Model PM5-CO
Single or Dual Input
Conductivity/Resistivity/ppm
Panel Mount Display/Controller
Quick Reference Guide

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

Table of Contents

1 Introduction

This quick reference guide contains basic information for the installation and operation of the single or dual input PM5 Conductivity /Resistivity/ppm Monitor. The complete instruction manual for this instrument can be downloaded from www.aicpl.com.au.

Inputs are provided for one two or 3 wire or two 2 wire temperature sensors for automatic temperature compensation. The PM5 can accept 100Ω RTD (Pt100) or 1000Ω RTD (Pt1000) type temperature sensors for automatic temperature compensation or the temperature can be manually set. The default display can be set to either resistivity, conductivity, ppm or percent rejection. The display will toggle between temperature/conductivity or temperature/resistivity or temperature/ppm or temperature/percent rejection indication by pressing either the ▲ or ▼ button. The conductivity display units can be set to show either milliSiemens per metre, milliSiemens per centimetre, microSiemens per metre or microSiemens per centimetre. The resistivity display is in MΩ. The TDS display is in PPM.

The default display can be set to either resistivity or conductivity, the display will toggle between channel 1, channel 2, percent rejection and temperature indication by pressing either the ▲ or ▼ button. The default display is channel 1, the instrument will revert to this display after switch on and will automatically revert to channel 1 after approx. 1 minute if the display has been toggled to a different value. When a display other than channel 1 is viewed a message will flash approximately every 8 seconds to indicate what value is being displayed e.g. Ch2 will flash prior to channel 2 reading, Pcnt prior to percent rejection and °C prior to the temperature. The conductivity display units can be set to show either milliSiemens per metre, milliSiemens per centimetre, microSiemens per metre or microSiemens per centimetre. The resistivity display is in MΩ. The percent rejection display requires that channel 2 is the inlet channel and channel 1 is the outlet channel.

Calibration, setpoint and other set up functions are easily achieved by push buttons (located at the rear panel and/or front panel depending on model). A standard inbuilt relay provides an alarm/control function, additional relays, retransmission and DC output voltage may also be provided. Unless otherwise specified at the time of order, your PM5 has been factory set to a standard configuration. Like all other PM5 series instruments the configuration and calibration are easily changed by the user.

Full electrical isolation between power supply, conductivity/resistivity cell and retransmission output is provided by the PM5, thereby eliminating grounding and common voltage problems. This isolation feature makes the PM5 ideal for interfacing to computers, PLCs and other data acquisition devices.

The PM5 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. LED models are available in 4 digit (20mm), 5 digit (14.2mm) with keypad, 6 digit (14.2mm) with keypad, and 20 segment bar graph with 5 digit (7.6mm) versions. LCD models are available in 4 digit (12.7mm) and 6 digit (12.7mm) versions.

1.1 Setup function access levels

Each setup function is assigned a default access level number from 1 to CAL. Three access methods are available. For two of these access levels the user can choose the required access level and then add or remove up to 16 functions to this access level. Level 1 access is by default empty but functions can be allocated to this level if required. For example if relay 1 high alarm and relay 1

hysteresis were the only functions required for regular access then these could both be allocated to level 1 and access method 1 or 2 below set to allow access to level 1.

The default access levels are shown in the following function table. Refer to the main “Operation and Instruction Manual” for a full table showing function numbers.

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

1.3 Accessing setup functions

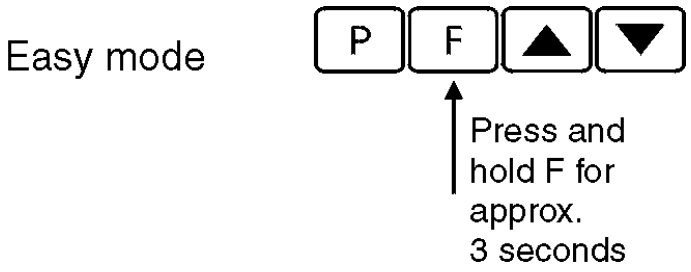
The setup functions allow adjustment of the instruments operation functions. There are five different ways of accessing setup functions. Each mode allows a selection of access levels i.e. allows some choice of which functions are accessible.

As as summary the methods available are:

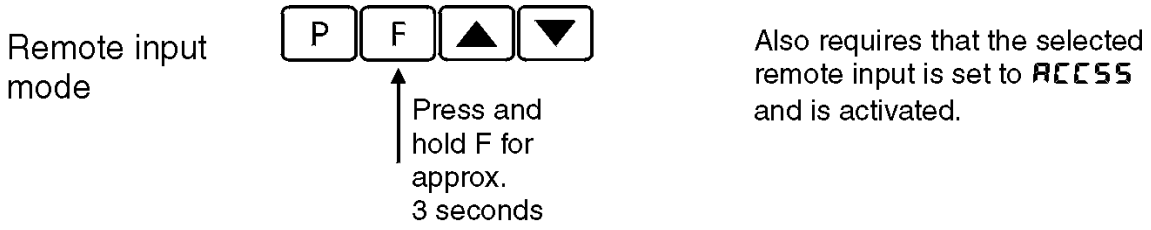
- **Easy mode** - this is the easiest access mode simply requiring the **F** button to be pressed for 3 seconds. This mode would normally be used to gain access to functions which require frequent adjustment.
- **Remote input mode** - this uses the Easy method of access but also requires the use of a 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.

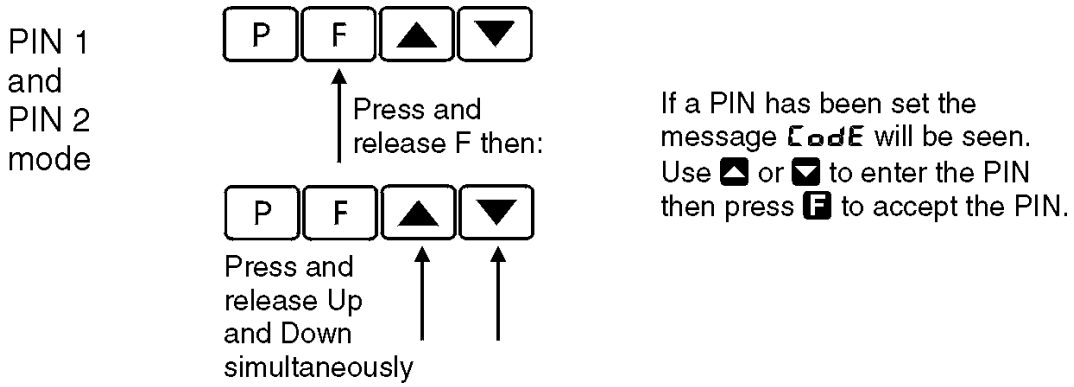
- **Easy mode** - Allows access to the level set by the **EASY LEVEL** function in the **ACCES** menu. By default the Easy access is set to **NONE** which blocks access to all setup functions. To allow access to functions using this method choose the access level required at the **EASY LEVEL** function.
  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 nPt LEVEL** function in the **ACCES** 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.

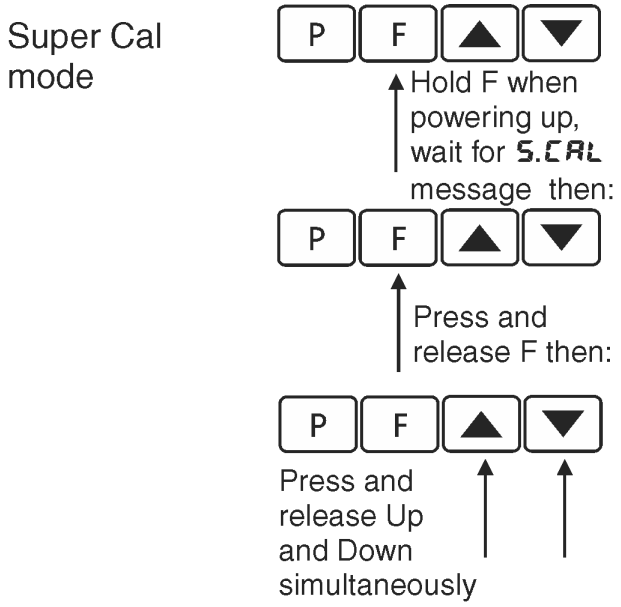


- **PIN 1 mode** - Allows access to the level set by the **USr. 1 LEVEL** function in the **ACCES** menu.
  The PIN 1 mode requires the **F** button is pressed and released then within 2 seconds press the **▲** and **▼** buttons at the same time. The PIN can be set via the **USr. 1 PIn** function in the **ACCES** 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 PIn** 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.



