



## **SENSOLUTION™ C600**

### **2-wire Conductivity Transmitter**



### **Installation and Operating Instructions**

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## 2. Introduction

Thank you for selecting a C600 Transmitter. This isolated output 4-20mA transmitter is a sturdy microprocessor-based instrument that measures conductivity and temperature and transmits its output via the 2-wire power supply loop.

This transmitter has many user-friendly features – all of which are completely accessible through the water-resistant membrane keypad. Your transmitter includes an instruction manual and a warranty card.

Please read this manual thoroughly before operating your transmitter.



## 3. Installation

### 3.1. Mechanical Installation

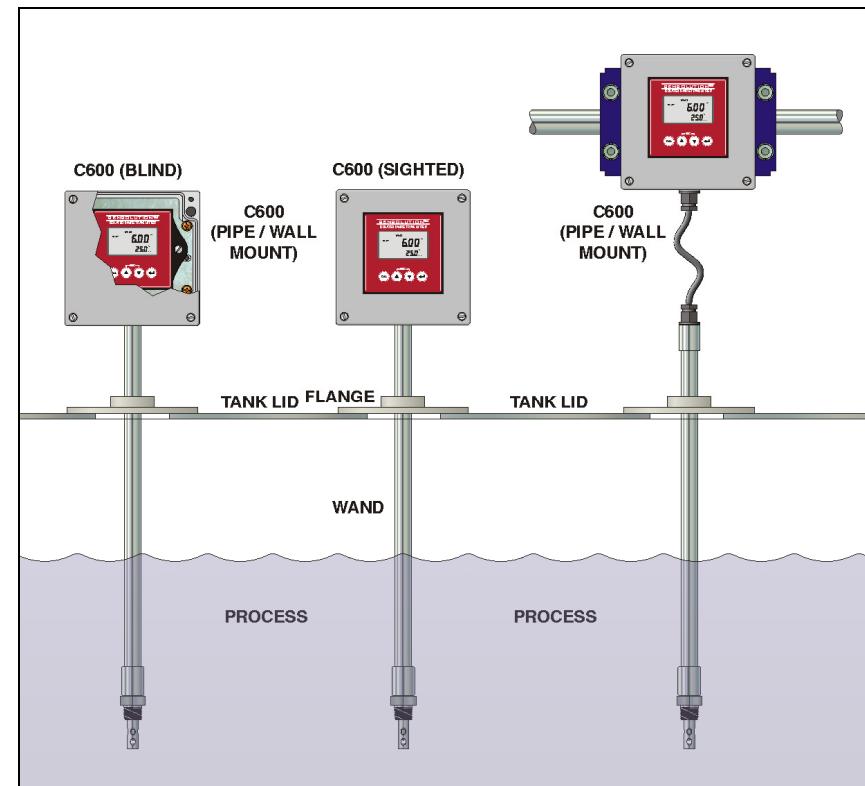
The C600 is normally supplied with a probe and wand, as shown in the diagram.

To install the sensor:

- Cut a 50mm diameter hole in the tank lid.
- Insert the wand through the hole and allow the assembly to rest on the flange.
- Loosen the grub screw in the flange to adjust the depth of the probe.

**Note:** There is not normally any need to bolt the flange down.

If the transmitter is to be mounted separately, use an Astles Control Systems universal mounting kit (part number 500/9501) to fix it to a pipe or wall.



### 3.2. Electrical Installation

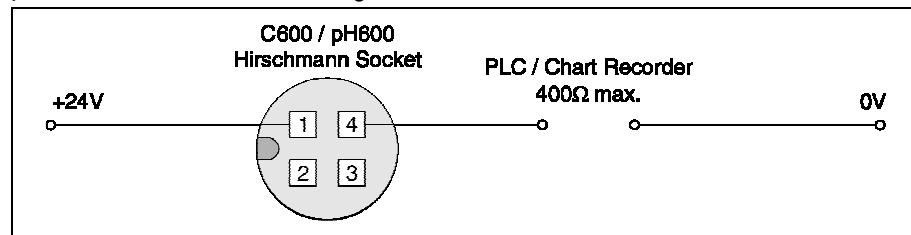
#### 3.2.1. Power supply requirements

The C600 requires a 12 to 24V dc supply. Other devices, such as chart recorders and PLCs, may be connected in series. Use screened cable if the 4~20mA conductivity signal is required.

