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BI-650 Online Conductivity Controller

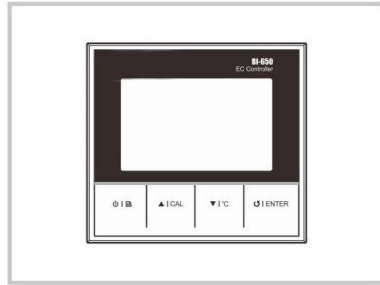
Instruction Manual

Introduction

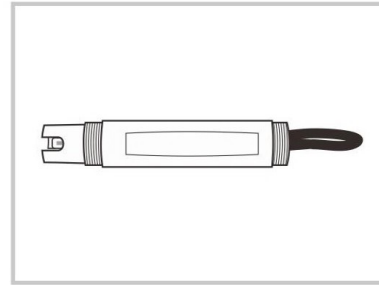
Thank you for selecting the BI-650 online conductivity controller. This manual provides a step-by-step guide to help you operate the meter, please carefully read the following instructions before use.

Unpacking

The following list describes the standard components of the controller. After the unpacking, please check all components are complete. If any are damaged or missing, please contact nearest distributor.



BI-650 Online Conductivity Controller



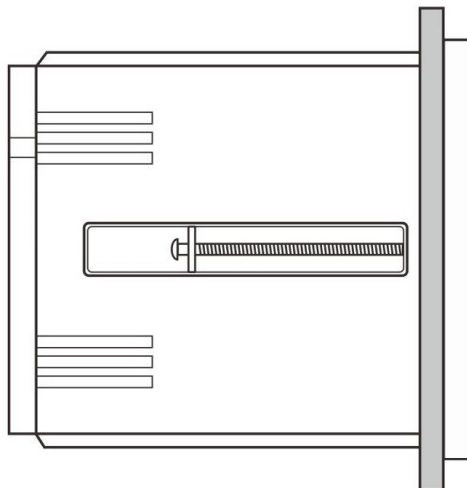
IE-50MT Industrial Conductivity Electrode

Safety Warning

- The controller shall be installed and operated only in the manner specified in this instruction manual.
- Only skilled, trained or authorized person should carry out installation, setup and operation of the controller.
- Do not install the controller in the following environmental conditions: relative humidity is greater than 80%, ambient temperature is higher than 60°C or strong magnetic fields around controller.
- The rear panel of the controller has two screw terminals that used for connecting the DC24V power supply. Make sure to cut off the main power before installation or maintenance.
- Once the power supply cables are connected to controller, do not touch any screw terminals on the rear panel of the controller.

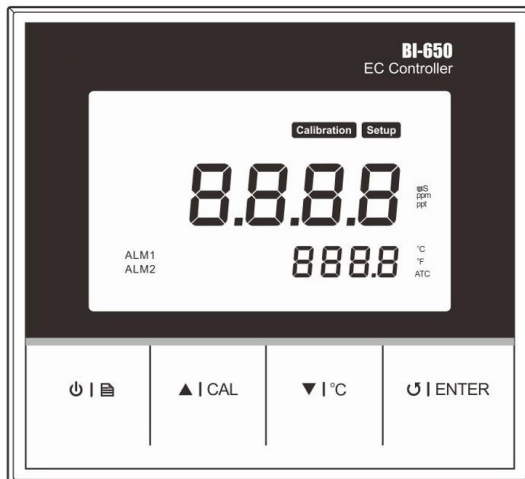
Installation

- Cut out a square hole approximately 91(W) × 91(H)mm in the mounting panel.
- Remove the mounting bracket from controller, place the controller into the square hole.
- Replace the mounting bracket and push the controller forward until it is fully seated on the mounting plate.



Display

The BI-650 online conductivity controller is equipped with an easy-read LCD display that used to show measured values and mode icons. The following table describes the function of each icon.



