Operating Instructions

IM/4600–USP_4

Analyze^{IT}

USP<645> Conductivity Transmitters

Models 4623 and 4628

Industrial^{IT} enabled™

ABB

ABB

The Company

EN ISO 9001:2000

Cert. No. Q 05907

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

EN 29001 (ISO 9001)

Lenno, Italy – Cert. No. 9/90A

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

Stonehouse, U.K.

0255

The UKAS Calibration Laboratory No. 0255 is just one of the ten flow calibration plants operated by the Company and is indicative of our dedication to quality and accuracy.

Use of Instructions

Warning.
An instruction that draws attention to the risk of injury or death.

Note.
Clarification of an instruction or additional information.

Caution.
An instruction that draws attention to the risk of damage to the product, process or surroundings.

Information.
Further reference for more detailed information or technical details.

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Marketing Communications Department.

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

CONTENTS

1 INTRODUCTION

The 4623 and 4628 conductivity transmitters and associated measuring cells have been designed to meet United States Pharmacopœia USP<645> requirements for continuous monitoring and control of the conductivity of demineralised water, and de-ionised water.

The 4623 model is a wall-mounted instrument and the 4628 model a panel-mounted, DIN sized instrument. Both instruments have a single programmable conductivity input channel and a single temperature input channel. When making temperature compensated measurements the sample temperature is sensed by a Pt100 resistance thermometer mounted in the measuring cell or, alternatively, using a separate temperature sensor.

Instrument operation and programming is via four tactile membrane keys located on the front panel. Programmed functions are protected from unauthorised alteration by a five-digit security code.

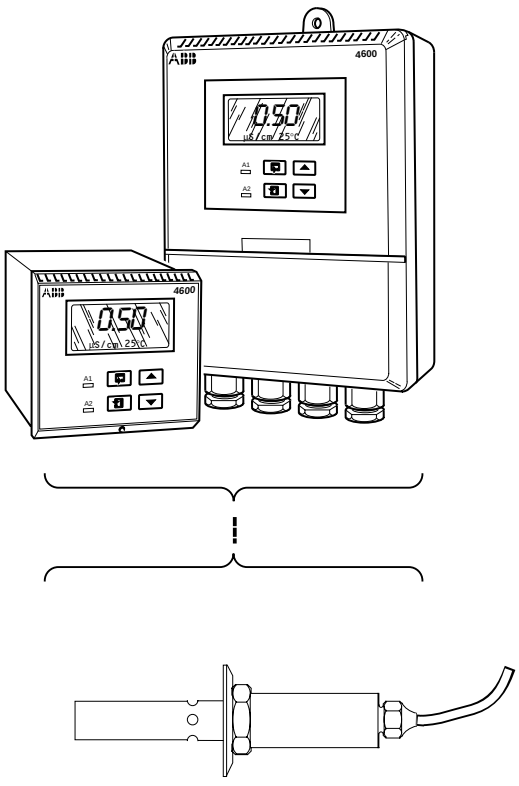


Fig. 1.1 System Schematic

2 PREPARATION

2.1 Checking the Code Number

2.1.1 Wall-/Pipe-mounted Instruments – Fig. 2.1

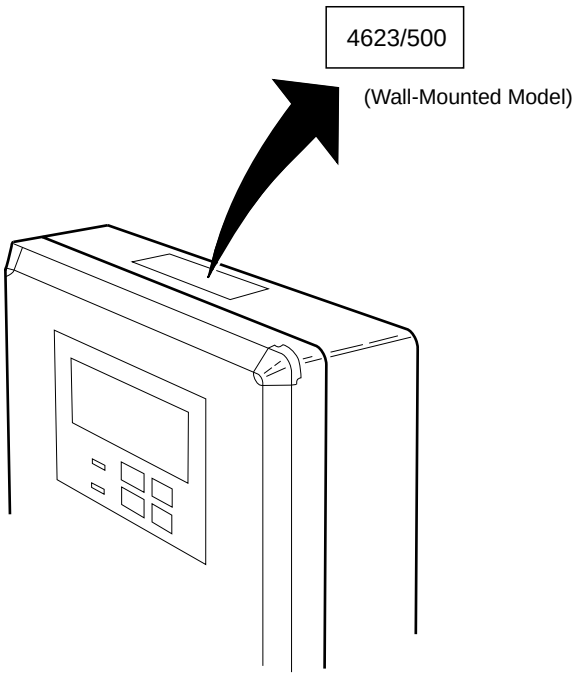


Fig. 2.1 Checking the Code Number (Model 4623)

2.1.2 Panel-mounted Instruments – Fig. 2.2

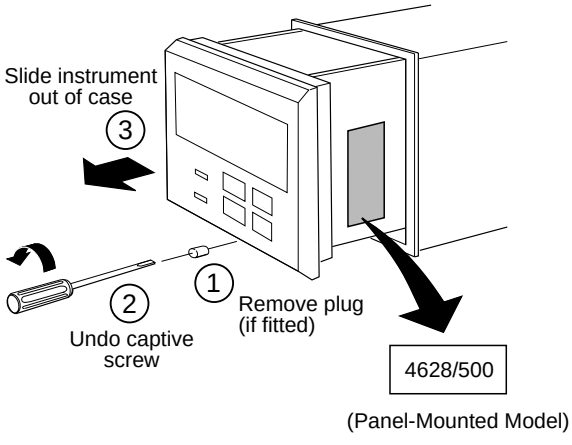
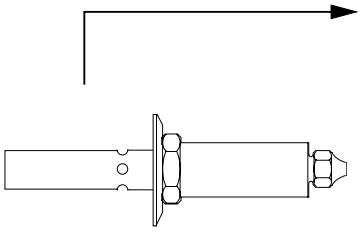


Fig. 2.2 Checking the Code Number (Model 4628)

2.1.3 Conductivity Cells – Fig. 2.3



Model 2278/305

Basic Type No.	Version	Constant (K)	Process Connection Type	Temperature Compensation
Code Characters 1, 2	3, 4, 5	6	7	8
22 Electrolytic conductivity measuring cells	78/ Stainless steel	3 0.05	0 2in. Tri-clover Hygienic fitting	0 None 5 Pt100 resistance thermometer

Fig. 2.3 Checking the Conductivity Cell Code Number

3 MECHANICAL INSTALLATION

3.1 Siting Requirements

3.1.1 Instruments – Fig. 3.1

Caution.

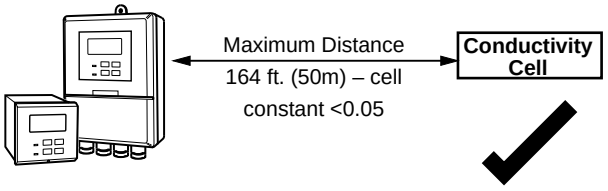
- Mount in a location free from excessive vibration.
- Mount away from harmful vapours and/or dripping fluids.

Information. It is preferable to mount the instrument at eye level, allowing an unrestricted view of the front panel displays and controls

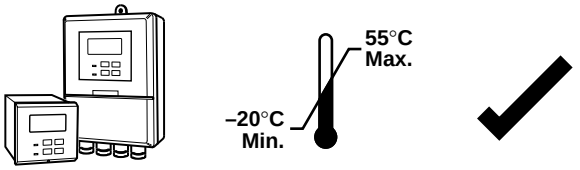
3.1.2 Conductivity Cells – Fig. 3.2

Caution. Ensure that the integral cable (where applicable) does not hang against hot or abrasive objects when the plug is connected to the bulkhead socket.

Note. Allow sufficient clearance for easy removal of cell for cleaning – see Section 3.4 for overall dimensions of cells.



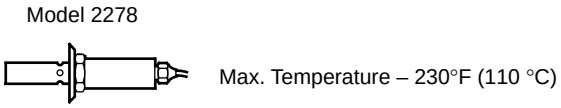
A – Maximum Distance of Instrument to Cell



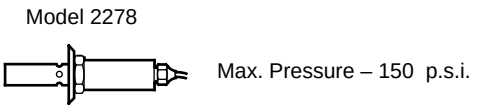
B – Within Temperature Limits

C – Within Environmental Limits

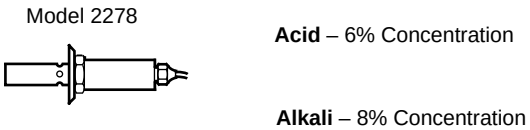
Fig. 3.1 Siting Requirements – Instrument



