CX105 Conductivity/Resistivity Transmitter

User Manual

REV A.6

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IMPORTANT SAFETY INFORMATION

Please read and observe the following:

- Remove line power before wiring transmitter connections
- Wiring or repairs should only be performed by qualified personnel and only to an unpowered transmitter
- Whenever it appears that transmitter safety is questionable, disable the Transmitter to ensure against any unintended operation. For example, an unsafe condition is likely when:

1） The transmitter appears visibly damaged

2） The transmitter fails to operate properly or provide the intended measurements

3） The transmitter has been stored for long periods at temperatures above 176°F (80°C)

- The transmitter must be installed by qualified personnel in accordance with relevant codes and instructions contained in this user manual. Observe the Transmitter's specifications and relative parameter's ratings.

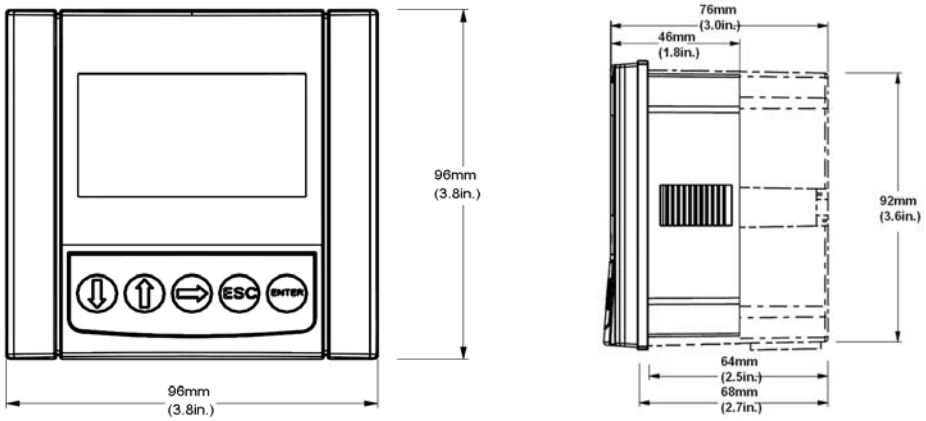
Table of Contents

1 Introduction

The CX105 conductivity/resistivity transmitter is a 2-wire transmitter designed for process conductivity/resistivity monitoring, measurement and control applications. This user's manual contains the information needed to install, set up, operate and maintain the transmitter.

2 Dimension Drawings

2.1 Front and Side View



Front view **Side view**

Panel Mount & Field Mount

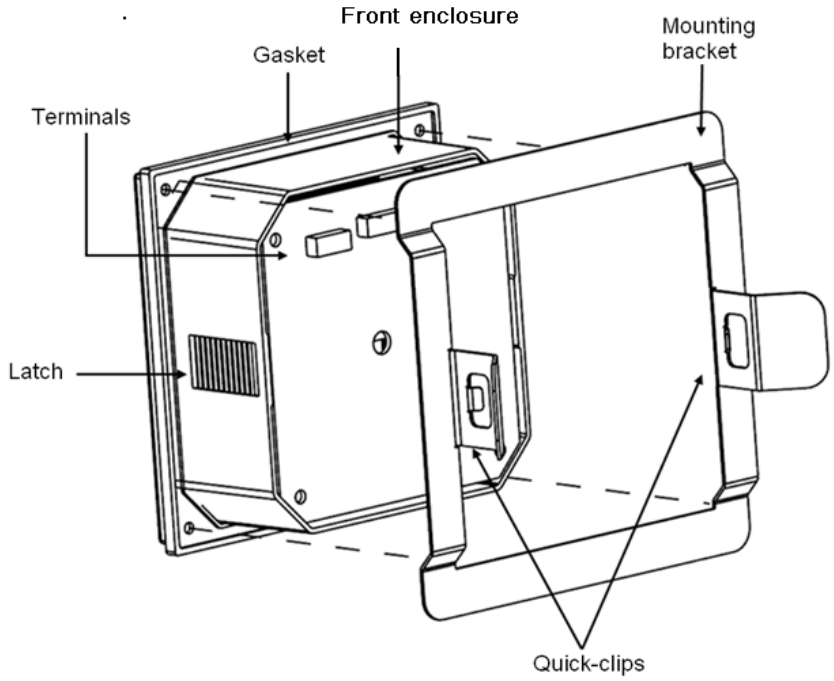
2.2 Installation

The CX105 conductivity/resistivity transmitters are supplied with hardware to install as panel mount or field(wall) mount.