ICON	DESCRIPTION
Calibration	Indicates the meter is in the calibration mode.
Setup	Indicates the meter is in the setting mode.
ATC	Indicates the temperature compensation is enabled.
ALM1	Indicates the measurement exceeded the specified high limit.
ALM2	Indicates the measurement exceeded the specified low limit.

Keypad Information

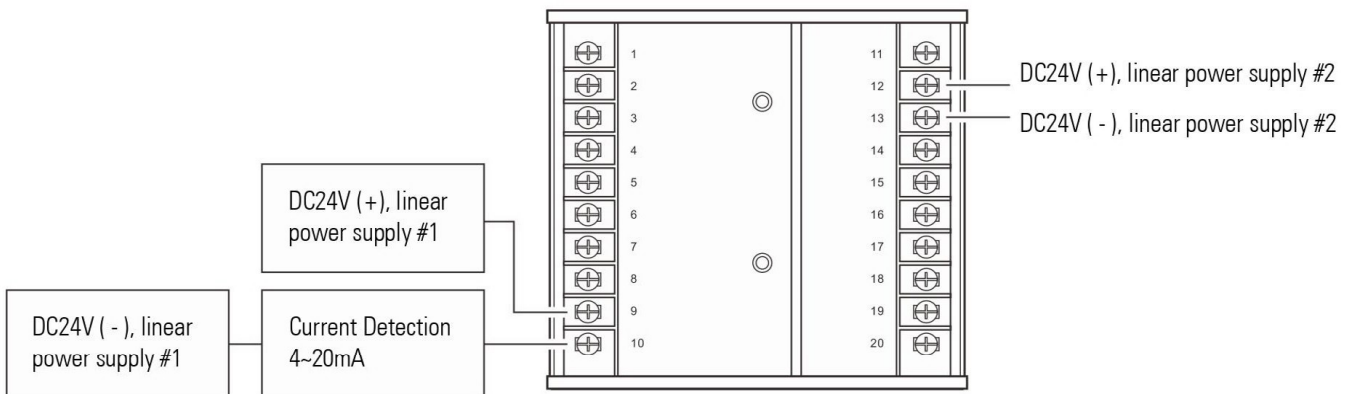
KEY	FUNCTION
	<ul style="list-style-type: none"> Power the meter ON/OFF. Enters the setup menu (Press and hold the key for 3 seconds). Exits the calibration or setting and returns to measurement.
CAL	<ul style="list-style-type: none"> Starts calibration. Increase the setting value.
°C	<ul style="list-style-type: none"> Sets the temperature. Decrease the setting value.
ENTER	<ul style="list-style-type: none"> Toggles between conductivity and TDS measurement modes. Confirms the calibration, settings or displayed options.

Connecting the Cables

- Before proceeding, ensure the power supply cables are disconnected from the power source.
- The following list describes the definition of the each screw terminal on rear of the controller.

INDEX:

NO.	TERMINAL	DESCRIPTION
1	---	No connection
2	EC (+)	Conductivity/TDS input
3	EC (-)	Conductivity/TDS input
4	---	No connection
5	TC (-)	Temperature input (-)
6	TC (+)	Temperature input (+)
7	485 (B)	RS485 signal output (B)
8	485 (A)	RS485 signal output (A)
9	DC24 (+)	DC24V (+), linear power supply #1
10	DC24 (-), 4~20mA	DC24V (-), linear power supply #1, 4~20mA analog output
11	GND	Earth ground
12	DC24 (+)	DC24V (+), linear power supply #2
13	DC24 (-)	DC24V (-), linear power supply #2
14	NC2	Relay resting position (NC2)
15	NO2	Relay working position (NO2)
16	COM2	Relay Common (COM2)
17	NC1	Relay resting position (NC1)
18	NO1	Relay working position (NO1)
19	COM1	Relay Common (COM1)
20	---	No connection



Setup Menu


The BI-650 online conductivity controller contains an integrated setup menu that is used to customize the displayed option to meet measurement requirements.

