Level	**CAL**
Function number	**4960**

When the **CAL OPEr** function is set to **SCALE** the **INPUt** factor and the **SCALE** factor are used to scale the display to read in engineering units e.g. metres. The **SCALE** value must always be a whole number, see **CAL OPEr** function for formula used.

5.25 Scale value

Section:	INPUT
Display:	SCALE
Range:	Any display value
Default Value:	1
Default Access Level	CAL
Function number	49E 1

When the CAL OPER function is set to F.SCLE the INPUT factor and the SCALE factor are used to scale the display to read in engineering units e.g. metres. The SCALE value must always be a whole number, see CAL OPER function for formula used.

5.26 Timeout

Section:	INPUT
Display:	t.OUt
Range:	OFF or On
Default Value:	On
Default Access Level	CAL
Function number	49F0

This function allows a display timeout visual and/or alarm warning that the input signal has failed. If set to On the display will flash the message t.out if the input signal fails. If the AL 1 to AL 8 tout function is also set to On the selected alarm or alarms will also activate along with any relays allocated to these alarms when the input signal fails.

5.27 Slave display

Section:	INPUT
Display:	SLAVE
Range:	OFF or On
Default Value:	OFF
Default Access Level	CAL
Function number	49EF

When set to On the display will act as a slave display and may be connected to a master PM5-SSI or LD5-SSI display. When used as a slave display the clock output from the unit is turned off and the clock and data line from the master are connected to the slave.

5.28 Dual read

Section:	INPUT
Display:	duAL rEAd
Range:	OFF or On
Default Value:	OFF
Default Access Level	CAL
Function number	49EE

Some SSI encoders have the ability to double send the position value. If this duAL rEAd function is set to On the display will read the value twice and if there is a miss match in the readings it will trigger an error message of dAtA Err on the display.

5.29 Uncalibrate

Section:	INPUT
Display:	Un.CAL
Range:	n/a
Default Value:	n/a
Default Access Level	CAL
Function number	0620

When the CAL OPER is set to the U.SCL mode the display scaling can be cleared (i.e. reset) at this function. To clear the scaling at this function press the F button then use the ▲ button to toggle to YES. The display should show the message Un.CAL End and the scaling the scaling will revert to revert to a 1:1 equivalent i.e. the raw output value from the encoder.

5.30 First calibration point

Section:	INPUT
Display:	CAL 1
Range:	n/a
Default Value:	n/a
Default Access Level	CAL
Function number	0600

Allows entry of a first calibration scaling point when the CAL OPER function is set to U.SCL. Refer to the CAL OPER function for details of this method of scaling.

5.31 Second calibration point

Section:	INPUT
Display:	CAL 2
Range:	n/a
Default Value:	n/a
Default Access Level	CAL
Function number	0610

Allows entry of a second calibration scaling point when the CAL OPER function is set to U.SCL. Refer to the CAL OPER function for details of this method of scaling.

5.32 Set zero

Section:	INPUT
Display:	SET ZERO
Range:	n/a
Default Value:	n/a
Default Access Level	CAL
Function number	0640

Only seen if the INPUT CAL OPER function is set to U.CAL. This function allows an alternative method of zeroing the display. To zero the display press F then press ▲ to toggle to YES and press the F button again, the display will now show the current display value (the value which will become zero if the process is completed). Press F to continue, the display should show the message ZERO End to indicate that the zero operation has been completed.

5.33 Display scale offset

Section:	INPUT
Display:	OFFSET
Range:	n/a
Default Value:	n/a
Default Access Level	CAL
Function number	0660

Only seen if the INPUT CAL OPER function is set to U.CAL. This function allows an offset scaling to be undertaken. For example if the display is reading a value of 5 low across the entire scale an offset scaling can be used to adjust the reading. To perform an offset scaling at the OFFSET function press the F button then use the ▲ button to toggle to YES, the display will then show the current value. Press the F button again, the display value will flash and can be adjusted to show the new required value using the ▲ and ▼ pushbuttons. When the new required value is on the display press F again, the display should show the message OFSt End to indicate that the offset scaling is complete.