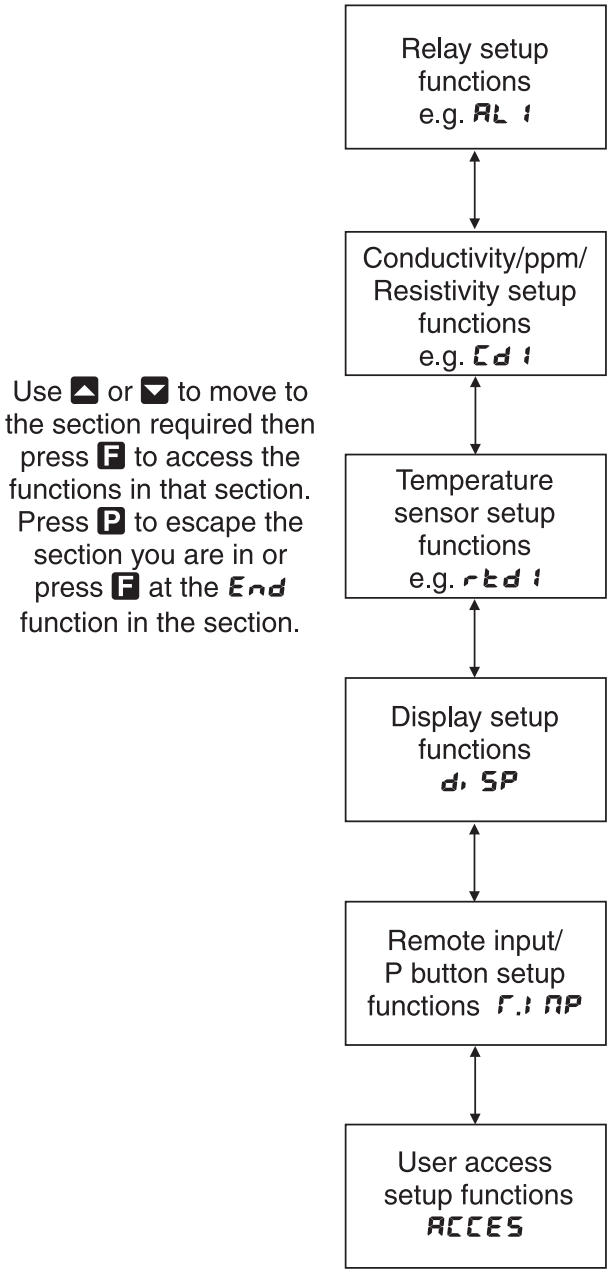
- **PIN 2 mode** - Allows access to the level set by the USr.2 LEUEL function in the ACCES menu.
  This method uses the same access method as PIN 1 mode above. A USr.2 P1n setting of 0 disables the PIN. If the USr.1 LEUEL or a USr.2 P1n function has been set to a number other than 0 then the first function 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 LEUEL function or enter the USr.2 P1n PIN to gain access to the level set at the USr.2 LEUEL 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.

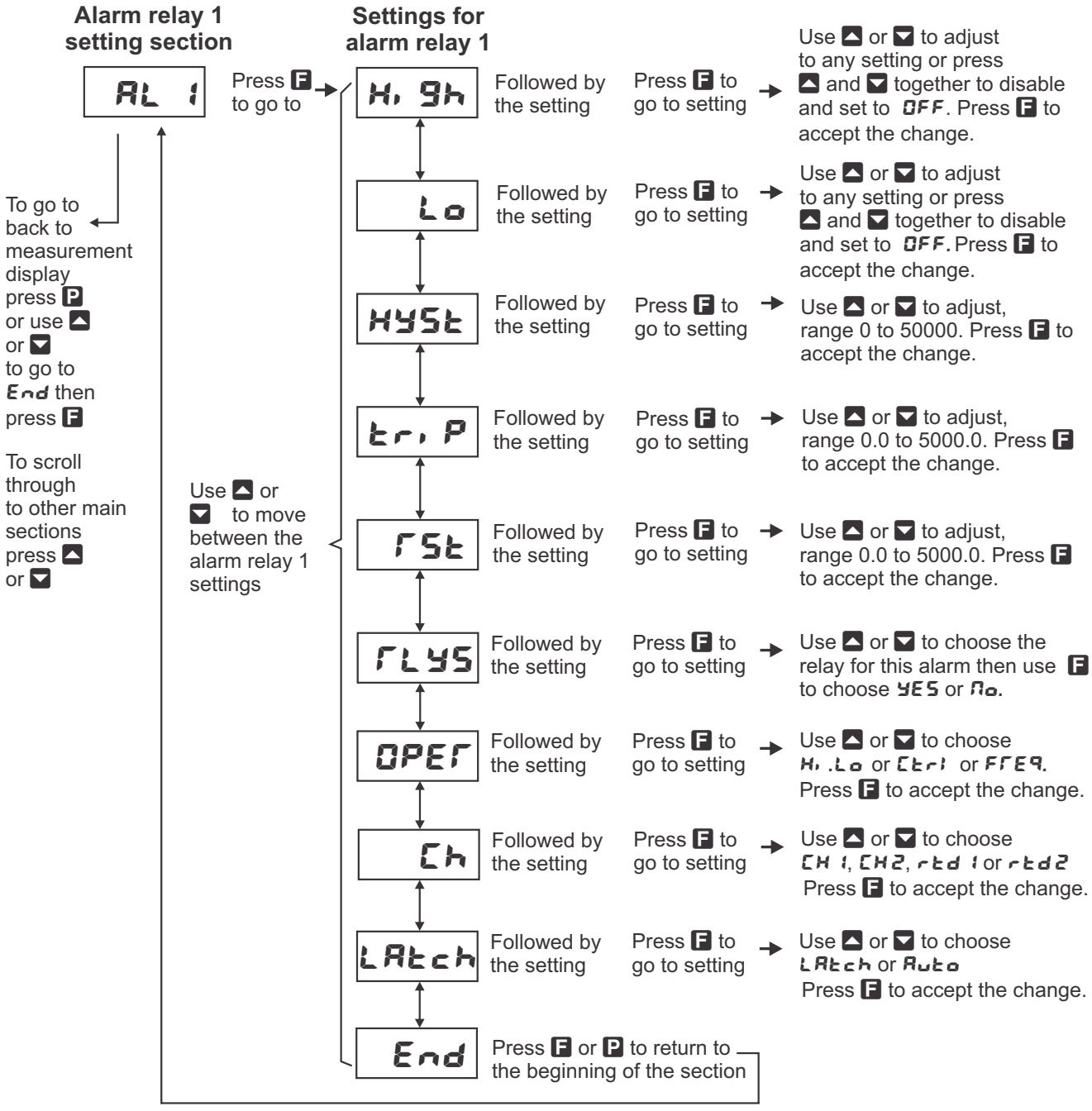


The setup functions are organised in blocks or sections e.g. all the settings for relay 1 are in the AL 1 section. Once access to setup functions has been gained use the ▲ and ▼ buttons to select the section required then press F to enter this section and again us the ▲ and ▼ buttons to select the required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



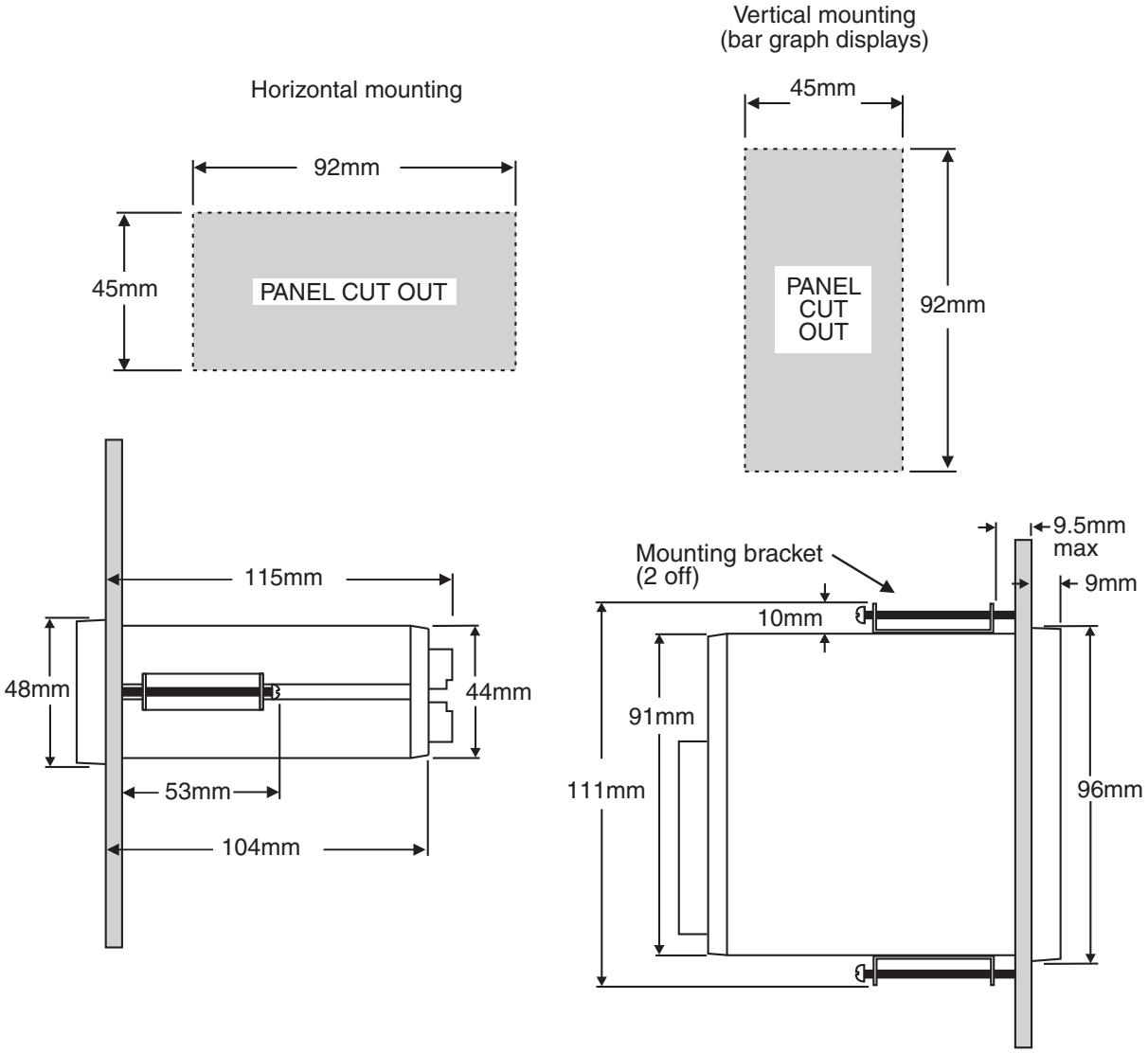
The example in the flowchart below shows the method using alarm relay 1 setup function.