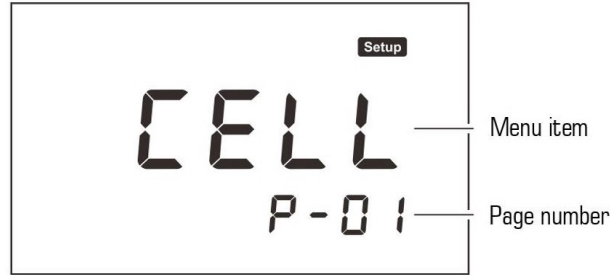
MENU	DESCRIPTION	OPTIONS	DESCRIPTION	DEFAULT
CELL	Set the cell constant to match connected electrode	0.1	K=0.1	K=1
		1	K=1	
		10	K=10	
CAL	Set the number of calibration points	1	1 point	1 point
		2	2 points	
		3	3 points	
COE	Set the linear temperature compensation coefficient	2.10	Range: 0.0~10.0%/°C	2.1%/°C
TDS	Set the TDS conversion factor	0.5	Range: 0.1~1.0	0.5
UNIT	Set the default temperature unit	°C	Degrees Celsius	°C
		°F	Degrees Fahrenheit	
AL-L	Set the Low Alarm Limit	0.02	Range: 0.02µS/cm ~20.00mS/cm	0.02µS/cm
ALH1	Set the hysteresis value (Low)	10	Range: 1%~99%	10%
AL-H	Set the High Alarm Limit	1000	Range: 0.02µS/cm ~20.00mS/cm	1000µS/cm
ALH2	Set the hysteresis value (High)	1	Range: 1%~99%	1%
AO-L	Set the analog output (Low)	0.02	Range: 0.02µS/cm ~20.00mS/cm	0.02µS/cm
AO-H	Set the analog output (High)	20.00	Range: 0.02µS/cm ~20.00mS/cm	20.00mS/cm
RST	Reset	YES	Restores the controller back to factory default settings	Disable
		NO	Disable	

Additional information




- Select a High/Low limit setting value will activate the controller when the conductivity or TDS value goes above or below the setting value. Note, both setting values cannot input the same value.
- Hysteresis prevents rapid contact switching if the measuring value is fluctuating near the set point. Example: You have set the high alarm point at 20mS/cm and hysteresis value at 1%. If the measuring value overshoots the 20.2mS/cm, the controller will activate an external device. When the measuring value drops to 19.8mS/cm, the external device will switch off.
- The controller has RS485 communication function, the default is 0.02µS/cm~20.00mS/cm corresponds to 4.00~20.00mA.
- Reset function will restore the controller back to factory default settings, all calibration values and selected parameters will be reset.

Setting the default option

1. Press and hold the  key for 3 seconds to enter the setup menu, the display shows the menu item and page number.



2. Press the ▲ or ▼ key to scroll through menu, select the parameter you want to set (Refer to Setup Menu).
3. Press the **Enter** key, the display shows an option in the submenu.
4. Press the ▲ or ▼ key to set the value or select an option.
5. Press the **Enter** key to confirm, the controller returns to the measurement mode. Setting is completed.

 If you want to exit the setting, press the  |  key.

Temperature Compensation and Calibration

The BI-650 online conductivity controller supplied with an industrial conductivity electrode with a built-in temperature sensor. When the wires of the sensor are connected to controller, the display will immediately show “ATC” icon. The controller is now switched to the automatic temperature compensation mode.



Temperature calibration

During the measurement process, if the temperature reading displayed differs from that of an accurate thermometer, the controller needs to be calibrated.

1. Press the °C key to enter the temperature setting mode, the display shows current temperature reading.
2. Press the ▲ or ▼ key to set the value.
3. Press the **Enter** key confirm. Calibration is completed.

Selecting the Conductivity Electrode

The BI-650 online conductivity controller is capable of using the 3 types of conductivity electrodes. Prior to the calibration and measurement, you need to select the different sensors as per your sample concentration. The table below shows available electrode and its effective measuring ranges.