#### 3.2.2. Connecting using a plug and socket.

If the C600 has been supplied with a re-wireable socket, connect to the terminals as shown in the diagram below. When tightening the socket gland, ensure that a good seal is made around the cable.

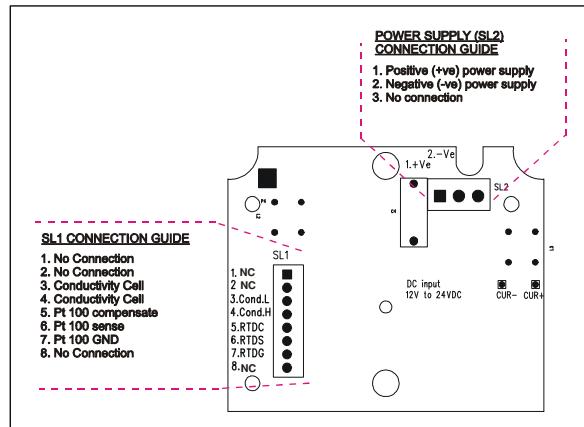
If the C600 has been supplied with a pre-moulded socket, connect the brown wire to positive and the black wire to negative.



#### 3.2.3. Connecting directly to the transmitter.

If the C600 does not have a plug and socket, connect to terminal block SL2.

- Remove the plastic back cover of the transmitter.
- Punch out one of the gland holes in the bottom of the transmitter and fit an M20 gland.
- Pass the power cable through the gland and wire to SL2 as shown in the diagram below.
- Replace the back cover.