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 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

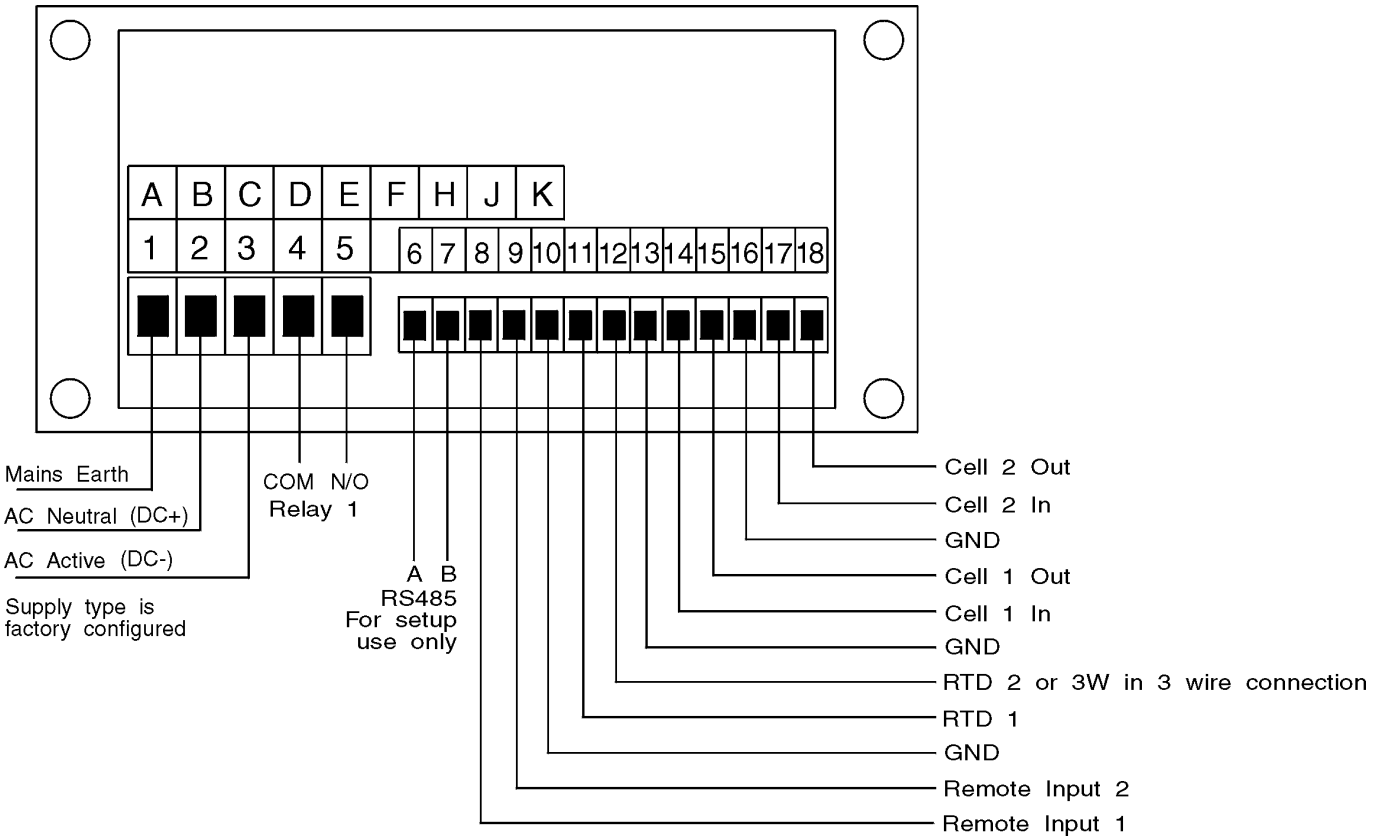
The PM5 Panel Meter is designed for continuous operation and no power switch is fitted to the unit. It is recommended that an external switch and fuse be provided to allow the unit to be removed for servicing.

The plug in, screw type, terminal blocks allow for wires of up to 2.5mm^2 for power, relays and optional outputs and 1mm^2 for sensor and other wiring 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.

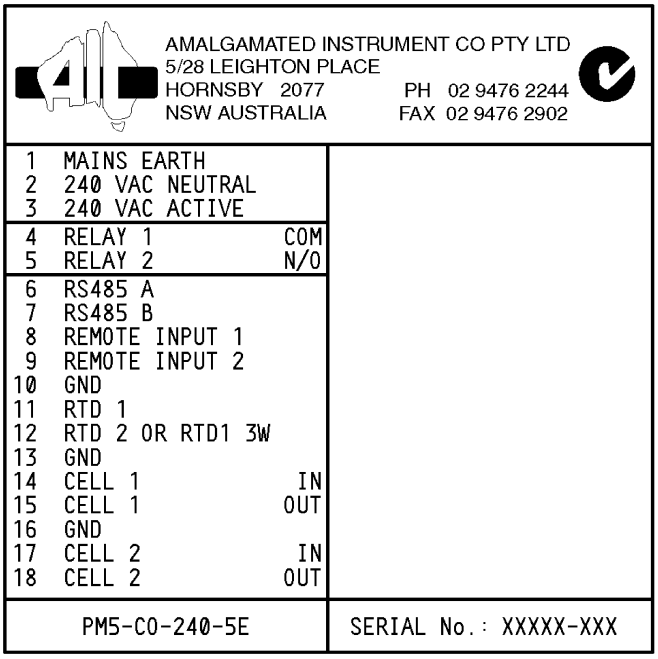
When power is applied the instrument will cycle through a display sequence indicating the software version and other status information, this indicates that the instrument is functioning. Acknowledgement of correct operation may be obtained by applying an appropriate input to the instrument and observing the reading. The use of screened cable is recommended for signal inputs.

For connection details of optional outputs refer to the separate "PM5 Panel Meter Optional Output Addendum" booklet supplied when options are fitted.

Rear panel connections



Instrument label (example)



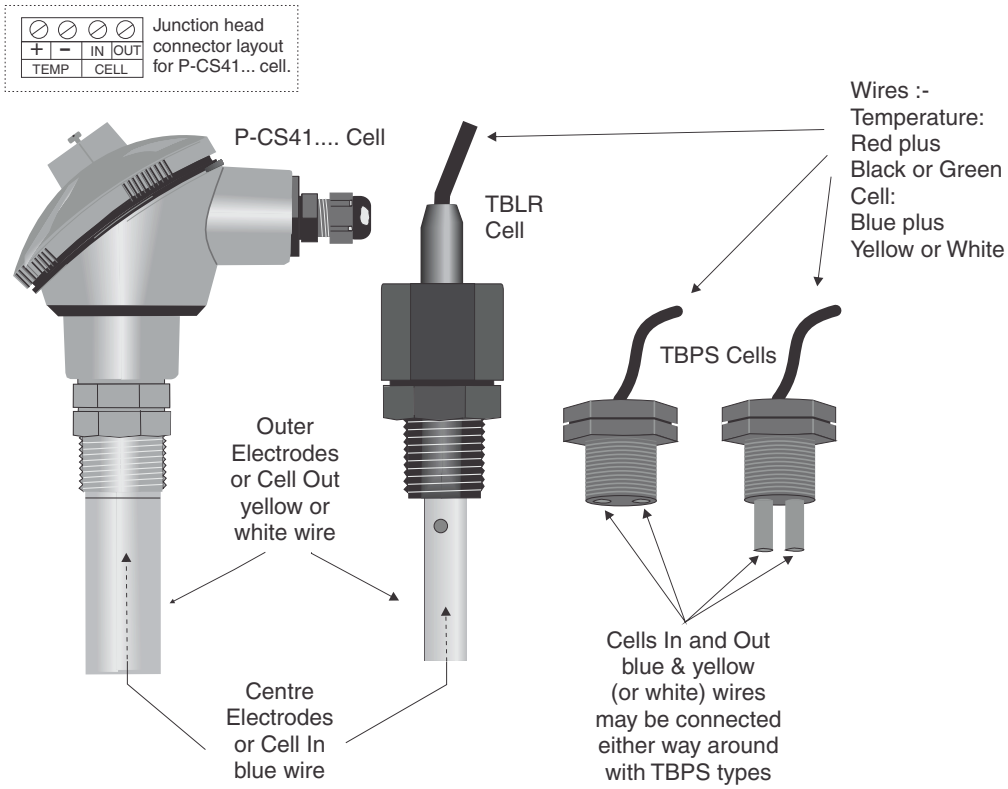
3.2 Electrical connection examples

If output options are fitted refer to the "PM5 Panel Meter Optional Output Addendum" booklet for connection details.