SENSOR	MEASURING RANGES	CELL CONSTANT
IE-50LT	0.1~100μS/cm	K=0.1
IE-50MT	0.01~10mS/cm	K=1
IE-50HT	0.1~200mS/cm	K=10

Conductivity Calibration

Make sure that you selected the cell constant between 0.1, 1 or 10 in the setup menu (Refer to Setup Menu).

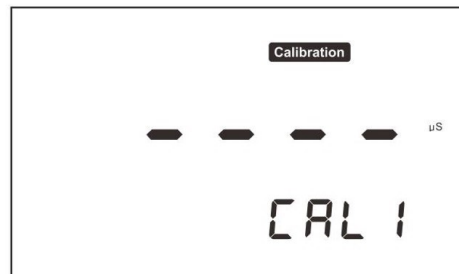
The controller allows up to 3 points calibration. To ensure higher accuracy, we recommend that you perform 3 points calibration or select a standard value close to the sample value you are measuring. The controller will automatically detect these conductivity standard solutions and prompt the user to calibrate the meter. When the calibration is completed, all new calibration values will automatically override existing data.

The following table shows acceptable conductivity range of calibration solution for each measuring range.

MEASURING RANGE	CALIBRATION SOLUTION RANGE	DEFAULT
0~20 μ S/cm	7~17 μ S/cm	10 μ S/cm
20~200 μ S/cm	70~170 μ S/cm	84 μ S/cm
200~2000 μ S/cm	700~1700 μ S/cm	1413 μ S/cm
2~20mS/cm	7~17mS/cm	12.88mS/cm
20~200mS/cm	70~170mS/cm	111.8mS/cm

Single point calibration

- 1.1 Rinse the conductivity electrode with distilled water, then rinse with a small amount of calibration solution.
- 1.2 Press the **Cal** key, the controller shows "----" and waits for recognizing the standard solution.

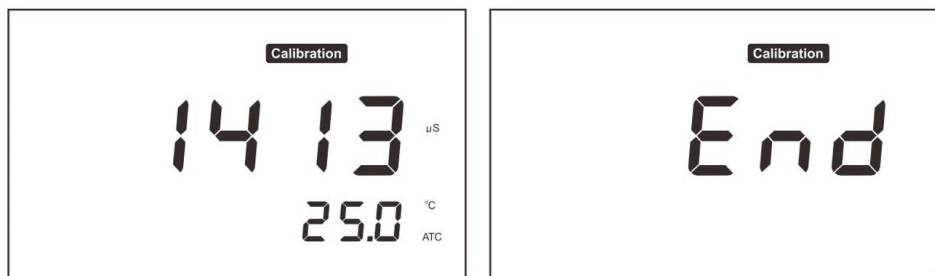


- 1.3 Place the electrode into the calibration solution, the controller automatically shows current calibration standard (e.g., 1413 μ S/cm).
- 1.4 Press the **Enter** key, the default calibration value begins flashing.



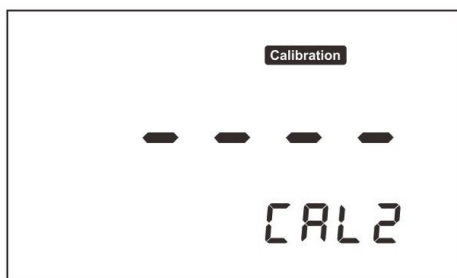
- 1.5 Press the **▲** or **▼** key to set the calibration value, press the **Enter** key to confirm and move to next digit. When the setting is completed, ensure that displayed value matches your calibration standard.

- 1.6 Press the **Enter** key, the controller begins the calibration. Wait for the reading to stabilize, the display automatically shows "END". Single point calibration is completed.



2 points calibration

- 2.1 Make sure that you have selected 2 points calibration in the setup menu.
 2.2 Repeat steps 1.1 to 1.6 above, when the first calibration point is completed, the display will show "CAL2". The controller prompts you to continue with second point calibration.



