

**Alpha CON 100 C/CX
Conductivity
Controller / Transmitter**

INSTRUCTION MANUAL

68X103704
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Preface

This manual serves to explain the use of the Alpha CON 100 Conductivity Controller/Transmitter. The units covered are Alpha C and CX Conductivity Controller/Transmitter.

The instruction manual functions in two ways: first, as a step by step guide to help you operate and understand the operation of the unit and second, as a handy reference guide.

The information presented in this manual is subject to change as improvements are made, and does not represent a commitment of Eutech Instruments Pte Ltd.

This instruction manual is written to cover as many anticipated applications of the Alpha CON 100 C/CX Conductivity Controller/Transmitter as possible. If there are doubts in the use, please do not hesitate to contact the nearest Eutech Instruments' Authorized Distributor.

Eutech Instruments cannot accept any responsibility for damage or malfunction of the unit due to improper use of instrument.

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1. INTRODUCTION

The alpha CON 100 series Conductivity Controller/Transmitter is an addition to the line of process controllers from Eutech Instruments. Incorporated with the ASIC (Application Specific Integrated Circuit) microprocessor technology, this panel-mounted on-line controller provides many user-friendly features desirable in conductivity Controllers.

This versatile conductivity controller can be used for measuring and controlling the Conductivity of a wide range of solutions in process streams.

Conductivity Ranges :

Range	Resolution	Cell Constant
0 - 99.9 μ S	0.1 μ S	0.1
0 - 999 μ S	1 μ S	0.1
0 - 999 μ S	1 μ S	1.0
0 - 9.99 mS	0.01 mS	1.0
0 - 99.9 mS	0.1 mS	1.0
0 - 200 mS	1 mS	1.0
0 - 200 mS	1 mS	10.0

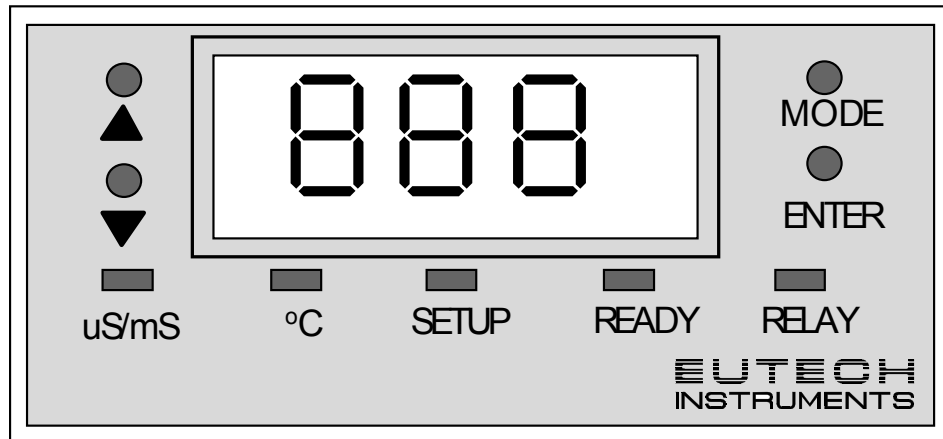
Some of the features of this Controller are :

- Automatic temperature compensation (with PT 100)
- Manual temperature compensation setting without the temperature probe
- Adjustable temperature coefficient from 0.0 to 10.0%
- Push button calibration with cell correction function
- High and Low alarm triggering relays
- User-defined Password feature to prevent unauthorized entry to change the calibration data, hysteresis function, high and low setpoints information
- Alarm and operational message annunciators
- Hysteresis function to prevent chattering of relays around the setpoint
- High-end transmitter model with 4-20 mA current output for datalogging purposes
- Built-in memory backup to ensure that calibration and other information will not be erased if power supply fails
- Switchable mains voltages of 110 VAC or 220 VAC via user selectable internal jumper

2. Getting Acquainted

2.1 Front Panel

The front panel consists of a 3 digit LED display together with 5 LED annunciators. There are also 4 keys as shown below.



The keys available are the ▲ (UP/INCREMENT), ▼ (DOWN/DECREMENT), **MODE** and **ENTER** keys.

The annunciators are $\mu\text{S}/\text{mS}$, $^{\circ}\text{C}$, SETUP, READY, and RELAY. The $\mu\text{S}/\text{mS}$ annunciator lights up in Conductivity measurement mode. The READY annunciator lights up when the Conductivity stabilizes. RELAY lights up when any of the HI SET or LO SET relays is activated.

The **MODE** key allows you to select between Conductivity display, the temperature display or the SETUP menu display. While in one of the SETUP menus, it also functions as an ESCAPE key. For example, while setting the Hi SET point, you can press **MODE** key to return to the measurement mode.

You can confirm changes or enter into further levels of the lower menu by pressing the **ENTER** key. The ▲ (UP/INCREMENT) and ▼ (DOWN/DECREMENT) keys allow you to change information or to select between different menus. Holding down the key increases the scrolling speed, i.e. changeover of 1st digit (ones) to 2nd (tens) and then 3rd digit (hundreds).

2.2 The Back Panel

The back panel consists of two connectors. The first one is a 4-way screw terminal and the second is a 12-way screw terminal. Refer to the label on top of the unit for diagram.

The connection for the 4-way screw terminals are (from the left to right):

1. PT 100 connection
2. PT 100 connection
3. Conductivity input (Inner core)
4. Conductivity input (Outer shield)

The connections for the 12-way screw terminals are (from left to right),

5. High Set Relay deactivated position
6. High Set Relay center pole
7. High Set Relay activated position
8. Low Set Relay deactivated position
9. Low Set Relay center pole
10. Low Set Relay activated position
11. 4-20 mA - ve connection (for transmitter models only)
12. 4-20 mA + ve connection (for transmitter models only)
13. Protective earth
14. Protective earth
15. Neutral
16. Live

2.3 Selecting Conductivity Measurement Range

You can set the appropriate conductivity measurement range from the front panel. See Section 4.2 for details on Setting the Controller Range (Software). Note that for “mA” the LED display shows “mA”.