A – Maximum Temperature Limits



B – Maximum Pressure Limits



C – Acid/Alkali Concentration Limits

Fig. 3.2 Siting Requirements – Conductivity Cell

3.2 Mounting

3.2.1 Wall-/Pipe-mounted Instruments – Figs. 3.3 and 3.4

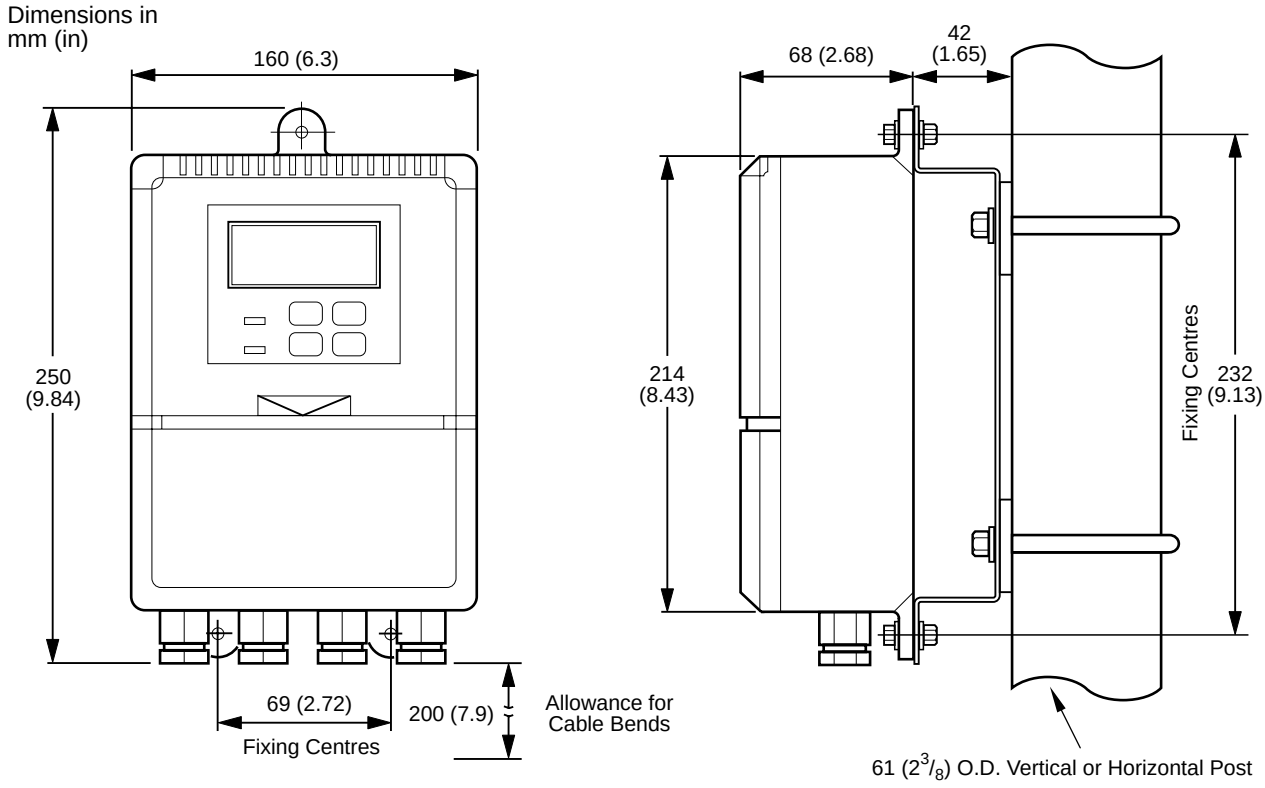
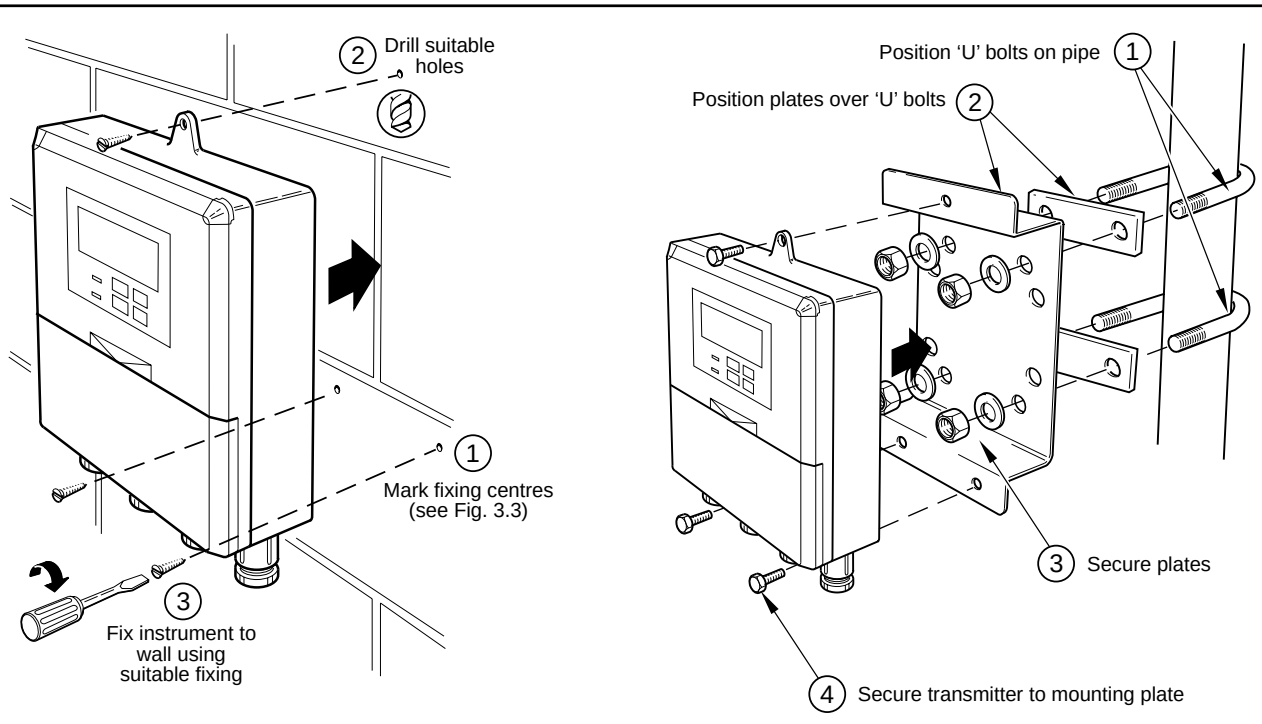


Fig. 3.3 Overall Dimensions



A – Wall-mounting

B – Pipe-mounting

Fig. 3.4 Wall-/Pipe-mounting

…3 MECHANICAL INSTALLATION

…3.2 Mounting

3.2.2 Panel-mounted Instruments – Figs. 3.5 and 3.6

Dimensions in mm (in)

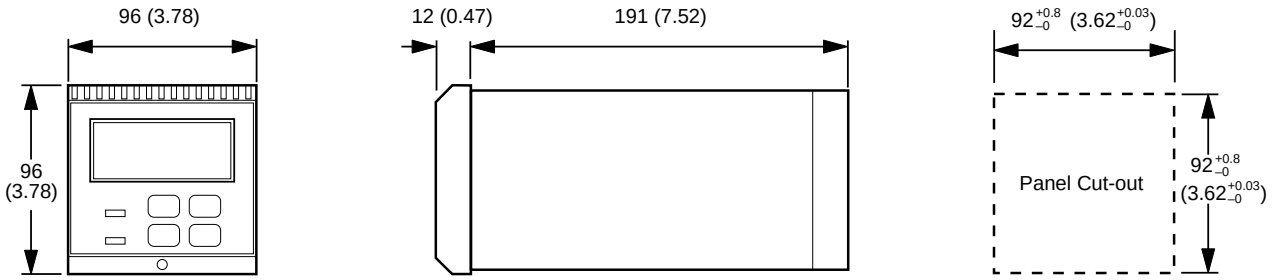
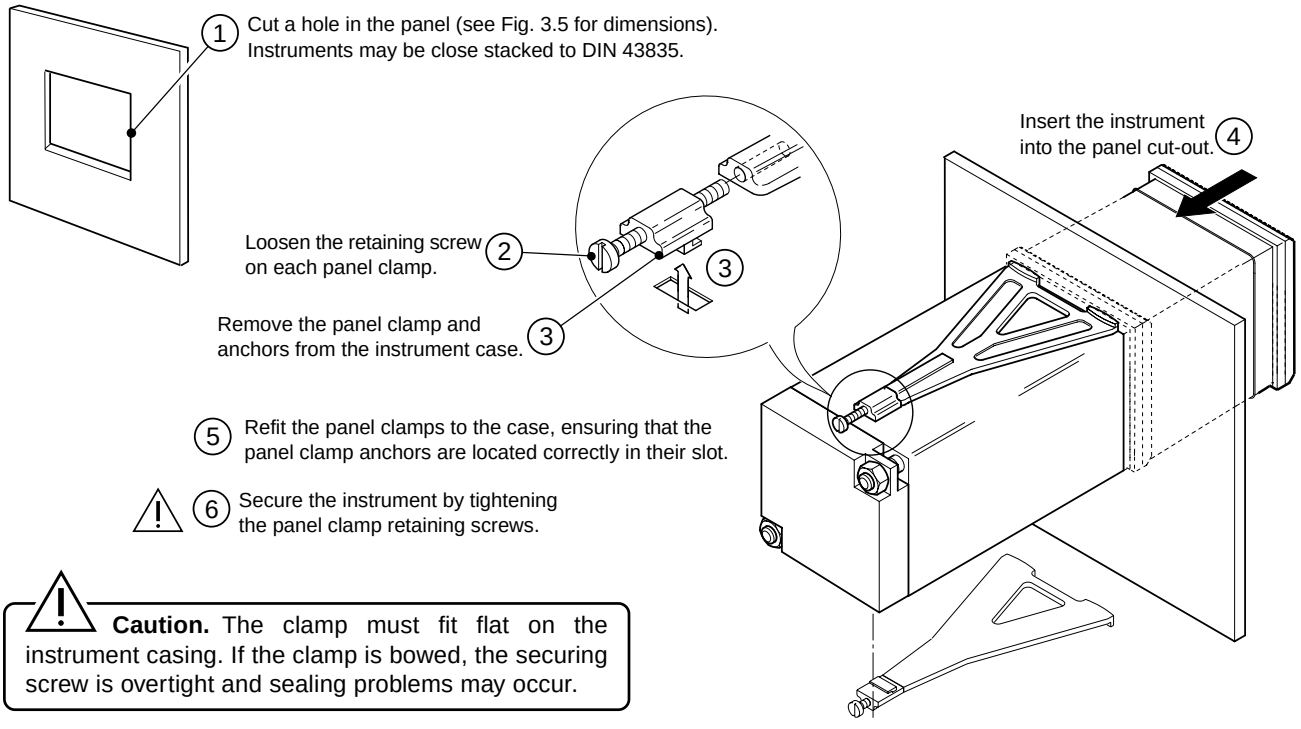


Fig. 3.5 Overall Dimensions



Caution. The clamp must fit flat on the instrument casing. If the clamp is bowed, the securing screw is overtight and sealing problems may occur.

Fig. 3.6 Panel Mounting

3.3 Cleaning Conductivity Cells

Before installing a conductivity cell, clean the electrodes as follows.

3.3.1 Stainless Steel Conductivity Cells

Unscrew the outer electrode and thoroughly clean it with a nylon-bristle brush (supplied) and a warm detergent solution. Clean the central electrode in a similar manner, taking care not to damage it. For more tenacious deposits a 2% hydrochloric acid solution may be used. Rinse thoroughly with distilled water after cleaning. The electrodes should have a dull, frosted appearance which must not be removed by polishing or abrasive cleaning. Refit the outer electrode.

3.4 Installing the Conductivity Cells

Caution. After cleaning and installing a conductivity cell, ensure it remains filled with liquid and is not allowed to dry out.

3.4.1 Bulkhead Socket – Fig. 3.7

Note. Used with cell types 2278. Mount the socket at a convenient location close to the cell.

Dimensions in mm

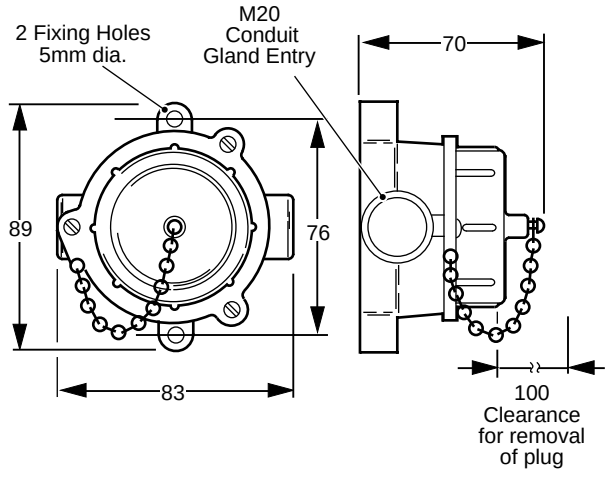


Fig. 3.7 Bulkhead Socket

3.4.2 Model 2278 Cell Dimensions – Fig. 3.8

Dimensions in mm

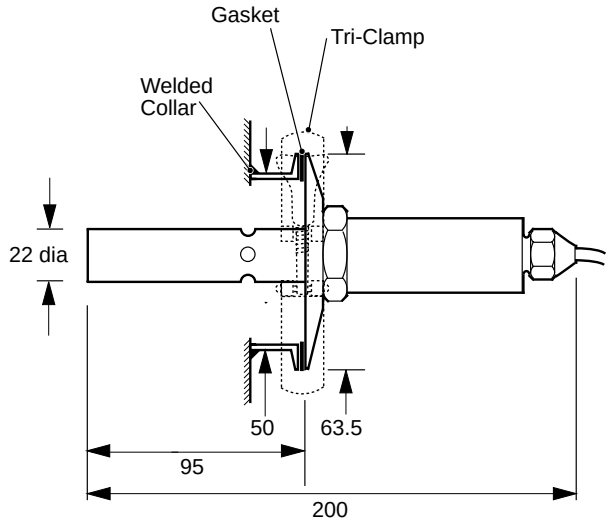


Fig. 3.8 Model 2278 Cell Dimensions

4 ELECTRICAL CONNECTIONS

Warning. Before making any connections, ensure that the power supply, any high voltage-operated control circuits and high common mode voltages are switched off.