5.34 Clear zero

Section:	INPUT
Display:	CLEAr 2Er0
Range:	n/a
Default Value:	n/a
Default Access Level	CAL
Function number	49E8

When the INPUT CAL OPER function is set to F.SCL this clear zero function allows clearing of any zero operation undertaken e.g. display zero through the P button zero operation or a remote input zero. To clear the zero and reset to press F then press ▲ to toggle to YES and press the F button again. This function does not work if the INPUT CAL OPER function is set to U.CAL.

5.35 Output voltage selection

Section:	P.Out
Display:	P.Out
Range:	5U, 12U
Default Value:	5U
Default Access Level	4
Function number	4d 1d

Allows selection of the output voltage where available on the input board at terminal 17. 5V or 12V (25mA max.) is available as transmitter supply this function allow selection of 5V (5U) or 12V (12U). Transmitter supply voltages are approximate.

5.36 Display brighness

Section:	d. SP
Display:	br9t
Range:	1 to 16
Default Value:	16
Default Access Level	2
Function number	22F6

Displays and sets the dulled digital display brightness. The display brightness is selectable from 1 to 16, where 1 = 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. See also the dull function.

To set brightness level go to the brgt function press F and when you see a digit of the value flash use the ▲ or ▼ push buttons to set the required value then press F to accept this selection.

5.37 Dimmed display brighness

Section:	diSP
Display:	dull
Range:	0 to 16
Default Value:	2
Default Access Level	2
Function number	22EC

Displays and sets the level for remote input brightness switching. When a remote input is set to dull the remote input can be used to switch between the display brightness level set by the brgt function and the dimmed display brightness set by the dull function. The display dull level is selectable from 0 to 16, where 0 = lowest intensity and 16 = highest intensity. This function is useful in reducing glare when the display needs to be viewed in both light and dark ambient light levels.

5.38 Serial operation mode

Section:	SEri
Display:	OPEr
Range:	nonE, Cont, Poll, A.bus, diSP or n.bus
Default Value:	nonE
Default Access Level	4
Function number	4480

Allows selection of the operating mode to be used for serial RS232 or RS485 communications. See the "PM5 Panel Meter Optional Output Addendum" Choices are:

- nonE - no serial comms. required.
- Cont - sends ASCII form of display data at a rate typically 90% of the sample rate.
- Poll - controlled by computer or PLC etc. as host. The host sends command via RS232/485 and instrument responds as requested.
- A.bus - this is a special communications mode used with Windows compatible optional PC download software. Refer to the user manual supplied with this optional software.
- diSP - sends image data from the display without conversion to ASCII. This mode should only be used when the serial output is connected to another display from the same manufacturer.
- n.bus - Modbus RTU.

5.39 Serial baud rate

Section:	SEri
Display:	bAud
Range:	1200, 2400, 4800, 9600, 19.2, 38.4, 57.6, 115.2
Default Value:	9600
Default Access Level	4
Function number	4484

Allows the baud rate to be set for serial communications. Choices are:

1200.2400.4800.9600. 19200.38400.57600 or 115200

5.40 Serial parity

Section:	SEri
Display:	PrtY
Range:	8NONE, 8EVEN, 8Odd, 7EVEN, 7Odd
Default Value:	8N
Default Access Level	4
Function number	4482

Allows selection of the parity check. The parity check selected should match that of the device it is being communicated with.

5.41 Serial address

Section:	SEri
Display:	Unit Addr
Range:	1 to 127
Default Value:	1
Default Access Level	4
Function number	0430

Allows selection of the unit address when the operation is set for POLL mode. The unit address is offset by 32(DECIMAL) to avoid clashing with ACSII special characters, therefore 42 (DECIMAL) or 2A (HEX) would be unit address 10.

5.42 Front P button operation mode

Section:	FunP
Display:	P.but
Range:	NONE, P.Hi , P.Lo, Hi .Lo, AL.Ac, ZERO
Default Value:	NONE
Default Access Level	4
Function number	4720

Sets the operation mode for front P button. Functions available are identical to the same functions used in the Fun1 function.