2.4 Wiring

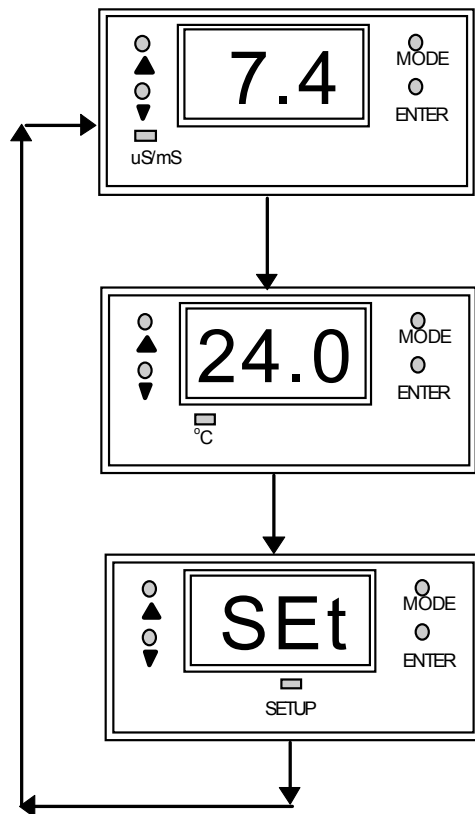
Connect the power supply to the GND (EARTH) - **13** or **14**, NEUTRAL - **15** and LIVE - **16** screw terminals. Make sure that the power supply jumper setting matches the mains voltage (110 VAC or 220 VAC). See Appendix 2 for the jumper setting for the voltage selection.

Connect the Conductivity electrode to the 4-way screw terminal at the back panel and the PT 100 temperature probe to the PT 100 connections.

Power on the controller and the display automatically shows the Conductivity reading. The uS/mS annunciator lights up. Once the reading is stable, the READY annunciator lights up. However, if the PT 100 temperature probe is not connected, automatic temperature compensation does not function. You can set the temperature at a selected value. The temperature is set to factory default at 25.0 °C.

NOTE : Eutech Instruments will not be responsible for incorrect application of the controller using improper voltage sources or wrong jumper settings.

3. Operating the Controller



The Main Display

Press **MODE** key to switch to three main displays - the Conductivity display, the temperature display and “**SEt**” display.

Press **MODE** key once to get into the temperature measurement. The °C annunciator lights up when you are measuring temperature. The display shows current measured temperature (with ATC) or the temperature that was set in MTC mode. Press **MODE** key again and the display toggles to the “**SEt**” for SETUP menu.

Press **ENTER** key to go into the lower-level setup menus while the display shows “**SEt**”. These lower-level menus allow calibration of Conductivity, Temperature and other parameters including set password, Hi or Lo Setpoints, Hi and Lo Hysteresis values and temperature coefficient.

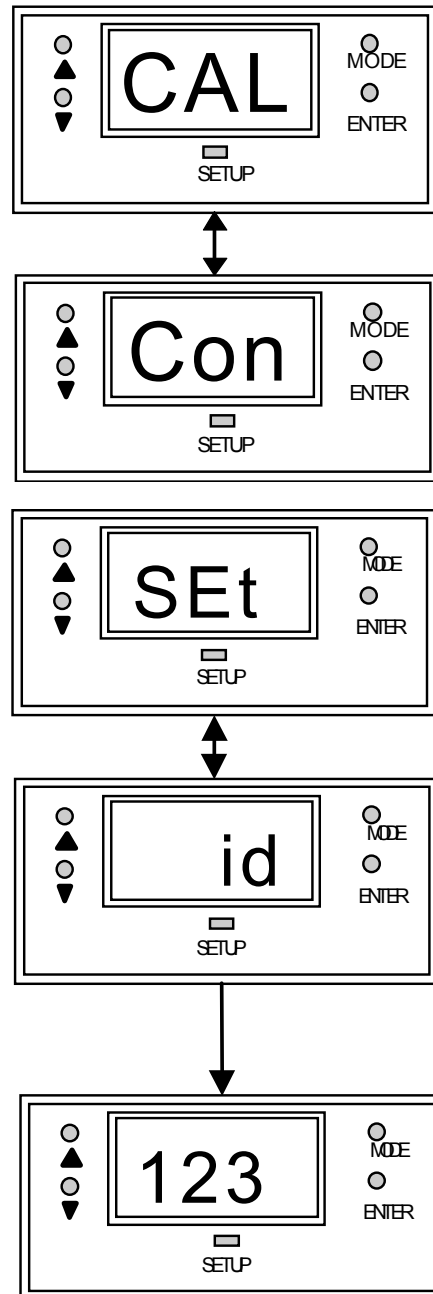
4. Setting Up the Controller

4.1 Setting and Changing the Password

4.1.1 Setting New Password

To set a password, press **MODE** key until the “**Set**” is displayed.

1. Press **ENTER** key and the display shows “**CAL**” and “**Con**” alternately. Press **▲** key once and the display shows “**Set**” “**id**”.
2. Press **ENTER** to enter your desired password. Follow the steps below (e.g. using a password “**123**”).
3. Initially, the display shows “**000**” with the first digit blinking.
4. Use **▲** (UP/INCREMENT) key to enter “**1**” on the 1st digit of the password. Press **ENTER** once and the second digit will blink. Similarly, enter the second digit of the password “**2**” and press **ENTER** key again. Repeat with the third digit accordingly.
5. Press **ENTER** key and the display shows “**CAL**” and “**CON**” alternately. Use **▲** or **▼** key to get into the “**Set**” and “**id**” menu, press **ENTER** and set your desired password by following the above steps.
6. Once completed, press **ENTER** to confirm and then press **MODE** key to return to the Conductivity display.



To calibrate the controller at any time, you may have to enter the password that you set, in order to access the calibration mode. Once you have entered the password correctly, the display shows "**CAL COn**" indicating that you are in one of the lower-level SETUP menus.

If you enter the wrong password, the display reverts back to the Conductivity display. Alternatively, if you prefer no password protection, set the password to "000", "**CAL COn**" immediately displays after you press **ENTER** key while you are in the "**SEt**" menu.

NOTE : The user set password is a protection code. Thus, it is very important to keep this password strictly confidential to authorized personnel. You are advised to remember the password that you have set, in order to protect the controller settings and prevent any unauthorized tampering to the system!