4.1 Access to Terminals

4.1.1 Wall-/Pipe-mounted Instruments – Fig. 4.1

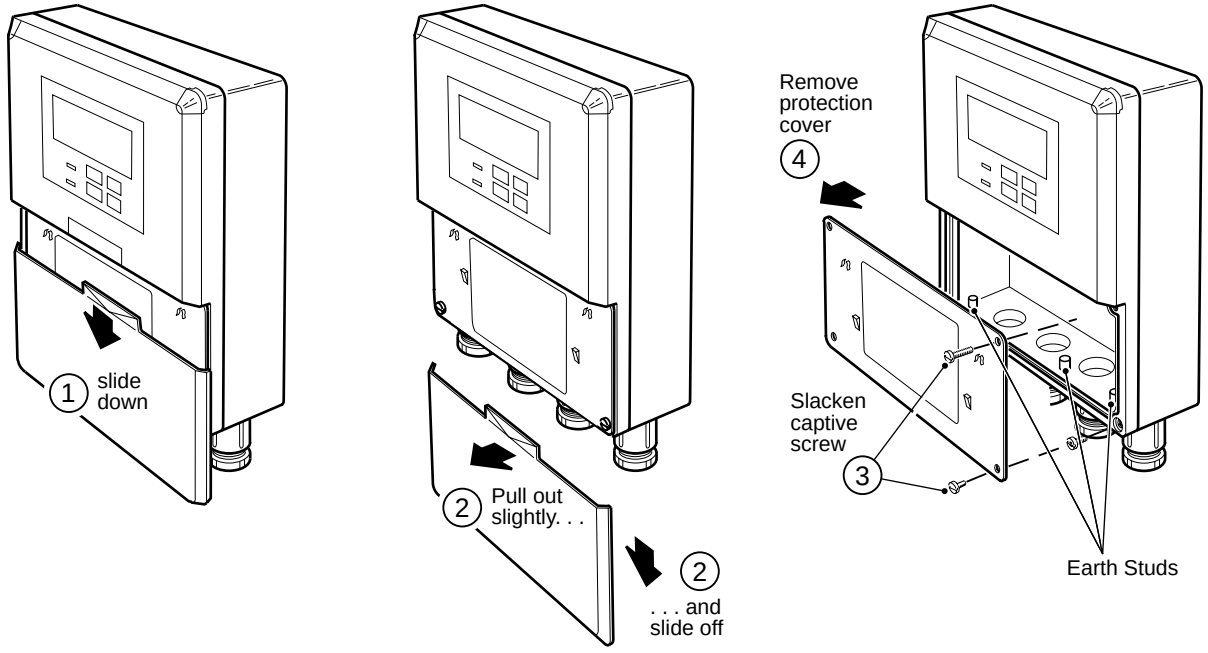


Fig. 4.1 Access to Terminals – Wall-/Pipe-mounted Instruments

4.1.2 Panel-mounted Instruments – Fig. 4.2

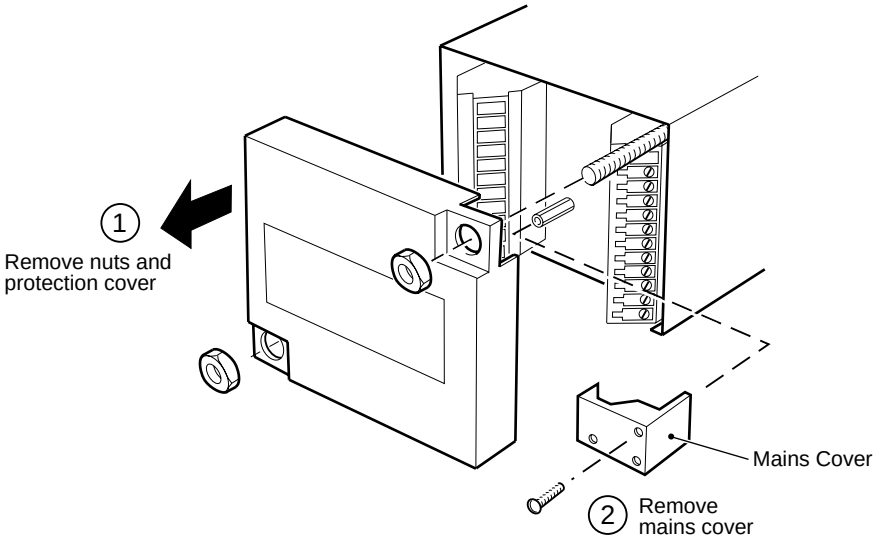


Fig. 4.2 Access to Terminals – Panel-mounted Instruments

4.2 Connections, General

Information.

- **Earthing (grounding) –** stud terminal(s) is (are) fitted to the transmitter case for bus-bar earth (ground) connection – see Fig. 4.1 or 4.5.
- **Cable lengths** – the integral cable may be extended using a suitable junction box but the total cable length must not exceed 164 ft. (50m) for cells with a constant of <0.05 (as is the case for cell model 2278/305).
- **Cable routing** – always route signal output/conductivity cell cable leads and mains-carrying/relay cables separately, ideally in earthed metal conduit. Employ twisted pair output leads or use screened cable with the screen connected to the case earth stud.

  Ensure that the cables enter the transmitter through the glands nearest the appropriate screw terminals and are short and direct. Do not tuck excess cable into the terminal compartment.
- **Cable glands & conduit fittings** – ensure a moisture-tight fit when using cable glands, conduit fittings and blanking plugs/bungs (M20 holes). The M16 glands ready-fitted to wall-mounted instruments accept cable of between 4 and 7mm diameter.
- **Relays** –the relay contacts are voltage-free and must be appropriately connected in series with the power supply and the alarm/control device which they are to actuate. Ensure that the contact rating is not exceeded. Refer also to Section 4.2.1 (below) for relay contact protection details when the relays are to be used for switching loads.
- **Retransmission output** – Do not exceed the maximum load specification for the selected current retransmission range – see Section 10, **SPECIFICATION**.

  The retransmission output is isolated therefore the –ve terminal **must** be connected to earth (ground) if connecting to the isolated input of another device.

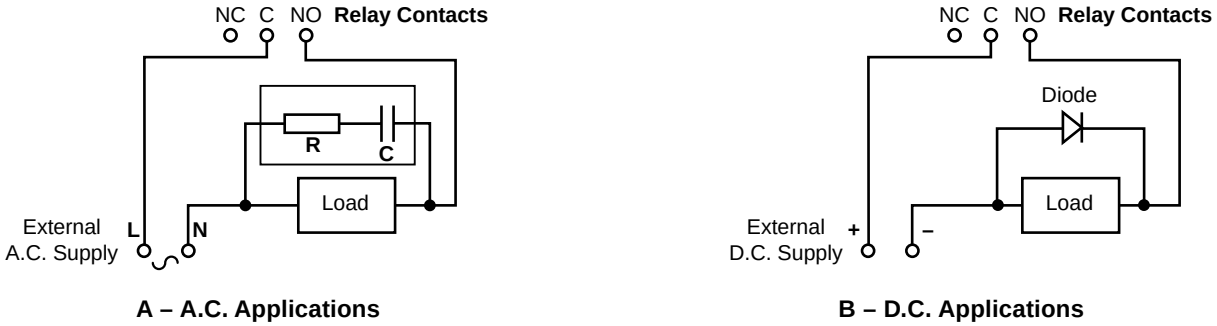
4.2.1 Relay Contact Protection and Interference Suppression – Fig. 4.3

If the relays are used to switch loads on and off, the relay contacts can become eroded due to arcing. Arcing also generates radio frequency interference (RFI) which can result in instrument malfunctions and incorrect readings. To minimize the effects of RFI, arc suppression components are required; resistor/capacitor networks for a.c. applications or diodes for d.c. applications. These components can be connected either across the load or directly across the relay contacts. On 4600 Series instruments, the RFI components must be fitted to the relay terminal block along with the supply and load wires – see Fig 4.3.

For **a.c. applications** the value of the resistor/capacitor network depends on the load current and inductance that is switched. Initially, fit a 100R/0.022µF RC suppressor unit (part no. B9303) as shown in Fig. 4.3A. If the instrument malfunctions (locks up, display goes blank, resets etc.) the value of the RC network is too low for suppression and an alternative value must be used. If the correct value cannot be obtained, contact the manufacturer of the switched device for details on the RC unit required.

For **d.c. applications** fit a diode as shown in Fig. 4.3B. For general applications use an IN5406 type (600V peak inverse voltage at 3A – part no. B7363).

Note. For reliable switching the minimum voltage must be greater than 12V and the minimum current greater than 100mA.



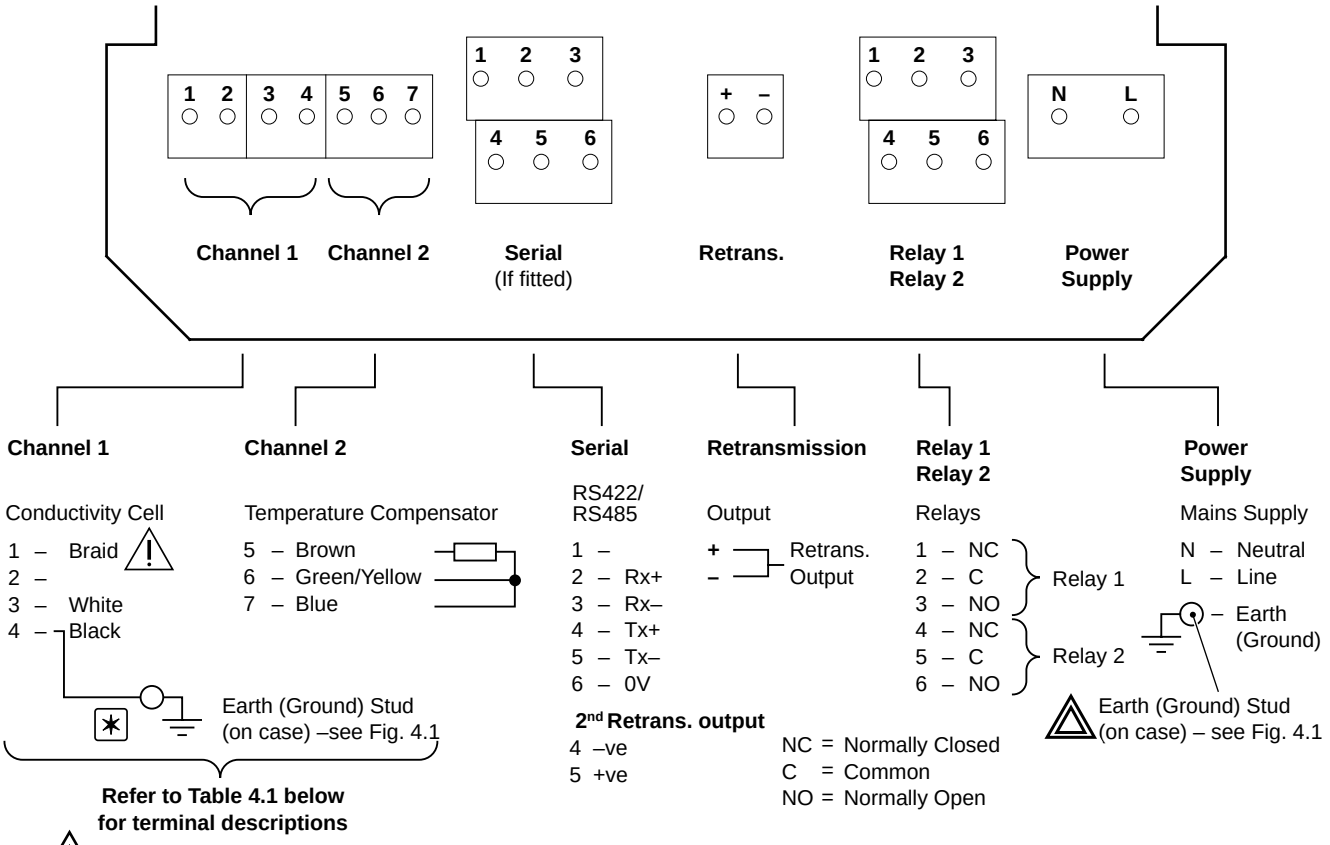
A – A.C. Applications **B – D.C. Applications**

Fig. 4.3 Relay Contact Protection

4.3 Wall-/Pipe-mounted Instrument Connections – Fig. 4.4

✶ **Note.** Refer to Fig. 4.1 for Access to Terminals.