5.43 Remote input 1 operation mode

Section:	r.1 nP
Display:	r.1 n. 1
Range:	nonE, P.Hol d, d.Hol d, P.H, , P.Lo, H, .Lo, AL.Ac, ACCSS, dul l , 2Er0
Default Value:	nonE
Default Access Level	r.1 n. 1
Function number	4721

Sets the operation mode for remote input 1 terminal at the rear of the instrument. Choices are as follows:

- **nonE** - If this option is selected then remote input 1 will have no function.
- **P.Hol d** - peak hold. The display will show the peak 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.Hol d** - display hold. The 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.
- **P.H,** - peak memory. The 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.
- **P.Lo** - valley memory. The minimum value stored in memory will be displayed. Otherwise operates in the same manner as the **P.H,** function described above.
- **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. **P.H,** or **P.Lo** will flash before each display to give an indication of display type.
- **AI .Ac** - alarm acknowledge. Allows the remote input to be used to acknowledge a latching alarm. See the **LAtch** and **Ac K** functions.
- **ACCSS** - remote input access. Allows the remote input to be used for access control purposes. See the function.
- **dul l** - 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 **dul l** function.
- **2Er0** - display zero. Zeroes the display when the remote input is activated. Note that the zero is not lost when power is removed (i.e. this is not the same as a tare function) and the display will zero as soon as the remote input is shorted.

5.44 Remote input 2 operation mode

Section:	rI nP
Display:	rI n.2
Range:	nonE, P.Hol d, d.Hol d, P.H , P.Lo, H .Lo, AL.Ac, ACCSS, dul I , 2Er0
Default Value:	nonE
Default Access Level	4
Function number	4722

Sets the operation mode for remote input 2 terminal at the rear of the instrument and has the same choices as remote input one. See rI n. 1 function for full description.

5.45 Easy access mode

Section:	ACCES
Display:	EASY LEVEL
Range:	nonE, 1, 2, 3, 4, 5, 6, CAL
Default Value:	nonE
Default Access Level	5.CAL
Function number	0C00

Allows choice of the access level available when using the easy access method. For example if this function is set to 3 then functions with levels 1, 2 and 3 can be viewed and changed when access to setup functions is made using this method. To access setup functions using the easy access method press and hold the F button until the message FUNC is seen followed by the first function message, this should take approximately 3 seconds. If the message FUNC End or no response is seen at this point it means that the access level has been set to nonE and that access to setup functions has been refused.

5.46 Remote input access mode

Section:	ACCES
Display:	rI nPut LEVEL
Range:	nonE, 1, 2, 3, 4, 5, 6, CAL
Default Value:	nonE
Default Access Level	5.CAL
Function number	0C01

This function allows choice of the access level available when using the remote input access method. To access setup functions using the remote input access method one of the remote inputs must be set to ACCSS and the chosen remote input must be shorted to ground. Press and hold the F button until the message FUNC is seen followed by the first function message, this should take approximately 3 seconds. If the message FUNC End is seen at this point it means that the access level has been set to nonE.

5.47 PIN code 1

Section:	ACCES
Display:	USr. 1 P, n
Range:	0 to 50000
Default Value:	0
Default Access Level	5.CAL
Function number	0C09

This function allows choice of the PIN code to be used for PIN code input access method. Associated

with the PIN is an access level (see **P1 n. 1AccS**). If a PIN is not required leave the setting at **0**. If a PIN other than 0 is chosen then this PIN must be entered to gain access to the the selected level.

To access setup functions using the PIN code input access method press then release the **F** button then within 2 seconds press the ▲ and ▼ buttons at the same time. The message **FUNC** is seen followed by the message **CodE**. If the message **FUNC End** is seen at this point it means that the access level has been set to **NonE**. Use the ▲ and ▼ buttons to enter the PIN then press **F** to accept the PIN and proceed to the setup functions.