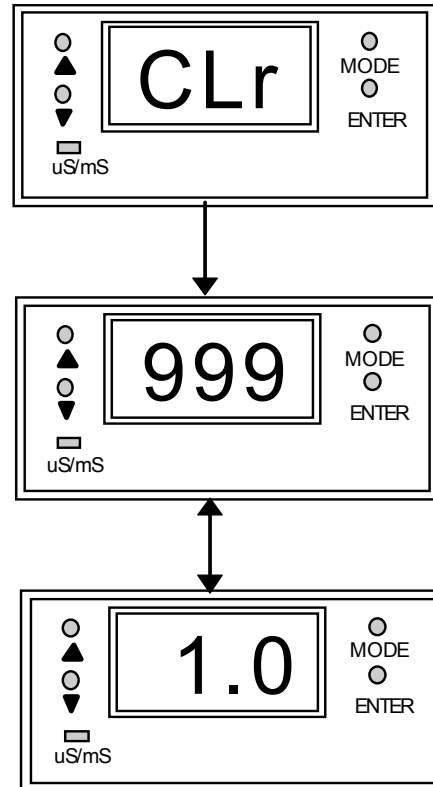
IMPORTANT : In case the password set is forgotten, use the master password "**555**".

4.1.2 Changing the Password

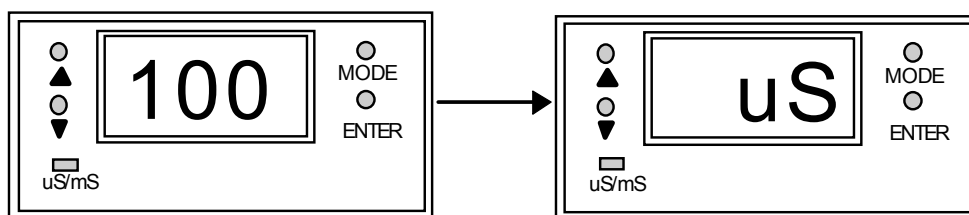
Enter the Set id menu with already set password or "555". Change a new password as per steps mentioned for setting the password.

4.2 Setting the Controller Range (Software)

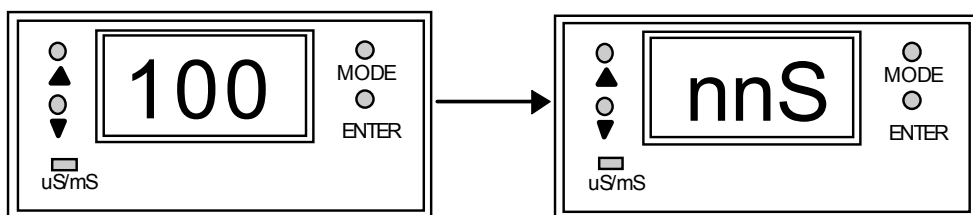
At the measurement mode, press both ▲ and ▼ keys simultaneously until the “CLr” display shows. Press ▲ or ▼ key to select the appropriate Conductivity measurement range. Press **ENTER** key to confirm.



Cell Constant either 0.1 or 1.0 blinks when the 999 uS range is selected



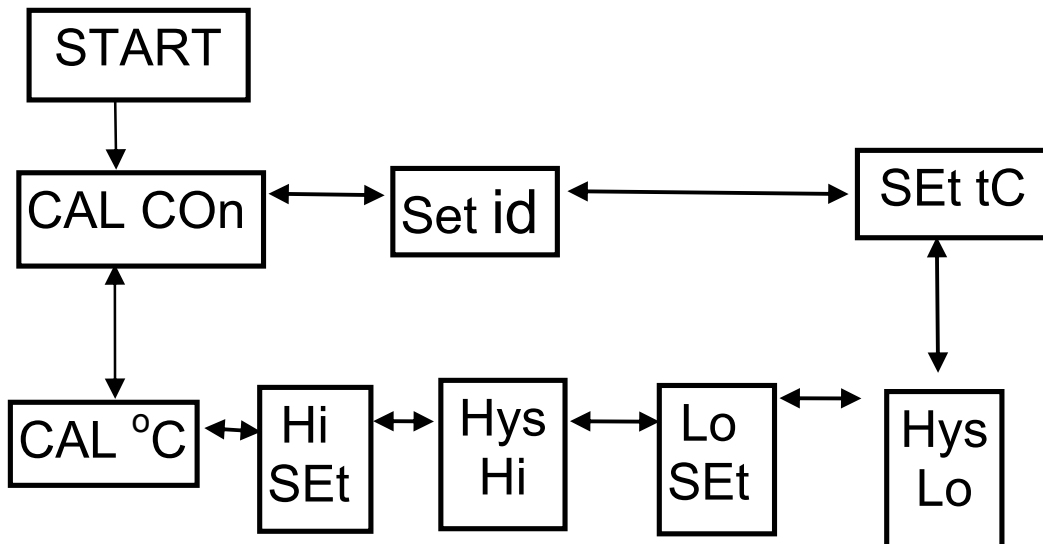
Value scrolls from uS to mS, indicating the measurement range or



5. Calibrating the Controller

5.1 The Lower Level Menus

The "CAL CO_n" display is the first menu seen upon entering the lower-level menus. Press ▲ or ▼ key to display the various menus as shown in the figure below. Press **ENTER** key to go to the lower level menus.