⚠ **Caution.** Slacken terminal screws fully before making connections.



⚠ **Warning.** The power supply earth (ground) **must** be connected to ensure safety to personnel, reduction of the effects of RFI interference and correct operation of the power supply interference filter.

⚠ **Caution.** The metal braid in the conductivity cell connecting cable **must not** be earthed (grounded), or allowed to touch earthed (grounded) components, and must be cut back to the insulation at the conductivity cell end.

✶ **Note.**

- Metal cells (isolated from earth [ground]), e.g. if mounted in plastic pipe or pocket – connect terminal 4 to earth (ground).
- Metal cells (earthed [grounded]) – ensure that the cell ground potential and that of the instrument's earth (ground) stud are the same.

Fig. 4.4 Wall-/Pipe-mounted Instrument Connections

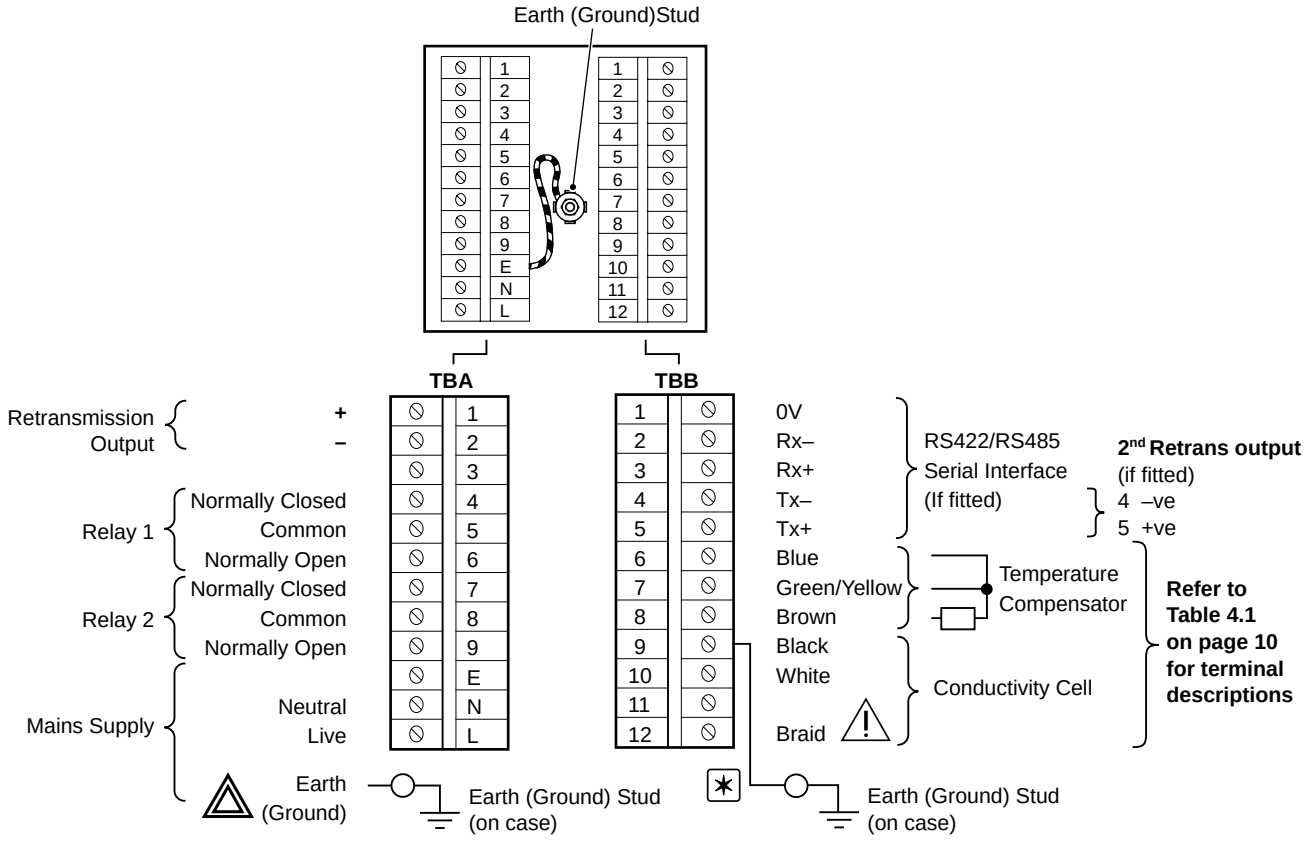
Instrument Type	Terminal Number						
Wall-mounted	1	2	3	4	5	6	7
Panel-mounted	12	11	10	9	8	7	6
	Driven screen output	N/A	Cell electrode input	Earth electrode input	PT100 input	PT100 3rd lead input	PT100 input

Table 4.1 Conductivity Cell and Temperature Compensator Terminal Descriptions

4.4 Panel-mounted Instrument Connections – Fig. 4.5

✶ **Note.** Refer to Fig. 4.2 for Access to Terminals.

⚠ **Caution.** Slacken terminal screws fully before making connections.



⚠ **Warning.** The power supply earth (ground) **must** be connected to ensure safety to personnel, reduction of the effects of RFI interference and correct operation of the power supply interference filter. Connect the earth (ground) lead directly to the case earth (ground) stud and **not** to the 'E' terminal.

⚠ **Caution.** The metal braid in the conductivity cell connecting cable **must not** be earthed (grounded), or allowed to touch earthed (grounded) components, and must be cut back to the insulation at the conductivity cell end.

✶ **Note.**

- Metal cells (isolated from earth [ground]), e.g. if mounted in plastic pipe or pocket – connect terminal 9 to earth (ground).
- Metal cells (earthed [grounded]) – ensure that the cell ground potential and that of the instrument's earth (ground) stud are the same.

Fig. 4.5 Panel-mounted Instrument Connections

4.5 Selecting the Mains Voltage

4.5.1 Wall-/Pipe-mounted Instruments – Fig. 4.6

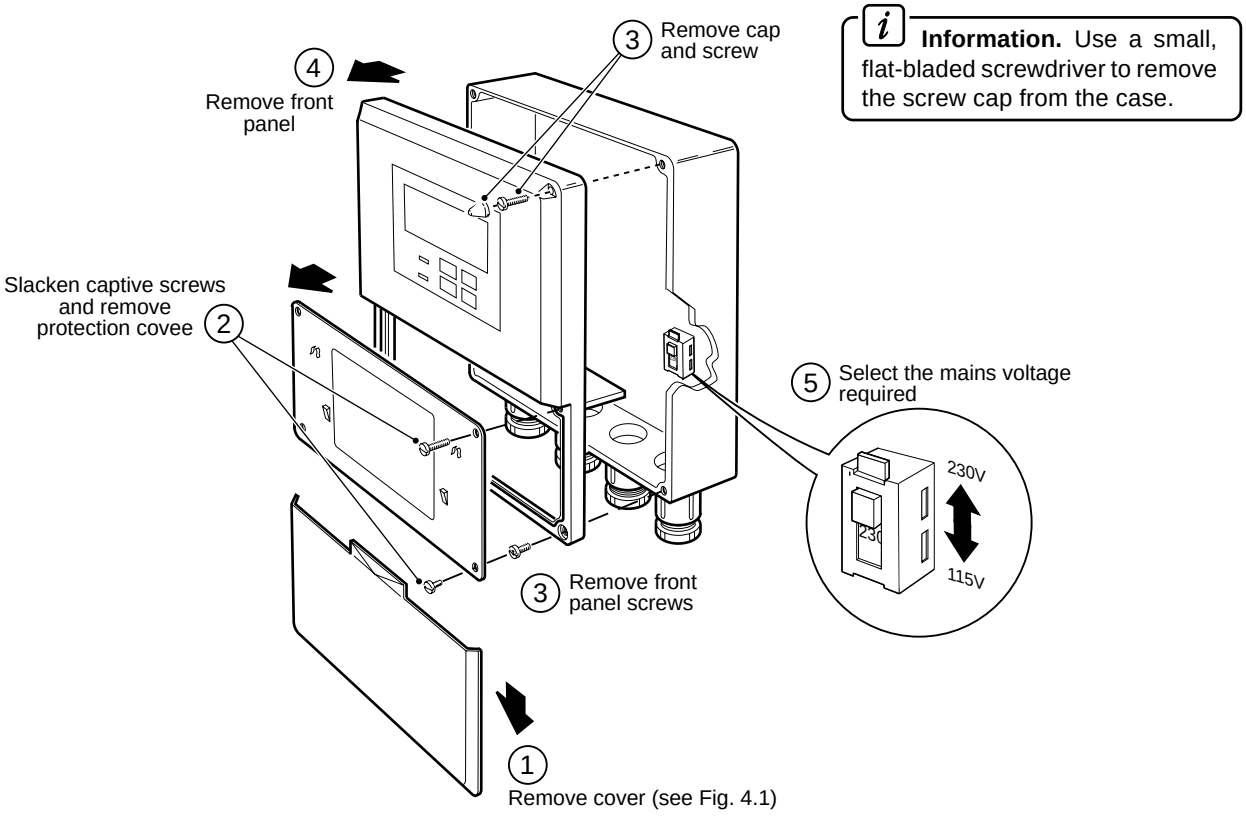


Fig. 4.6 Selecting the Mains Voltage – Wall-/Pipe-mounted Instruments.