5.48 PIN code 1 access level

Section:	**ACCES**
Display:	**USr.1 LEVEL**
Range:	**NONE**, **1**, **2**, **3**, **4**, **5**, **6**, **CAL**
Default Value:	**NONE**
Default Access Level	**5.CAL**
Function number	**0C02**

This function allows choice of the access level available when using the PIN code 1 input access method. To access setup functions using the PIN code 1 input access method press and hold the **F** button until the message **FUNC** is seen followed by the first function message, this should take approximately 3 seconds. If the message **FUNC End** is seen at this point it means that the access level has been set to **NonE**.

5.49 PIN code 2

Section:	**ACCES**
Display:	**USr.2 P1 n**
Range:	**0** to **50000**
Default Value:	**0**
Default Access Level	**5.CAL**
Function number	**0C0A**

This function allows choice of a second PIN code to be used for PIN code input access method. Associated with the PIN is an access level (see **P1 n.2AccS**). The second PIN would normally be used to allow a second person to have a higher access to setup functions via a different PIN. If a second PIN is not required leave the setting at **0**. If a PIN other than 0 is chosen then this PIN must be entered to gain access to the the selected level.

To access setup functions using the PIN code input access method press then release the **F** button then within 2 seconds press the ▲ and ▼ buttons at the same time. The message **FUNC** is seen followed by the message **CodE**. If the message **FUNC End** is seen at this point it means that the access level has been set to **NonE**. Use the ▲ and ▼ buttons to enter the PIN then press **F** to accept the PIN and proceed to the setup functions. Ony one **CodE** message will appear even though there can be a second PIN. If the number entered into the **CodE** at this point is the PIN code 1 number then access will be granted to the functions allocated to the first PIN. If the PIN code 2 value is entered then access will be granted to the functions allocated to the second PIN.

5.50 PIN code 2 access level

Section:	ACCES
Display:	USr.2 LEVEL
Range:	NONE, 1, 2, 3, 4, 5, 6, CAL
Default Value:	NONE
Default Access Level	5.CAL
Function number	0C03

This function allows choice of the access level available when using the PIN code 2 input access method. To access setup functions using the PIN code 2 input access method press and hold the F button until the message FUNC is seen followed by the first function message, this should take approximately 3 seconds. If the message FUNC End is seen at this point it means that the access level has been set to NonE.

5.51 User assignable access 1 function number

Section:	ACCES
Display:	Fn. 1 CodE
Range:	0000 to FFFF hex.
Default Value:	0000
Default Access Level	5.CAL
Function number	0C 10

In addition to being assigned an access level each setup function is assigned an individual function number. This functions and the ones which follow (Fn.2 CodE etc.) can be used to alter the access level for particular functions. For example if the user wishes to change the access level of the channel 1 display units (function number 43A0) from level 5 to level 1 then the value 43A0 would be entered at this function and the value 3 would be entered at the function which follows. This would then enable the channel 1 display unit functions to be accessed at the lowest access level.

5.52 User assignable access 1 level value

Section:	ACCES
Display:	Fn. 1 LEVEL
Range:	dFLt, 1, 2, 3, 4, 5, 6, CAL, 5.CAL
Default Value:	dFLt
Default Access Level	5.CAL
Function number	0C40

Allows a new access level for the function with the number set in the function to be chosen. If dFLt is chosen then the level reverts back to the original default level.

5.53 User assignable access 2 function number

Section:	ACCES
Display:	Fn.2 CodE
Range:	0000 to FFFF hex.
Default Value:	0000
Default Access Level	5.CAL
Function number	0C11

This function allows as second function access change and operates in the same manner as . Enter the function number required and then enter the new access level at the function which follows.

5.54 User assignable access 2 level value

Section:	ACCES
Display:	Fn.2 LEVEL
Range:	dFlt, 1, 2, 3, 4, 5, 6, CAL, S.CAL
Default Value:	dFlt
Default Access Level	S.CAL
Function number	OC41

Allows a new access level for the function with the number set in the function to be chosen. If dFlt is chosen then the level reverts back to the original default level.

5.55 User assignable access 3 function number

Section:	ACCES
Display:	Fn.3 CodE
Range:	0000 to FFFF hex.
Default Value:	0000
Default Access Level	S.CAL
Function number	OC 12

This function allows as third function access change and operates in the same manner as . Enter the function number required and then enter the new access level at the function which follows.