2.2.1 Panel Installation Instructions

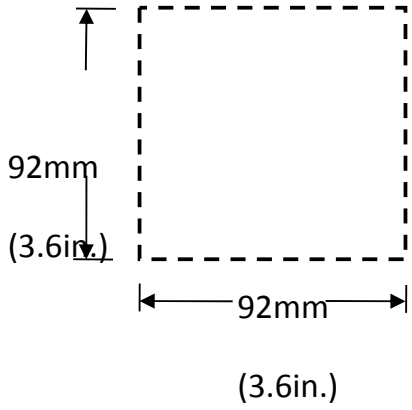
1) The panel mount version is designed for installation using a 1/4 DIN Punch (92mm(3.6in) x (92mm(3.6in).
2) Recommended clearance on all sides between instruments is 1 inch.

3) Slide the gasket over the back of the instrument.
4) Place the instrument into the panel cut-out.
5) Attach the mounting bracket to the back of the instrument by pulling apart the quick clips and sliding it over the back of the instrument. Make sure that the quick clips are securely attached to the latches.
6) Inspect the instrument to make sure that the instrument and the gasket are secured to the panel appropriately.
7) To disassemble, press the clips of the mounting bracket against the panel and pull the instrument away from the front.



Panel mount installation detail schematic

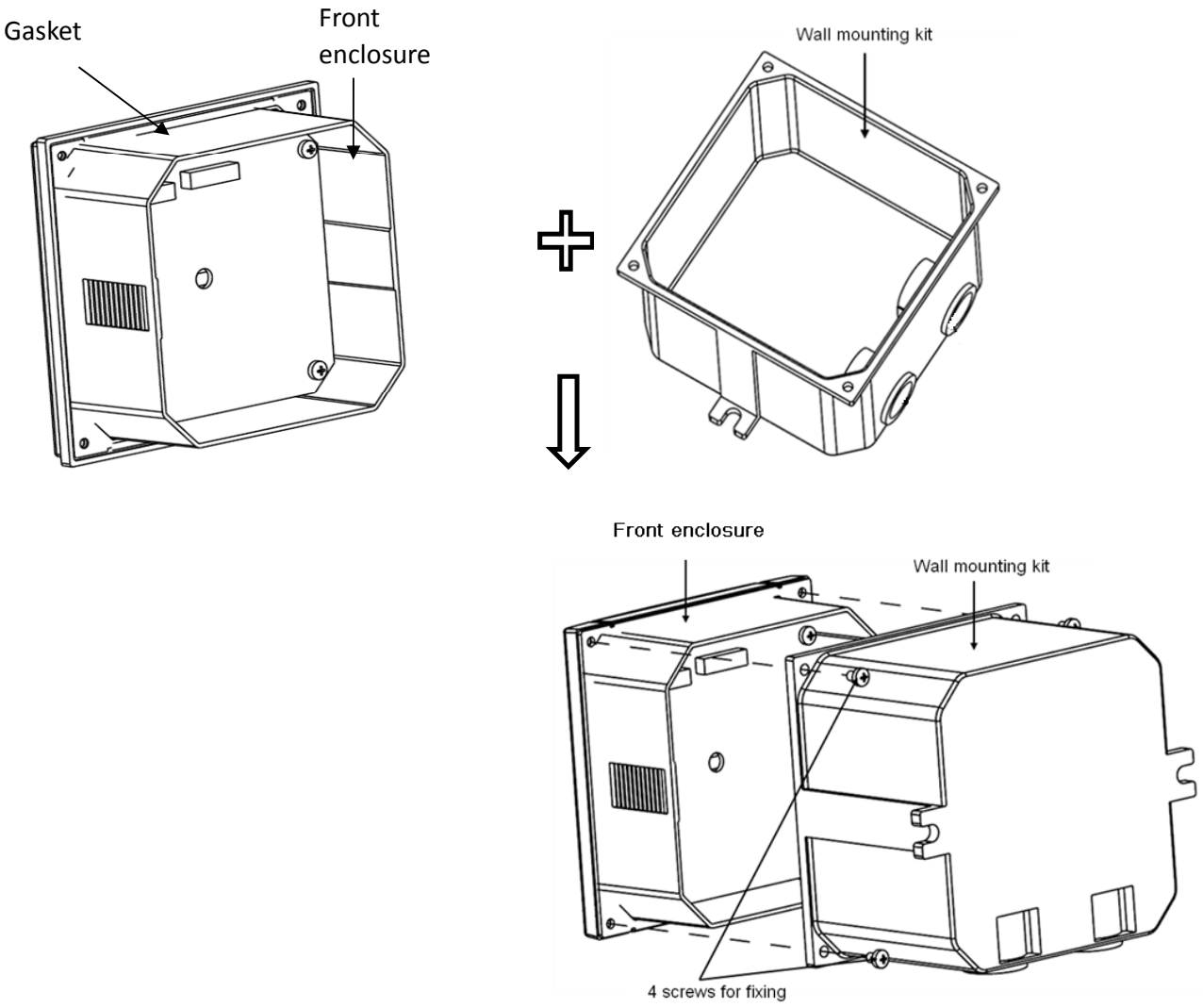
2.2.1.1 Panel Cut-out



2.2.2 Field(Wall) Mount Installation

The field(Wall) mount version requires a wall mounting kit, which includes a plastic wall mounting rear cover with gasket and 4 screws. This is included with your CX105 transmitter.. This makes it possible to install the transmitter on a variety of surfaces.

1) Place the gasket on the instrument.
2) Thread electrical cables through the connectors on the wall mounting rear cover.
3) Connect the power, sensor and OC output wires.
4) Secure the wall mounting rear cover to the front enclosure with screws.