5.2 Calibrating for Conductivity Measurement

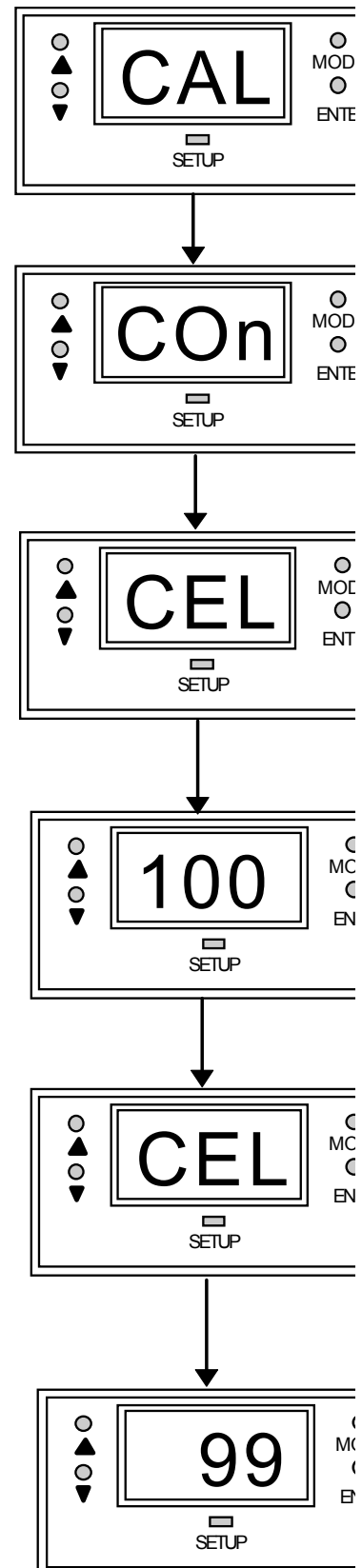
5.2.1 The CAL CO_n menu

1. Enter this menu by pressing the MODE key twice to the "SEt" display from the measurement mode.
2. Press ENTER key. If the password has been set earlier, key in the password using the method described in section 4.1. Press **ENTER** once to confirm. After you set the correct password, you can see the "CAL" and "CO_n" display blink alternately.
3. Press **ENTER** key to enter the Conductivity calibration mode. Dip both the Conductivity electrode and temperature probe in the standard solution
4. **NOTE: The Conductivity standard solution should have a conductivity value between 40% to 100% of its full scale range selected**

5. When “**CAL CON**” displays, press **ENTER** key to view the default cell constant at 100%. Press **ENTER** key again to show the measured conductivity value. Use ▲ and ▼ keys to scroll to the standard’s Conductivity value at 25 °C.
6. Press **ENTER** key to calibrate the Conductivity value shown. Display will show the new cell constant being displayed. This value will be between 70% to 130%. Otherwise an error message “**CAL**” and “**Err**” alternatively blinks to indicate out of calibration range.
7. Press **ENTER** key to complete the calibration, and you will return to “**CAL**” and “**CON**” menu.
8. Press **MODE** key and it brings you to the Measure mode.

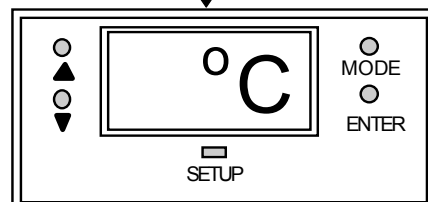
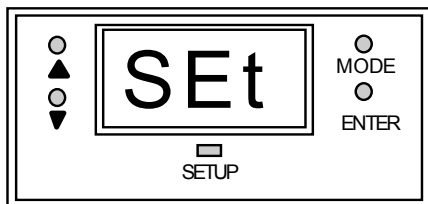
NOTE : Gently stir the electrode in a container filled with calibrating standard, and ENSURE that no bubble is trapped during the calibration process to avoid erroneous reading.

IMPORTANT : The correct Temperature Coefficient should be selected prior to Conductivity calibration. (Refer to Section 5.5 for Setting Temperature Coefficient).

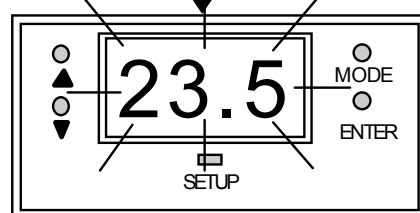
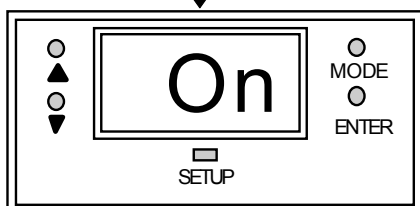
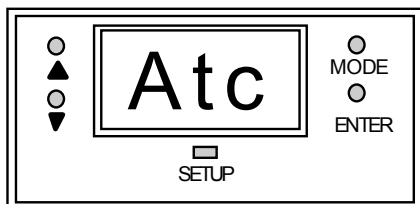


5.3 Calibrating the Controller for Temperature Measurement

5.3.1 The CAL °C menu



alternatively shows "Atc" and "On" or "Atc" and "OFF". Use ▲ and ▼ keys to choose between both ATC ON and



1. Enter this menu by pressing **MODE** key twice to the "SEt" display if you are in measurement mode.

2. Press **ENTER** key. If the password has been set earlier, key in the password using the method described in section 4.1. Press **ENTER** once to confirm. After you set the correct password, you see the "CAL" and "COn" display blinks alternatively. Press ▼ key once, the display shows "CAL" "°C" blinking.

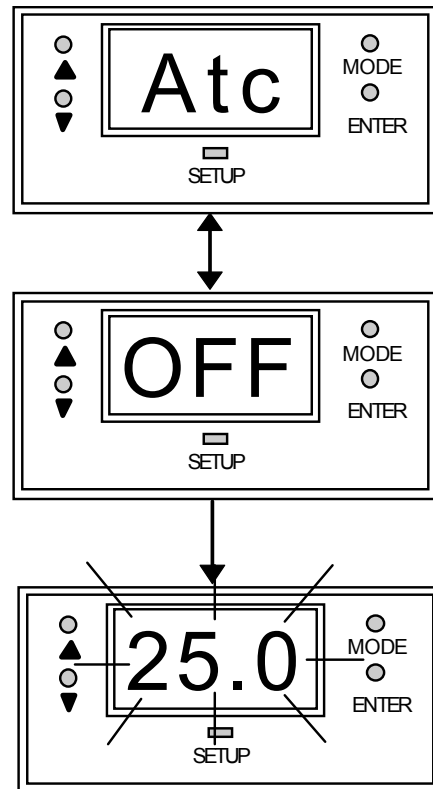
1. Press **ENTER** and the display alternatively shows "Atc" and "On" or "Atc" and "OFF". Use ▲ and ▼ keys to choose between both ATC ON and ATC OFF.

ATC ON : If a PT 100 is connected, use ▲ and ▼ keys to adjust the temperature offset of the PT 100 by ± 5 °C. Dip the probe into the sample liquid. Make sure that the display is set to ATC ON, press **ENTER** and the display now shows the actual temperature reading (blinking).

Use ▲ and ▼ keys to adjust the reading to its actual temperature - as measured by an external thermometer. Once done, press **ENTER** key and the display will flash "CAL" "COn" alternatively.

