Model TP4-PH
Dual Input PH/ORP
Display/Controller
Operation and Instruction Manual

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1 Introduction

General description

This manual contains information for the installation and operation of the weatherproof (IP65 rated) TP4 Monitor. The TP4-PH is a dual input pH or ORP (Redox) monitor with direct input for standard pH and/or ORP electrodes. Alternative 4-20mA inputs are provided for use with pH transmitters (not ORP). A maximum of two inputs can be used i.e. two direct electrode inputs or 4-20mA inputs or one of each type. An input is also provided for a temperature sensor for automatic pH temperature compensation. The TP4 can accept 100Ω RTD, 1000Ω RTD, 3kΩ Balco or LM335 temperature sensors.

Calibration, setpoint and other set up functions are easily achieved by push buttons located on the front panel. Four standard inbuilt relays provide for alarm/control functions. RS232, 4-20mA analog retransmission and a 24V (±12V) at 20mA max. transmitter supply are also provided as standard. The front ▲ and ▼ buttons can be used to toggle between channels and temperature display.

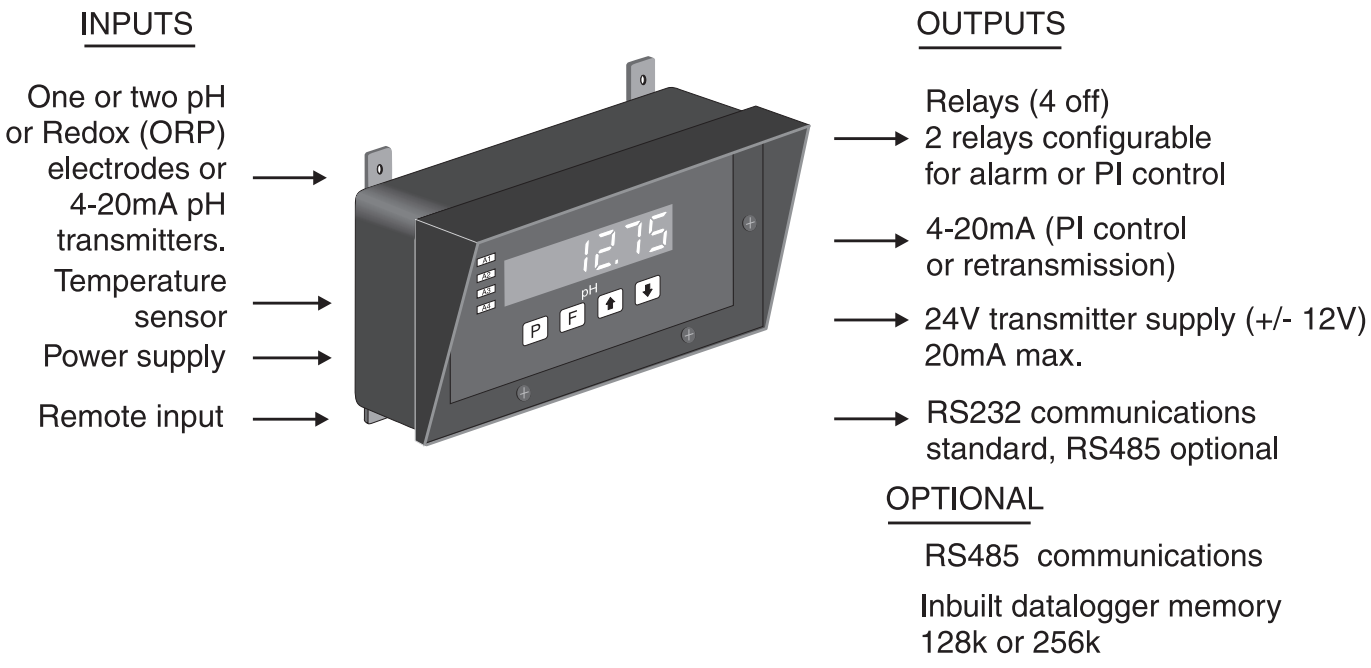
Unless otherwise specified at the time of order, your TP4 has been factory set to a standard configuration. The configuration and calibration is easily changed by the user. Initial changes may require dismantling the instrument to alter PCB links, other changes are made by push button functions.

Full electrical isolation between power supply, input voltage or current and retransmission output is provided by the TP4, thereby eliminating grounding and common voltage problems. This isolation feature makes the TP4 ideal for interfacing to computers, PLCs and other data acquisition devices.

The TP4 series is designed for high reliability in industrial applications. The high brightness LED display provides good visibility, even in areas with high ambient light levels.

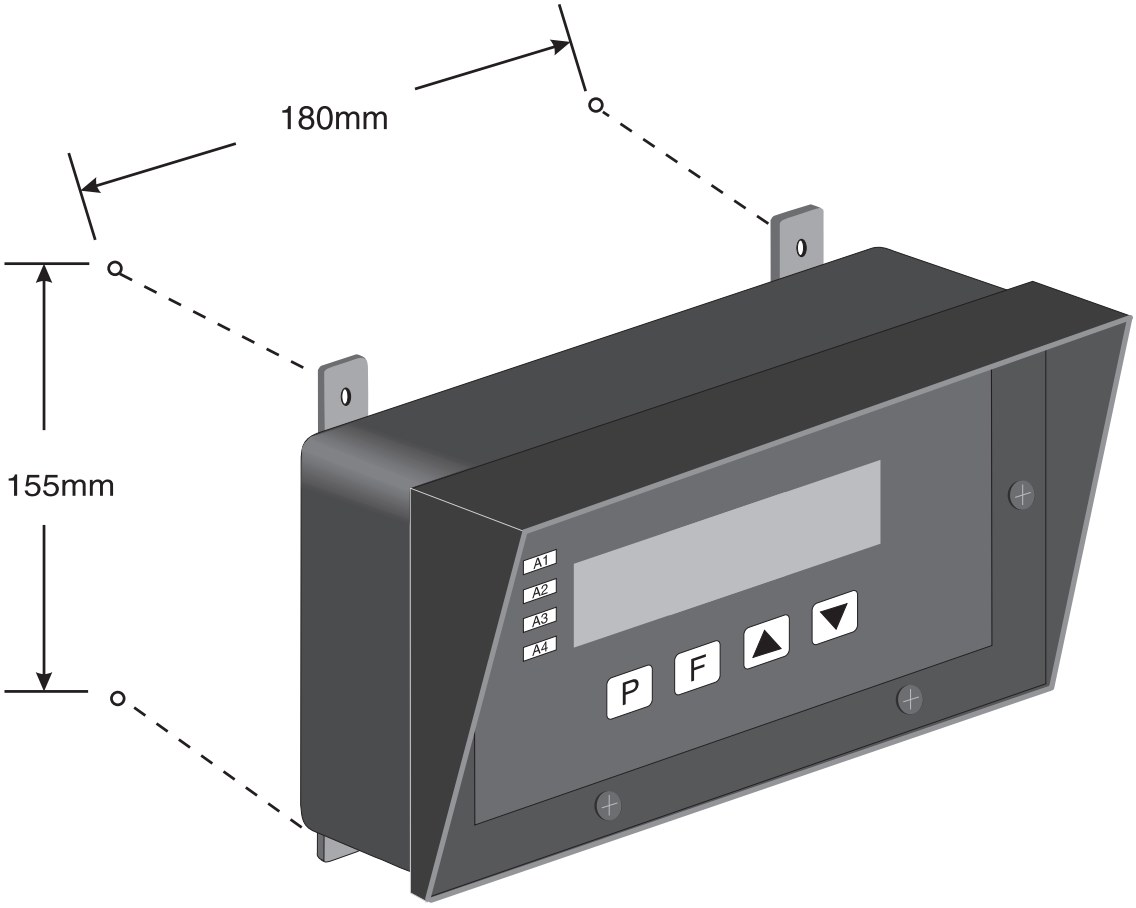
The PI control functions and Serial Communications functions are described in the separate "TP4-PH Output Addendum" booklet.

System inputs and outputs

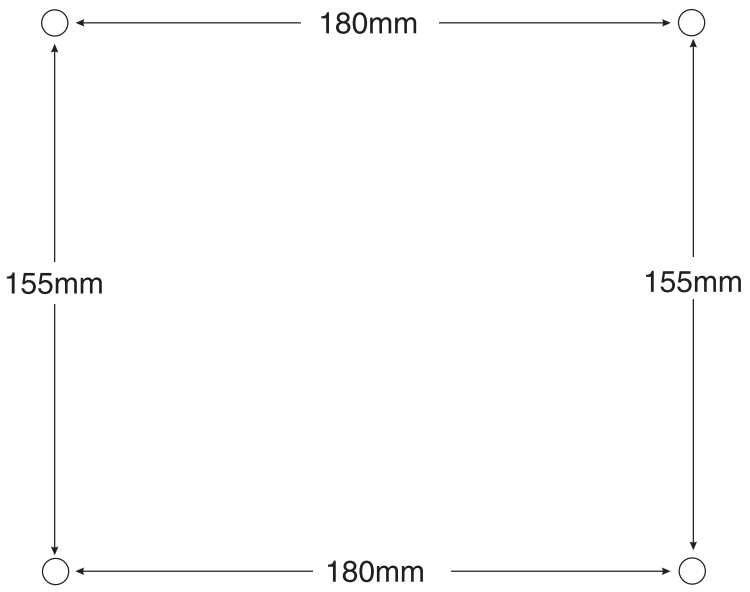


2 Mechanical Installation

The instrument is designed to be wall mounted using the four mounting brackets provided. Carefully measure and drill four holes as shown below. An optional panel mount kit is available for use with the TP4 see section 2.2. Overall enclosure dimensions are 255mm x 145mm x 125mm(max.).



Mounting Hole Locations

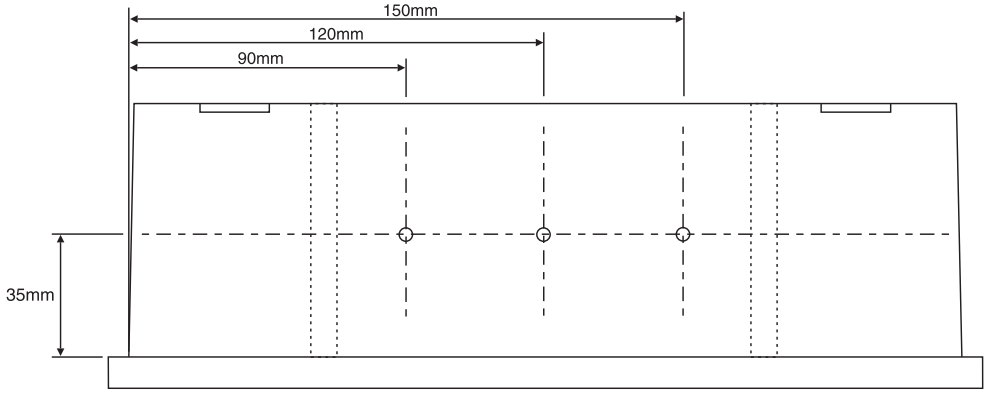


2.1 Fitting cable glands

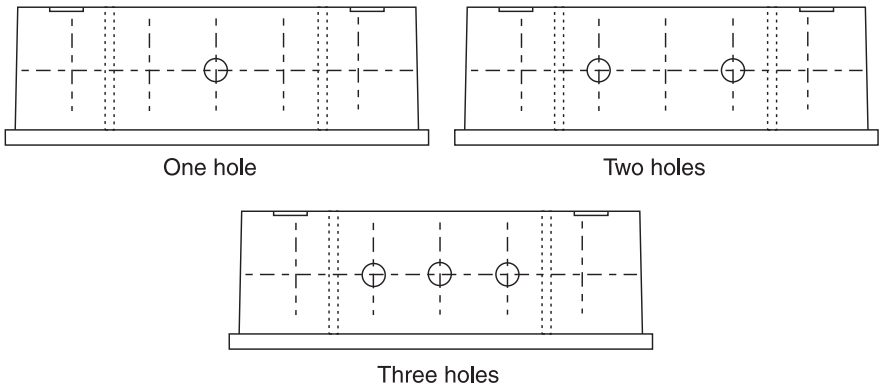
The instrument is supplied with one PG9 glandand one modified PG20 gland. The modification is to allow a standard BNC connector to pass through.

The weatherproof enclosure has incorporated mounting pillars for securing boards, plates etc. on the base and immediately under the front panel. The case material is Black ASA. Cable glands are readily obtainable from electrical wholesalers and some hardware shops if required. Circuit boards should be removed prior to drilling. The hood is moulded to the case but cases without the hood are optionally available.