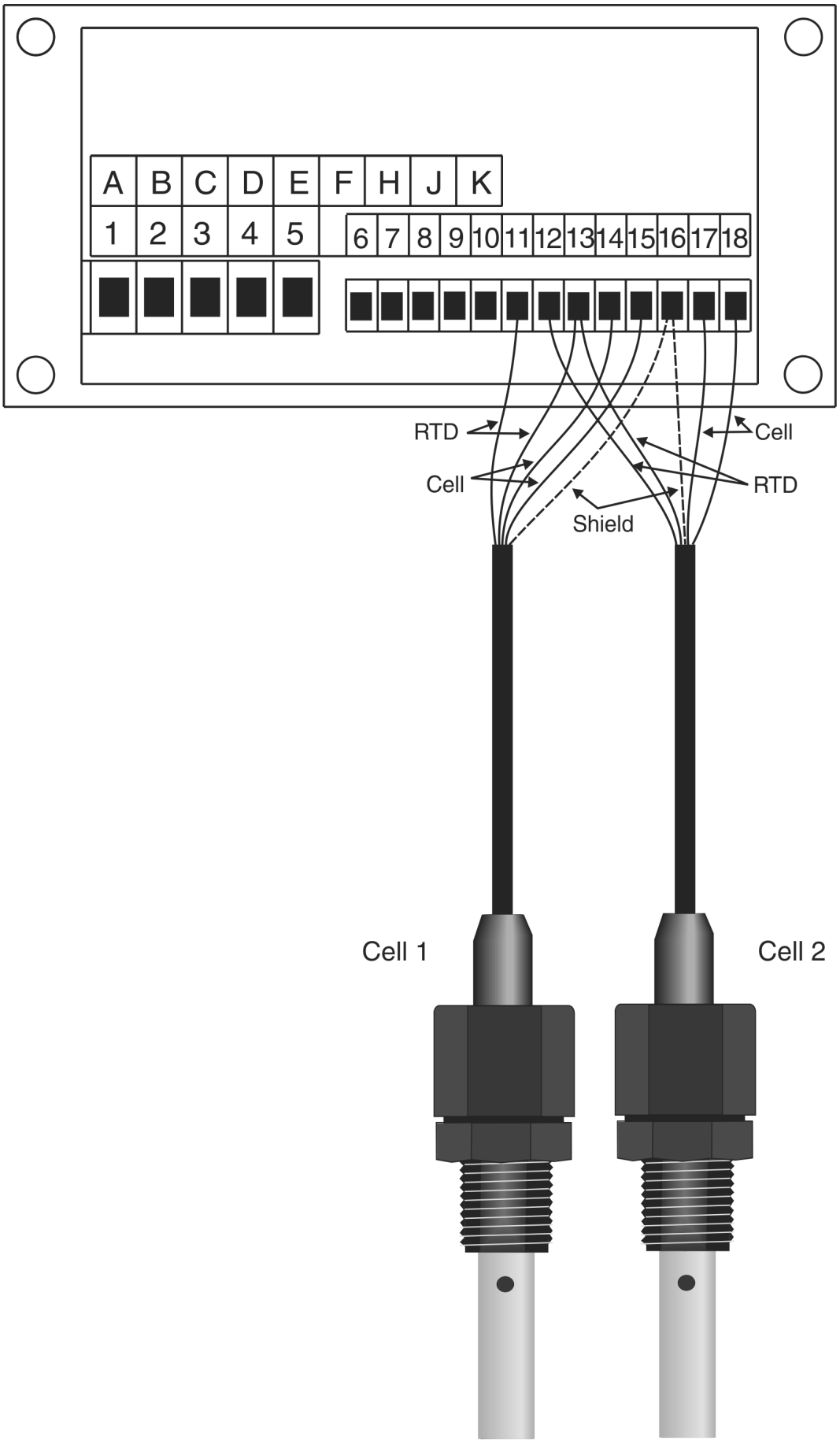
Conductivity/Resistivity/ppm Cells - Ensure that the **PrbE CnSt** function has been correctly set for probe type. AIC cells with temperature compensation sensors are all wired with Red, Black, Blue and Yellow (or White on older models) inner core cable. See the note below for details of TBPS cells without temperature compensation sensors.

The wiring connections are as below.

Cell wiring colour codes		
	AIC cells	**SDI cells**
Cell in	Blue	Black
Cell out	Yellow (or White)	White
Temperature +	Red	Red
Temperature -	Green (or Black)	Green
Shield	n/a	Clear


+ −
IN OUT
TEMP CELL
Junction head connector layout for P-CS41... cell.
P-CS41.... Cell
TBLR Cell
Wires :-
Temperature:
Red plus
Black or Green
Cell:
Blue plus
Yellow or White
TBPS Cells
Outer Electrodes or Cell Out yellow or white wire
Centre Electrodes or Cell In blue wire
Cells In and Out blue & yellow (or white) wires may be connected either way around with TBPS types

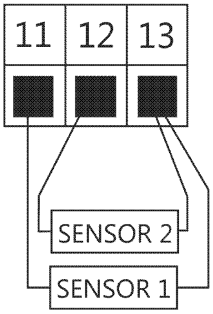
3.3 Conductivity cell and temperature sensor wiring example



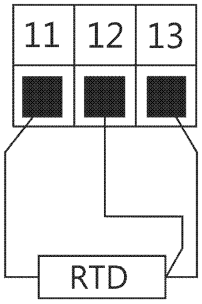
3.4 Temperature sensor - in most cases the temperature sensor is housed in the conductivity cell

If only one temperature sensor input is used then this temperature input will be used as the temperature compensation value for both channels. If two temperature sensor inputs are used then temperature sensor 1 will be allocated to cell 1 and temperature sensor 2 will be allocated to cell 2.

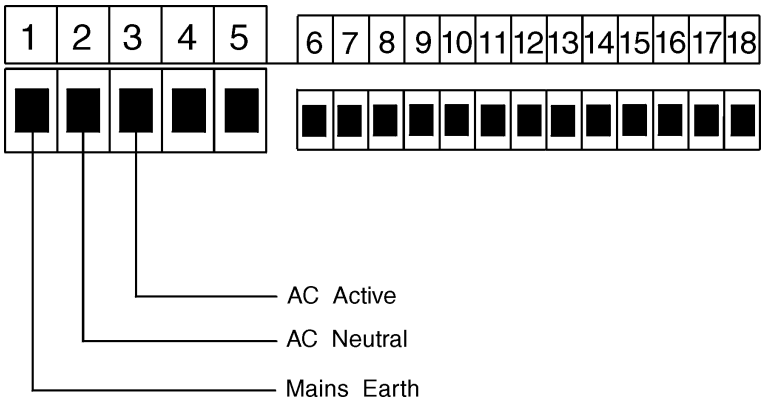
100Ω or 1000Ω RTDs
or 100Ω thermistor
2 Wire configuration
for one or two
temperature sensors



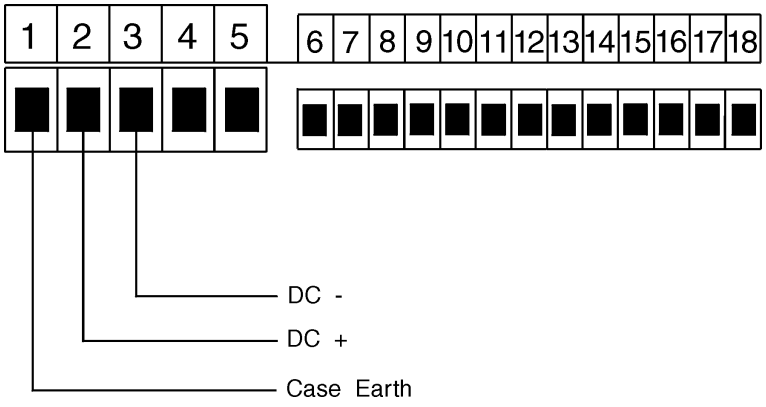
100Ω and 1000Ω RTDs
3 Wire configuration.
Single sensor only.



3.5 AC power connections - supply type is factory configured, check before connecting

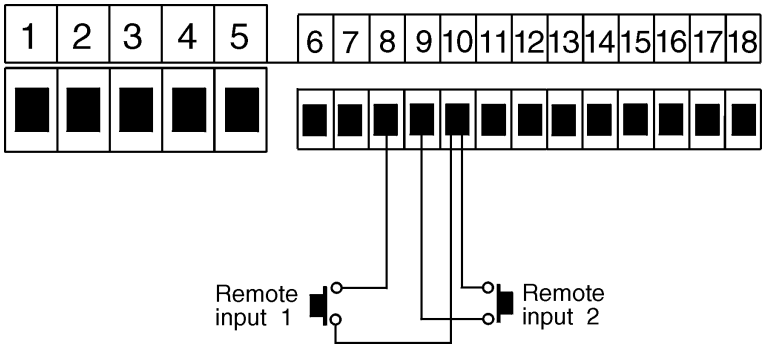


3.6 DC power connections (12 to 48VDC) - supply type is factory configured, check before connecting



3.7 Remote input connections

Use latching or momentary switches/relays depending on remote input function requirements. Input is not isolated and must use voltage free input only.