ATC OFF : If a PT 100 is not used, then the ATC should be set to OFF. In step 3 above, choose by pressing ▲ and ▼ keys to select ATC OFF. Then press **ENTER**. The display will now show the default of 25 °C or the last set value (blinking). Use ▲ and ▼ keys to set your desired value. Press **ENTER** to confirm and the display shows “**CAL**” “**Con**”.

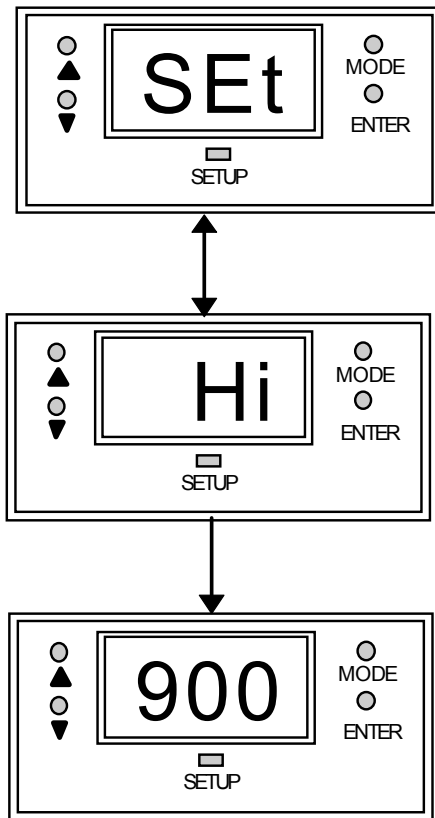
Note : For ATC OFF, you can adjust the set temperature values from 0.0 to 99.9 °C. This value will be used for its temperature compensation e.g. Conductivity in the MTC mode.



5.4 Setting the Alarm Feature

This menu allows you to change the Hi and Lo Setpoint and Hysteresis values. See Section 8 for hysteresis applications.

IMPORTANT : When SETUP mode is entered, the 4-20 mA output (only for transmitter model) freezes and the relay deactivates (if it was in an alarm condition).

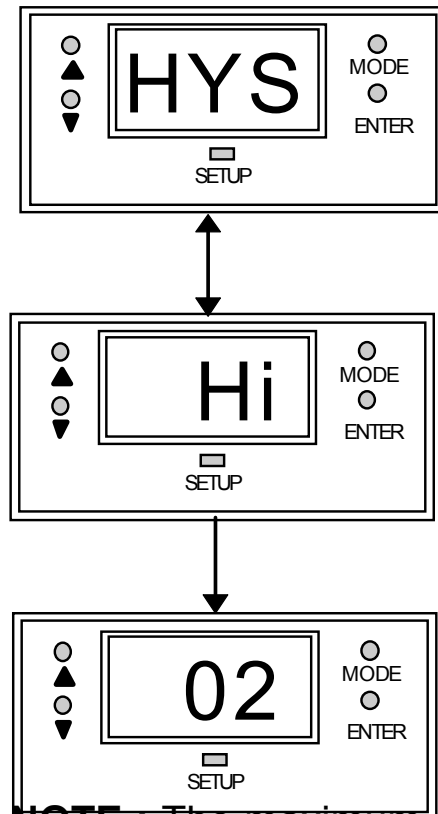


5.4.1 The Hi SET Menu

1. Enter this menu by pressing **MODE** key twice to the “**SEt**” display if you are in measurement mode.
2. Press **ENTER** key. If the password has been set earlier, key in the password using the method described in section 4.1. Press **ENTER** once to confirm.
3. After you set the correct password, you see the “**CAL**” and “**CO**n” display blinks alternately. Press ▼ key twice, the display shows “**Hi**” “**SEt**” blinking alternately.
4. Press **ENTER** key to access the Hi SET menu and the display shows the last Hi SET value or default (90% of Full Scale). Use ▲ and ▼ keys to change the value of the Hi SET point.
5. Press **ENTER** to confirm the value of the Hi SET point.
6. Press **MODE** key to exit to the measurement mode. You can press **MODE** key (as an ESCAPE key) to revert to the measurement value if **ENTER** is not pressed; the set value is not stored into memory.

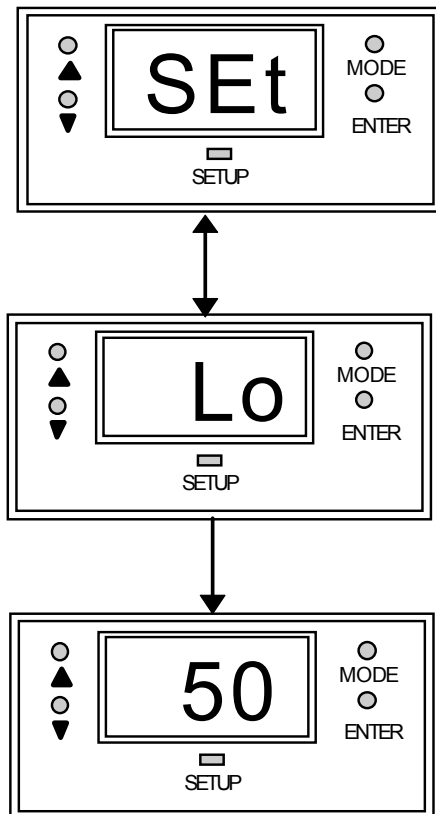
5.4.2 The Hi HYS Menu

1. Enter this menu by pressing the **MODE** key to the “**SEt**” display if you are in the measurement mode.
2. Press **ENTER** key. If the password has been set earlier, key in the password using the method described in section 4.1. Press **ENTER** once to confirm. After you set the correct password, you see the “**CAL**” and “**COOn**” display blinks alternatively. Press ▼ key thrice, the display shows “**Hi**” “**HYS**” blinking.
3. Press **ENTER** key to access the Hi HYS menu and the display shows the last Hi HYS value or default (2% of Full Scale). Use ▲ and ▼ keys to change the value of the Hi HYS point.
4. Press **ENTER** to confirm the value of the Hi HYS.
5. Press **MODE** key to exit to measurement mode. You can press **MODE** key (as an ESCAPE key) to revert to the measurement value if **ENTER** is not pressed; the set value is not stored into memory.



NOTE : The maximum value of Hysteresis is 4% of its Full Scale (FS) selected. The HI HYS hysteresis is spread equally on either side of the Hi SET point.