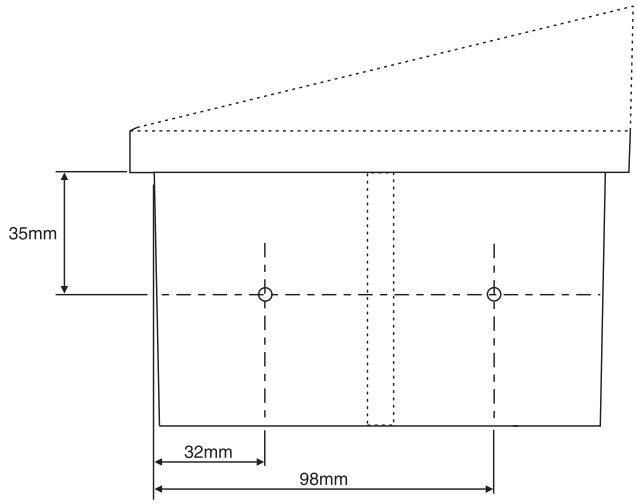
Suggested hole locations for up to 3 cable glands.



Suggested hole placement selection.

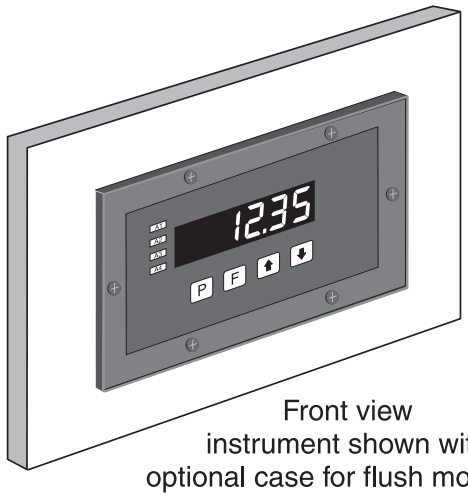


Suggested hole locations for up to 2 cable glands with side entry

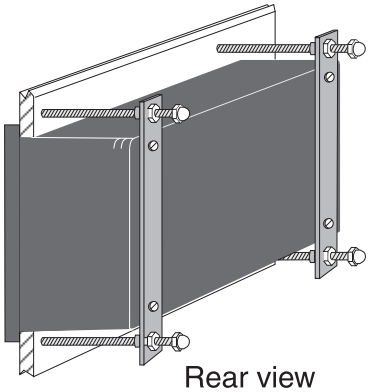


2.2 Panel mounting

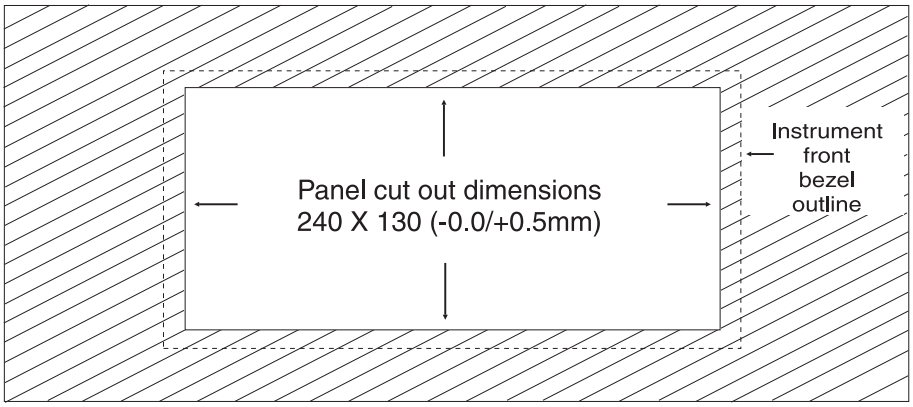
An optional panel mount kit is available. The kit comprises two adjustable bolts and two brackets. A case without the moulded hood is optionally available and is often used when panel mounting displays since it provides a mounting which projects less far the surface.



Front view
instrument shown with
optional case for flush mounting



Rear view

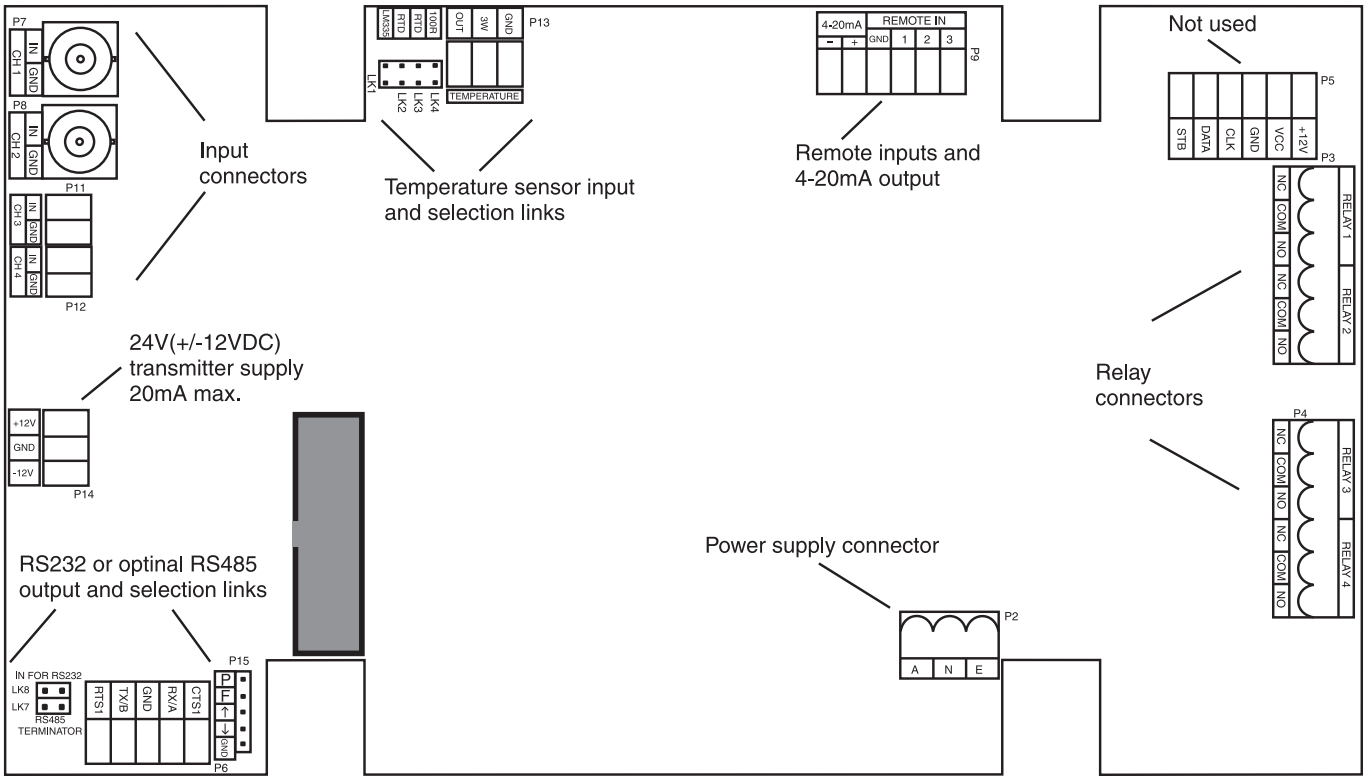


3 Electrical Installation

The TP4 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.

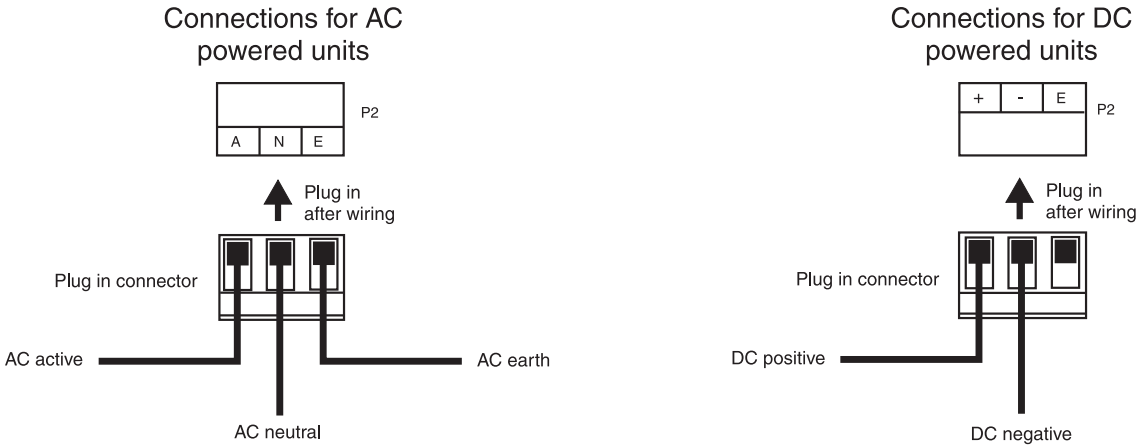
BNC connectors and plug in terminal blocks are provided to make installation easier. The terminal blocks allow for wires of up to 1.5mm2 (2.5mm2 for power supply and relay terminal blocks) to be fitted. Connect the wires to the appropriate terminals as indicated in the appropriate diagrams in this chapter. 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.

When an input is applied a display indication should be seen. The instrument will be set to a factory default scaling (unless otherwise arranged) and so it may be necessary to scale the instrument to the required engineering units for your application.



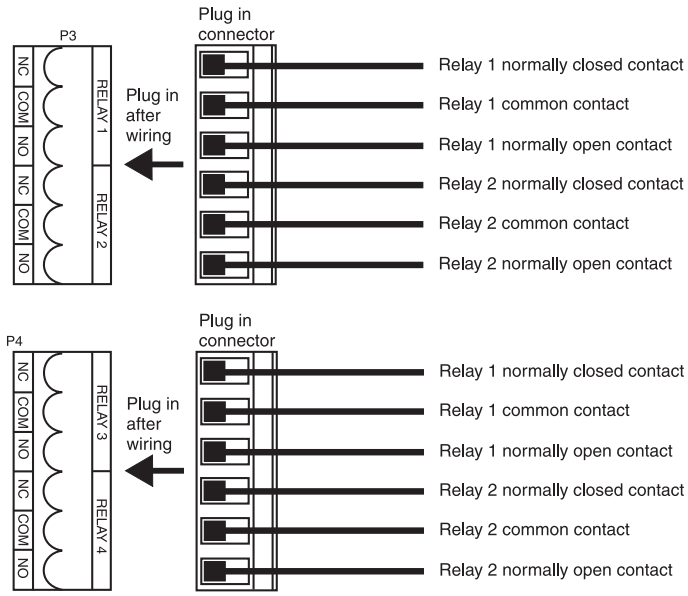
3.1 Power supply connections

The power supply for the instrument is factory fitted and is of a fixed type. If you are unsure of the supply requirement for your instrument it can be determined by the model number on the instrument label:-
TP4-PH-240-..... Requires 240VAC
TP4-PH-110-..... Requires 110VAC
TP4-PH-DC-..... Requires 12 to 48VDC



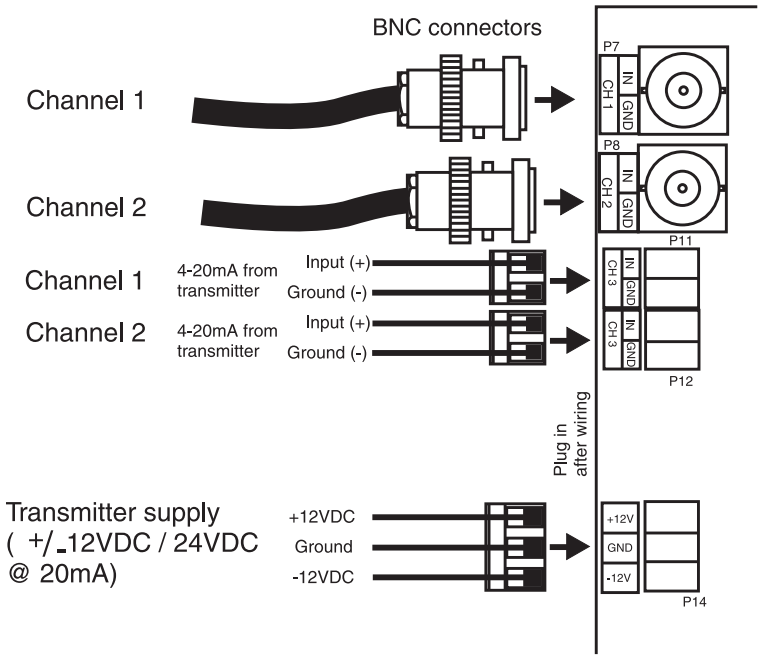
3.2 Relay connections

The TP4 is supplied with 4 alarm relays as standard. The relays are all single pole, double throw types and are rated at 5A, 240VAC into a resistive load. The relay contacts are voltage free. When switching inductive loads (e.g. a solenoid) a suppressor circuit should be used across the load or across the relay contacts. A simple suppressor circuit consists of a 100Ω resistor in series with a 0.1uF capacitor (ensure that the ratings for the resistor and capacitor are sufficient for the voltages and currents being switched) .