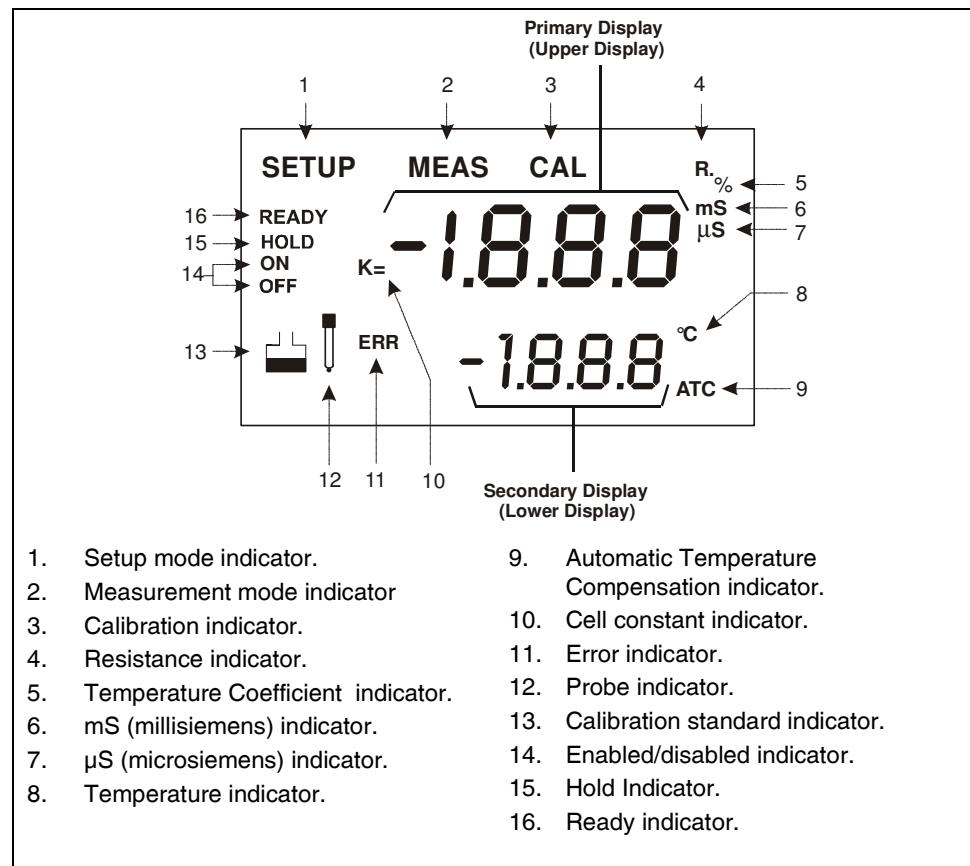
### 4. Display and Keypad Functions

#### 4.1. Display

The LCD has a primary and secondary display.

- The primary display shows the measured conductivity value.
- The secondary display shows the measured temperature. In Calibration mode, measured conductivity values are displayed here.

**Note:** If the transmitter's 'blind' (see diagram page 6), the front cover of the aluminium box must be removed before the display can be accessed.



## 4.2. Keypad

The four-button keypad allows easy and quick operations of the Transmitter.

Key	Function
CAL	<ul style="list-style-type: none"><li>Brings you directly into the Calibration mode.</li><li>If you were in Conductivity Measurement mode, press CAL to enter Conductivity Calibration mode.</li></ul>
▲ / ▼	<ul style="list-style-type: none"><li>To scroll through the various submenus</li><li>To increment/decrement values or toggle between options (in the SETUP/CAL modes)</li><li>When pressed together, serves as escape function to return to MEAS mode from any point (CAL or SETUP modes).</li></ul>
◀	<ul style="list-style-type: none"><li>To confirm your calibration values in Calibration mode.</li><li>To confirm selections in SETUP mode.</li><li>While in MEAS mode, pressing ▶ takes you directly to SETUP submenu</li></ul>



## 5. Calibration

### 5.1. Important Information on Transmitter Calibration.

Calibration should be carried when you are using your transmitter with a new electrode for the first time or when you suspect that the transmitter/electrode is out of calibration. Your transmitter allows you to perform temperature calibration and conductivity calibration.

As temperature readings affect the accuracy of conductivity measurements, it is recommended that temperature calibration should be carried out only if the temperature value displayed on the transmitter is different from that of a calibrated thermometer. A temperature offset calibration of  $\pm 5^{\circ}\text{C}$  from the default reading is allowed. Once a temperature calibration is performed, conductivity calibration should be carried out to ensure the accuracy of conductivity measurements are maintained.

Your transmitter has up to six selectable conductivity measuring ranges. The selection for the sixth range, range 6 (0.00 to 199.9 mS/cm), only appears in the Setup mode if the cell constant is selected to be K = 1.0 or K = 10 whereas range 1 (0.00 to 19.99  $\mu\text{S}/\text{cm}$ ), will only appear when cell constant is selected to be K = 0.1 or K = 1.0. Otherwise, the selection will be limited to five ranges only.

You can only calibrate one point in the measuring range that you have selected for your process application. You have to recalibrate your transmitter every time you change the measuring range since the calibration data of your transmitter will be erased every time a new measuring range is selected.

During conductivity calibration, the transmitter allows a calibration window of  $\pm 40\%$  from the measured default reading of the calibration standard. The minimum allowable calibration point is 10% of the full scale reading of the range selected.

For best results, select a standard value close to the sample value you are measuring. Table 1 (next page) lists the recommended standards for each range. You should calibrate, in the range that you have selected, using a solution that falls between the values in the "recommended calibration solution range" column.