5.4.3 The Lo SET Menu



1. Enter this menu by pressing **MODE** key twice to the "**SEt**" display if you are in measurement mode.
2. Press **ENTER** key. If the password has been set earlier, key in the password using the method described in section 4.1. Press **ENTER** once to confirm.
3. After you set the correct password, you see the "**CAL**" and "**CO**n" display blinks alternately. Press **▼** key four times, the display shows "**Lo**" "**SEt**" blinking alternately.

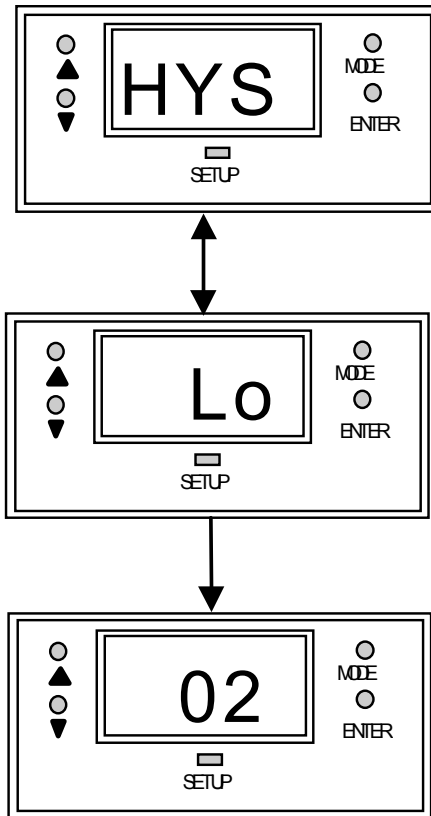
4. Press **ENTER** key to access the Lo SET menu and the display shows the last Lo SET value or default (5% of Full Scale). Use **▲** and **▼** keys to change the value of the Lo SET point.

NOTE : The Lo SET relay activates if the current Conductivity reading exceeds Lo SET point - $\frac{1}{2}$ Lo HYS value. The Lo SET value cannot be higher than the Hi SET value.

5. Press **ENTER** to confirm the value of the Lo SET point.
6. Press **MODE** key to exit to measurement mode. You can press **MODE** key (as an ESCAPE key) to revert to the measurement value if **ENTER** is not pressed; the set value is not stored into memory.

5.4.4 The Lo HYS Menu

1. Enter this menu by pressing the **MODE** key to the “**SET**” display if you are in the measurement mode.
2. Press **ENTER** key. If the password has been set earlier, key in the password using the method described in section 4.1.
3. Press **ENTER** once to confirm. After you set the correct password, you see the “**CAL**” and “**CO**n” display blinks alternatively. Press **▼** key five times, the display shows “**Lo**” “**HYS**” blinking alternately.
4. Press **ENTER** key to access the Lo HYS menu and the display shows the last Lo HYS value or default (2% of Full Scale). Use **▲** and **▼** keys to change the value of the Lo HYS point.
5. Press **ENTER** to confirm the value of the Lo HYS. Press **MODE** key to exit to the measurement mode. You can press **MODE** key (as an ESCAPE key) to revert to the measurement value if **ENTER** is not pressed; the set value is not stored into memory.



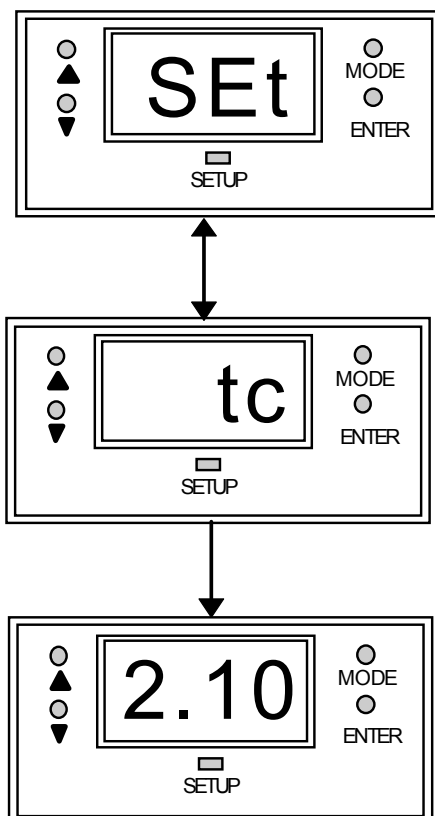
NOTE : The maximum value of Hysteresis is 4% of its Full Scale (FS) selected. The Lo HYS hysteresis is spread equally on either side of the Lo SET point.

IMPORTANT : The Lo SET + $\frac{1}{2}$ Lo HYS should be less than Hi SET - $\frac{1}{2}$ Hi HYS i.e. Hi SET and Lo SET value (in consideration of the hysteresis band) can never overlap. Lo HYS and Hi HYS can be set independent of each other; this allows non-symmetrical hysteresis option.

5.5 Setting Temperature Coefficient

5.5.1 Temperature Coefficient

This menu allows you to set the Temperature Coefficient corresponding to the solution whose Conductivity is being measured. In most controllers, this is fixed at 2.10% per °C. However, for alpha CON 100 C/CX models, it is adjustable from 0.0 to 10.0% per °C (please refer to Appendix 3 for Temperature Coefficient determination and limits).



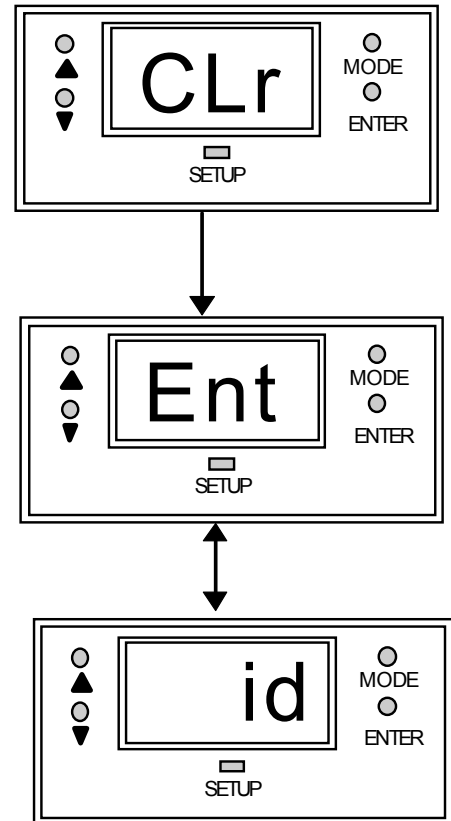
1. Enter this menu by pressing the **MODE** key to the “SEt” display if you are in the measurement mode.
2. Press **ENTER** key to access the SETUP menu. Press **▲** key twice to enter the “SEt tc” menu. If you do not wish to effect any change and keep the Temperature Compensation as the previous value, press **MODE** key. This will take you out of this mode and back to its measurement mode.
3. Press **ENTER** and the display shows the current value of Temperature Coefficient (blinking).
4. Use **▲** or **▼** key to change the value of the Temperature Coefficient. Press **ENTER** to confirm the value to be used. Press **MODE** key to exit to measurement mode.