4 Function tables - summary of setup functions

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

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

4.1 Alarm relay function table

Display	Function	Range	Default	Your record	Access level
AL 1 to AL 8 HI SH	High setpoint value for designated alarm	Any display value or OFF	OFF	See 4.15	2
AL 1 to AL 8 LO	Low setpoint value for designated alarm	Any display value or OFF	OFF	See 4.15	2
AL 1 to AL 8 HYST	Hysteresis value for the designated alarm	0 to 50000	10	See 4.15	3
AL 1 to AL 8 TR1 P	Trip time delay for the designated alarm relay x.	0 to 5000.0 secs	0.0	See 4.15	3
AL 1 to AL 8 RST	Reset time delay for the designated alarm relay x.	0 to 5000.0 secs	0.0	See 4.15	3
AL 1 to AL2 SPAN	Relay PI control span	Any display value	1000	See 4.15	4
AL 1 to AL2 SETP	Relay PI control setpoint	Any display value	1000	See 4.15	4
AL 1 to AL2 P.G	Relay PI control proportional gain value	Any display value	0.0 10	See 4.15	4
AL 1 to AL2 I.G	Relay PI control integral gain value	Any display value	0.000	See 4.15	4
AL 1 to AL2 I.H	Relay PI control integral high limit value	0 to 100.0 %	100.0	See 4.15	4
AL 1 to AL2 I.L	Relay PI control integral low limit value	0 to 100.0 %	100.0	See 4.15	4

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

AL 1 to AL2 bi AS	Relay PI control bias	0 to 100.0 %	50.0	See 4.15	4
AL 1 to AL2 duty SECS	Relay PI control duty cycle	0 to 5000.0 secs	0.0	See 4.15	4
AL 1 to AL2 on SECS	Relay PI frequency control "on" time	0 to 5000.0 secs	0.0	See 4.15	4
AL 1 to AL8 rLYS	Relay selection On or OFF	On or OFF	OFF	See 4.15	4
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 4.15	4
AL 1 to AL8 OPEr	Alarm relay operating mode	Hi .Lo, Ctrl , FrEq	Hi .Lo	See 4.15	4
AL 1 to AL8 Ch	Alarm relay operation input selection	CH 1, CH2, rtd 1, rtd2	CH 1	See 4.15	4
AL 1 to AL8 LAtch	Alarm relay latching operation	Auto, LAtch	Auto	See 4.15	4

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

4.2 Relay function table

Display	Function	Range	Default	Your record	Access level
rLY 1 to rLY 7 rLY	Alarm relay x action to normally open (de-energised) or normally closed (energised)	n.o, n.c	n.o	See 4.15	4
rLY 1 to rLY 7 AcK	Relay acknowledge	OFF or ON	OFF	See 4.15	4
rLY 1 to rLY 7 bool	Alarm relay Boolean logic operation	Or, And	Or	See 4.15	4

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

4.3 Digital output function table

Display	Function	Range	Default	Your record	Access level
d.Out InPut	Channel for digital retransmission (*Optional)	CH 1.CH2. rtd 1.rtd2 or Pcnt	CH 1		4
d.Out O.Put	Output mode for digital retransmission (*Optional)	bin2.bin. b.SCL or bcd	bin2		4
d.Out Pol	Output polarity for digital retransmission (*Optional)	Lo or Hi 9h	Lo		4
d.Out bcd OFSt	Offset for BCD retransmission (*Optional)	0. 1.2 or 3	0		4
d.Out Lo	Low value for scaled binary retransmission (*Optional)	Any display value	0		4
d.Out Hi 9h	High value for scaled binary retransmission (*Optional)	Any display value	0		4
d.Out E.Out	Excitation voltage on binary retransmission output (*Optional)	5 or 24	5		4

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

4.4 Analog output 1 function table

Display	Function	Range	Default	Your record	Access level
rO 1 OutPt	Output selection for analog output 1. Not seen if output is fixed at 4-20mA (*Optional)	4-20, 0-1.0, 0-10	4-20		4
rO 1 InPut	Input selection for analog output 1 (*Optional)	CH 1, CH2, rtd 1, rtd2	CH 1		4
rO 1 P.Ctl	Analog output 1 PI control on or off (*Optional)	no or YES	no		4
rO 1 SEtP	Analog output 1 PI control setpoint (*Optional)	Any display value	0		4
rO 1 SPAn	Analog output 1 PI control span (*Optional)	Any display value	1000		4
rO 1 P.G	Analog output 1 PI control proportional gain (*Optional)	Any display value	1.000		4
rO 1 I.G	Analog output 1 PI control integral gain (*Optional)	Any display value	0.000		4
rO 1 I.H	Analog output 1 PI control integral high limit (*Optional)	0 to 100.0 %	1.000		4
rO 1 I.L	Analog output 1 PI control integral low limit (*Optional)	0 to 100.0 %	1.000		4
rO 1 bIAS	Analog output 1 PI control bias (*Optional)	0 to 100.0 %	50.0		4
rO 1 Lo	Analog output 1 option low display value (*Optional)	Any display value	0		4
rO 1 HI Sh	Analog output option high display value (*Optional)	Any display value	1000		4
rO 1 LoG	Linear or logarithmic analog output selection (*Optional)	LIn, LoG	LIn		4

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

4.5 Analog output 2 function table

Display	Function	Range	Default	Your record	Access level
rO2 OutPt	Output selection for analog output 2. Not seen if output is fixed at 4-20mA (*Optional)	4-20, 0-1.0 or 0-10	4-20		4
rO2 InPut	Input selection for analog output 2 (*Optional)	CH 1, CH2, rtd 1 or rtd 2	CH 1		4

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

r02 P.Cti	Analog output 2 PI control on or off (*Optional)	no or YES	no		4
r02 Lo	Analog output 2 option low display value (*Optional)	Any display value	0		4
r02 Hi.Sh	Analog output option high display value (*Optional)	Any display value	1000		4
r02 Log	Linear or logarithmic analog output selection (*Optional)	Lin or Log	Lin		4
r02 SEtP	Analog output 2 PI control setpoint (*Optional)	Any display value	0		4
r02 SPAn	Analog output 2 PI control span (*Optional)	Any display value	1000		4
r02 P.G	Analog output 2 PI control proportional gain (*Optional)	-32.768 to 32.767	1.000		4
r02 I.G	Analog output 2 PI control integral gain (*Optional)	-32.768 to 32.767	0.000		4
r02 I.H	Analog output 2 PI control integral high limit (*Optional)	0.0 to 100.0	1.000		I.H
r02 I.L	Analog output 2 PI control integral low limit (*Optional)	0.0 to 100.0	1.000		4
r02 bAS	Analog output 2 PI control bias (*Optional)	0.0 to 100.0	50.0		4

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

4.6 Bargraph display function table

Display	Function	Range	Default	Your record	Access level
bAr9 Ch	Bargraph channel	CH 1, CH2, rtd 1 or rtd2	CH 1		4
bAr9 tYPE	Bargraph type	bAr, S.dot, d.dot. c.bAr or r.dot	bAr		4
bAr9 Lo	Bargraph low value	Any display value	0		4
bAr9 Hi	Bargraph high value	Any display value	1000		4

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

4.7 Conductivity channel 1 setup function table

Display	Function	Range	Default	Your record	Access level
Cd 1 Cd.Ch	Set number of input channels	1 or 2	1		CAL
Cd 1 dCPt	Decimal point for channel 1	0, 0. 1, 0.02 or 0.003	0		CAL
Cd 1 drnd	Display rounding for channel one	1 to 5000 units	1		CAL
Cd 1 FiLr	Digital filter for channel 1	0 to 8	3		CAL
Cd 1 uni t	Conductivity measuring units for channel 1	uS.cm, uS.m, mS.cm, mS.m, TESt, PPm or Pcnt	uS.cm		CAL
Cd 1 SENS	Cell type for channel 1	CELL or coil	CELL		CAL
Cd 1 FrEQ	Drive frequency for channel 1	100, 150, 200, 250, 300, 350 or 400	100		CAL
Cd 1 SLOPE	Solution temperature compensation slope for channel 1	-6.00 to 0.00	-2.00		CAL
Cd 1 SOL	Solution temperature compensation reference for channel 1	-40.0 to 150.0	25.0		CAL

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

Cd 1 PrObE	Cell K factor for channel 1	0.01.0.05. 0.1.0.5. 1.0. 2.0.5.0. 10. 20.50 or 100	0.1		CAL
Cd 1 H.I on	Hydrogen Ion compensation for channel 1	oFF or On	oFF		CAL
Cd 1 PPM FACt	PPM conversion factor for input 1	0.200 to 2.000	0.560		CAL
Cd 1 Pcnt rEJ	Percent rejection display enable	OFF or On	OFF		CAL
Cd 1 U.CAL	Conductivity uncalibration for channel 1	n/a	n/a		4
Cd 1 nULL	Conductivity null calibration for channel 1	n/a	n/a		4
Cd 1 CAL 1	First point conductivity calibration for channel 1	n/a	n/a		4
Cd 1 CAL2	Second point conductivity calibration for channel 1	n/a	n/a		4