4.5.2 Panel-mounted Instruments – Fig. 4.7

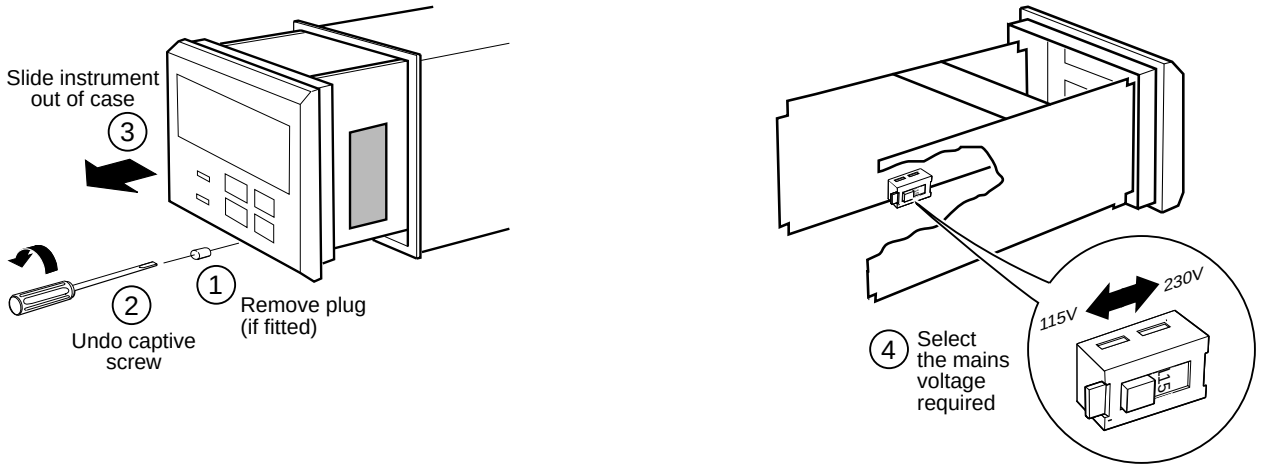


Fig. 4.7 Selecting the Mains Voltage – Panel-mounted Instruments

4.6 Conductivity Cell and Bulkhead Socket Connections – Fig. 4.8

Information. Use only the recommended cables:
J/0233/811 (cell electrodes)
J/0233/819 (temperature compensator only)

Note. Socket viewed from inside.

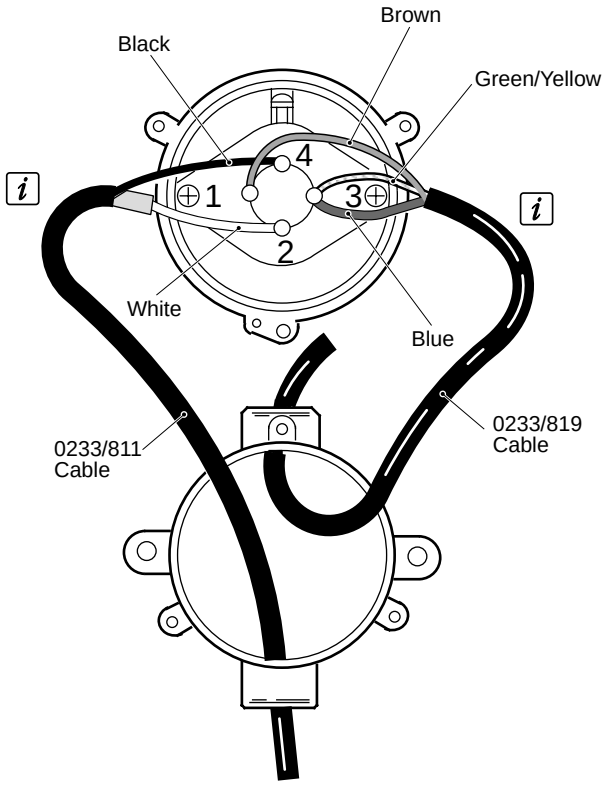


Fig. 4.8 Conductivity Cell and Bulkhead Socket Connections

5 CONTROLS AND DISPLAYS

5.1 Displays – Fig. 5.1

The display comprises a 5-digit, 7-segment digital upper display line and a 16-character dot-matrix lower display line. The upper display line shows actual values of conductivity, temperature, alarm set points or programmable parameters. The lower display line shows the associated units or programming information.

5.2 Control Familiarisation

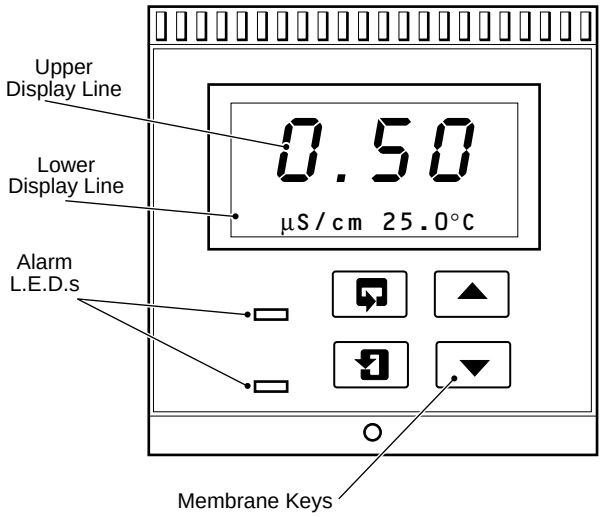
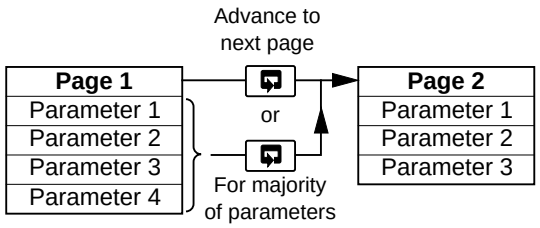
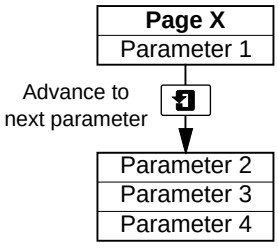


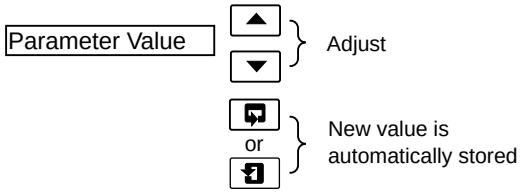
Fig. 5.1 Location of Controls and Displays



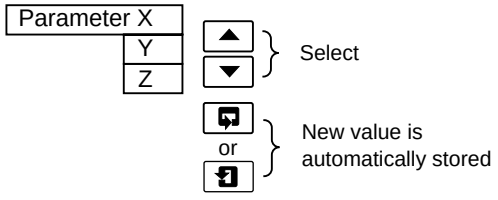
A – Advancing to Next Page



B – Moving Between Parameters



C – Adjusting and Storing a Parameter Value



D – Selecting and Storing a Parameter Choice

Fig. 5.2 Membrane Key Functions

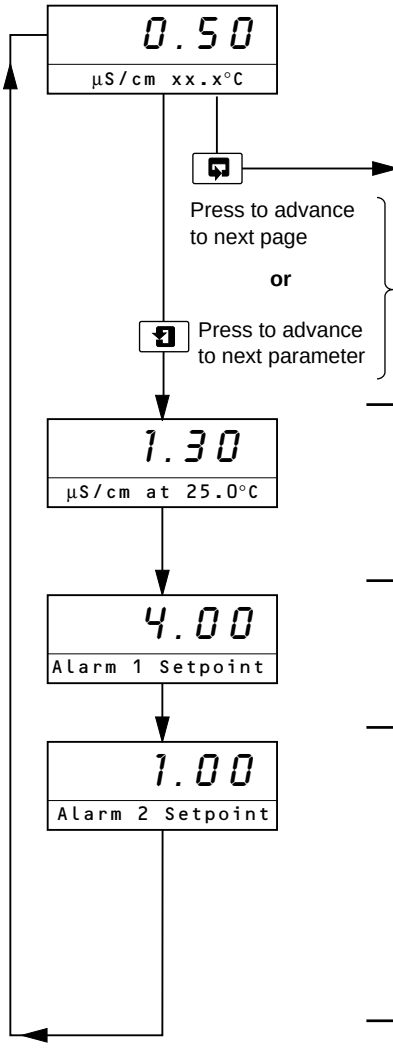
6 OPERATION

6.1 Instrument Start-up

Ensure all electrical connections have been made correctly and switch on.

6.2 Operating Page

The **Operating Page** is a general use page in which parameters are viewed only and cannot be altered. To alter or program a parameter refer to the programming pages in Section 7.



Sample Conductivity and Temperature:
The upper display line shows the conductivity of the sample in µS/cm.
The lower display line shows the temperature of the sample in the units selected in Section 7.3, **Set up Parameters Page**.

These two keys are used to advance to all subsequent parameters and pages.

Adjusted Conductivity:
The instrument software adjusts the measured conductivity of the sample to the value it would be if the temperature of the sample was 25°C (77°F).
The upper display line shows the adjusted conductivity value in µS/cm.

Alarm 1 Set Point:
The set point value and relay/l.e.d. action are programmable – see Section 7.4, **Set Up Alarms Page**.

Alarm 2 Set Point:
The set point value and relay/l.e.d. action are programmable – see Section 7.4, **Set Up Alarms Page**.
Alarm 2 type set to `Temp` or `Cond` – Programmed Alarm Setpoint is displayed.
Alarm 2 type set to `USP` – USP Alarm (including offset) is displayed.

Advance to **Access to Secure Parameters** on page 17.

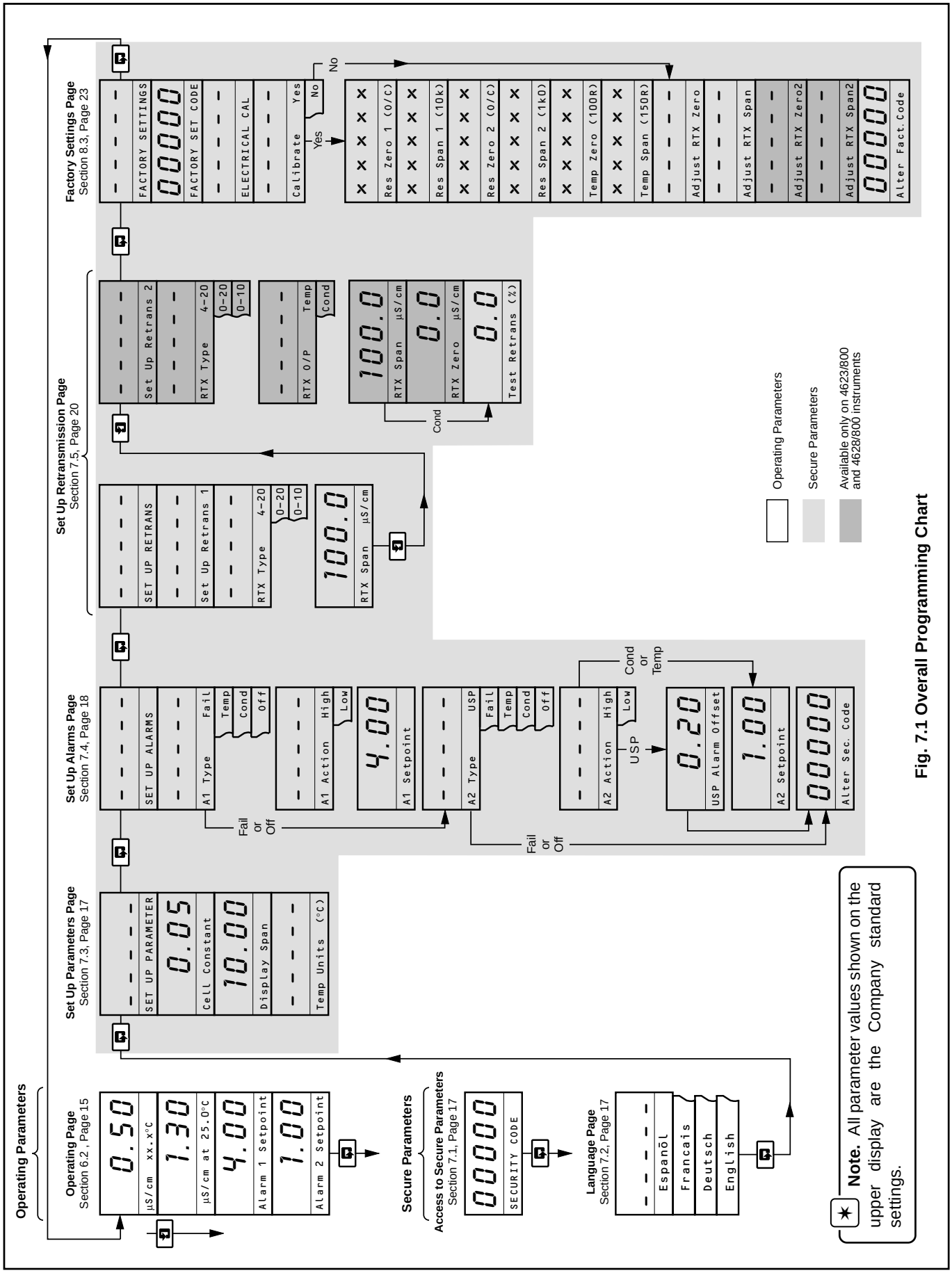
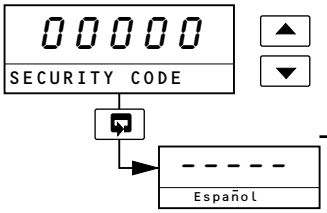