6. Setting to Factory Default

All the controller settings and user-defined password, except calibration data will be cleared when you enter into the “Usr” “Clr” menu.

Press both the ▲ and ▼ keys simultaneously while you are in any mode menu. The unit requests for the password if it was set previously. Enter the password and press **ENTER**. The display will show “CLr”. Press **ENTER** to confirm. The display will blink briefly - the password is reset to its factory default and toggles to its measurement mode.

The Master Password is “555” and default user set password is “000”. The Master Password can be used even if any other password was set previously.



Key the master password “555” after entering into the “Ent” “id” display, you will see “Usr” and “Clr” display alternately. Press **ENTER** to confirm and the display returns to its measurement mode.

7. Using the Controller Current Loop for Datalogging (for Transmitter Model Only)

The 4-20 mA Current Loop

A 4-20 mA current loop can be connected if a remote data logging is required. The current will be proportional to the Conductivity displayed on the panel display. The 4-20 mA current loop can drive a load resistance of no more than 200 Ω .

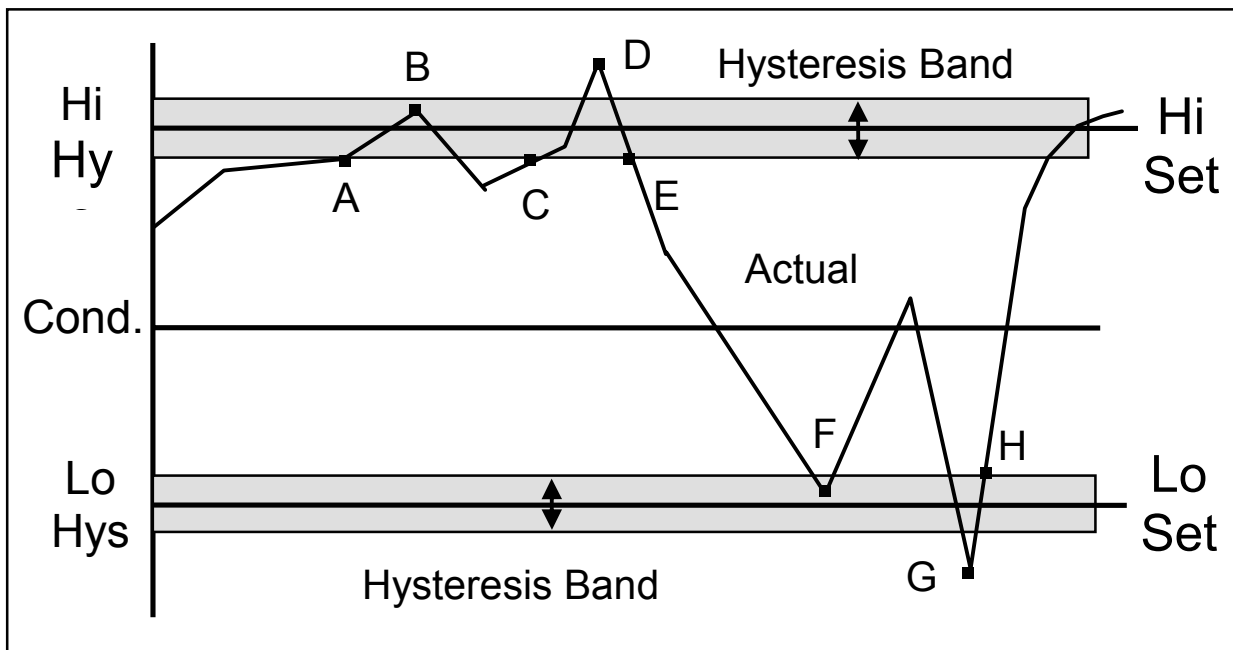
If the calculated Conductivity is less than 0 uS (due to incorrect TC and temperature setting), the current will be set to approximately 0 mA. If Conductivity exceeds the value that can be measured in the range, current will be set to approximately 21 mA. In this way, the remote data logger can detect when out of range conditions arise. Please note that the 4-20 mA loop is not galvanically isolated from the source.

8. Additional Information

The controller allows you to set High and Low alarms that switch on or off relays, and activating or deactivating devices linked to the controller. In cases where the Conductivity values fluctuate close to the high or low setpoints, the relays will continuously switch on/off very quickly and may cause problems to the linked devices. The hysteresis band allows you to set an allowable range of fluctuations to prevent the relays from activating and deactivating too quickly. See below.

It is not possible to set the high set point lower than the low set point and vice versa (taking the hysteresis band into consideration). For example, when the high set point is 8.50 mS and the high hysteresis band is set at 0.40 mS, then the low setpoint cannot be set at higher than $8.50 - \frac{1}{2} \text{ Hi HYS}$.

NOTE : The shaded area indicates the hysteresis band.