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

4.8 Conductivity channel 2 setup function table

Display	Function	Range	Default	Your record	Access level
Cd2 dCPt	Decimal point for channel 2	0, 0.1, 0.02 or 0.003	0		CAL
Cd2 drnd	Display rounding for channel 2	1 to 5000 units	1		CAL
Cd2 FiLtr	Digital filter for channel 2	0 to 8	3		CAL
Cd2 unit	Conductivity measuring units for channel 2	uS.cm, uS.m, mS.cm, mS.m, rESt, PPm or Pcnt	uS.cm		CAL
Cd2 SEnS	Cell type for channel 2	CELL or coil	CELL		CAL
Cd2 FrEq	Drive frequency for channel 2	100, 150, 200, 250, 300, 350 or 400	100		CAL
Cd2 SLOPE	Solution temperature compensation slope for channel 2	-6.00 to 0.00	-2.00		CAL
Cd2 SOL	Solution temperature compensation reference for channel 2	-40.0 to 150.0	25.0		CAL
Cd2 PrObE	Cell K factor for channel 2	0.01.0.05. 0.1.0.5. 1.0. 2.0.5.0. 10. 20.50 or 100	0.1		CAL
Cd2 H.Ion	Hydrogen Ion compensation for channel 2	oFF or On	oFF		CAL
Cd2 PPm FACt	PPM conversion factor for input 2	0.200 to 2.000	0.560		CAL
Cd2 U.CAL	Conductivity uncalibration for channel 2	n/a	n/a		4
Cd2 nULL	Conductivity null calibration for channel 2	n/a	n/a		4
Cd2 CAL 1	First point conductivity calibration for channel 2	n/a	n/a		4
Cd2 CAL2	Second point conductivity calibration for channel 2	n/a	n/a		4

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

4.9 Temperature sensor 1 function table

Display	Function	Range	Default	Your record	Access level
rtd1 InPt	Temperature sensor configuration	rtd3, rtd2 or 2rt2	rtd3		CAL
rtd1 tYPE	Temperature sensor type for channel 1	100, 1000, t 100 or NONE	100		CAL
rtd1 dEF °C	Manual temperature setting for input 1	-40.0 to 200.0	25.0		CAL
rtd1 U.CAL	Temperature uncalibration for input 1	No or YES	No		4
rtd1 CAL 1	First calibration point for temperature input 1	n/a	n/a		4
rtd1 CAL2	Second calibration point for temperature input 1	n/a	n/a		4

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

4.10 Temperature sensor 2 function table

Display	Function	Range	Default	Your record	Access level
rtd2 tYPE	Temperature sensor type for channel 2	100, 1000, t 100 or NONE	100		CAL
rtd2 dEF °C	Manual temperature setting for input 2	-40.0 to 200.0	25.0		CAL
rtd2 U.CAL	Temperature uncalibration for input 2	No or YES	No		4
rtd2 CAL 1	First calibration point for temperature input 2	n/a	n/a		4
rtd2 CAL2	Second calibration point for temperature input 2	n/a	n/a		4

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

4.11 Display function table

Display	Function	Range	Default	Your record	Access level
d. SP brGt	Display brightness	1 to 16	16		2
d. SP dull	Dimmed display brighness	0 to 16	2		2

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

4.12 P button and remote inputs function table

Display	Function	Range	Default	Your record	Access level
F.1 nP P.but	Front P button operation mode	NONE, P.H. , P.Lo, H. , Lo or AL.Ac	NONE		4
F.1 nP F.1 n. 1	Remote input 1 operation mode	NONE, P.Hold, d.Hold, P.H. , P.Lo, H. , Lo, AL.Ac, ACCSS or dull	NONE		4
F.1 nP F.1 n.2	Remote input 2 operation mode	NONE, P.Hold, d.Hold, P.H. , P.Lo, H. , Lo, AL.Ac, ACCSS or dull	NONE		4

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

4.13 Access control function table

Display	Function	Range	Default	Your record	Access level
ACCES EASY LEVEL	Easy access mode	NONE, 1, 2, 3, 4, 5, 6, CAL	NONE		S.CAL
ACCES F.1 nPt LEVEL	Remote input access mode	NONE, 1, 2, 3, 4, 5, 6, CAL	NONE		S.CAL

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

ACCES USr. 1 P. n	PIN code 1	0 to 50000	0		S.CAL
ACCES USr. 1 LEVEL	PIN code 1 access level	nONE, 1, 2, 3, 4, 5, 6, CAL	nONE		S.CAL
ACCES USr.2 P. n	PIN code 2	0 to 50000	0		S.CAL
ACCES USr.2 LEVEL	PIN code 2 access level	nONE, 1, 2, 3, 4, 5, 6, CAL	nONE		S.CAL
ACCES Fn. 1 CodE	User assignable access function 1	0000 to FFFF hex.	0000		S.CAL
ACCES Fn. 1 LEVEL	User assignable access 1 level value	dFI t, 1, 2, 3, 4, 5, 6, CAL, S.CAL	dFI t		S.CAL
ACCES Fn.2 CodE	User assignable access function 2	0000 to FFFF hex.	0000		S.CAL
ACCES Fn.2 LEVEL	User assignable access 2 level value	dFI t, 1, 2, 3, 4, 5, 6, CAL, S.CAL	dFI t		S.CAL
ACCES Fn.3 CodE	User assignable access function 3	0000 to FFFF hex.	0000		S.CAL
ACCES Fn.3 LEVEL	User assignable access 3 level value	dFI t, 1, 2, 3, 4, 5, 6, CAL, S.CAL	dFI t		S.CAL
ACCES Fn.4 CodE	User assignable access function 4	0000 to FFFF hex.	0000		S.CAL
ACCES Fn.4 LEVEL	User assignable access 4 level value	dFI t, 1, 2, 3, 4, 5, 6, CAL, S.CAL	dFI t		S.CAL

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

4.14 Serial communciations function table

Display	Function	Range	Default	Your record	Access level
SEri OPEr	Serial operation mode (*Optional)	nonE.Cont. Poll. A.buS.di SP or ñ.buS	nonE		4
SEri bAud	Serial baud rate (*Optional)	1200, 2400, 4800, 9600, 19.2, 38.4, 57.6, 115.2	9600		4
SEri PrtY	Serial parity (*Optional)	8n, 8E, 8O, 7E, 7O	8n		4
SEri Unit Addr	Serial address (*Optional)	1 to 127	1		4

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

4.15 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 9h								
Lo								
HYSt								
tr.P								
rSt								
SPAn			n/a	n/a	n/a	n/a	n/a	n/a
SEtP			n/a	n/a	n/a	n/a	n/a	n/a
P.9			n/a	n/a	n/a	n/a	n/a	n/a
1.9			n/a	n/a	n/a	n/a	n/a	n/a
1.H			n/a	n/a	n/a	n/a	n/a	n/a
1.L			n/a	n/a	n/a	n/a	n/a	n/a
bi AS			n/a	n/a	n/a	n/a	n/a	n/a
duty SECS			n/a	n/a	n/a	n/a	n/a	n/a
on SECS			n/a	n/a	n/a	n/a	n/a	n/a
rLYS								
trAi L								
OPEr								
Ch								
LAtch								

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							

Error Messages

- **CAL FAIL** - Calibration error, this can be seen during conductivity, resistivity or temperature calibration.

  This indicates that the calibration attempt has failed and can be seen at the null calibration or first or second calibration point. This error most usually occurs when there is not enough change in conductivity/resistivity/temperature level between calibration points (if the change is less than 5 percent of the sensor range the error message may be seen). If a null calibration is attempted when the measured conductivity is not close to zero then the same error message will be seen.

  If this message is seen at only one calibration point then try proceed with the second point. If the second point is successful then try the first point again. If the error message is seen at both points then see below.

  For conductivity/resistivity uncalibrate and check the reading with at least one known value solution. If the reading is not close to the known value there is no point in trying to calibrate, check the cell, the cell wiring and settings. If then reading is close to the known value then try calibration again with a higher conductivity or lower resistivity solution and ensure than null calibration was correctly carried out.

  For temperature uncalibrate and check the reading on the display at a know temperature. If the reading is not close to the known temperature there is no point in trying to calibrate, check the temperature sensor resistance, the wiring of the temperature input and settings. If the reading is close try calibration again after checking all temperature settings and ensuring that there is a significant change in temperature between calibration points.

- **-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. Alternatively this error message can be seen if the value to be displayed is outside the range of the sensor or the measuring range of the display for that sensor e.g. above 200 degrees C for a temperature display.

- **-ur-** - underrange message - This indicates that the input is below the range expected for that input. e.g. below -40 degrees C for a temperature display.

- **Int 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 and proceed to normal operation.

Note: It is essential in conductivity measurement that the resistance across the cell is always greater than 80Ω. If the resistance is less than this then it may be necessary to use a cell with a higher cell constant. The resistance at any given conductivity level can be found from the formula:

$$Resistance\,(Ohms) = \frac{1}{Conductivity\,/cm} \times K\,factor$$

5 Calibration

5.1 Introduction

A null calibration feature (see NULL) allows the probe to be referenced to the instrument at a zero conductivity level. A null calibration should be undertaken before a single or two point calibration to ensure that the probe and instrument are matched. Before calibrating the instrument it is also important to ensure that the correct cell constant has been chosen. The CAL 1 function together with the NULL function sets the calibration slope, the CAL2 calibration function can used to compensate for head resistance when long cable lengths are used.

When using a temperature probe temperature calibration is carried out with the CAL 1 and CAL2 functions, ensure that the correct temperature probe type has been selected (see tYPE). If a temperature compensation sensor is used it is essential that the temperature input is reading correctly before performing a conductivity calibration. If necessary calibrate the temperature input before the conductivity input.