Fig. 7.1 Overall Programming Chart

7.1 Access to Secure Parameters

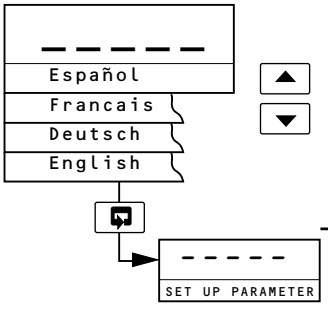
A 5-digit security code is used to prevent tampering with the secure parameters.



Security Code
Enter the required code number, between 00000 and 19999, to gain access to the secure parameters. If an incorrect value is entered, access to subsequent programming pages is prevented and the display reverts to the **Operating Page**.

Advance to **Language Page**.

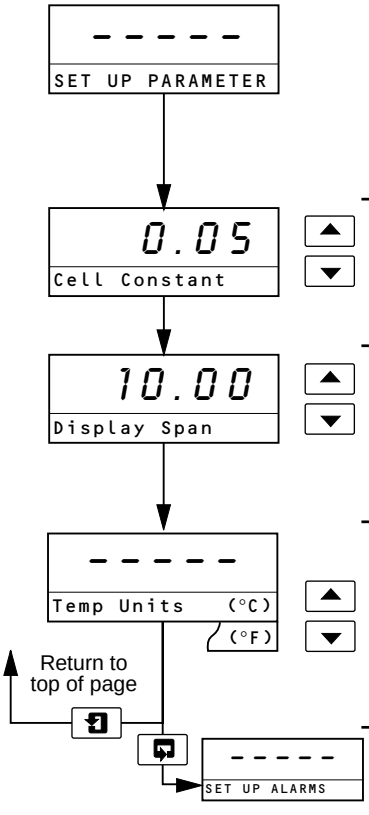
7.2 Language Page



Language Page
Select the language to be displayed on all subsequent pages.

Advance to **Set Up Parameters Page**.

7.3 Set Up Parameters Page



– press to advance to next parameter
or
– press to advance to next page.

These two keys are used to advance to all subsequent parameters and pages. If a parameter is changed it is automatically stored on operation of either key.

Cell Constant:
Enter the cell constant for the type of measuring cell in use – see Section 2.1.3, **Conductivity Cells**.

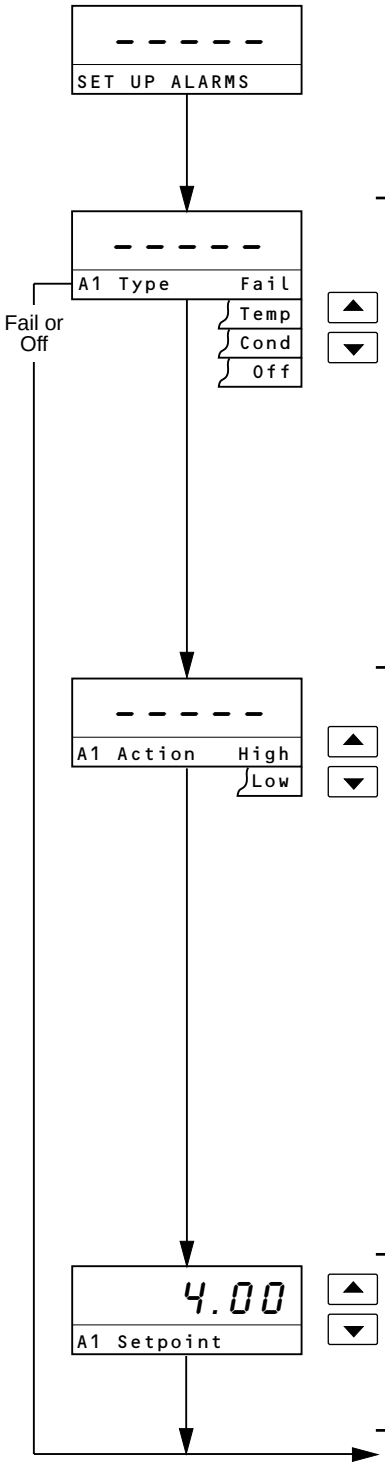
Display Span (Full Scale)
Set the full scale value required.

Temperature Units
The temperature of the sample can be displayed in either degrees Fahrenheit or Celsius.

Select either °C or °F.

Advance to **Set Up Alarms Page**.

7.4 Set Up Alarms Page



↵ – press to advance to next parameter

or

↵ – press to advance to next page.

These two keys are used to advance to all subsequent parameters and pages. If a parameter is changed it is automatically stored on operation of either key.

Alarm 1 Type

Select the type of alarm required. For `Fail`, `Temp` and `Cond` alarm types, the alarm l.e.d. is off and the relay energized during normal conditions. In a fail condition, the l.e.d. is on and the relay de-energized.

`Fail` – The instrument alerts the operator to either a power failure or a condition that causes any of the error messages listed in Table 9.1 to be displayed.

`Temp` – The instrument alerts the operator if the temperature of the process fluid exceeds or drops below the value set in the **Alarm 1 Set Point** parameter, depending on the type of **Alarm 1 Action** selected below.

`Cond` – The instrument alerts the operator if the conductivity of the process fluid exceeds or drops below the value set in the **Alarm 1 Set Point** parameter, depending on the type of **Alarm 1 Action** selected below.

`Off` – If selected, no alarms are set and the alarm l.e.d. is off and the relay de-energized at all times.

Alarm 1 Action

For **'Fail-safe'** alarm operation the relay's alarm state must be the same as the power-down state, i.e. the relay is de-energized.
For `High` alarm operation the relay must be energized below the alarm set point.
For `Low` alarm operation the relay must be energized above the alarm set point.
The alarm l.e.d.s are illuminated in the alarm condition.
Select the required alarm 1 action from the following table:

Alarm Action	LED Condition for Input Above Set Point	LED Condition for Input Below Set Point	Relay Condition for Input Above Set Point	Relay Condition for Input Below Set Point
High	ON	OFF	De-energized	Energized
Low	OFF	ON	Energized	De-energized

The set point band is defined as the actual value of the set point plus or minus the hysteresis value. The hysteresis value is ± 1% of the set point value displayed in the Set Up Parameters Page – see page17. Alarm action occurs if the input value is above or below the set point band. If the input moves within the set point band the last alarm action is maintained.

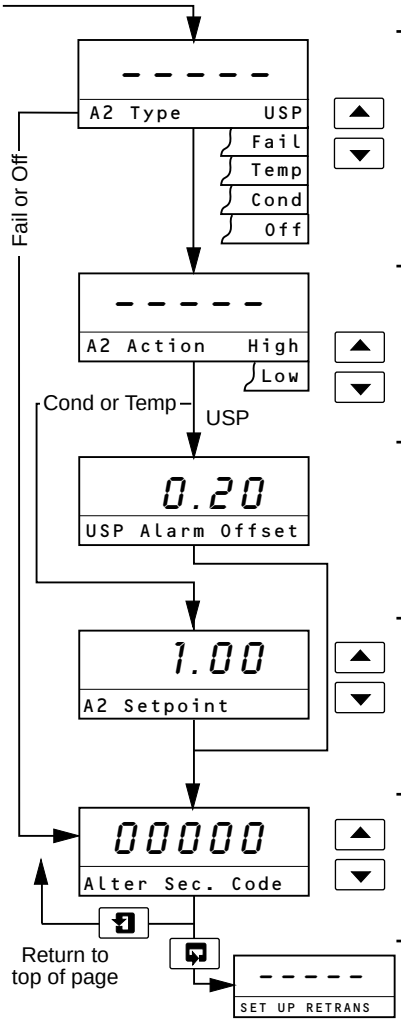
Alarm 1 Set Point

The alarm 1 set point can be set to any value within the input range being displayed. The set point value is subject to hysteresis as detailed above.

Set the alarm set point to the required value.

continued on next page.

…7.4 Set Up Alarms Page



Alarm 2 Type
Repeat as for **Alarm 1 type** on the previous page.

USP – The alarm setpoint changes automatically with temperature – see table 7.1.

Alarm 2 Action
Repeat as for **Alarm 1 Action** on the previous page.

USP Alarm Offset (Displayed only if Alarm A2 Type is set to USP)
The offset enables the alarm trip point to be triggered early for increased protection. The value set is deducted from the setpoint table value – see table 7.1.
Set between 0.00 and 0.50 in 0.01 increments.

Alarm 2 Set Point (Displayed only if Alarm A2 Type is set to Cond or Temp)
Repeat as for **Alarm 1 Set Point** on previous page.

Alter Security Code
Set the security code to a value between 00000 and 19999.

Advance to **Set up Retransmission Page**.

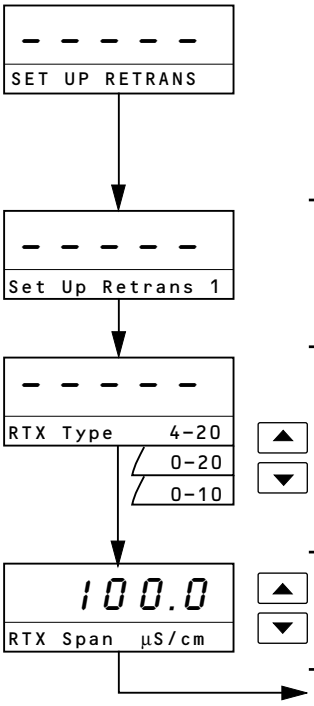
Temperature (°C)	Conductivity (µS/cm)
0	0.6
5	0.8
10	0.9
15	1.0
20	1.1
25	1.3
30	1.4

Temperature (°C)	Conductivity (µS/cm)
35	1.5
40	1.7
45	1.8
50	1.9
55	2.1
60	2.2
65	2.4

Temperature (°C)	Conductivity (µS/cm)
70	2.5
75	2.7
80	2.7
85	2.7
90	2.7
95	2.9
100	3.1

Table 7.1 – USP Alarm Setpoint Values

7.5 Set Up Retransmission Page



– press to advance to next parameter

or

– press to advance to next page.

These two keys are used to advance to all subsequent parameters and pages. If a parameter is changed it is automatically stored on operation of either key.