Table 1

Conductivity Measuring Range	Recommended Calibration Solution
0.00 → 19.99 µS	84 µS
0.0 → 199.9 µS	84 µS
0 → 1999 µS	1413 µS
0.00 → 10.00 mS	1413 µS
0.00 → 19.99 mS	12880 µS
0.0 → 199.9 mS	12880 µS

To view current calibration point, see Section 6.8 ‘Viewing Calibration Point’.

Do not reuse calibration solutions after calibration. Contaminants in the solution can affect the calibration, and eventually the accuracy of the measurements. Use fresh calibration solution each time you calibrate your meter.

**Note:** Your transmitter is factory set to a temperature coefficient of 2.1% per °C. For most applications this will provide good results. The factory default value for normalisation temperature is 25 °C. If you need to set a different temperature coefficient or change the normalisation temperature value, see Section 6.5 ‘Temperature Coefficient and Normalisation Temperature Setting’ for further information.

**Note:** In the CAL mode, the 4/20 mA output current will be automatically held. ‘HOLD’ will be displayed on LCD. After calibration is performed and when the transmitter is back to the measurement mode, the ‘HOLD’ is automatically released. Please refer to Section 6.3 ‘Hold Current Setting’ for more details.

## 5.2. Temperature Calibration

You need to perform temperature calibration if your transmitter temperature reading is inaccurate or if the transmitter’s cell constant setting is changed. It is because the transmitter’s temperature offset calibration will be erased once a new cell constant is selected.

It is important to ensure that temperature calibration is carried out first prior to conductivity calibration since temperature readings affect the accuracy of conductivity measurements. Your transmitter allows a one point temperature calibration using reference of a thermometer known to be accurate. Please refer to Section 6.2 ‘Temperature Compensation Setting’ for temperature calibration procedure.

### 5.3. Conductivity Calibration

A 1-point Calibration is required for this transmitter. If the calibration process is aborted, your transmitter will revert to the previous calibration data.

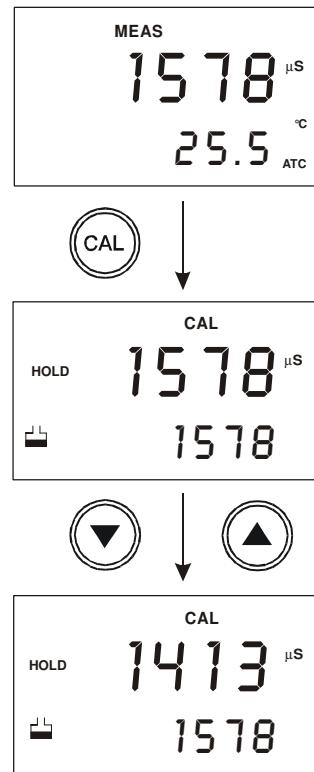
- Organise your calibration standard solution in two beakers – one for rinsing and the other for calibration. Prepare separate de-ionised water for electrode rinsing.
- Rinse the electrode in de-ionised water and then rinse with the calibration standard.
- Dip the electrode to the calibration standard intended for calibration and swirl gently to create a homogenous sample. Wait for the reading to stabilise.
- Press the CAL key to enter calibration mode. The upper display will show the measured reading based on the last calibration setting whereas the lower display will show the measured default reading of the standard.
- Use the ▲ or ▼ keys to adjust the upper display to the calibration standard value.

**Note:** You can offset the conductivity reading within  $\pm 40\%$  from the default reading of the standard. The minimum allowable calibration point is 10% of the full scale reading of the range selected.

- Press the ← key to confirm the calibration value and to return to the measurement mode.

**Note:** To exit this program without confirming the calibration, press the ▲ and ▼ keys together (Escape).

**Note:** When there is a calibration error, the buffer icon and ERR annunciator will appear together with a blinking electrode icon. Press both ▲ and ▼ keys together TWICE to return to the measurement mode.