Explanation of the diagram in the previous page

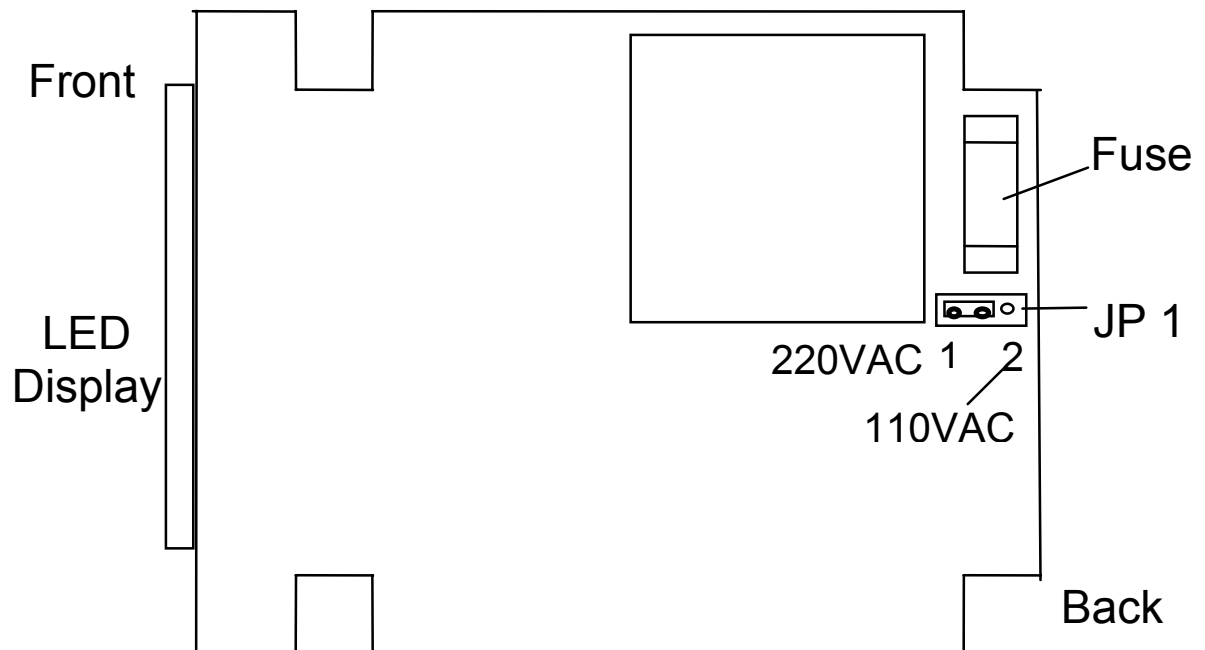
- A - Reading reaches $(\text{Hi SET} - \frac{1}{2} \text{Hi HYS})$, the Hi-Set relay remains inactivated.
- B - Reading reaches above High Setpoint but below $(\text{Hi SET} + \frac{1}{2} \text{Hi HYS})$, Hi-Set relay remains inactivated.
- C - Reading reaches between $(\text{Hi SET} - \frac{1}{2} \text{Hi HYS})$, the Hi-Set relay remains inactivated.
- D - Reading reaches above $(\text{Hi SET} + \frac{1}{2} \text{Hi HYS})$, and the Hi-Set relay is activated.
- E - The Hi-Set relay is inactivated only when the reading falls below $(\text{Hi SET} - \frac{1}{2} \text{Hi HYS})$.
- F - Reading reaches between $(\text{Lo SET} - \frac{1}{2} \text{Lo HYS})$, the Lo-Set relay remains inactivated.
- G - Reading reaches below $(\text{Lo SET} - \frac{1}{2} \text{Lo HYS})$, the Lo-Set relay is activated.
- H - The Lo-Set relay remains activated until the reading goes above the $(\text{Lo SET} + \frac{1}{2} \text{Lo HYS})$

F

Appendix 1

Jumper Positions - Internal to the Controller

JP1	Selects the input voltage between 110 VAC or 220 VAC.
Fuse	Note that there is a fuse internal to the Controller. Before opening the unit, ENSURE that the power cable is physically separated from the mains supply. Replace the fuse with the one recommended by the manufacturer.



Appendix 2

Temperature Coefficient

The Temperature Coefficients (TC) of most solutions vary between 1.8 to 2.4 % per °C. This is true of most salt solutions when the Conductivity exceeds about 100 uS. Thus, the default value of TC will be set to 2.10 % per °C when the Controller is shipped from the factory. However, if the Temperature Coefficient is known to be different from the default, the user can set this value.

Temperature Coefficient can also be determined by taking 2 uncompensated readings at known temperatures. Uncompensated readings can be taken by setting TC to 0.0 % or setting the temperature to 25 °C by changing ATC ON to ATC OFF.

If G1 and G2 are the conductivity measured at two temperatures T1 and T2, then TC is given by the relation:

$$\% \text{ TC} = \frac{G2 - G1}{G1(T2 - 25) - G2(T1 - 25)} * 100$$

Technical Specifications

Specifications	Range	Resolution	Cell Constant
Conductivity Range	0 - 99.9 uS	0.1 uS	0.1
	0 - 999 uS	1 uS	0.1
	0 - 999 uS	1 uS	1.0
	0 - 9.99 mS	0.01 mS	1.0
	0 - 99.9 mS	0.1 mS	1.0
	0 - 200 mS	1 mS	1.0
	0 - 200 mS	1 mS	10.0
Relative Accuracy	+/- 1% full scale		
Cell Constant	0.1, 1.0 or 10.0		
Measurement Range	7 separate ranges (software selectable, non auto-ranging)		
Calibration	Push-button (cell constant correction function)		
Temperature Coefficient	0.0 to 10.0 % from 5 to 50 °C		
Temperature Compensation	Automatic / Manual (0 to 100.0 °C)		
Temperature	0 to 100 °C		
<i>Resolution</i>	0.1 °C		
<i>Relative Accuracy</i>	+/- 0.5 °C		
<i>Sensor</i>	PT 100		
Output	4-20 mA, screw terminals (non-isolated); Max. load 200 Ω		
Display	LED, 3 digits		
Inputs	screw terminals		
Recommended Input Cable Length	Less than 5 meters		
Relays <i>No. Of Relays</i> <i>Maximum Voltage</i> <i>Maximum Current</i> <i>High Hys. Band</i> <i>Low Hys. Band</i>	2 - High set & Low set SPDT 240 VAC 3A 4% of Full Scale Reading 4% of Full Scale Reading		
Power Requirements	110 VAC or 220 VAC (Jumper selectable)		
Environmental Requirements <i>Operating</i> <i>Storage</i> <i>Humidity Limits</i>	0 to 50 °C -10 to 60 °C 10 to 95% RH (non condensing)		
Storage Temp. Range	0 to 50 °C		
Dimensions	1/8 DIN size; 96 (L) x 48 (H) mm (Front panel)		

NOTES

For more information on Eutech Instruments products, contact your nearest Eutech Instruments distributor or visit our website listed below:

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