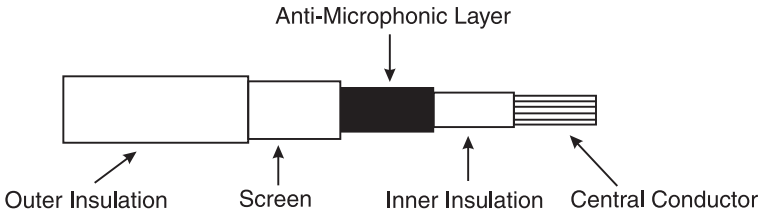


3.3 pH/ORP input

The TP4 has provision for two separate pH or ORP electrode inputs via BNC connector. One or two of the inputs shown below may be used, not all four. The inputs can be mixed if required e.g one pH and ORP mixed, BNC and 4-20mA mixed. Setup functions are used to select the connector used and the input type, see **1 InPt tYPE**, **CH2 tYPE**, **Ch 1** and **Ch2** functions. Note that the 4-20mA inputs can be used for pH transmitters only and not for ORP or other transmitters.

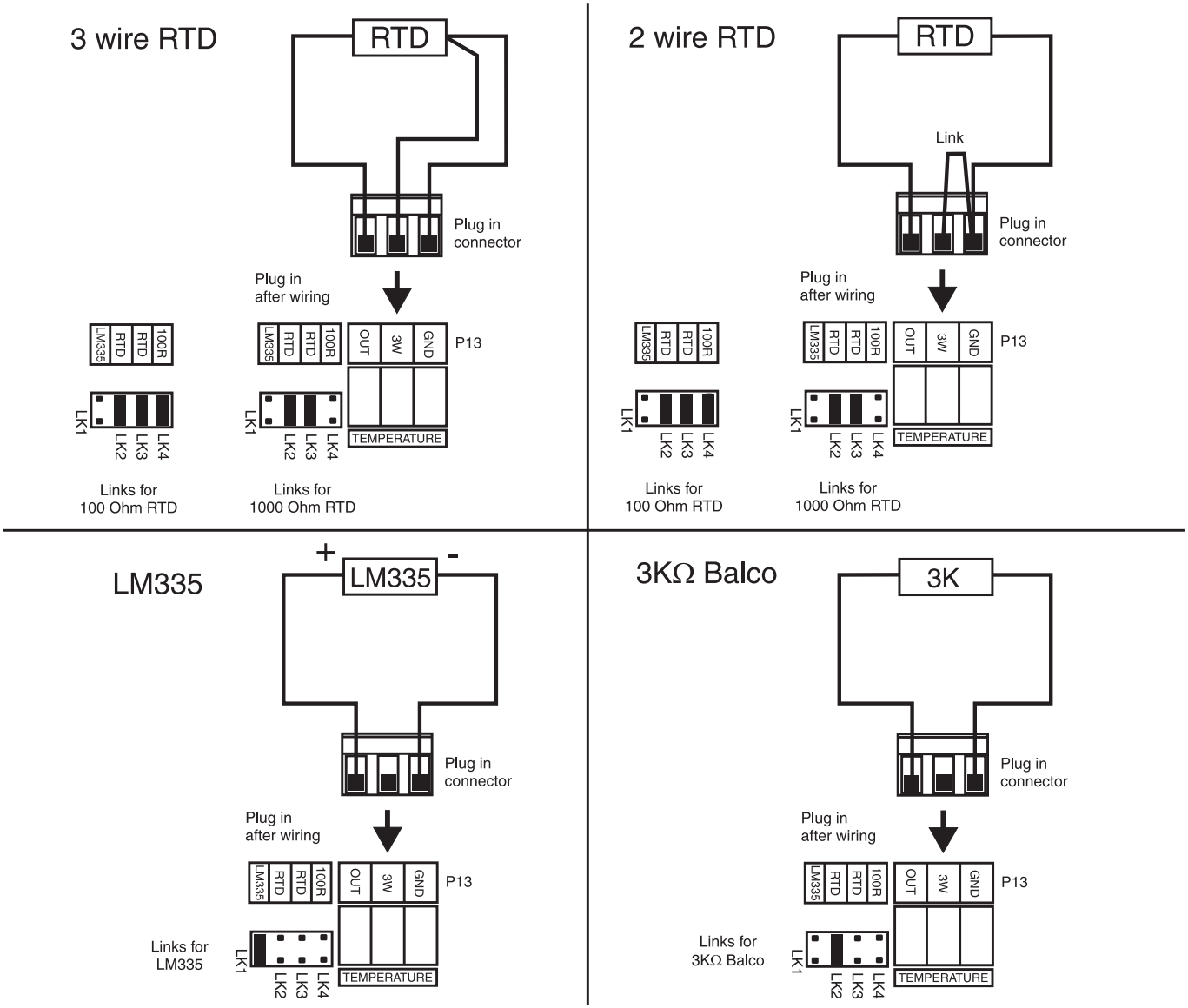


When using low noise cable with an anti-microphonic layer ensure that this layer is not in contact with the exposed central conductor wires. Trim the layer with a blade, take care that the inner insulation is not cut whilst doing this. This layer is conductive and may cause a short circuit between the centre conductor and the cable screen resulting in an incorrect pH indication. This fault will show up as a constant 7.00 pH indication on the instrument to which the electrode is connected.



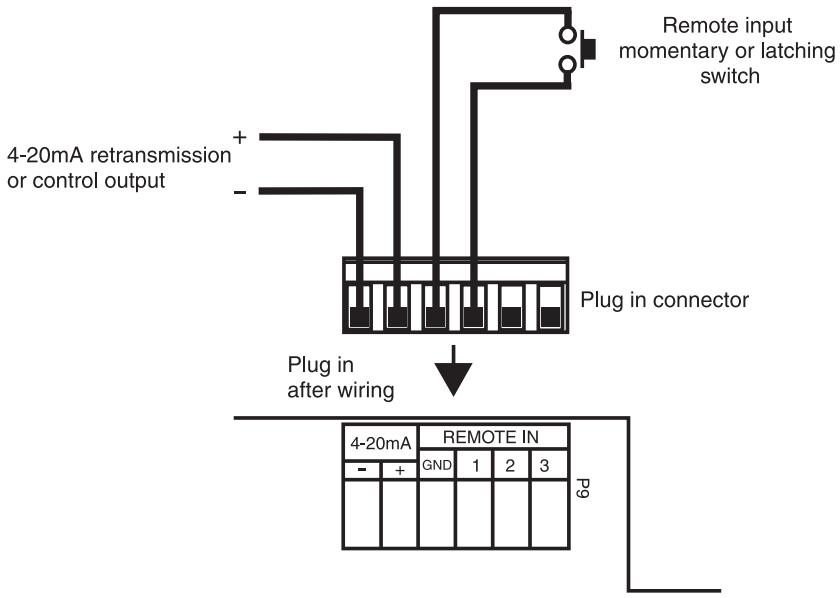
3.4 Temperature compensation sensor input

The TP4 will accept an LM335, Pt100 (100Ω RTD), Pt1000 (1000Ω RTD) or 3KΩ Balco type temperature sensor for automatic temperature compensation. Wiring and link settings for each type are as shown below. If dual temperature sensors are fitted then the colour code is: Red and Black Pt100, Green and White Pt1000. The Pt100, Pt1000 and Balco type sensors are not polarised.



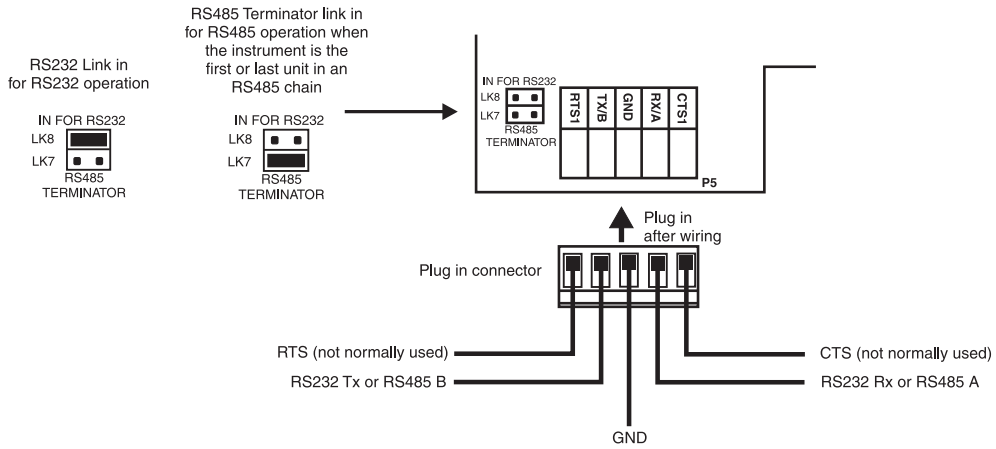
3.5 Remote input and analog retransmission

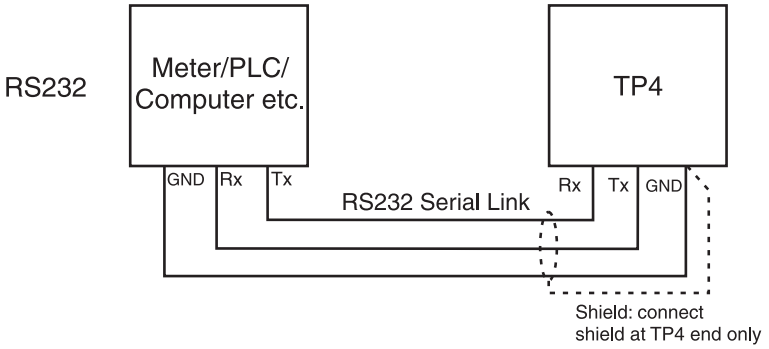
A remote input is provided to allow special function operation (see Explanation of functions Chapter 5 for a description of the remote input functions **r.i nP**). A separate remote input switch connection is required for operation of the chosen function. Choose a momentary switch for those functions requiring a brief closure (e.g. tare and zero) or latching switch for functions which require a longer closure (e.g. peak hold and display hold). Remote input 2 and 3 connections are not used in this instrument software version. The 4-20mA output is connected as shown and is configurable for retransmission or PI control output. The 4-20mA output is powered by the TP4 and will drive the 4-20mA signal into loads of up to 1kΩ.

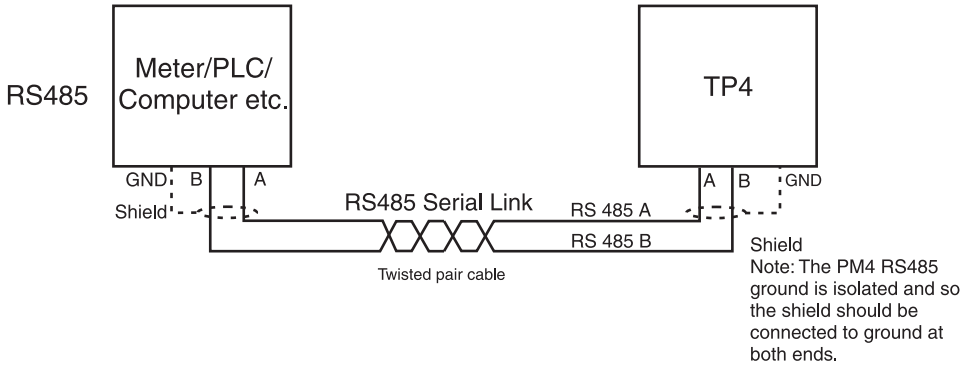


3.6 Serial output

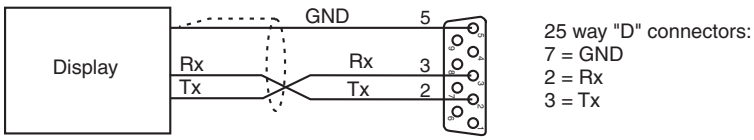
When using the standard RS232 output link LK8 must be in, Tx at the TP4 end connects to Rx at the other end of the serial link, likewise Rx at the TP4 end connects to Tx at the other end of the link. When using the optional RS485 connections are A the TP4 end to A at the other end of the link and B at the TP4 end to B at the other end. The ground line should be connected in each case. If the TP4 is the first or last unit in a RS485 chain then the link LK7 may need to be in, this places a terminating resistor across the input to help prevent signal reflections in long cable runs.







Standard PC 9 pin male "D" type RS232 serial port connector.
Rear terminals (solder side) shown.