### 6. Advanced Setup Functions

The advanced setup mode lets you customise your transmitter's preferences and defaults. This transmitter features different sub groups that organise all setup parameters. The sub-groups are:

#### 6.1. Range and Zooming Selection Setting

This transmitter provides six selections of conductivity measurement ranges to suit your process application needs. Zooming selection is available where both the 4 mA and 20 mA output current can be assigned to specific conductivity values for a more refined output.

From the measurement mode,

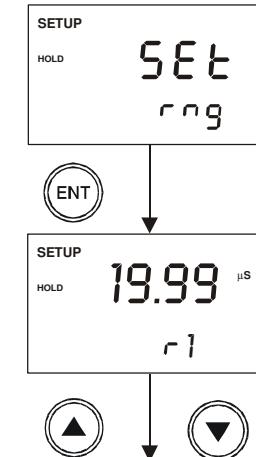
- Press the SETUP key to enter the setup mode. Transmitter displays 'SETUP' indicating the range setup mode.
- Press the SETUP key again. The display will show the last set conductivity measurement range.
- Use the ▲ or ▼ keys to scroll through the six ranges and press the SETUP key to select your desired range. The transmitter will now switch to the zooming selection and display the low zoom value setup.

**Note:** Range 6 selection page will only appear in the setup mode when the cell constant is selected as K = 1.0 or K = 10. Range 1 will only appear when cell constant is selected as K = 0.1 or K = 1.0

- For zooming setting, use the ▲ or ▼ keys to set the conductivity low zoom value for the 4 mA current and press the SETUP key to confirm. The transmitter now displays the high zoom value setup.

Use the ▲ or ▼ keys again to set the conductivity high zoom value for the 20 mA current and press the SETUP key to confirm and return to the range setup mode.

Press both ▲ and ▼ keys together to return to the measurement mode.



**Six Range selection**



## 6.2. Temperature Compensation Setting

Conductivity readings are affected by temperature. Under varying temperature conditions, use ATC to compensate for the conductivity values. If temperature of sample is constant, and a temperature sensor/probe is not available, Manual Temperature Compensation can be utilised.

### 6.2.1. Automatic Temperature Compensation

For automatic temperature compensation (ATC) selection, a probe with a temperature sensor must be fitted.

1. Press the  $\leftarrow$  key to enter the setup mode. Use the  $\blacktriangle$  or  $\blacktriangledown$  keys to scroll through the sub-menus till LCD displays 'SEt °C'.
2. Press the  $\leftarrow$  key to enter the temperature compensation mode. Display shows 'AtC On' or 'AtC Off'. Use  $\blacktriangle$  or  $\blacktriangledown$  keys to select 'AtC On' and then press the  $\leftarrow$  key.
3. Dip ATC sensor into a solution of known temperature (i.e. a temperature bath). Allow time for temperature sensor to acclimatise with surrounding bath temperature.
4. Use  $\blacktriangle$  or  $\blacktriangledown$  keys to adjust the displayed reading to the correct temperature value according to the temperature bath. Maximum adjustments allowed is  $\pm 5^{\circ}\text{C}$  ( $\pm 9^{\circ}\text{F}$ ) from the default reading.
5. Once you have adjusted to the correct temperature value, press the  $\leftarrow$  key to confirm the setting.
6. Press  $\blacktriangle$  and  $\blacktriangledown$  keys together to return to the measurement mode.

The ATC indicator will light up on the LCD.

**Note:** If you are using a temperature sensor, the sensor must be submersed in the liquid you are measuring.

### 6.2.2. Manual Temperature Compensation

For manual temperature compensation you can set the process and calibration temperatures. This allows calibration at a temperature other than the process temperature. Example: setting a calibration temperature of  $25^{\circ}\text{C}$  lets you calibrate using standard solutions at  $25^{\circ}\text{C}$ , even if your process temperature is different from  $25^{\circ}\text{C}$ .