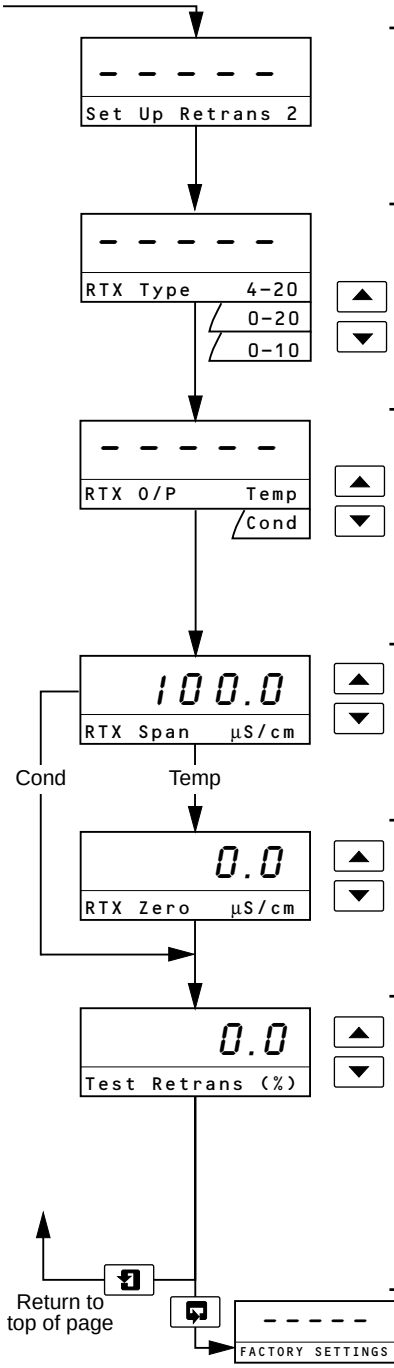
Set Up Retransmission 1

Retransmission 1 Output Range
Set the retransmission output current range for retransmission channel 1.

Retransmission 1 Span
Set the required span over which the retransmission output is to operate to between 10 and 100% of the display span – see Section 7.3, **Set Up Parameters Page**.

Continued on next page.

…7.5 Set Up Retransmission Page



Set Up Retransmission 2

Note. Available only on 4623/800 and 4628/800 instruments.

Retransmission 2 Output Range

Set the retransmission output current range for retransmission channel 2.

Retransmission 2 Output Assignment

Select the Retransmission output required:

`Temp` – Temperature

`Cond` – Conductivity

Retransmission 2 Span

Set the required span over which the retransmission output is to operate to between 10 and 100% of the display span – see Section 7.3, **Set Up Parameters Page**.

Retransmission 2 Zero

Set the zero point for the retransmission 2 output.

Test Retransmission Output

The instrument automatically transmits a test signal of 0, 25, 50, 75 or 100% of the retransmission range selected above. The % test signal selected is shown on the upper display.

Example – for a selected range of 0 to 20mA and 50% retransmission test signal, 10mA is transmitted.

Select the required retransmission test signal.

Advance to **Factory Settings Page**.

8 CALIBRATION

Note. The instrument is calibrated by the Company prior to despatch and recalibration should be carried out:

- **Only** if the instrument's accuracy is suspect **and** suitably calibrated test equipment is available.
- At 12 monthly intervals for re-validation provided suitably calibrated test equipment is available.

8.1 Equipment Required

a) Decade resistance box (cell input simulator): 0 to 10KΩ (in increments of 0.1Ω), accuracy ±0.1%.

b) Decade resistance box (temperature input simulator): 0 to 1KΩ (in increments of 0.01Ω), accuracy ±0.1%.

c) Digital milliammeter (current output measurement): 0 to 20mA.

Note.

- Resistance boxes have an inherent residual resistance which may range from a few mΩ up to 1 ohm. This value must be taken into account when simulating input levels, as should the overall tolerance of the resistors within the boxes.
- All test equipment must be traceable, with valid test certification.

8.2 Preparation

a) Switch off the supply and disconnect the conductivity cell, temperature compensator and current output from the instrument's terminal blocks – see Fig. 4.4 (page 10) or Fig. 4.5 (page 11).

b) Connect the decade boxes to the appropriate terminals – see Table 8.1. Ensure the earth on the conductivity decade box is connected to the case earth (ground) stud. Connect the milliammeter to the retransmission output terminals – see Fig 4.4 (page 10) or Fig. 4.5 (page11).

c) Switch on the supply and allow ten minutes for the circuits to stabilize.

d) Select the `FACTORY SETTINGS` page and carry out Section 8.3.

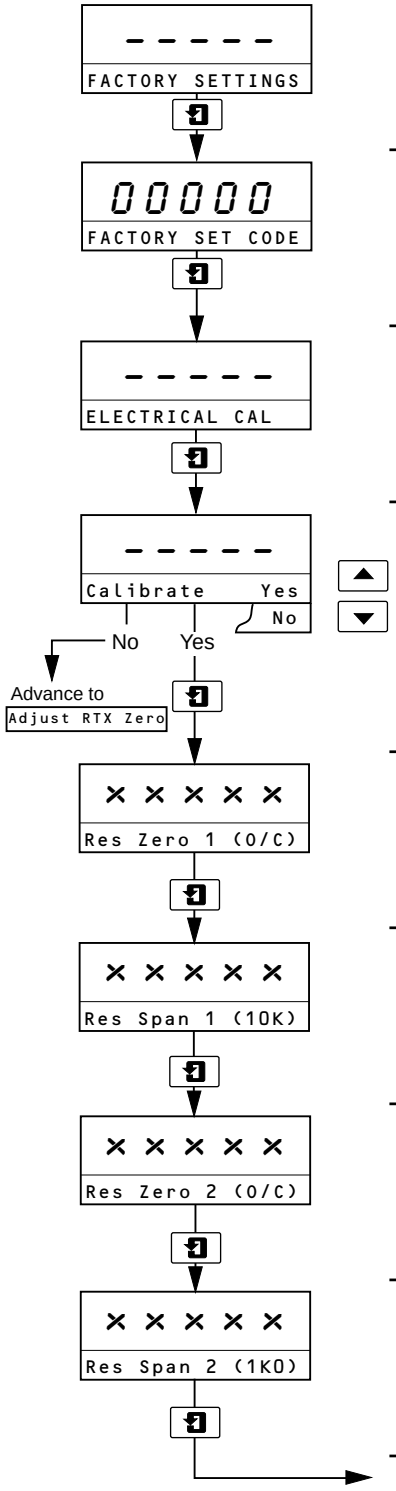
Instrument Type	Terminal Number						
Wall-mounted	1	2	3	4	5	6	7
Panel-mounted	12	11	10	9	8	7	6
	–	–	Cell electrode input	Cell electrode input *	PT100 input	Link to terminal 7 (6)	PT100 input

* Link to case earth (ground) stud.

Table 8.1 Test Equipment Connections

8.3 Factory Settings Page

When carrying out the electrical calibration procedure, the actual values denoted by ✕✕✕✕✕ are unimportant and are used only to determine display reading stability.



Factory Settings Access Code
Enter the required code number, between 00000 and 19999, to gain access to the factory settings. If an incorrect value is entered, access to subsequent parameters is prevented and the display reverts to the top of the **Factory Settings Page**.

Electrical Calibration
Select `Yes` to access the electrical calibration sequence. Select `No` to advance to **Adjust Retransmission Zero**.

Caution. Do not select `Yes` unless instrument calibration is required.

Advance to next parameter.

Calibrate Cell Zero 1
Open circuit the cell simulator and allow the instrument display to stabilize.

Advance to next parameter.

Calibrate Cell Span 1
Set the cell simulator to 10KΩ and allow the instrument display to stabilize.

Advance to next parameter.

Calibrate Cell Zero 2
Open circuit the cell simulator and allow the instrument display to stabilize.

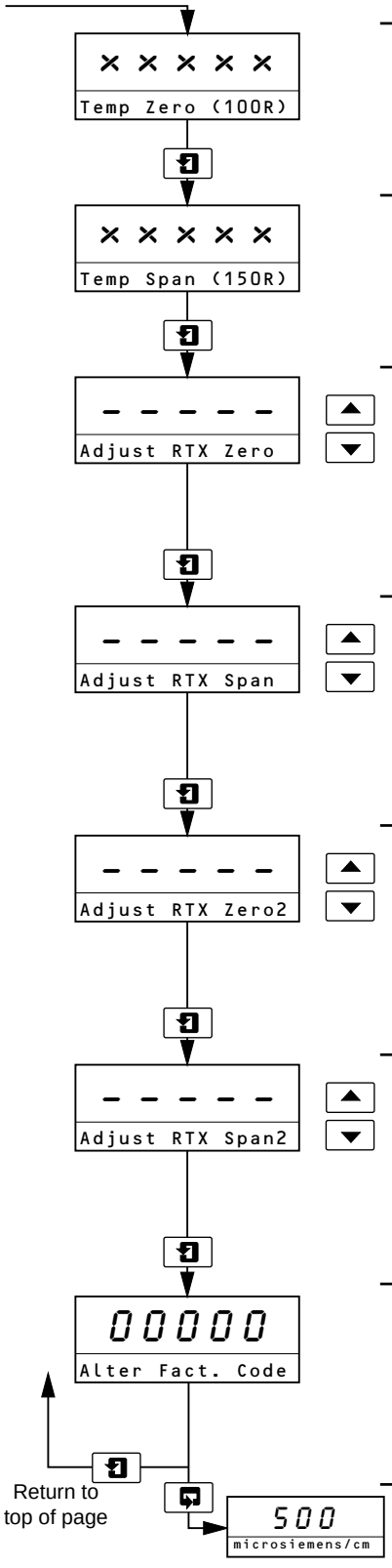
Advance to next parameter.

Calibrate Cell Span 2
Set the cell simulator to 1kΩ and allow the instrument display to stabilize.

Advance to next parameter.

Continued on next page.

…8.3 Factory Settings Page



Calibrate Temperature Zero
Set the temperature simulator to 100Ω and allow the instrument display to stabilize.

Advance to next parameter.

Calibrate Temperature Span
Set the temperature simulator to 150Ω and allow the instrument display to stabilize.

Advance to next parameter.

Adjust Retransmission 1 Zero
Set the milliammeter reading to 4mA.

Note. The retransmission range selected in the **Set Up Retransmission Page** does not affect the reading.

Advance to next parameter.

Adjust Retransmission 1 Span
Set the milliammeter reading to 20mA.

Note. The retransmission range selected in the **Set Up Retransmission Page** does not affect the reading.

Advance to next parameter.

Adjust Retransmission 2 Zero (available only on 4623/800 and 4628/800 instruments)
Set the milliammeter reading to 4mA.

Note. The retransmission range selected in the **Set Up Retransmission Page** does not affect the reading.

Advance to next parameter.

Adjust Retransmission 2 Span (available only on 4623/800 and 4628/800 instruments)
Set the milliammeter reading to 20mA.

Note. The retransmission range selected in the **Set Up Retransmission Page** does not affect the reading.

Advance to next parameter.

Alter Factory Code
Set the factory settings access code to a value between 00000 and 19999.

Return to **Operating Page.**

9 SIMPLE FAULT FINDING

9.1 Error Messages

If erroneous or unexpected results are obtained the fault may be indicated by an error message – see Table 9.1. However some faults may cause problems with instrument calibration or give discrepancies when compared with independent laboratory measurements.