RS485 connection terminals may vary, check documentation when connecting.
Terminal A is sometimes labeled "+" and terminal B is sometimes labeled "-"

4 Function tables - summary of setup functions

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

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

Display	Function	Range	Default	Your record	Ref/Page
C.SEt	Analog output PI control setpoint	Any display value	0		5.1 / 20
A 1.SP	Relay 1 PI control setpoint	Any display value	0		5.2 / 20
A2.SP	Relay 2 PI control setpoint	Any display value	0		5.3 / 21
A 1Lo	Displays and sets the low setpoint value for alarm relay 1.	Any display value or OFF	OFF	See 4.1	5.4 / 21
A2Lo, A3Lo and A4Lo	Displays and sets the low setpoint value for alarm relay 2, 3 and 4.	Any display value or OFF	OFF	See 4.1	5.5 / 21
A 1H,	Displays and sets the high setpoint value for alarm relay 1.	Any display value or OFF	OFF	See 4.1	5.6 / 22
A2H, , A3H, and A4H,	Displays and sets the high setpoint value for alarm relay 2, 3 and 4.	Any display value or OFF	OFF	See 4.1	5.7 / 22
A 1HY	Displays and sets the hysteresis value for alarm relay 1.	0 to 9999	10	See 4.1	5.8 / 22
A2HY, A3HY and A4HY	Displays and sets the hysteresis value for alarm relay 2, 3 and 4.	0 to 9999	10	See 4.1	5.9 / 23
A 1tt	Displays and sets the trip time delay for alarm relay 1.	0 to 9999	0	See 4.1	5.10 / 23
A2tt, A3tt and A4tt	Displays and sets the trip time delay for alarm relay 2, 3 and 4.	0 to 9999	0	See 4.1	5.11 / 24
A 1rt	Displays and sets the reset time delay for alarm relay 1.	0 to 9999	0	See 4.1	5.12 / 24
A2rt, A3rt and A4rt	Displays and sets the reset time delay for alarm relays 2, 3, 4.	0 to 9999	0	See 4.1	5.13 / 24

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

A 1n.o or A 1n.c	Displays and sets the setpoint alarm relay 1 action to normally open (de-energised) or normally closed (energised)	A 1n.o or A 1n.c	A 1n.o	See 4.1	5.14 / 24
A2n.o or A2n.c, A3n.o or A3n.c, A4n.o or A4n.c	Displays and sets the setpoint alarm relay 2, 4 and 4 action to normally open (de-energised) or normally closed (energised)	Ax n.o or Ax n.c	Ax n.o	See 4.1	5.15 / 25
AxSP or Axt 1 etc.	Relay operation independent setpoint or trailing setpoint	AxSP or Axt 1 etc.	AxSP	See 4.1	5.16 / 25

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

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

Display	Function	Range	Default	Your record	Ref/Page
A 1 OPEr	Relay 1 PI control	A 1.AL, A 1.tP or A 1.FF	A1 .AL		5.17 / 25
A2 OPEr	Relay 2 PI control	A2.AL, A2.tP or A2.FF	A2.AL		5.18 / 25
ctrl SPAn	Relay PI control span	1 to any positive value	1		5.19 / 26
A 1. P9	Relay 1 PI control proportional gain	-32.767 to 32.767	0.000		5.20 / 26
A2. P9	Relay 2 PI control proportional gain	-32.767 to 32.767	0.000		5.21 / 26
A 1. I 9	Relay 1 PI control integral gain	-32.767 to 32.767	0.000		5.22 / 26
A2. I 9	Relay 2 PI control integral gain	-32.767 to 32.767	0.000		5.23 / 26
A 1. I L	Relay 1 PI control integral low limit	0.0 to 100.0	0.0		5.24 / 27
A2. I L	Relay 2 PI control integral low limit	0.0 to 100.0	0.0		5.25 / 27
A 1. I H	Relay 1 PI control integral high limit	0.0 to 100.0	0.0		5.26 / 27

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

A2.iH	Relay 2 PI control integral high limit	0.0 to 100.0	0.0		5.27 / 27
A1.bS	Relay 1 PI control bias	0.0 to 100.0	50.0		5.28 / 27
A2.bS	Relay 2 PI control bias	0.0 to 100.0	50.0		5.29 / 28
A1.dc	Relay 1 PI control minimum off time	0.0 to 100.0	1.0		5.30 / 28
A2.dc	Relay 2 PI control minimum off time	0.0 to 100.0	1.0		5.31 / 28
A1.dr	Relay 1 PI control on time	0.0 to 100.0	0.0		5.32 / 28
A2.dr	Relay 2 PI control on time	0.0 to 100.0	0.0		5.33 / 28
brgt	Display brightness level	1 to 15	15		5.34 / 29
duLL	Display remote brightness switching	0 to 15	1		5.35 / 29
OFSt CAL1	Offset calibration for input channel 1	n/a	n/a		5.36 / 29
OFSt CAL2	Offset calibration for input channel 2	n/a	n/a		5.37 / 29
CAL1	Channel 1 first calibration point	n/a	n/a		5.38 / 30
CAL2	Channel 1 second calibration point	n/a	n/a		5.39 / 30
CH2 CAL1	Channel 2 first calibration point	n/a	n/a		5.40 / 30
CH2 CAL2	Channel 2 second calibration point	n/a	n/a		5.41 / 30
rEC_	Analog output option low display value	Any display value	0		5.42 / 30
rEC¯	Analog output option high display value	Any display value	1000		5.43 / 31
drnd	Display rounding	1 to 5000	1		5.44 / 31
CH1 dCPt	Channel 1 decimal point	0, 0.1 or 0.02	0		5.45 / 31
FLtr	Digital filter	0 to 8	2		5.46 / 31
1nPt POL	Channel 1 input polarity	POS or nEG	POS		5.47 / 32
UCAL 1On	Channel 1 uncalibrate	n/a	n/a		5.48 / 32
°C tYPE	Temperature sensor type	nonE, 100, 1000, L335 or 3tc	nonE		5.49 / 32
dEF °C	Default solution temperature	0.0 to 200.0	25.0		5.50 / 32
CAL °C	Calibrate temperature sensor	n/a	n/a		5.51 / 33

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

UCAL °C	Uncalibrate temperature sensor	n/a	n/a		5.52 / 33
F.I nP	Remote input (external input) function	nONE, P.HLd, d.HLd, Hi, Lo, Hi Lo, SP.Ac, no.Ac or dULL	nONE		5.53 / 33
Pbut	P button function	nONE, Hi, Lo or Hi Lo	nONE		5.54 / 34
I nPt tYPE	Channel 1 input type	PH or ORP	PH		5.55 / 34
Ch 1	Channel 1 input connector	bnc or 4-20	bnc		5.56 / 35
Ch2 tYPE	Channel 2 input type	PH or ORP	PH		5.57 / 35
Ch2	Channel 2 input connector	bnc or 4-20	bnc		5.58 / 35
Ch2 POL	Channel 2 input polarity	POS or nEG	POS		5.59 / 35
CH2 dCPt	Channel 2 decimal point	0, 0.1 or 0.02	0		5.60 / 36
UCAL Ch2	Channel 2 uncalibrate	n/a	n/a		5.61 / 36
ACCS	Access mode	OFF, EASY, nONE or ALL	OFF		5.62 / 36
SPAC	Setpoint access mode	A1, A1-2, A1-3 or A1-4	A1		5.63 / 36
A1, A2 etc.	Alarm relay operation mode	Lo uE, CH2, °C, P.HLd, d.HLd, Hi, Lo or di SP	Lo uE	See 4.1	5.64 / 37
rEC	Analog retransmission output mode	Lo uE, CH2, °C, P.HLd, d.HLd, Hi, Lo or di SP	Lo uE		5.65 / 38
Log UPdt	Data logger logging period (*Optional)	0.10 to 60.00	1.00		5.66 / 39
Clr Log	Clear data logger memory (*Optional)	0.10 to 60.00	n/a		5.67 / 39
SEt rtc	Set datalogger clock (*Optional)	0.01 to 24.00	n/a		5.68 / 39
SEt dAtE	Set datalogger date (*Optional)	01.01 to 31.12	Date		5.69 / 40

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

SEt YEAr	Set datalogger year (*Optional)	1970 to 2037	Year		5.70 / 40
rEC ctrl	Analog output PI control	on or OFF	OFF		5.71 / 40
C.SPn	Analog PI output control span	0 to any positive value	0		5.72 / 40
C P9	Analog PI control proportional gain	-32.767 to 32.767	0.000		5.73 / 40
C P0	Analog PI control proportional offset	0.0 to 100.0	0.0		5.74 / 41
C I 9	Analog PI control integral gain	-32.767 to 32.767	0.000		5.75 / 41
C I L.H	Analog PI control integral high limit	0.0 to 100.0	0.0		5.76 / 41
C I L.L	Analog PI control integral low limit	0.0 to 100.0	0.0		5.77 / 41
rEC SPAC	Analog PI control setpoint access	on or OFF	OFF		5.78 / 41
bAUd	Baud rate for serial communications	300.600. 1200.2400. 4800.9600. 19.2 or 38.4	9600		5.79 / 42
PrtY	Parity for serial communications	nonE.EUEn or odd	nonE		5.80 / 42
O.Put	Output for serial communications (*Optional)	dI SP.Cont. POLL or A.buS	Cont		5.81 / 42
Addr	Instrument address for serial communications	0 to 31	0		5.82 / 42

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

4.1 Settings for relays - record settings here

Display	Relay 1	Relay 2	Relay 3	Relay 4
A 1.SP		n/a	n/a	n/a
A2.SP	n/a		n/a	n/a
AxLo				
AxHi				
AxHY				
Axtt				
Axrt				
Axn.o or Axn.c				
AxSP or Axt 1 etc.	n/a			
A 1 OPEr		n/a	n/a	n/a
A2 OPEr	n/a		n/a	n/a
ctrl SPAn			n/a	n/a
A 1. Pg			n/a	n/a
A2. Pg			n/a	n/a
A 1. 1 g			n/a	n/a
A2. 1 g			n/a	n/a
A 1. 1 H			n/a	n/a
A2. 1 H			n/a	n/a
A 1. 1 L			n/a	n/a
A2. 1 L			n/a	n/a
A 1. bS			n/a	n/a
A2. bS			n/a	n/a
A 1. dc			n/a	n/a
A2. dc			n/a	n/a
A 1. dr			n/a	n/a
A2. dr			n/a	n/a

5 Explanation of functions

The setup and calibration functions are configured through a push button sequence. The push buttons located at the front of the instrument are used to alter settings. Two basic access modes are available:

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

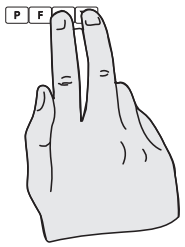
CAL mode (power up sequence plus push button sequence) allows access to all functions including calibration parameters.

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

Entering CAL Mode

1. Remove power from the instrument. Hold in the F button and reapply power. The display will briefly indicate CAL as part of the "wake up messages" when the CAL message is seen you can release the button. Move to step 2 below.

2. When the "wake up" messages have finished and the display has settled down to its normal reading press, then release the F button. Move to step 3 below.



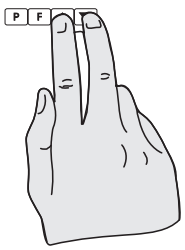
3. Within 2 seconds of releasing the F button press, then release the ▲ and ▼ buttons together. The display will now indicate FUNC followed by the first function.

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

Entering FUNC Mode

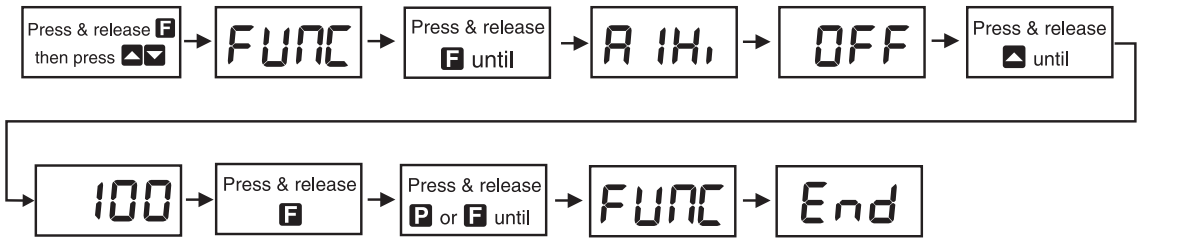
No special power up procedure is required to enter FUNC mode.

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

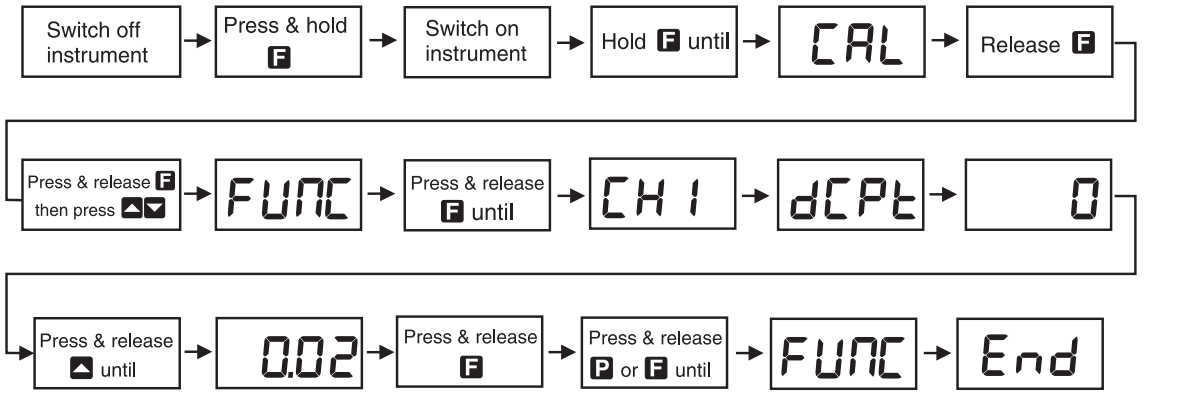


2. Within 2 seconds of releasing the F button press, then release the ▲ and ▼ buttons together. The display will now indicate FUNC followed by the first function.