5.56 User assignable access 3 level value

Section:	ACCES
Display:	Fn.3 LEVEL
Range:	dFlt, 1, 2, 3, 4, 5, 6, CAL, S.CAL
Default Value:	dFlt
Default Access Level	S.CAL
Function number	OC42

Allows a new access level for the function with the number set in the function to be chosen. If dFlt is chosen then the level reverts back to the original default level.

5.57 User assignable access 4 function number

Section:	ACCES
Display:	Fn.4 CodE
Range:	0000 to FFFF hex.
Default Value:	0000
Default Access Level	S.CAL
Function number	OC 13

This function allows as fourth function access change and operates in the same manner as . Enter the function number required and then enter the new access level at the function which follows.

5.58 User assignable access 4 level value

Section:	ACCES
Display:	Fn.4 LEVEL
Range:	dFlt, 1, 2, 3, 4, 5, 6, CAL, S.CAL
Default Value:	dFlt
Default Access Level	S.CAL
Function number	0C43

Allows a new access level for the function with the number set in the function to be chosen. If dFlt is chosen then the level reverts back to the original default level.

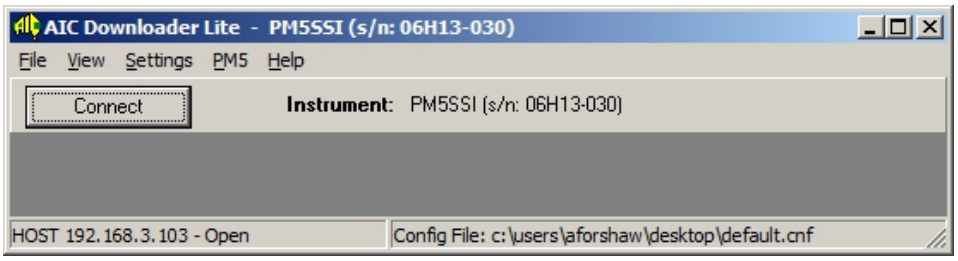
5.59 Error Messages

- t.Out - This message indicates a timeout error i.e. no valid data received. If the tout function is set to On then the timeout error will trigger the relay selected.
- dAtA - This message indicates a data error.
- -d.or- - overrange message - This indicates that the value to be displayed has too many digits to be displayed e.g. you cannot display 199999 on a 5 digit display.
- -d.ur- - underrange message - This indicates that the value to be displayed is too large a negative number to be displayed.
- Init FF02 - this message indicates that the power has been cycled on and off too quickly i.e. switched off then on again quickly. The display will normally recover from this on its own and proceed to normal operation.

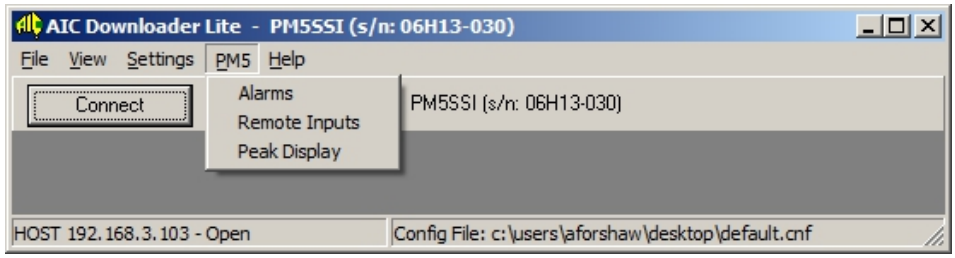
6 PC/Laptop software

Instruments fitted with internal datalogger memory will be supplied with software to communicate with the display and download data logs. A separate booklet will be provided with these models but a free software is available which will allow some operations including calibration and some configuration to be undertaken via PC or laptop. Contact the supplier of this instrument for software downloading instructions. The software is designed to be used intuitively but this chapter gives a basic guide.