- 2.3 Place the electrode into the calibration solution, the display automatically shows current calibration standard (e.g., 12.88mS/cm).



- 2.4 Press the **Enter** key, the default calibration value begins flashing.
 2.5 Press the **▲** or **▼** key to set the calibration value, press the **Enter** key to confirm and move to next digit. When the setting is completed, press the **Enter** key, the controller begins the calibration.
 2.6 Wait for the reading to stabilize, the display automatically shows "END". Second calibration point is completed.

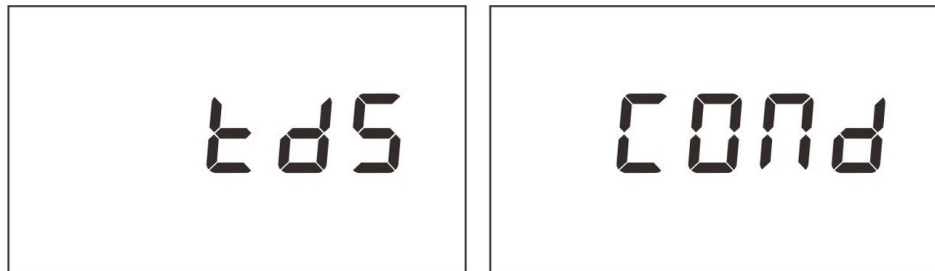
3 points calibration

- 3.1 If you have selected 3 points calibration in the setup menu, the display will show "CAL3". The controller prompts you to continue with third point calibration.
 3.2 Repeat the steps above until the display shows "END", the controller returns to the measurement mode. Calibration is completed.

- ① Performing the conductivity calibration will simultaneously calibrate the corresponding TDS value. If you want to exit the calibration, press the **⏻** | **☰** key.

Switching the Measurement Mode

1. In the conductivity mode, press the \cup | ENTER key until the display shows "TDS". The controller is now enters to the TDS measurement mode.
2. Press the \cup | ENTER key again, the controller returns to the conductivity mode.

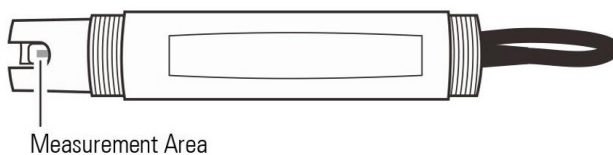


Measurement

1. Rinse the conductivity electrode with distilled water.
2. Place the electrode into the sample solution. Stir the electrode gently.
3. Record the measured value when the reading is stable.

Conductivity Electrode Care and Maintenance

- DO NOT touch the measurement area of electrode and always make sure that is clean.
- If there is a build-up of solids inside the measurement area, these should be removed very carefully with a cotton bud soaked in solvent, taking care not to touch the metal parts of the inner cell. After the solids are removed, the electrode must be recalibrated.



Troubleshooting

LCD DISPLAY	CAUSE	CORRECTIVE ACTION
---	Electrode dried out	Soak the conductivity electrode in tap water for 10 minutes.
	Measured value is out of range	Check the electrode whether dirty or broken.
Err	Electrode does not suit the current sample	Replace the conductivity electrode.
	Setting value does not match calibration solution	Reset the calibration value or check the calibration solution.
	Electrode is broken	Replace the conductivity electrode.