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



Example: Entering CAL mode to change decimal point CH 1 dCPt function from 0 to 0.02



Explanation of Functions

5.1 Analog output PI control setpoint

Display: C.SEt
Range: Any display value
Default Value: 0

Selects analog output PI control setpoint. Refer to the separate Output Addendum booklet for further details.

5.2 Relay 1 PI control setpoint

Display: A 1.SP
Range: Any display value
Default Value: 0

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

5.3 Relay 2 PI control setpoint

Display: A2.SP
Range: Any display value
Default Value: 0

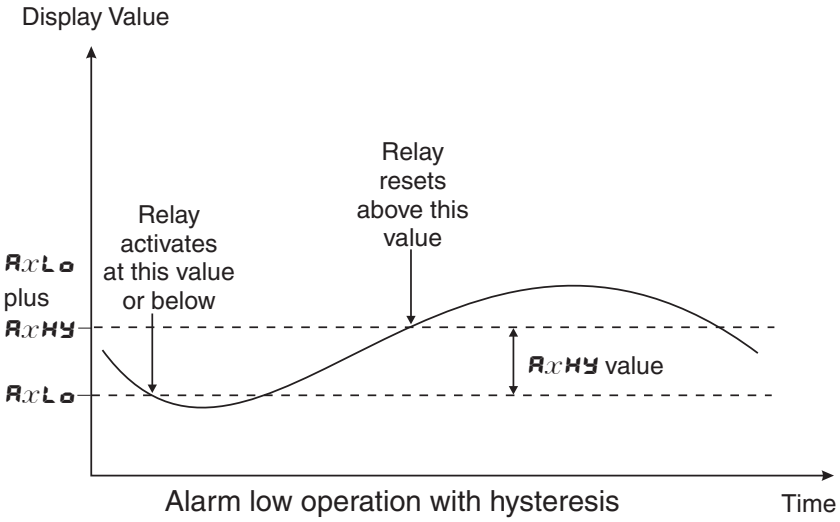
Selects Relay 2 PI control setpoint. This function will not be seen unless the A2 OPEr function is set to on. Refer to the separate Output Addendum booklet for further details.

5.4 Alarm relay low setpoint

Display: A 1Lo
Range: Any display value or OFF
Default Value: OFF

Displays and sets the low setpoint value for alarm relay 2. Use this low setpoint function if a relay operation is required when the display value becomes equal to or less than the low setpoint value. To set a low alarm value go to the AxLo function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value. The low alarm setpoint may be disabled by pressing the ▲ and ▼ push buttons simultaneously. When the alarm is disabled the display will indicate OFF. If the relay is allocated both a low and high setpoint then the relay will activate when the value displayed moves outside the band set by the low and high setpoints. The value at which the relay will reset is controlled by the AxHY function.

Example:
If A 1Lo is set to 10 then relay 1 will activate when the display value is 10 or less.



5.5 Alarm relay low setpoint for relays 2, 3, 4

Display: A2Lo, A3Lo and A4Lo
Range: Any display value or OFF
Default Value: OFF

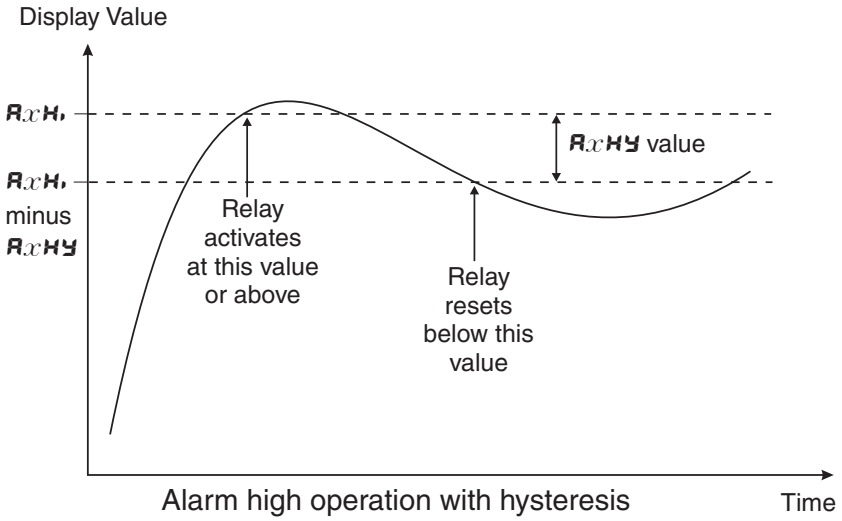
These functions set the alarm relay low level for relays 2, 3 and 4 and operate in the same manner as A 1Lo. See A 1Lo for further description.

5.6 Alarm relay high setpoint

Display: A 1H
Range: Any display value or OFF
Default Value: OFF

Displays and sets the high setpoint value for alarm relay 1. Use this high setpoint function if a relay operation is required when the display value becomes equal to or more than the low setpoint value. To set a high alarm value go to the AxH function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value. The high alarm setpoint may be disabled by pressing the ▲ and ▼ push buttons simultaneously. When the alarm is disabled the display will indicate OFF. If the relay is allocated both a low and high setpoint then the relay will activate when the value displayed moves outside the band set by the low and high setpoints. The value at which the relay will reset is controlled by the AxHY function.

Example:
If A 1H is set to 100 then relay 1 will activate when the display value is 100 or higher.



5.7 Alarm relay high setpoint for relays 2, 3, 4

Display: A2H , A3H and A4H
Range: Any display value or OFF
Default Value: OFF

These functions set the alarm relay high level for relays 2, 3 and 4 and operate in the same manner as A 1H . See A 1H for further description.

5.8 Alarm relay hysteresis (deadband)

Display: A 1HY
Range: 0 to 9999
Default Value: 10

Displays and sets the alarm relay hysteresis limit for the relay 1. To set a relay hysteresis value go to the AxHY function and use the ▲ or ▼ push buttons to set the value required then press F

to accept this value. The hysteresis value is common to both high and low setpoint values. The hysteresis value may be used to prevent too frequent operation of the relay when the measured value is rising and falling around setpoint value. e.g. if **A 1HY** is set to zero the alarm will activate when the display value reaches the alarm setpoint (for high alarm) and will reset when the display value falls below the setpoint, this can result in repeated on/off switching of the relay at around the setpoint value. The hysteresis setting operates as follows: In the high alarm mode, once the alarm is activated the input must fall below the setpoint value minus the hysteresis value to reset the alarm. e.g. if **A 1H,** is to **50.0** and **A 1HY** is set to **3.0** then the setpoint output relay will activate once the display value goes to **50.0** or above and will reset when the display value goes below **47.0** i.e. at **46.9** or below. In the low alarm mode, once the alarm is activated the input must rise above the setpoint value plus the hysteresis value to reset the alarm. e.g. if **A 1Lo** is to **20.0** and **A 1HY** is set to **10.0** then the alarm output relay will activate when the display value falls to **20.0** or below and will reset when the display value goes above **30.0** i.e at **30.1** or above. The hysteresis units are expressed in displayed engineering units. **Example:**
If **A 1H,** is set to **100** and **A 1HY** is set to **10** then relay 1 will activate when the display value is **100** or higher and will reset at a display value of **89** or lower.

5.9 Alarm relay hysteresis (deadband) for relays 2, 3, 4

Display: **A2HY**, **A3HY** and **A4HY**
Range: **0** to **9999**
Default Value: **10**

These functions set the alarm relay hysteresis level for relays 2, 3 and 4 and operate in the same manner as **A 1HY**. See **A 1HY** for further description.

5.10 Alarm relay trip time

Display: **A 1tt**
Range: **0** to **9999**
Default Value: **0**

Displays and sets the alarm trip time in seconds. The trip time is common for both alarm high and low setpoint values. The trip time provides a time delay before the alarm relay will activate when an alarm condition is present. The alarm condition must be present continuously for the whole trip time period before the alarm will activate. If the input moves out of alarm condition during this period the timer will reset and the full time delay will be restored. This trip time delay is useful for preventing an alarm trip due to short non critical deviations from setpoint. The trip time is selectable over **0** to **9999** seconds. To set a trip time value go to the **Axtt** function and use the ▲ or ▼ push buttons to set the value required then press **F** to accept this value. **Example:**
If **A 1tt** is set to **5** seconds then the display must indicate an alarm value for a full 5 seconds before relay 1 will activate.

5.11 Alarm relay trip time for relays 2, 3, 4

Display: A2tt, A3tt and A4tt
Range: 0 to 9999
Default Value: 0

These functions set the alarm relay trip time in seconds for relays 2, 3 and 4 and operate in the same manner as A 1tt. See A 1tt for further description.

5.12 Alarm relay reset time

Display: A 1rt
Range: 0 to 9999
Default Value: 0

Displays and sets the alarm reset delay time in seconds. The reset time is common for both alarm high and low setpoint values. With the alarm condition is removed the alarm relay will stay in its alarm condition for the time selected as the reset time. If the input moves back into alarm condition during this period the timer will reset and the full time delay will be restored. The reset time is selectable over 0 to 9999 seconds. To set a reset time value go to the Axrt function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value.
Example:
If A 1rt is set to 10 seconds then the resetting of alarm relay 1 will be delayed by 10 seconds.

5.13 Alarm relay reset time for relays 2, 3, 4

Display: A2rt, A3rt and A4rt
Range: 0 to 9999
Default Value: 0

These functions set the alarm relay trip time in seconds for relays 2, 3 and 4 and operate in the same manner as A 1rt. See A 1rt for further description.

5.14 Alarm relay normally open/closed

Display: A 1n.o or A 1n.c
Range: A 1n.o or A 1n.c
Default Value: A 1n.o

Displays and sets the setpoint alarm relay 1 action to normally open (de-energised) or normally closed (energised), when no alarm condition is present. Since the relay will always be open open circuit between the NO and COM terminals when power is removed a normally closed alarm is often used to provide a power failure alarm indication. To set the alarm alarm for normally open or closed go to the Axn.o or Axn.c 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 between the NO and COM terminals when the display is outside alarm condition and will be closed (short circuit across NO and COM terminals) when the display is in alarm condition. The NC and COM terminals will be in the opposite state.

5.15 Alarm relay normally open/closed for relays 2, 3, 4

Display: **A2n.o** or **A2n.c**, **A3n.o** or **A3n.c**, **A4n.o** or **A4n.c**
Range: **Ax n.o** or **Ax n.c**
Default Value: **Ax n.o**

These functions set the alarm normally open or normally closed condition for relays 2, 3 and 4 and operate in the same manner as **A 1n.o** or **A 1n.c**. See **A 1n.o** or **A 1n.c** for further description.

5.16 Alarm relay setpoint or trailing operation

Display: **AxSP** or **Axt 1** etc.
Range: **AxSP** or **Axt 1** etc.
Default Value: **AxSP**

Relay operation independent setpoint or trailing setpoint. Each alarm, except relay 1, may be programmed to operate with an independent setpoint value or may be linked to operate at a fixed difference to another relay setpoint, known as trailing operation. The operation is as follows:

Alarm 1 (**A1**) is always independent. Alarm 2 (**A2**) may be independent or may be linked to Alarm 1. Alarm 3 (**A3**) may be independent or may be linked to Alarm 1 or Alarm 2. Alarm 4 (**A4**) may be independent or may be linked to Alarm 1, Alarm 2 or Alarm 3. The operation of each alarm is selectable by selecting, for example, (Alarm 4) **A4.SP** = Alarm 4 normal setpoint or **A4.t 1** = Alarm 4 trailing Alarm 1 or **A4.t2** = Alarm 4 trailing Alarm 2 or **A4.t3** = Alarm 4 trailing Alarm 3. For trailing set points the setpoint value is entered as the difference from the setpoint being trailed. If the trailing setpoint is to operate ahead of the prime setpoint then the value is entered as a positive number and if operating behind the prime setpoint then the value is entered as a negative number. **Example:**
With Alarm 2 set to trail alarm 1, if **A 1H,** is set to **1000** and **A2H,** is set to **50** then Alarm 1 will activate at **1000** and alarm 2 will activate at **1050** (i.e. 1000 + 50). If Alarm 2 had been set at **-50** then alarm 2 would activate at **950** (i.e. 1000 – 50).