Error Message	Possible Cause
FAULTY PT100	Temperature compensator/associated connections are either open/short circuit.
FAULTY MODULE	The conductivity input module may be faulty.
NV MEMORY ERROR	The contents of the non-volatile memory has not been read correctly during power up.*

***** To rectify the fault, switch off, wait 10 seconds and switch on again. If the fault persists contact the Company.

Table 9.1 Error Messages

9.2 No Response to Conductivity Changes

The majority of problems are associated with the conductivity cell, which must be cleaned as an initial check. It is also important that all program parameters have been set correctly and have not been altered inadvertently – see Section 7.

If the above checks do not resolve the fault:

a) Check that the instrument responds to a resistance input. Disconnect the conductivity cell cable and connect a suitable resistance box directly to the transmitter input – see Section 4.3 or 4.4. Check that the instrument displays the correct values as set on the resistance box using Table 9.2 below or the expression:

$$R = \frac{K \times 10^6}{G}$$

Where: R = equivalent resistance

K = cell constant

G = conductivity

	Cell Constant (K)		
Conductivity μS/cm (G)	**0.05**	**0.1**	**1.0**
	Resistance (R)		
0.055	909.091kΩ	–	–
0.1	500kΩ	1MΩ	–
0.5	100kΩ	200kΩ	–
1	50kΩ	100kΩ	1MΩ
5	10kΩ	20kΩ	200kΩ
10	5kΩ	10kΩ	100kΩ
50	1kΩ	2kΩ	20kΩ
100	500Ω	1kΩ	10kΩ
500	100Ω	200Ω	2kΩ
1000	–	100Ω	1kΩ
5000	–	–	200Ω
10000	–	–	100Ω

Table 9.2 Conductivity Readings for Resistance Inputs

Failure to respond to the input indicates a fault with the instrument which must be returned to the Company for repair. Correct response, but with incorrect readings, usually indicates an electrical calibration problem. Re-calibrate the instrument as detailed in Section 8.3.

b) If the response in a) is correct, reconnect the conductivity cell cable and connect the resistance box to the cell end. Check that the instrument displays the correct values as set on the resistance box in this configuration.

If the instrument passes check a) but fails check b), check the cable connections and condition. If the response for both checks is correct, replace the conductivity cell.

9.3 Checking the Temperature Input

Check that the instrument responds to a temperature input. Disconnect the PT100 leads and connect a suitable resistance box directly to the transmitter inputs – see Section 4.3 or 4.4. Check that the transmitter displays the correct values as set on the resistance box – see Table 9.3.

Incorrect readings usually indicate an electrical calibration problem – re-calibrate the instrument as detailed in Section 8.3.

Temperature °C	Input Resistance (Ω)
0	100.00
10	103.90
20	107.79
25	109.73
30	111.67
40	115.54
50	119.40
60	123.24
70	127.07
80	130.89
90	134.70
100	138.50
130.5	150.00

Table 9.3 Temperature Readings for Resistance Inputs

10 SPECIFICATION

Display

Measured value:
5-digit, 7-segment back-lit l.c.d.

Information:
16-character, single line, dot matrix back-lit l.c.d.

Ranges:
programmable 0 to 1.00µS/cm up to 10.00µS/cm

Scaling:
µS/cm at xx °C (°F).

Accuracy:
±1% f.s.d., ±1 digit.

Linearity:
±0.2% f.s.d.

Resolution:
±0.1% f.s.d.

Temperature measuring range:
–10°C to 110°C (14 to 230°F).

Temperature compensation:
–10°C to 110°C (14 to 230°F) automatic.

Temperature coefficient:
Fixed at 2.0%/°C (1%/°F).

Temperature sensor:
Pt100 resistance thermometer.

Reference temperature:
25°C (77°F) fixed.

Set Points and Relays

No. of set points:
Two.

Set point adjustment:
Programmable.

Set point hysteresis:
±1% of setpoint (fixed).

Local set point annunciation:
Red l.e.d.

No. of relays:
Two.

Relay contacts:
Single pole changeover

Rating:	250V a.c.	50V d.c. max.
	3A a.c.	3A d.c. max.
Loading:		
(non-inductive)	750VA	30W max.
(inductive)	75VA	3W max.

Insulation, contacts to earth:
2kV r.m.s.

Retransmission

No. of retransmission signals:
One, fully isolated – standard.
Two, fully isolated – optional.

Output current:
0 to 10, 0 to 20 or 4 to 20mA programmable.

Output ranges:
Retransmission 1:
Zero – 0, fixed.
Span – 10 to 100% of the display range.
Retransmission 2 (optional):
Programmable – Conductivity or Temperature
Conductivity – as per Retransmission 1
Temperature – 10 to 150°C (14 to 302°F), min. span 20°C (36°F)

Accuracy:
±0.25% f.s.d.

Resolution:
0.1% of f.s.d.

Max. load resistance:
750Ω (20mA max.).

Serial communication:
RS422/RS485 (optional).

Power Supply

Voltage requirements:
115V nom. ±15V, 50/60Hz.
230V nom. ±30V, 50/60Hz

Power consumption:
< 10VA a.c.

Error due to power supply variation:
less than ±2% for +6% -20% variation from nominal supply voltage.

Insulation:
mains to earth 2kV r.m.s.

Environmental Data

Operating temperature limits:
–20° to 55°C (–4 to 131°F).

Storage temperature limits:
–25° to 55°C (–13 to 131°F).

Operating humidity limits:
up to 95% RH non-condensing.

Mechanical Data

Mounting:
Model 4623 wall mounting, Model 4628 panel mounting.

Protection:
Model 4623 IP66, Model 4628 IP66 (front only).

Overall dimensions:
Model 4623 – 160 x 250 x 68mm (6.3 x 9.84 x 2.68in.) – see Fig. 3.3
Model 4628 – 96 x 96 x 191mm (3.78 x 3.78 x 7.52in.) – see Fig. 3.5

Panel cut-out:
$92\ ^{+0.8}_{-0.0}$ mm x $92\ ^{+0.8}_{-0.0}$ mm ($3.62\ ^{+0.03}_{-0.00}$ x $3.62\ ^{+0.03}_{-0.00}$ in.)

Weight:
Model 4623 – 2kg ($4^1/_2$lb)
Model 4628 – 1.5kg ($3^1/_4$lb)

APPENDICES

A1 Automatic Temperature Compensation

At high purity water conductivity levels, the conductivity/ temperature relationship is made up of two components: the first component, due to the impurities present, generally has a temperature coefficient of approximately 0.02/°C; and the second, which arises from the effect of the H^+ and OH^- ions, becomes predominant as the ultra-pure water level is approached.

Consequently, to achieve full automatic temperature compensation, the above two components must be compensated for separately, according to the following expression:

$$G_{25} = \frac{G_t - G_{upw}}{[1 + \propto (t - 25)]} + 0.055$$

Where: G_t = conductivity at temperature t°C

G_{upw} = ultra-pure water conductivity at temperature t°C

$\propto$ = impurity temperature coefficient

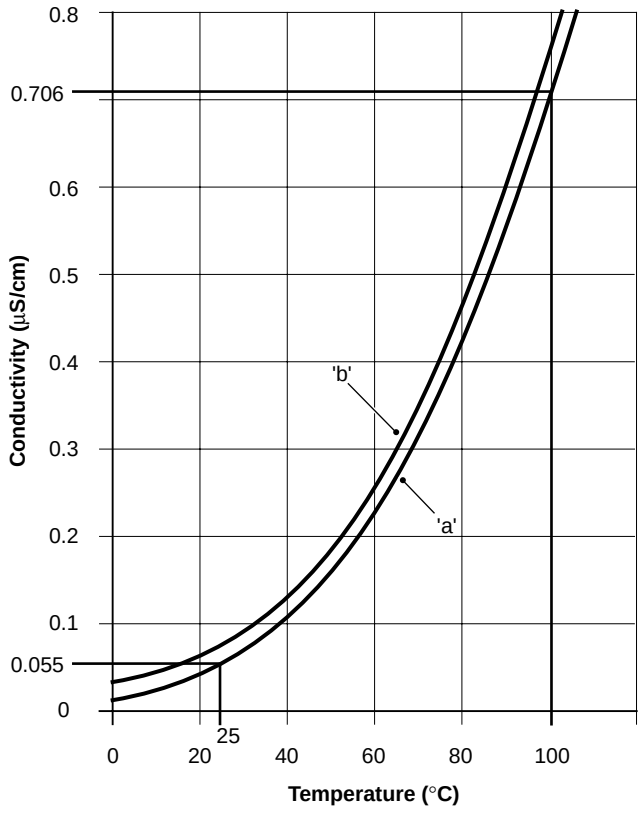
0.055 = conductivity in µS/cm of ultra-pure water at 25°C

The expression is simplified as follows:

$$G_{25} = \frac{G_{imp}}{[1 + \propto (t - 25)]} + 0.055$$

Where: G_{imp} = impurity conductivity at temperature t°C

The above expression was solved in earlier analog instrumentation by using two temperature sensing elements located in the conductivity measuring cell. However, models 4623 and 4628 now utilize the computational ability of a microprocessor to achieve ultra-pure water temperature compensation using only a single platinum resistance thermometer and mathematically calculating the temperature compensation required to give the correct conductivity at the reference temperature.



Curve 'a' – Theoretical ultra-pure water conductivity

Curve 'b' – High purity water conductivity (ultra-pure water with slight impurity)

Fig. A1 Theoretical Ultra-pure Water Conductivity and High Purity Water Conductivity v Temperature

NOTES

PRODUCTS & CUSTOMER SUPPORT

Products

Automation Systems

- ***for the following industries:***
  - Chemical & Pharmaceutical
  - Food & Beverage
  - Manufacturing
  - Metals and Minerals
  - Oil, Gas & Petrochemical
  - Pulp and Paper

Drives and Motors

- ***AC and DC Drives, AC and DC Machines, AC motors to 1kV***
- ***Drive systems***
- ***Force Measurement***
- ***Servo Drives***

Controllers & Recorders

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- ***Circular Chart , Strip Chart and Paperless Recorders***
- ***Paperless Recorders***
- ***Process Indicators***

Flexible Automation

- ***Industrial Robots and Robot Systems***

Flow Measurement

- ***Electromagnetic Flowmeters***
- ***Mass Flow Meters***
- ***Turbine Flowmeters***
- ***Flow Elements***

Marine Systems & Turbochargers

- ***Electrical Systems***
- ***Marine Equipment***
- ***Offshore Retrofit and Refurbishment***

Process Analytics

- ***Process Gas Analysis***
- ***Systems Integration***

Transmitters

- ***Pressure***
- ***Temperature***
- ***Level***
- ***Interface Modules***

Valves, Actuators and Positioners

- ***Control Valves***
- ***Actuators***
- ***Positioners***

Water, Gas & Industrial Analytics Instrumentation

- ***pH, conductivity, and dissolved oxygen transmitters and sensors***
- ***ammonia, nitrate, phosphate, silica, sodium, chloride, fluoride, dissolved oxygen and hydrazine analyzers.***
- ***Zirconia oxygen analyzers, katharometers, hydrogen purity and purge-gas monitors, thermal conductivity.***

Customer Support

We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

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Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671

United States of America

ABB Inc.
Tel: +1 (0) 755 883 4366
Fax: +1 (0) 755 883 4373

Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification.

Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:

1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

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