5.2 Conductivity/Resistivity/ppm Calibration Null

Null calibration allows the cell to be referenced to the meter. The instrument should be nulled as the first calibration point. For resistivity the display should be set to read conductivity and a conductivity null and calibration carried out then the display can be switched back to read resistivity. Calibrating or nulling with the display set to read resistivity is not possible. To null the instrument the following procedure should be followed.

1. If calibration problems have been experienced for either temperature or conductivity then prior to calibration uncalibrate the display using the temperature or conductivity U.CAL function. Uncalibrating the display returns the calibration settings to factory default values and clears any incorrect calibration attempts which may be stored in memory.

2. If a temperature compensation sensor is used check that the temperature reading is correct and calibrate the temperature reading if necessary, see "Temperature Calibration" sections in this chapter. Also check that the SLOPE function is correctly set. If no temperature sensor is being used check that the tYPE is set to NONE and that the dEF °C function is set to the required default temperature.

3. Using pure water clean the cell to be nulled, dry the cell and place in air.

4. Enter the setup functions and step through the functions until the channel to be null is reached e.g. Cd 1. Press F to access the channel setup and then press and release the ▲ pushbutton until NULL is displayed.

5. Press F the display will show the message no. Use the ▲ or ▼ pushbutton to toggle this to YES then press F to accept this. The display will show a value which should be zero or very close to zero.

6. Press F, the display will show CAL End indicating that the selected channel has been successfully nulled.

5.3 Conductivity/Resistivity/ppm Calibration

After performing the null calibration as previously described place the required probe in a solution of known conductivity or PPM and that the solution is within the measuring range of the cell. For resistivity calibration the display should be set to read conductivity and a conductivity calibration carried out then the display can be switched back to read resistivity. Calibrating with the display set to read resistivity is not possible.

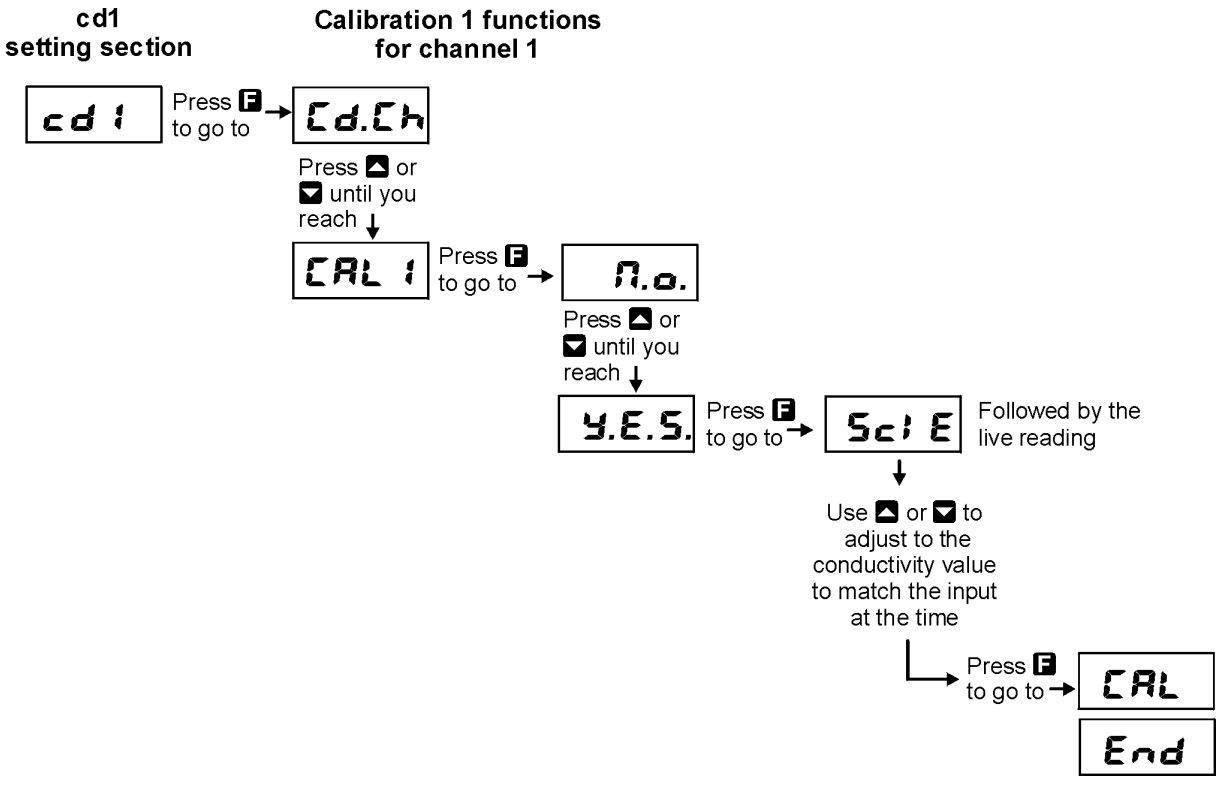
Follow the procedure below.

First calibration point

1. Enter the setup functions and step through the functions until the channel to be calibrated is reached e.g. **Cd 1**. Press **F** to access the channel setup and then press and release the ▲ pushbutton until **CAL 1** is displayed.
2. Press **F** the display will show the message **no**. Use the ▲ or ▼ pushbutton to toggle this to **YES** then press **F** to accept this. The display will show the **CAL 1** followed by a value which should be close to the value of the calibration solution. Allow the reading to stabilise (typically 20 – 30 seconds).
3. Press and release **F**, the display will show the message (channel number e.g. **Cd 1**) followed by **CAL 1 Sc1 E** followed by a value.
4. Use the ▲ or ▼ pushbutton to adjust the displayed value to that of the calibration solution then press **F** to accept the new calibration scaling.
5. Press and release **F**, the display will show **CAL End** to indicate that the calibration scaling has been accepted..

Channel 1 calibration point 1 flow chart

Note: The cell must be placed in a known conductivity solution and the conductivity reading and temperature reading allowed to stabilise prior to following these steps.

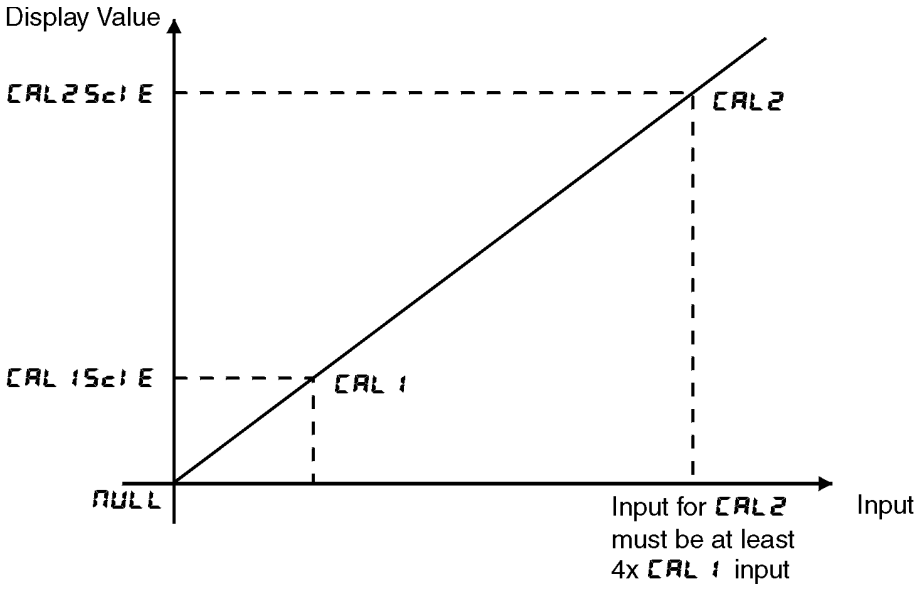


Second calibration point

If required a second point, CAL 2 may now be undertaken. The second calibration point is normally used only to compensate for head resistance when long cell cables are used or to improve linearity when measuring over a wide conductivity range. In many installations the second point is not required. If the second point is required follow the sequence below.

1. Clean the probe in pure water then insert into a second solution of known conductivity/resistivity/ppm (the second solution must be at least 2.5x higher (or 10x lower for resistivity or 2.5x ppm higher) in value from the first solution, see note below if it is not possible to have a 2.5x difference (or 10x difference for resistivity or 2.5x ppm) in the process you are using).
2. At the CAL 2 function press F then use the ▲ or ▼ pushbutton to select YES and press F. The display will show the the live conductivity reading from the cell. Allow time for this reading to stabilise (typically 20 – 30 seconds).
3. Press and release F, the display will show a value with cd 1 (orcd2 if cell 2 is being calibrated) CAL 2 Sc1 E flashing every few seconds.
4. Adjust the value displayed to the known solution value using the ▲ and ▼ pushbuttons.
5. Press and release F, the display will show CAL End to indicate that the second calibration point has been accepted.

Note: If the range you are using does not allow for a 2.5x difference (or 10x difference for resistivity or 2.5x ppm) between CAL 1 and CAL 2 then you should use the Null Calibration and CAL 1 only. The solution used for CAL 1 should be as close as possible to the highest value you will be using.