5.17 Relay 1 PI control

Display: **A 1 OPEr**
Range: **A 1.AL**, **A 1.tP** or **A 1.FF**
Default Value: **A1 .AL**

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

5.18 Relay 2 PI control

Display: **A2 OPEr**
Range: **A2.AL**, **A2.tP** or **A2.FF**
Default Value: **A2.AL**

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

5.19 Relay PI control span

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

Sets the Relay PI control span value. This setting is common to both relays. This function will not be seen unless the A1 OPER or A1 OPER function is set to on. Refer to the separate Output Addendum booklet for further details.

5.20 Relay 1 PI control proportional gain

Display: A1. P9
Range: -32.767 to 32.767
Default Value: 0.000

Sets the Relay 1 PI proportional gain value. This function will not be seen unless the A1 OPER function is set to on. Refer to the separate Output Addendum booklet for further details.

5.21 Relay 2 PI control proportional gain

Display: A2. P9
Range: -32.767 to 32.767
Default Value: 0.000

Sets the Relay 2 PI proportional gain value. This function will not be seen unless the A2 OPER function is set to on. Refer to the separate Output Addendum booklet for further details.

5.22 Relay 1 PI control integral gain

Display: A1. I 9
Range: -32.767 to 32.767
Default Value: 0.000

Sets the Relay 1 PI integral gain value. This function will not be seen unless the A1 OPER function is set to on. Refer to the separate Output Addendum booklet for further details.

5.23 Relay 2 PI control integral gain

Display: A2. I 9
Range: -32.767 to 32.767
Default Value: 0.000

Sets the Relay 2 PI integral gain value. This function will not be seen unless the A2 OPER function is set to on. Refer to the separate Output Addendum booklet for further details.

5.24 Relay 1 PI control integral low limit

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

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

5.25 Relay 2 PI control integral low limit

Display: A2. I L
Range: 0.0 to 100.0
Default Value: 0.0

Sets the Relay 2 PI integral low limit value. This function will not be seen unless the A2 OPEr function is set to on. Refer to the separate Output Addendum booklet for further details.

5.26 Relay 1 PI control integral high limit

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

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

5.27 Relay 2 PI control integral high limit

Display: A2. I H
Range: 0.0 to 100.0
Default Value: 0.0

Sets the Relay 2 PI integral high limit value. This function will not be seen unless the A2 OPEr function is set to on. Refer to the separate Output Addendum booklet for further details.

5.28 Relay 1 PI control bias

Display: A 1. bS
Range: 0.0 to 100.0
Default Value: 50.0

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

5.29 Relay 2 PI control bias

Display: A2. bS
Range: 0.0 to 100.0
Default Value: 50.0

Sets the Relay 2 PI control bias. This function will not be seen unless the A2 OPEr function is set to on. Refer to the separate Output Addendum booklet for further details.

5.30 Relay 1 PI control minimum off time

Display: A 1. dc
Range: 0.0 to 100.0
Default Value: 1.0

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

5.31 Relay 2 PI control minimum off time

Display: A2. dc
Range: 0.0 to 100.0
Default Value: 1.0

Sets the Relay 2 PI proportional bias. This function will not be seen unless the A2 OPEr function is set to on. Refer to the separate Output Addendum booklet for further details.

5.32 Relay 1 PI control on time

Display: A 1. dr
Range: 0.0 to 100.0
Default Value: 0.0

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

5.33 Relay 2 PI control on time

Display: A2. dr
Range: 0.0 to 100.0
Default Value: 0.0

Sets the Relay 2 PI proportional bias. This function will not be seen unless the A2 OPEr function is set to on. Refer to the separate Output Addendum booklet for further details.

5.34 Display brightness

Display: brgt
Range: 1 to 15
Default Value: 15

Displays and sets the digital display brightness. The display brightness is selectable from 1 to 15, where 1 = lowest intensity and 15 = highest intensity. This function is useful for 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 and use the ▲ or ▼ push buttons to set the value required then press F to accept this value.

5.35 Display remote brightness switching

Display: dull
Range: 0 to 15
Default Value: 1

Displays and sets the level for remote input brightness switching, see r.i nP function. When a remote input is set to dull the remote input can be used to switch between the display brightness level set by the brgt function 5.34 and the display brightness set by the dull function. The display dull level is selectable from 0 to 15, where 0 = lowest intensity and 15 = highest intensity. This function is useful in reducing glare when the display needs to be viewed in both light and dark ambient light levels. To set dull level go to the dull function and use the ▲ or ▼ push buttons to set the value required then press F to accept this value.

Example: With dull set to 4 and brgt set to 15 and the r.i nP function set to dull the display brightness will change from the 15 level to 4 when a switch connected to the remote input terminals is activated.

5.36 Offset calibration for input channel 1

Display: OFSt CAL 1
Range: n/a
Default Value: n/a

Offset calibration for channel 1 function. Refer to chapter 6.

5.37 Offset calibration for input channel 2

Display: OFSt CAL2
Range: n/a
Default Value: n/a

Offset calibration for channel 2 function. Refer to chapter 6.

5.38 Channel 1 first calibration point

Display: CAL 1
Range: n/a
Default Value: n/a

First calibration point for channel 1 pH or ORP input. Refer to the Calibration chapter 6

5.39 Channel 1 second calibration point

Display: CAL2
Range: n/a
Default Value: n/a

Second calibration point for channel 2 pH or ORP input. Refer to the Calibration chapter 6

5.40 Channel 2 first calibration point

Display: CH2 CAL 1
Range: n/a
Default Value: n/a

First calibration point for channel 2 pH or ORP input. Refer to the Calibration chapter 6

5.41 Channel 2 second calibration point

Display: CH2 CAL2
Range: n/a
Default Value: n/a

Second calibration point for channel 2 pH or ORP input. Refer to the Calibration chapter 6

5.42 Analog output option low value

Display: rEC_
Range: Any display value
Default Value: 0

Displays and sets the 4–20mA analog retransmission output low value (4mA) in displayed units. To set the analog output low value go to the rEC_ function and use the ▲ or ▼ push buttons to set the required value then press F to accept this selection.

Example:
If it is required to retransmit 4mA when the display indicates 0.0 then select 0.0 in this function using the ▲ or ▼ button.

5.43 Analog output option high value

Display: rEC-
Range: Any display value
Default Value: 1000

Displays and sets the 4–20mA analog retransmission output high value (20mA) in displayed units. To set the analog output high value go to the rEC- function and use the ▲ or ▼ push buttons to set the required value then press F to accept this selection.

Example:
If it is required to retransmit 20mA when the display indicates 14.0 then select 14.0 in this function using the ▲ or ▼ button.

5.44 Display rounding

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

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

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

5.45 Channel 1 decimal point selection

Display: CH1dCPt
Range: 0, 0.1 or 0.02
Default Value: 0

Displays and sets the decimal point for the channel 1 input. By pressing the ▲ or ▼ pushbuttons the decimal point position may be set. The display will indicate as follows: 0 (no decimal point), 0.1 (1 decimal place) or 0.02 (2 decimal places).

5.46 Digital filter

Display: FLtr
Range: 0 to 8
Default Value: 2

Displays and sets the digital filter value. Digital filtering uses a weighted average method of determining the display value and is used for reducing display value variation due to short term interference. The digital filter range is selectable from 0 to 8, where 0 = none and 8 = most

filtering. Use ▲ or ▼ at the FLtr function to alter the filter level if required. Note that the higher the filter setting the longer the display may take to reach its final value when the input is changed, similarly the relay operation and any output options will be slowed down when the filter setting is increased. To set the digital filter value go to the FLtr function and use the ▲ or ▼ push buttons to set the required value then press F to accept this selection.

5.47 Channel 1 input polarity

Display: 1 nPt POL
Range: POS or nEG
Default Value: POS

Allow selection of POS (positive) or nEG (negative) input polarity. For most applications POS would be used. Use nEG if the electrode signal has been inverted e.g. if an inverting amplifier is used between the electrode and the TP4.

5.48 Channel 1 uncalibrate

Display: UCAL 1 On
Range: n/a
Default Value: n/a

Uncalibrate i.e. revert to factory calibration for channel 1. Refer to the Calibration chapter 6

5.49 Temperature sensor type

Display: °C tYPE
Range: nonE, 100, 1000, L335 or 3tc
Default Value: nonE

Displays and selects the input sensor type being used. Select from: nonE (no temperature sensor), 100 (100Ω RTD or Pt100), 1000 (1000Ω RTD or Pt1000), L335 (LM335 semiconductor sensor) or 3tc (3KΩ Balco temperature sensor used by certain pH electrode manufacturers e.g. TBI, Uniloc and Bradley James Corporation).

5.50 Default solution temperature

Display: dEF °C
Range: 0.0 to 200.0
Default Value: 25.0

Displays and sets the display default solution temperature when no temperature sensor is used. The default solution temperature chosen is used to calculate the pH temperature compensation and so this value should be set as close as possible to the solution temperature. Default temperature can be set from 0.0 to 200.0^{o}C. When a temperature sensor input is selected at the °C tYPE function and connected the default solution temperature is ignored and the live temperature reading used.

5.51 Calibrate temperature sensor

Display: CAL °C
Range: n/a
Default Value: n/a

Temperature sensor calibration function Refer to chapter 6.

5.52 Uncalibrate temperature sensor

Display: UCAL °C
Range: n/a
Default Value: n/a

Temperature sensor uncalibration function. Refer to chapter 6.

5.53 Remote input function

Display: r.i nP
Range: nonE , P.HLd , d.HLd , Hi , Lo , Hi Lo , SP.Ac , no.Ac or duLL
Default Value: nonE

Remote input function - When these remote input terminals are short circuited, via a switch, relay, keyswitch etc. the instrument will perform the selected remote input function. A message will flash to indicate which function has been selected when the remote input pins are short circuited. The remote input functions are as follows:

nonE - no remote function required i.e. activating the remote input has no effect.

P.HLd - 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.HLd - 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.

Hi - 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.

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

Hi Lo - toggle between **Hi** and **Lo** displays. This function allows the remote input to be used to toggle between peak and valley memory displays. The first operation of the remote input will cause the peak memory value to be displayed, the next operation will give a valley memory display. **PHi** or **PLo** will flash before each display to give an indication of display type.

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

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

dULL - display brightness control. The remote input can be used to change the display brightness. When this mode is selected the display brightness can be switched, via the remote input terminals, between the brightness level set at the **brgt** function and the brightness level set at the **dULL** function.

5.54 P button function

Display: **Pbut**
Range: **nONE**, **Hi**, **Lo** or **Hi Lo**
Default Value: **nONE**

P button function. The P button may be set to operate some of functions also available via the remote input. If both the remote input and P button function are operated simultaneously the P button will override the remote input. Functions available are:

nONE - no function required i.e. pressing the P button has no effect.

Hi - peak memory. The peak value stored in memory will be displayed if the P button is pressed momentarily, the display will return to normal measurement after 20 seconds. If the P button is held pressed for 3 seconds or the power is removed from the instrument then the memory will be reset.

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

Hi Lo - toggle between **Hi** and **Lo** displays. This function allows the P button to be used to toggle between peak and valley memory displays. The first operation of the P button will cause the peak memory value to be displayed, the next operation will give a valley memory display. **PHi** or **PLo** will flash before each display to give an indication of display type.

5.55 Channel 1 input type

Display: **1 InPt tYPE**
Range: **PH** or **ORP**
Default Value: **PH**

Displays and sets the input type to be used for channel 1. Choices available are: **PH** (pH electrode input) or **ORP** (ORP/Redox electrode input).

5.56 Channel 1 input connector

Display: Ch 1
Range: bnc or 4-20
Default Value: bnc

Displays and sets the input type and connector to be used for channel 1 input. Select **bnc** if the input is directly from a pH or ORP electrode. The BNC connector for channel 1 is connector P7 marked "CH1". If a pH transmitter is used (conversion of pH signal to 4–20mA signal) then select **4-20**. Note that the 4-20mA input can only be used for pH (not ORP or other signals). The 4–20mA input for channel 1 is P11 marked as "CH3".

5.57 Channel 2 input type

Display: Ch2 tYPE
Range: PH or ORP
Default Value: PH

Displays and sets the input type to be used for channel 2. Choices available are: **PH** (pH electrode input) or **ORP** (ORP/Redox electrode input).

5.58 Channel 2 input connector

Display: Ch2
Range: bnc or 4-20
Default Value: bnc

Displays and sets the input type and connector to be used for channel 2 input. Select **bnc** if the input is directly from a pH or ORP electrode. The BNC connector for channel 1 is connector P8 marked "CH2". If a pH transmitter is used (conversion pH signal to 4–20mA signal) then select **4-20**. Note that the 4-20mA input can only be used for pH (not ORP or other signals). The 4–20mA input for channel 2 is P12 marked as "CH4".