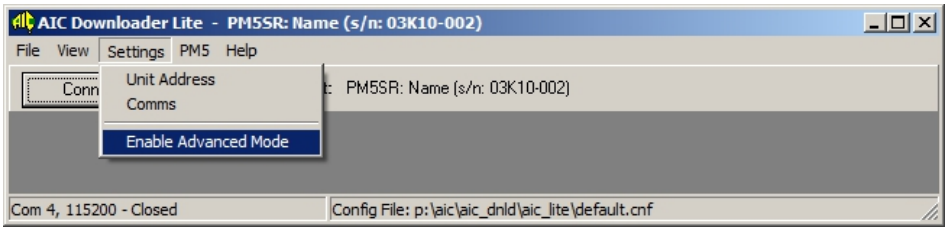
Once the software has been downloaded and run a main menu page as illustrated below will appear. With your LD5 connected via one of its standard or optional communication ports click on **Settings** then **Comms** to bring up the communications options menu and set as required. Alteration of configuration and calibration require the entry of a password, go to **Tools** then **Enter Password** to enter the password. The default password is **Password** but this can be changed at the window accessed via **View** then **Password Configuration**. A separate user guide will be provided if the optional full version of this software has been obtained.



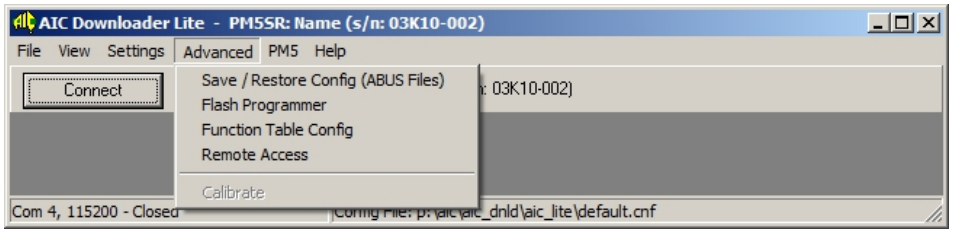
Software main menu



Some configuration options



To enable advanced operations hold “Ctrl” then click on **Settings** then click on **Enable Advanced Mode**



Some of the advanced operation options

7 Modbus RTU and TCP functions

When using Modbus RTU communications the instrument must be set up electrically for RS232 or RS485 communications and the **SEr1 OPEr** function must be set to **n.bu5**. For Ethernet communications Modbus TCP can be used. The maximum recommended baud rate for Modbus RS232 or RS485 operation is 9600. Functions 1 and 3 are available with register and address ranges as shown below:

Functions 1 and 3 register and address ranges

Func Code	Description	Register Range	Address Range
0x01	Read Coil Status	1 - 9999	0x0000 - 0x270E
0x03	Read Holding Registers	40001 - 49999	0x0000 - 0x270E

Modbus Function 1 - Read coil status
Reads the ON/OFF status of the relay coils. Broadcast is not supported. Relay addresses are offset by 1 e.g. relay 1 is addressed as 0, relay 2 is addressed as 1 etc. Logic 1 = ON, Logic 0 = OFF. To read the coil status a query is sent to the instrument, the instrument then responds to the query. An example of a query to read coils 1 to 8 from the instrument at address 2 is given below.

Field name	RTU Example(Hex)	TCP Example(Hex)
Transaction ID Hi	Not used	00
Transaction ID Lo	Not used	01
Protocol ID Hi	Not used	00
Protocol ID Lo	Not used	00
Message length Hi	Not used	00
Message length Lo	Not used	06
Unit address	02	02
Function	01	01
Starting address Hi	00	00
Starting address Lo	00	00
Number of points Hi	00	00
Number of points Lo	08	08
Error check (LRC or CRC)	– (e.g. 3d ff)	Not sent

In Modbus RTU this would be sent as 02 01 0000 0008 followed by the CRC e.g. 3dff
In Modbus TCP this would be sent as 0001 0000 0006 02 01 0000 0008
Transaction ID value increments by one each time a new transmission is sent in a session.
Protocol ID for Modbus TCP is always 0000

An example of a response is given below:

Field name	RTU Example(Hex)	TCP Example(Hex)
Transaction ID Hi	Not used	00
Transaction ID Lo	Not used	01
Protocol ID Hi	Not used	00
Protocol ID Lo	Not used	00
Message length Hi	Not used	00
Message length Lo	Not used	06
Unit address	02	02
Function	01	01
Byte count	01	01
Data (coils 8 to 1)	B6	B6
Error check (LRC or CRC)	–	Not used

The status of the relay coils is shown in the Data B6 (hex) or binary 10110110. Relay 1 is indicated by the least significant binary bit. The status of the relays is therefore:

Relay 1 - OFF, Relay 2 - ON, Relay 3 - ON, Relay 4 - OFF, Relay 5 - ON, Relay 6 - ON, Relay 7 - OFF and Relay 8 - ON.