5.4 Conductivity/Resistivity/ppm Uncalibration

This function sets the instrument calibration back to the factory calibrated value. Uncalibration is used as a reset when an error exists due to incorrect calibration. The uncalibration procedure is as follows:

1. Enter the setup functions and step through the functions until the channel to be calibrated is reached e.g. Cd 1. Press F to access the channel setup and then press and release the ▲ pushbutton until U.CAL is displayed.

2. Press F the display will show the message no. Use the ▲ or ▼ pushbutton to toggle this to YES then press F to accept this. The display will show the message UCAL End to indicate that the uncalibration is complete.

5.5 Temperature Calibration

A two point calibration is provided for temperature sensors. The two point calibration requires that the sensor is allowed to stabilise at two known temperatures. Ideally the temperatures chosen should span the normal temperature measurement range of the process being measured. A minimum difference of 25 degrees C between temperature calibration points is recommended.

The calibration procedure is as follows:

First calibration point

1. Place the sensor to be calibrated at a known low temperature and allow 5 minutes to stabilise.

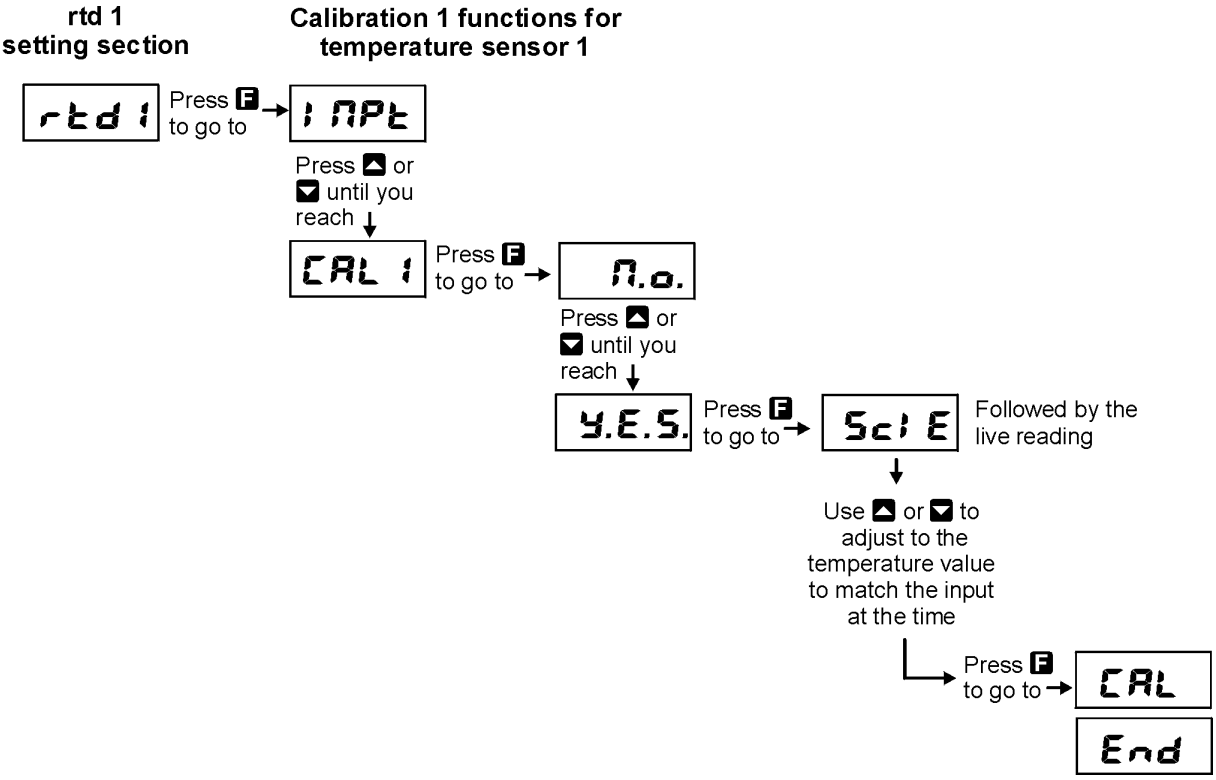
2. Enter the setup functions and step through the functions until the temperature channel to be calibrated is reached e.g. rtd 1. Press F to access the channel setup and then press and release the ▲ pushbutton until CAL 1 is displayed.

3. Press F the display will show the message no. Use the ▲ or ▼ pushbutton to toggle this to YES then press F to accept this. The display will show the temperature. When the temperature is stable press F.

4. The display will show the message Sc1 E followed by a value. Use the ▲ or ▼ pushbuttons to adjust the value to the known low temperature value. Then press F to accept this.

5. The display will show the message CAL End to indicate that the first calibration point has been accepted.

Channel 1 temperature calibration point 1 flow chart



Second calibration point

1. Once the first calibration point has been completed place the sensor in a second temperature environment and allow 5 minutes for the temperature to stabilise.
2. Enter the setup functions and step through the functions until the temperature channel to be calibrated is reached e.g. rtd 1. Press F to access the channel setup and then press and release the ▲ pushbutton until is displayed.
3. Press F the display will show the message no. Use the ▲ or ▼ pushbutton to toggle this to YES then press F to accept this. The display will show the temperature. When the temperature is stable press F.
4. The display will show the message Sci E followed by a value. Use the ▲ or ▼ pushbuttons to adjust the value to the known low temperature value. Then press F to accept this.
5. The display will show the message CAL End to indicate that the second calibration point has been accepted.

5.6 Temperature Uncalibration

This function sets the instrument calibration back to the factory calibrated value. Uncalibration is used as a reset when an error exists due to incorrect calibration. The uncalibration procedure is as follows:

1. Enter the setup functions and step through the functions until the temperature channel to be calibrated is reached e.g. rtd 1. Press F to access the channel setup and then press and release the ▲ pushbutton until is displayed.

2. Press F the display will show the message No. Use the ▲ or ▼ pushbutton to toggle this to YES then press F to accept this. The display will show the message UCAL End to indicate that the uncalibration is complete.

5.7 Standard ppm conversion factors

The PPMFACt (ppm factor) function value is used with the input from the cell to calculate the ppm value of the solution concerned. The displayed ppm figure is calculated from:

$$ppm = conductivity\,(uS/cm) \times PPmFACt$$

The factor will vary with the composition and concentration of the solution being measured. Suggested ppm factors for four standard solutions are given below. The suggested factors are based on conductivities of approx. 14,000 uS/cm at 25°C. For example the default setting for the instrument is 0.560 which is a figure used for NaCl (sodium chloride solution or salt water).

Standard solution	**Use**	**Suggested PPMFACt value**
NaCl	Salt water and dairy products	0.560
442 (40% sodium sulphate, 40% sodium bicarbonate, 20% sodium chloride)	General fresh water e.g. rivers, lakes and reverse osmosis water	0.860
KCL	Can be used in applications a NaCl standard is used but is normally used as a conductivity standard rather than ppm standard	0.580
CaCO3	Boiler and cooling tower water	0.480

6 Specifications

6.1 Technical Specifications

Input:	One or two conductivity cells (K=0.01, 0.05, 0.1, 0.5, 1.0, 2.0, 5.0, 10, 20, 50 or 100) or toroidal conductivity cells
Temperature Input:	1 x 3 wire or 2 x 2 wire 100Ω RTD or 1000Ω RTD or 100Ω NTC thermistors (100D–5 type) or manually set
Measuring Range:	(K = 0.01) 0 to 125uS/cm (K = 0.1) 0 to 1250uS/cm (K = 1.0) 10 to 12,500uS/cm (K = 10.0) 100 to 125,000uS/cm Selectable measuring units uS/cm, uS/m, mS/cm, mS/m, MΩ and PPM Temperature: -40 to 200^{o}C (automatic) or -40 to 150^{o}C (manually set)
Accuracy:	Better than 1% of full scale
Sample Rate:	1 per sec for single channel. 1 sample every 5 seconds for dual channel
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. LED Bar Graph 20 segment bar + 5 digit 7.6mm LED plus relay status LEDs LCD and 4 digit LED displays are available for computer or remote keypad only setup and calibration
Power Supply:	AC 240V, 110V, 48V, 32V 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 160mA at 12V, 80mA at 24V (basic model with no output options)
Output (standard):	1 x relay, Form A rated 5A at 240VAC resistive load
Relay Action:	Programmable N.O. or N.C. On/off alarm/control or PI control (pulse width or frequency)

6.2 Output Options

Extra Relays:	1, 2, or 3 extra relays (form A, 3A @ 240VAC) First extra relay configurable for alarm or PI control 6 extra relays (form A, 2A @ 240VAC) 5 extra relays (form A, 2A @ 240VAC) available only with serial retransmission
Analog Retransmission:	Isolated 12 bit 4-20mA output only single or dual channel or 16 bit single or dual channel 4-20mA, 0 to 1V or 0 to 10V analog output options 4 to 20mA output can drive into 800Ω load maximum Analog output 1 can be set for PI control, linear or logarithmic Analog output 2 can be set for linear or logarithmic output
Serial Communications:	RS232 or RS485 or Ethernet
Digital output:	16 bit NPN or PNP (factory configured) binary of BCD

Output options are available in certain combinations e.g. Analog output plus extra relay, contact supplier for details.

6.3 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 and -0mm
Connections:	Plug in screw terminals (max 1.5mm wire)
Weight:	400 gms Basic model, 450 gms with option card

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

This product is designed and manufactured in Australia.