Specifications

Conductivity	Model	BI-650
	Range	0.01~20.00, 200.0, 2000 μ S/cm, 20.00, 200.0mS/cm
	Accuracy	\pm 1% F.S
	Resolution	0.001, 0.01, 0.1, 1
	Calibration Points	1 to 3 points
	Calibration Solutions	84 μ S/cm, 1413 μ S/cm, 12.88mS/cm, 111.8mS/cm
TDS	Range	0~10.00, 100.0, 1000ppm, 10.00, 100.0ppt (Max. 200ppt)
	Accuracy	\pm 1% F.S
	TDS Factor	0.1~1.0 (Default 0.5)
Temperature	Range	0~100 $^{\circ}$ C, 32~221 $^{\circ}$ F
	Accuracy	\pm 1 $^{\circ}$ C
	Resolution	0.1 $^{\circ}$ C
	Calibration Points	1 point
Transmitter Function	Signal Output	4~20mA
	Load	500 Ω
	Low and high alarm limits	0.02 μ S/cm~20.0mS/cm, Selectable
	Communication Interface	RS485
General	Temperature Compensation	0~100 $^{\circ}$ C, 32~212 $^{\circ}$ F, Manual or Automatic
	Temperature Coefficient	0.0~10.0%/ $^{\circ}$ C
	Cell Constant	K=0.1, 1, 10
	Normalization Temperature	25 $^{\circ}$ C
	Power Requirements	DC24V
	Ambient Temperature	< 60 $^{\circ}$ C
	Relative Humidity	< 80%
	Dimensions	96 (L) \times 96 (W) \times 75 (H)mm
	Weight	350g

Addendum 1: Preparation of Conductivity Standard Solutions

Place AR potassium chloride reagent in a 50ml beaker and dry in an oven for 3 to 5 hours at 105°C, then cool to room temperature in desiccator.

CALIBRATION SOLUTIONS	REAGENT
84µS/cm	Accurately weigh out 42.35mg of KCL and dissolve in 1 litre deionised water.
1413µS/cm	Accurately weigh out 745.9mg of KCL and dissolve in 1 litre deionised water.
12.88mS/cm	Accurately weigh out 7.45g of KCL and dissolve in 1 litre deionised water.
111.8mS/cm	Accurately weigh out 74.5g of KCL and dissolve in 1 litre deionised water.

Stir the solution until the reagent has thoroughly mixed. Preparation is completed.

Addendum 2: How to calculate the temperature coefficient

To determine the temperature coefficient of sample solution use the formula below:

$$T_c = \frac{C_{TB} - C_{TA}}{C_{TA}(T_B - 25) - C_{TB}(T_A - 25)} \times 100\%$$

Where:

T_c = Temperature coefficient

C_{TA} = Conductivity at Temperature A

C_{TB} = Conductivity at Temperature B

T_A = Temperature A

T_B = Temperature B

1. Press and hold the °C key for 3 seconds to enter the temperature setting.
2. Press the ▲ or ▼ key to set the temperature to 25°C.
3. Place the electrode into the sample solution A and record the temperature value T_A and conductivity value C_{TA} .
4. Condition the sample solution and electrode to a temperature that is about 5°C to 10°C different from T_A . Record the temperature value T_B and conductivity value C_{TB} .
5. Calculate the temperature coefficient according to the formula above.

Addendum 3: How to calculate the TDS conversion factor

To determine the TDS conversion factor use the formula below:

$$\text{Factor} = \frac{\text{Actual TDS}}{\text{Actual Conductivity @ 25°C}}$$

Where:

Actual TDS: value from the high purity water and precisely weighed NaCl or KCL reagent.

Actual Conductivity: the meter measured conductivity value.

For example: dissolve 64g of potassium chloride reagent in 1 litre distilled water. If its conductivity value is 100mS/cm, then TDS conversion factor is 0.64.

Hazardous Substance Statement

Instruments is committed to the reduction and eventual elimination of all hazardous substances in both the manufacturing process and finished products we supply. We have an active manufacturing and procurement program to minimize and eliminate the use of harmful heavy metals such as cadmium, lead, mercury and the like. New technologies and design parameters are also promoting these efforts and we expect to have little or no such materials in our product in the coming years. We welcome our customer suggestions on how to speed up these efforts.



Warranty

The warranty period for controller is one year from the date of shipment. Above warranty does not cover the sensor and calibration solutions. Out of warranty products will be repaired on a charged basis. The warranty on your controller shall not apply to defects resulting from:

- Improper or inadequate maintenance by customer.
- Unauthorized modification or misuse.
- Operation outside of the environment specifications of the products.

For more information, please contact the nearest authorized distributor.