5.59 Channel 2 input polarity

Display: Ch2 POL
Range: POS or NEG
Default Value: POS

Allow selection of **POS** (positive) or **NEG** (negative) input polarity. For most applications **POS** would be used. Use **NEG** if the electrode signal has been inverted e.g. if an inverting amplifier is used between the electrode and the TP4.

5.60 Channel 2 decimal point selection

Display: CH2 dCPt
Range: 0, 0.1 or 0.02
Default Value: 0

Displays and sets the decimal point for the channel 2 input. By pressing the ▲ or ▼ pushbuttons the decimal point position may be set. The display will indicate as follows: 0 (no decimal point), 0.1 (1 decimal place) or 0.02 (2 decimal places).

5.61 Channel 2 uncalibrate

Display: UCAL Ch2
Range: n/a
Default Value: n/a

Uncalibrate i.e. revert to factory calibration for channel 2. Refer to the Calibration chapter 6

5.62 Access mode

Display: ACCS
Range: OFF, EASY, NONE or ALL
Default Value: OFF

Access mode - the access mode function ACCS has four possible settings namely OFF, EASY, NONE and ALL. If set to OFF the mode function has no effect on alarm relay operation. If set to EASY the "easy alarm access" mode will be activated. Refer to "Easy alarm relay adjustment access facility" section. If set to NONE there will be no access to any functions via FUNC mode, entry via CAL mode must be made to gain access to alarm and calibration functions. If set to ALL then access to all functions, including calibration functions, can be gained via FUNC mode.

5.63 Setpoint access mode

Display: SPAC
Range: A1, A1-2, A1-3 or A1-4
Default Value: A1

Setpoint access. Sets the access via FUNC mode and "easy alarm access" mode to the alarm relay setpoints. The following choices are available:
A1 - Allows setpoint access to alarm 1 only.
A1-2 - Allows setpoint access to alarms 1 and 2.
A1-3 - Allows setpoint access to alarms 1,2 and 3.
A1-4 - Allows setpoint access to alarms 1,2,3 and 4.
The remote input function (r.inP) must be set to SP.AC for this function to operate. Note: Only the setpoints which have been given a value will be accessible e.g. if A1H, is set to OFF then there will be no access to the A1H, function when SPAC is used.

5.64 Alarm relay operation mode

Display: A 1.A2 etc.

Range: L, uE.CH2.°C.P.HLd.d.HLd.H, .Lo or dI SP

Default Value: L, uE

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

L, uE - live input mode for channel 1. The alarm relay operation will always follow the channel 1 electrical input at the time irrespective of the 7 segment display value. e.g. assume the remote input is set to PHLd and A 1Lo is set to 7.0. The display may be indicating a peak reading of 8.0 but if the electrical input changes to correspond with a normal display value of 7.0 or less then the alarm will operate. This will be the normal setting used unless one of the special modes which follow is required.

CH2 - live input mode for channel 2. The alarm relay follows the live input as per the L, uE function above but follows channel 2 rather than channel 1.

°C - temperature mode. When set to temperature mode the alarm relay will operate from the temperature reading i.e. setpoint will be in ^{o}C rather than pH or ORP.

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

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

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

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

dI SP - display mode. If the display mode is used then the alarms will operate purely on the display value at the time i.e. if the display is showing above high setpoint or below the low setpoint value then the alarm relay will activate. For example if the remote input were set to peak memory and A 1 were set to display mode then, unless the display is actually showing the peak memory value (i.e. the remote input has just been activated), the alarm relay is free to operate from the changing display value i.e. the memory does not have to be reset to clear an alarm condition. Note: in display mode any decimal points on the display will be ignored e.g. a reading of 4.7 will be taken as having a value of 47, this should be borne in mid when setting the A 1Lo and A 1H, functions.

5.65 Analog retransmission output mode

Display: rEC

Range: L, uE, CH2, °C, P.HLd, d.HLd, H, , Lo or dI SP

Default Value: L, uE

The following choices are available for analog retransmission operation mode (note the rEC ctrl function must be set to OFF to use these modes):

L, uE - live input mode for channel 1. The retransmission will follow the electrical input on channel 1 and will not necessarily follow the 7 segment display. For example if the remote input is set for peak hold operation then when the remote input is closed the 7 segment display will only show the peak value but the retransmission will be free to change to follow the electrical input. This will be the normal setting used unless one of the special modes which follow is required.

CH2 - live input mode for channel 2. The retransmission follows the live input as per the L, uE function above but follows channel 2 rather than channel 1.

°C - temperature mode. When set to temperature mode the retransmission will follow the temperature reading.

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

d.HLd - display hold mode. The 7 segment display and retransmission value will be held whilst the remote input display hold switch is closed. When the switch is opened the retransmission value will remain fixed at the held value although the 7 segment display value will be free to alter. The held retransmission output can be cleared by closing the remote input switch for another operation or by removing power from the instrument.

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

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

dI SP - display mode. The retransmission output will follow whatever value is on the 7 segment display. Note: in display mode any decimal points on the display will be ignored e.g. a reading of 1.4 will be taken as having a value of 14, this must be compensated for when setting the rEC_ and rEC¯ functions.

5.66 Data logger logging period

Display: LoG UPdt
Range: 0.10 to 60.00
Default Value: 1.00

Select log update time - seen only with data logger option. Refer tothe separate "TP4-PH Output Addendum" booklet for further details. .

Displays and sets the time period between each log sample. Available selections are:

0.10 (10 seconds), 0.20 (20 seconds), 0.30 (30 seconds), 1.00 (1 minute), 2.00 (2 minutes), 3.00 (3 minutes), 4.00 (4 minutes), 5.00 (5 minutes), 6.00 (6 minutes), 10.00 (10 minutes), 15.00 (15 minutes), 20.00 (20 minutes), 30.00 (30 minutes) and 60.00 (60 minutes).

Note: The data log memory (see CLr LoG below) must be cleared whenever the log update time is changed or the date and time is changed.

5.67 Clear data logger memory

Display: CLr LoG
Range: 0.10 to 60.00
Default Value: n/a

Clear data log memory - seen only with data logger option. Refer tothe separate "TP4-PH Output Addendum" booklet for further details .
This function clears the data log memory, to clear the memory press then release ▲ and ▼ simultaneously, the display will show CLr? asking if you really want to clear the memory. If you wish to clear memory then press then release ▲ and ▼ simultaneously again. The log memory will then be cleared and the log period reset, the display will indicate Prog LoG to confirm this. Once the memory is cleared all previously logged records will be lost from the instruments memory, if the CLr? message is reached and it is not wished to clear the log memory then pressing and releasing either F or P will abort the function.

5.68 Set datalogger clock

Display: SEt rtc
Range: 0.01 to 24.00
Default Value: n/a

Set time - seen only with data logger option. Refer tothe separate "TP4-PH Output Addendum" booklet for further details .
Displays and sets the current time in hours and minutes (24 hour format HH.MM) e.g. set as 17.20 for 5:20 pm.

5.69 Set datalogger date

Display: SEt dAtE
Range: 01.01 to 31.12
Default Value: Date

Set date - seen only with data logger option. Refer tothe separate "TP4-PH Output Addendum" booklet for further details . Displays and sets the current date in days and months (DD.MM format). The months will roll over automatically (up at the end of the month, down at the beginning of the month) as the day is scrolled up or down.

5.70 Set datalogger year

Display: SEt YEAr
Range: 1970 to 2037
Default Value: Year

Set year - seen only with data logger option. Refer tothe separate "TP4-PH Output Addendum" booklet for further details . Displays and sets the current year (YYYY format). Valid years settings are from 1970 to 2037 (valid Julian time format years).

5.71 Analog output PI control

Display: rEC ctrl
Range: on or OFF
Default Value: OFF

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

5.72 Analog PI control output span

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

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

5.73 Analog PI control proportional gain

Display: C Pg
Range: -32.767 to 32.767
Default Value: 0.000

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

5.74 Analog PI control proportional offset

Display: CPO
Range: 0.0 to 100.0
Default Value: 0.0

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

5.75 Analog PI control integral gain

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

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

5.76 Analog PI control integral high limit

Display: CIL.H
Range: 0.0 to 100.0
Default Value: 0.0

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

5.77 Analog PI control integral low limit

Display: CIL.L
Range: 0.0 to 100.0
Default Value: 0.0

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

5.78 Analog PI control setpoint access

Display: rEC SPAC
Range: on or OFF
Default Value: OFF

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

5.79 Baud rate for serial communications

Display: bAUd
Range: 300.600. 1200.2400.4800.9600. 19.2 or 38.4
Default Value: 9600

Select from 300.600. 1200.2400.4800.9600. 19.2k or 38.4k baud. Refer to the separate "TP4-PH Output Addendum" booklet for further details .

5.80 Parity for serial communications

Display: PrtY
Range: nONE.EUEn or odd
Default Value: nONE

Select parity check to either nONE, EUEn or odd. Refer to the separate "TP4-PH Output Addendum" booklet for further details .

5.81 Output mode for optional serial communications

Display: O.Put
Range: di SP.Cont.POLL or A.buS
Default Value: Cont

Set serial interface mode - seen only with serial output option. Refer to the separate "TP4-PH Output Addendum" booklet for further details. . Allows user to select the serial interface operation as follows:

di SP - sends image data from the display without conversion to ASCII.
Cont - sends ASCII form of display data at a rate typically 90% of the sample rate.
POLL - controlled by computer or PLC as host. Host sends command via RS232/485 and instrument responds as requested.
A.buS - is a special communications mode used with Windows compatible optional PC download software. Refer to the user manual supplied with this optional software.

5.82 Instrument address for serial communications

Display: Addr
Range: 0 to 31
Default Value: 0

Set unit address for polled (POLL) mode (0 to 31). Allows several units to operate on the same RS485 interface reporting on different areas etc. The host computer or PLC may poll each unit in turn supplying the appropriate address. The unit address ranges from 0 to 31 (DEC) but is offset by 32 (DEC) to avoid clashing with ASCII special function characters (such as <STX> and <CR>). Therefore 32 (DEC) or 20 (HEX) is address 0, 42 (DEC) or 2A (HEX) is address 10. Refer to the separate "TP4-PH Output Addendum" booklet for further details .

Easy alarm relay adjustment access facility

The display has an easy alarm access facility which allows access to the alarm setpoints simply by pressing the F button at the front or rear of the instrument. The first setpoint will then appear and changes to this setpoint may be made to this setpoint via the ▲ or ▼ buttons. Press the F button to accept any changes or to move on to the next setpoint. Note: this easy access also functions in the same manner for the PI control setpoint (relay and/or analog PI output) if PI control is available. The instrument must be set in the manner described below to allow the easy access facility to work:

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

5.83 Troubleshooting

The most common cause of errors seen in pH and OPR measurement is caused by electrode failure or wiring. Electrodes wear out in normal use, an industrial electrode will have a typical life of 2-3 years but contaminating solutions and high temperatures or will reduce electrode life. Glass is used externally and internally in these electrodes and any shock to the electrode can cause fractures which will cause the electrode to fail. Electrode measuring errors are also commonly caused by coating of the electrode surface which reduces the electrode output. When coating occurs the electrode must be cleaned.

The examples given below illustrate typical problems which may occur when setting up an instrument of this type.

1. Display shows "- - - -" or **SPANERR** message. The "- - - -" message indicates that the input is open circuit, over range or that the input type is incorrect. This could be caused by a broken wire, loose termination or a broken electrode or temperature sensor. It could also indicate that the instrument is seeing an input which is out of its range. Check that the **1 InPt tYPE** (or **Ch2 tYPE**) function selection matches the sensor being used or **°C tYPE** if this error message is seen on the temperature display.

   The **SPAN ERR** message indicates that the calibration attempted has not been successful due to the two inputs used being too close together in electrical input. Ensure that the temperature reading is correct and if necessary recalibrate the temperature sensor also ensure that two buffers with a wide difference in value are used e.g. 4.00 and 7.00 pH. If repeated efforts to recalibrate fail then uncalibrate using the **UCAL 1 On** (or **UCAL Ch2** for channel 2) function to set the calibration back to the factory settings and try calibrating again. If this also fails then the electrode needs to be checked.

If none of the above has been successful then the electrode needs to be checked. Ideally a simulator should be used to check the display response and the electrode checked on a different display but if neither of these are available try the following. Uncalibrate the input channel being used and remove the electrode. Place a short circuit across the display input terminals. If the display is functioning correctly the display should show 0mV if ORP is being displayed or 7 pH if pH is being displayed. If the display is found to be working correctly from this test then the electrode or wiring between the electrode and display is likely to be the problem.

2. A new set of calibration values have been entered but the display is not indicating correctly. If a temperature sensor is used first check that the temperature reading is correct. Calibrate the temperature sensor if necessary. Ensure when calibrating pH or ORP that the values shown at **CAL 1** and **CAL2** (or **CH2 CAL 1** and **CH2 CAL2**) were steady before being accepted. If they are not steady then the electrode and cabling needs to be investigated.