From the measurement mode,

1. Press the  $\leftarrow$  key and use  $\blacktriangle$  or  $\blacktriangledown$  keys to select 'SEt °C'.
2. Press the  $\leftarrow$  key to enter the temperature compensation mode. Display shows 'AtC On' or 'AtC Off'. Use  $\blacktriangle$  or  $\blacktriangledown$  keys to select 'AtC Off' and then press the  $\leftarrow$  key.
3. The primary display will show temperature (default is  $25.0$ ), and the secondary display shows ' $P^{\circ}\text{C}$ '. This is the page for setting the temperature of your process or sample by using an accurate thermometer as reference.
4. Use  $\blacktriangle$  or  $\blacktriangledown$  keys to set the transmitter to the temperature of your process or sample. Press the  $\leftarrow$  key.
5. The primary display shows temperature (default is  $25.0$ ), and secondary display shows ' $C^{\circ}\text{C}$ '. This is the page for setting the temperature of your calibration solutions.
6. Use  $\blacktriangle$  or  $\blacktriangledown$  keys to set the transmitter to the temperature of your calibration solutions. Press the  $\leftarrow$  key.
7. Press  $\blacktriangle$  and  $\blacktriangledown$  keys together, to return to the measurement mode.

The transmitter will now compensate conductivity readings for the manually set temperature (values taken from  $P^{\circ}\text{C}$ ).

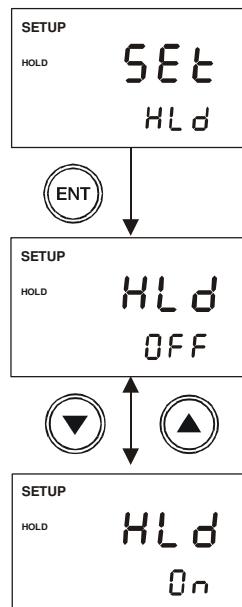
### 6.3. Hold Current Setting

When Transmitter is in CAL or SETUP modes, it automatically goes into a 'HOLD' mode.

To indicate Transmitter is in 'HOLD' mode, output current can be set to 22 mA output by activating the 'HLD On'.

1. Press  $\leftarrow$  key and use  $\blacktriangle$  or  $\blacktriangledown$  keys to scroll till LCD displays 'SEt' in the upper display; and 'HLd' in the lower display. Press  $\leftarrow$  again.
2. Upper display now shows 'HLd'. Lower display will show either 'OFF' or 'On'. Use  $\blacktriangle$  or  $\blacktriangledown$  keys to toggle between 'On' or 'OFF'. Press  $\leftarrow$  to accept selection.
3. Press  $\blacktriangle$  and  $\blacktriangledown$  keys together, to return to MEAS mode.

**Note:** If 'HLd' is set to 'OFF', then current output will be equivalent to last measured value.

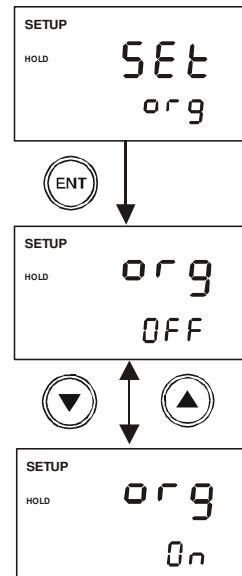


### 6.4. Out-of-Range Current Setting

If conductivity readings exceed the scale, LCD displays 'Or' (over-range), or 'Ur' (under-range). Transmitter current output can be set to 3.8 mA to indicate Out-of Range situation.

1. Press  $\leftarrow$  key and use  $\blacktriangle$  or  $\blacktriangledown$  keys to scroll till LCD displays 'SEt' in the upper display; and 'org' in the lower display. Press  $\leftarrow$  again.
2. Upper display now shows 'org'. Lower display will show either 'OFF' or 'On'. Use  $\blacktriangle$  or  $\blacktriangledown$  keys to toggle between 'On' or 'OFF'. Press  $\leftarrow$  to accept selection.
3. Press  $\blacktriangle$  and  $\blacktriangledown$  keys together, to return to MEAS mode.