Function 3 - Read holding registers

This function reads the binary contents of the holding registers in the instrument being addressed. The value for this function is stored as a 32 but two's compliment number in two 16 bit registers per channel. Note; a value of 32000 represents a positive overrange and -32000 a negative overrange.

Registers 4001 to 4008 are addressed as 0x0000 to 0x0007.

Registers 4009 to 4016 hold the alarm high values for relays 1 to 8. Note a value of 0x8000 means that the relay is set to OFF and has no high value. Registers 4009 to 4016 are addressed as 0x008 to 0x00f.

Registers 4017 to 4024 hold the alarm low values for relays 1 to 8. Note a value of 0x8000 means that the relay is set to OFF and has no low value. Registers 4017 to 4024 are addressed as 0x0010 to 0x0017.

Registers 4025 to 4032 represent the decimal point settings for channels 1 to 8. Registers 4025 to 4032 are addressed as 0x0018 to 0x0020.

An example of a query to read input channels 1 to 3 from an instrument at address 5 is given below.

Field name	RTU Example(Hex)	TCP Example(Hex)
Transaction ID Hi	Not used	00
Transaction ID Lo	Not used	01
Protocol ID Hi	Not used	00
Protocol ID Lo	Not used	00
Message length Hi	Not used	00
Message length Lo	Not used	06
Unit address	05	05
Function	03	05
Starting address Hi	00	00
Number of points Hi	00	00
Number of points Lo	03	03
Error check (LRC or CRC)	–	Not sent

Transaction ID value increments by one each time a new transmission is sent in a session.
Protocol ID for Modbus TCP is always 0000

An example of a response is given below:

Field name	**RTU Example(Hex)**	**TCP Example(Hex)**
Transaction ID Hi	Not used	00
Transaction ID Lo	Not used	01
Protocol ID Hi	Not used	00
Protocol ID Lo	Not used	00
Message length Hi	Not used	00
Message length Lo	Not used	06
Unit address	05	05
Function	03	03
Byte count	06	06
Data Hi(register 1)	00	00
Data Lo(register 1)	33	33
Data Hi(register 2)	00	00
Data Lo(register 2)	25	25
Data Hi(register 3)	00	00
Data Lo(register 3)	17	17
Error check (LRC or CRC)	–	Not used

The value of register 1 is 0033 Hex which is 51 Dec. The value of register 2 is 0025 Hex which is 37 Dec. The value of register 3 is 0017 Hex which is 23 Dec.

Modbus Register Table

Register	**Name**	**Data Type**	**Units**	**Func**	**Address**	**R/W**
1	Relay 1	1 bit		0x01	0x0000	R
2	Relay 2	1 bit		0x01	0x0001	R
3	Relay 3	1 bit		0x01	0x0002	R
4	Relay 4	1 bit		0x01	0x0003	R
5	Relay 5	1 bit		0x01	0x0004	R
6	Relay 6	1 bit		0x01	0x0005	R
7	Relay 7	1 bit		0x01	0x0006	R
8	Relay 8	1 bit		0x01	0x0007	R
40001/2	Display Value	32 bit Integer		0x03	0x0000, 0x0001	R
40003/4	Valley Memory	32 bit Integer		0x03	0x0002, 0x0003	R
40005/6	Peak Memory	32 bit Integer		0x03	0x0004, 0x0005	R
40007/8	Display Hold	32 bit Integer		0x03	0x0006, 0x0007	R
40025	Display Decimal	16 bit Integer		0x03	0x0018	R
40257/8	Alarm 1 High	32 bit Integer		0x03	0x0100, 0x0101	R
40259/60	Alarm 2 High	32 bit Integer		0x03	0x0102, 0x0103	R