3. Display value is fluctuating wildly. Check electrode connections.
   Try increasing the **FLtr** function setting.
   If a recent calibration change has been made check that the buffer values were changed between calibration points i.e. **CAL 1** and **CAL2** (or **CH2 CAL 1** and **CH2 CAL2**) did not use the same buffer input.

4. Display resets itself during normal operation i.e. the "wake up" display messages seen when power is applied to the instrument appear on the display without power being removed. Check for voltage surges or drop outs on the power supply line, also check for gross electrical noise pickup (typical electrical noise sources are motors, generators, solenoids, relays, high voltage cables etc.). If power surges or dropouts are experienced then investigate the cause and rectify or place the instrument on another power circuit.

6 Calibration

6.1 pH calibration

The 2 point calibration method (CAL 1 and CAL2) is used to calibrate the display to the pH electrode output. The CAL 1 and CAL2 scaling functions may be set independently. Two point scaling functions are provided for both channel 1 and channel 2 inputs.

6.1.1 CAL 1 (channel 1 input first point scale)

CAL 1 and CAL2 functions are used together to scale the instruments display. Two calibration buffer solutions e.g. 4.00 and 7.00 pH buffers or two process solutions of known pH value will be required. The CAL 1 function sets the first calibration point. Note: CAL 1 and CAL2 can be set independently and in some applications only one calibration point is used (usually CAL2) for routine calibrations and two points being used periodically for full calibration.

The procedure for entering the first scaling point is:

1. Ensure that the temperature reading is correct and if necessary calibrate the temperature reading before calibrating pH.
2. Place a cleaned (use distilled water for cleaning the probe) and dabbed dry probe into the first buffer solution e.g. 4.00 pH.
3. At the CAL 1 function press ▲ and ▼ simultaneously, then release them. The display will indicate the live input value. Do not be concerned at this stage if the live input display value is not the pH value required. Allow time for the reading to stabilise. It is important that the live input value seen is a steady value. If the reading does not stabilise then the input needs to be investigated before proceeding with the scaling.
4. Press, then release the F button. The display will indicate SCL 1 followed by a value. Use the ▲ or ▼ button to change this value to the buffer value at this input. e.g. 4.00 for a 4.00 pH buffer. Press the F button to accept changes or the P button to abort the scaling. The display should show the message CAL End when the calibration is accepted then move on to the next function.

6.1.2 CAL2 (channel 2 input second scaling point)

The second point scaling is performed in exactly the same manner as CAL 1 (i.e. at CAL2 press the ▲ and ▼ pushbuttons simultaneously etc.) except that SCL2 will be seen instead of SCL 1. It is essential that the second buffer is substantially different in value to the one used for the CAL 1 input e.g. 7.00 pH can be used for the second buffer if 4.00 pH was used as the first.

The procedure for entering the second scaling point is:

1. Place a cleaned (use distilled water for cleaning the probe) and dabbed dry probe into the second buffer solution e.g. 7.00 pH.
2. At the CAL2 function press ▲ and ▼ simultaneously, then release them. The display will indicate the live input value. Do not be concerned at this stage if the live input display value is not the pH value required. Allow time for the reading to stabilise. It is important that the live input value seen is a steady value. If the reading does not stabilise then the input needs to be investigated before proceeding with the scaling.

3. Press, then release the F button. The display will indicate SCL2 followed by a value. Use the ▲ or ▼ button to change this value to the buffer value at this input. e.g. 7.00 for a 7.00 pH buffer. Press the F button to accept changes or the P button to abort the scaling. The display should show the message CAL End when the calibration is accepted then move on to the next function.

6.1.3 CH2 CAL 1 and CH2 CAL 1 (channel 2 input first and second calibration points for channel 2)

These functions are the two point calibration functions for channel 2 input. Follow the procedure for channel 1 input calibration above.

6.1.4 Example - 2 point pH calibration

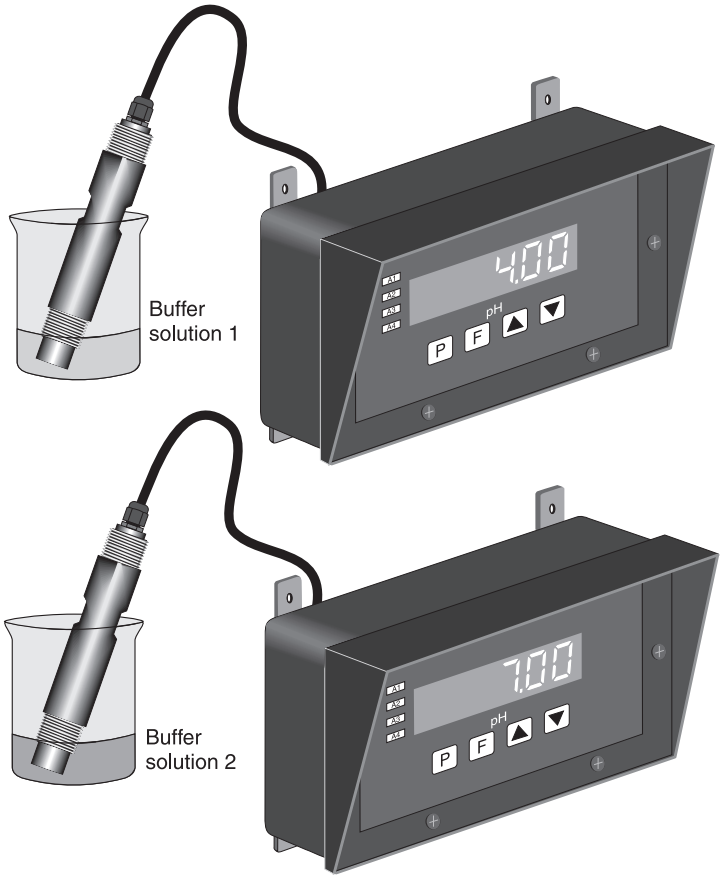
Always ensure that the temperature reading is correct before calibrating.

First point

Place probe in buffer 1 e.g. 4.00 pH. At the CAL 1 function press the ▲ and ▼ pushbuttons simultaneously. A live reading will be seen. Allow the reading to stabilise then press the F pushbutton. The display will show SCL 1 followed by a value. Use the ▲ or ▼ pushbutton to make this value equal the first buffer value e.g. 4.00 for a 4.00 pH buffer.

Second point

Wash and dab dry the probe then place probe in buffer 2 e.g. 7.00 pH. At the CAL2 function press the ▲ and ▼ pushbuttons simultaneously. A live reading will be seen. Allow the reading to stabilise then press the F pushbutton. The display will show SCL2 followed by a value. Use the ▲ or ▼ pushbutton to make this value equal the first buffer value e.g. 7.00 for a 7.00 pH buffer.



6.2 Redox (ORP) calibration

Redox meters are normally initially scaled using a mV source, future calibration is not normally necessary since Redox electrodes do not normally require calibration.If the scaling needs to be checked or the electrode calibrated then follow the method below.

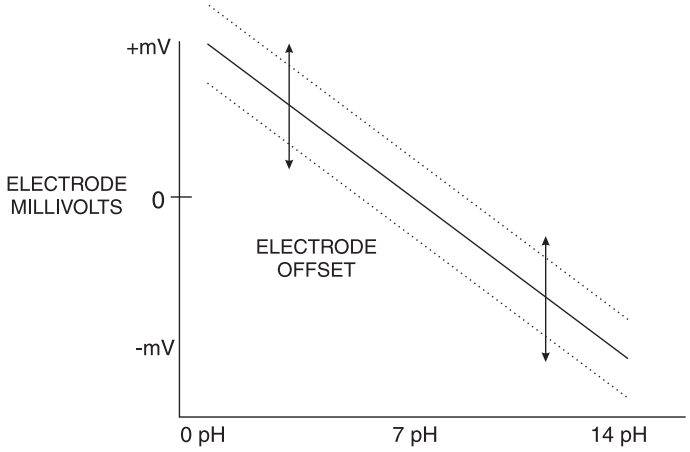
The method used for pH calibration (see "pH calibration" section) can also be used for Redox calibration. Two Redox buffers may be used if calibrating from the Redox electrode input or two known mV input levels from an external source may be used as the inputs e.g. 0mV for CAL 1/SCL 1 and 500mV for CAL2/SCL2.

Using buffer solutions ensure that the buffers have different mV values. Typical mV buffer solutions are "ZoBell" which has a value of 186mV at 25^{o}C and quinhydrone added to a know pH buffer solution (mV value depends upon concentration and temperature). Ready made buffer solutions of various mV values are commercially available.

6.3 Channel 1 offset calibration

The offset calibration offers a single point adjustment across the whole pH or Redox calibration slope. The offset procedure can be used to adjust the reading when the same error exists at all readings e.g. reading 0.5 pH high.

To enter the offset function press the ▲ and ▼ pushbuttons simultaneously at the **OFSt CAL 1** function - the display will indicate the live pH reading for the solution. Place the probe in a known buffer solution or in the process solution if the pH of this solution is accurately known. When the display has stabilised, press the **F** button - the display will now read **OFSt SCLE** followed by the value in memory, the offset may now be changed using the ▲ or ▼ pushbuttons to read the correct value of the buffer or process solution. To enter the corrected value into memory press the **F** button. The display will show **OFSt End** and the system offset will be adjusted so that the display will match the corrected value.



6.4 Channel 2 offset calibration

This function allows an offset calibration for input channel 2. Refer to **OFSt CAL 1** function above for further description.

6.5 Uncalibration of pH or Redox

The **UCAL1 ON** function can be used to uncalibrate the channel 1 input. The **UCAL Ch2** function can be use to uncalibrate the channel 2 input. These functions are used to set the instrument back to the factory calibration values. This function is only used when calibration problems exist and the calibration memory needs to be cleared, other settings are not affected. To uncalibrate the instrument pH or Redox reading press the ▲ and ▼ buttons simultaneously at the **UCAL1 ON** or **UCAL Ch2** function. The display message **UCAL End** should be seen and the display will move to the next function.

6.6 Temperature calibration

A single step temperature calibration function is provided. For automatic temperature compensation of pH reading a temperature sensor should be used in most cases the temperature sensor is inside the pH electrode. The temperature can be viewed via the front ▲ or ▼ pushbuttons.

The steps for pH temperature sensor calibration are:

- Place the temperature sensor in a solution of known temperature.
- At the CAL °C function press the ▲ and ▼ pushbuttons simultaneously. A live input reading from temperature sensor will be seen. Allow the reading to stabilise then press the F button.
- The display will show °C followed by a value. Use the ▲ or ▼ pushbutton to make the value read the known temperature of the solution.
- Press the F button to accept the change, the display should show the message °C End then move on to the next function.

6.7 Temperature uncalibration

Used to set the instrument back to the factory temperature calibration values. This function is only used when calibration problems exist and the calibration memory needs to be cleared, other settings are not affected. To uncalibrate press the ▲ and ▼ buttons simultaneously at the UCAL °C function. The display will show the message UCAL End to indicate that the uncalibration process is complete.

7 Specifications

7.1 Technical specifications

Input type:	Two inputs from a selection of four connectors available: pH - any electrode where Eo=7. Redox - any standard Redox (ORP) electrode (-2V to 2V nominal). Direct electrode connection for pH or ORP or 4-20mA transmitter inputs for pH only available.
Impedance:	Greater than $10^{10}\Omega$
Temperature input:	Temperature probe type 100Ω RTD, 1000Ω RTD, LM335 or 3KΩ Balco (link and software selectable).
Accuracy:	± 0.2% of full scale ± 1 display digit for pH and Redox
Sample Rate:	1 sample per second
Conversion Method:	20,000 count quad slope ADC
Microprocessor:	HC68HC11F CMOS
Ambient temperature:	LED -10 to 60^o C
Humidity:	5 to 95% non condensing
Display:	6 digit 20mm + 4 way keypad and annunciator LEDs
Power Supply:	AC 240V or 110V 50/60Hz or DC isolated wide range 12 to 48V Note: supply type is factory configured.
Power Consumption:	AC supply 15 VA max, DC supply typically 500mA at 12VDC depends on display type and options fitted
Output (standard):	4 x relay, Form C, rated 5A resistive 240VAC Relays 1 and 2 are configurable for either alarm or pulse width PI control or frequency PI control 4-20mA analog output configurable as retransmission or PI control output RS232 serial communications (non isolated) 24V (12V) transmitter supply @ 20mA

7.2 Optional outputs

Serial communications:	Isolated RS485 (requires removal of RS232)
Datalogger:	128k or 256k internal datalogger memory

7.3 Physical Characteristics

Case Size:	255mm x 145mm x 125mm
Panel Cut Out:	If using this method of mounting the panel cut out size is 240 x 130mm -0.0mm/+0.5mm
Connections:	Plug in screw terminals (max 1.5mm wire, 2.5mm for relays and power supply). Two BNC connectors
Weight:	1.3kgs

8 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.