**Note:** If 'org' is set to 'OFF', under-range will be set at 4 mA, while over-range will be set at 20 mA.



### 6.5. Temperature Coefficient and Normalisation Temperature Setting

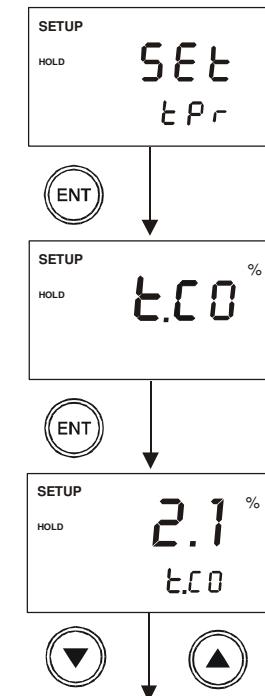
Since different process liquid may require different temperature coefficient factor for its temperature compensation calculation, C600 transmitter allows 0 to 10% temperature coefficient factor adjustment to cater for your different application needs. You also have the selection of 25.0 °C or 20.0 °C for the conductivity measurement normalisation temperature.

#### 6.5.1. Setting the temperature coefficient

From the measurement mode,

1. Press the  $\leftarrow$  key to enter the setup mode. Use the  $\blacktriangle$  or  $\blacktriangledown$  keys to scroll until LCD displays 'SEt' in the upper display; and 'tPr' in the lower display.
2. Press the  $\leftarrow$  key to view the temperature coefficient setup page, 'tC.O.'
3. Press the  $\leftarrow$  key to enter the setup page and use the  $\blacktriangle$  or  $\blacktriangledown$  keys to set the temperature coefficient value.

Press the  $\leftarrow$  key to confirm your setting. The transmitter will now switch to the normalisation setup page 'tn.r'



#### 6.5.2. Setting the normalisation temperature

1. Press the  $\leftarrow$  key to enter the normalisation setup page.
2. Use the  $\blacktriangle$  or  $\blacktriangledown$  keys to select the desired normalisation temperature (25.0 °C or 20.0 °C).
3. Press the  $\leftarrow$  key to set the normalisation temperature.
4. Press  $\blacktriangle$  and  $\blacktriangledown$  keys together, to return to the measurement mode..

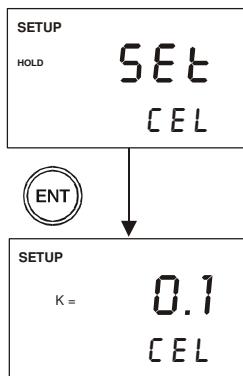


## 6.6. Cell Constant Setting

You can select up to three types of cell constant in the setup mode: - K=1.0, K=0.1 or K=10.

From the measurement mode,

1. Press the **⬅** key to enter the setup mode. Use the **▲** or **▼** keys to scroll till LCD displays 'SET' in the upper display; and 'CEL' in the lower display.
2. Press the **⬅** key to enter the cell constant setup page.
3. Use the **▲** or **▼** keys to select the desired cell constant and press the **⬅** key to confirm the selection.
4. Press **▲** and **▼** keys together, to return to the measurement mode.

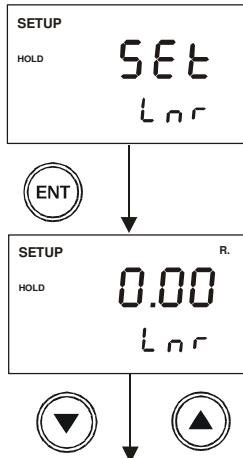


## 6.7. Line resistance Setting

Line resistance of an electrode cable constitutes to error in measurement of high conductivity values as in range 6. This error can be compensated by inputting the electrode cable line resistance value in the setup mode.