Register	Name	Data Type	Units	Func	Address	R/W
40261/2	Alarm 3 High	32 bit Integer		0x03	0x0104, 0x0105	R
40263/4	Alarm 4 High	32 bit Integer		0x03	0x0106, 0x0107	R
40265/6	Alarm 5 High	32 bit Integer		0x03	0x0108, 0x0109	R
40267/8	Alarm 6 High	32 bit Integer		0x03	0x010a, 0x010b	R
40269/70	Alarm 7 High	32 bit Integer		0x03	0x010c, 0x010d	R
40271/2	Alarm 8 High	32 bit Integer		0x03	0x010e, 0x010f	R
40273/4	Alarm 1 Low	32 bit Integer		0x03	0x0110, 0x0111	R
40275/6	Alarm 2 Low	32 bit Integer		0x03	0x0112, 0x0113	R
40277/8	Alarm 3 Low	32 bit Integer		0x03	0x0114, 0x0115	R
40279/80	Alarm 4 Low	32 bit Integer		0x03	0x0116, 0x0117	R
40281/2	Alarm 5 Low	32 bit Integer		0x03	0x0118, 0x0119	R
40283/4	Alarm 6 Low	32 bit Integer		0x03	0x011a, 0x011b	R
40285/6	Alarm 7 Low	32 bit Integer		0x03	0x011c, 0x011d	R
40287/8	Alarm 8 Low	32 bit Integer		0x03	0x011e, 0x011f	R
40289	Alarm 1 Decimal	16 bit Integer		0x03	0x0120	R
40290	Alarm 2 Decimal	16 bit Integer		0x03	0x0121	R
40291	Alarm 3 Decimal	16 bit Integer		0x03	0x0122	R
40292	Alarm 4 Decimal	16 bit Integer		0x03	0x0123	R
40293	Alarm 5 Decimal	16 bit Integer		0x03	0x0124	R
40294	Alarm 6 Decimal	16 bit Integer		0x03	0x0125	R
40295	Alarm 7 Decimal	16 bit Integer		0x03	0x0126	R
40296	Alarm 8 Decimal	16 bit Integer		0x03	0x0127	R

8 Specifications

8.1 Technical specifications

Input :	Synchronous Serial Interface (SSI) selectable as binary or Gray code (up to 32 bits)
SSI Clock frequency	140kHz
Microprocessor:	HC68HC11 CMOS
Ambient temperature:	LED -10 to 60^o C, LCD -10 to 50^o 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 LCD Models: 4 digit 12.7mm, 6 digit 12.7mm
Power Supply:	AC 240V, 110V or 24V 50/60Hz or DC isolated wide range 12 to 48V. Note: supply type is factory configured.
Power Consumption:	AC supply 4 VA max, DC supply typically 80mA at 12VDC and 40mA at 24VDC for PM5 with no optional outputs, actual current drawn depends on display type and options fitted
Output (standard):	1 x relay, Form A, rated 5A resistive 5V or 12VDC transmitter supply 25mA max on terminal 17
Relay Action:	Programmable N.O. or N.C

8.2 Optional outputs - available in certain combinations

Extra Relays:	Available as one, two, three or six extra relays.
Analog Retransmission:	12 bit isolated 4 to 20mA, or 16 bit 4 to 20mA 0 to 1V or 0 to 10V (single or dual analog output versions available). (4-20mA will drive into resistive loads of up to 800Ω)
Serial Communications:	Isolated RS232 or RS485 (ASCII)
Ethernet:	Ethernet plus RS485 and RS232 (Both RS232 or RS485 but only one at a time can be used)
Datalogger:	Internal 8MB data logger memory available with Ethernet option
Digital output:	16 bit NPN or PNP versions available
Excitation:	Isolated 24V (+/-12VDC) supply at 20mA max.

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^2 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 two years from the date of dispatch.

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

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

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

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

This product is designed and manufactured in Australia.