From Range 6 measurement mode,

1. Press the **⬅** key to enter the setup mode. Use the **▲** or **▼** keys to scroll till LCD displays 'SET' in the upper display; and 'Lnr' in the lower display.
2. Press the **⬅** key to enter the line resistance setup page.
3. Use the **▲** or **▼** keys to set the line resistance value (0 to 50 ohms) and press the **⬅** key to confirm the setting.
4. Press **▲** and **▼** keys together, to return to the measurement mode.



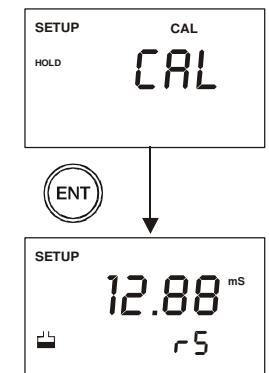
NOTE: The line resistance setup mode can be accessed only from range 6 measurement mode.

## 6.8. Viewing Calibration Point

This mode lets you view the current calibration point and its range.

From the measurement mode of a selected measuring range,

1. Press the **⬅** key to enter the setup mode. Use the **▲** or **▼** keys to scroll till LCD displays 'CAL' in the upper display.
2. Press the **⬅** key to enter the calibration point viewing page. The display will show the current calibration point and its range.
3. Press **▲** and **▼** keys together, to return to the measurement mode.



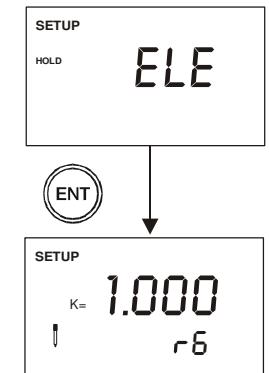
NOTE: This setup mode will only show the calibration point for the selected measuring range. If there is no calibration done in the selected range, the display will show '---'.

## 6.9. Viewing the Electrode Data

The C600 transmitter lets you check the electrode's parameters for diagnostic purposes. This option shows you the current effective cell constant and its range. The cell constant is adjusted according to your calibration.

From the measurement mode,

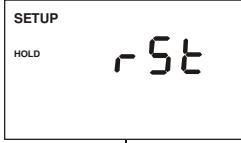
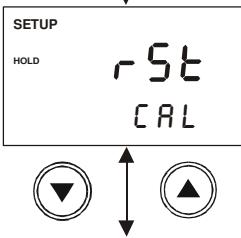
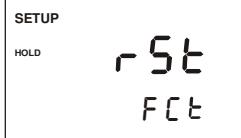
1. Press the **⬅** key to enter the setup mode. Use the **▲** or **▼** keys to scroll till LCD displays 'ELE' in the upper display.
2. Press the **⬅** key to enter the electrode data viewing page. The display will show the current effective cell constant and its range.
3. Press **▲** and **▼** keys together, to return to the measurement mode.



## 6.10. Reset Function

The reset function lets you choose to either reset the transmitter's conductivity calibration only or conductivity calibration plus all setup functions that you might have changed back to factory default settings. However, the temperature compensation setting, as in Section 6.2, will remain unchanged.

From the measurement mode,

1. Press the **◀** key to enter the setup mode. Use the **▲** or **▼** keys to scroll till LCD displays 'rSt' in the upper display.  

2. Press the **◀** key to enter the reset page. Use the **▲** or **▼** keys to toggle between 'CAL' and 'FCT' for reset type selection.  

3. Press the **◀** key to confirm your selection. The lower display will blink momentarily before returning to the reset function setup mode.  


Press **▲** and **▼** keys together, to return to the measurement mode.

**Astles Control Systems.**

B3 Regent Park, Summerleys Road,  
Princes Risborough, HP27 9LE. UK.

Tel: +44 (0)1844 273301

[sales@astles.co.uk](mailto:sales@astles.co.uk)

Fax: +44 (0)1844 343530

<http://www.astles.co.uk/>