5) Fix the wall mounting rear cover to the surface by using screws or cables.



Field(wall) mount installation

3 Specifications

Display:

- LCD: 128*65 dot matrix, figure or alphabet: 12x8, 28x15, 32x18, etc.
- Update rate: 1 second
- Contrast: User selected, 5 levels

Measurement:

- Conductivity: 0.05 to 500,000 µS/cm
- Resistivity: 1KΩ•cm to 18.3MΩ•cm
- TDS: 0.023 to 200,000 ppm
- Accuracy: ± 0.5% of reading
- Repeatability*: ± 0.05% of span
- Temperature： -10 to 70℃

*These performance specifications are typical at 25°C

Electrical:

- Power: 19 -48VDC, regulated, 30mA maximum

Current Output:

- Isolated 4-20 mA output with 0.004 mA (12-bit) resolution
- Update Rate: 1 second
- Maximum Loop Impedance: 250Ω @24V; 600Ω @31V; 1500Ω @48V

Memory:

- Non-volatile: All user settings are retained indefinitely without battery backup

Open-Collector Output:

- Isolated, 40 VDC max. pull-up voltage

  The OC output can be configured to be one of three modes below:

  High mode, Low mode, Proportional pulses

Ambient Conditions:

- Operation: -10 °C to 70 °C (14 °F to 158 °F); 0-95% relative humidity, non-condensing
- Transport/storage: -15°C to 80°C(5°F to 176°F); 0-95% relative humidity, non-condensing

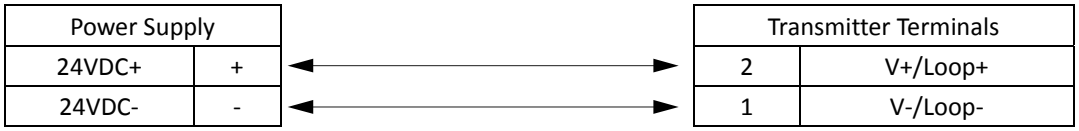
Standards and Approvals

- CE: Certified Compliant to European Community Standards.

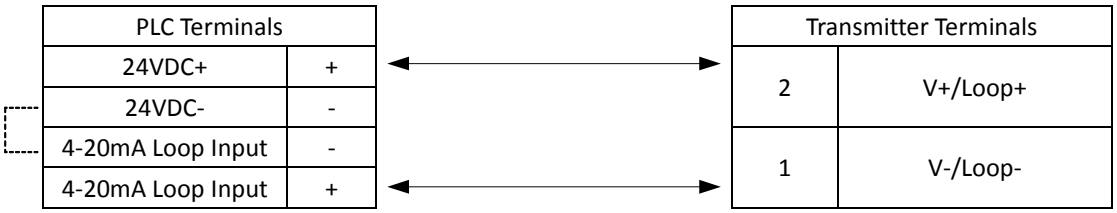
4 Electrical Connections

4.1 System Power & Loop Connections

- ***Standalone application, loop current isn't used***

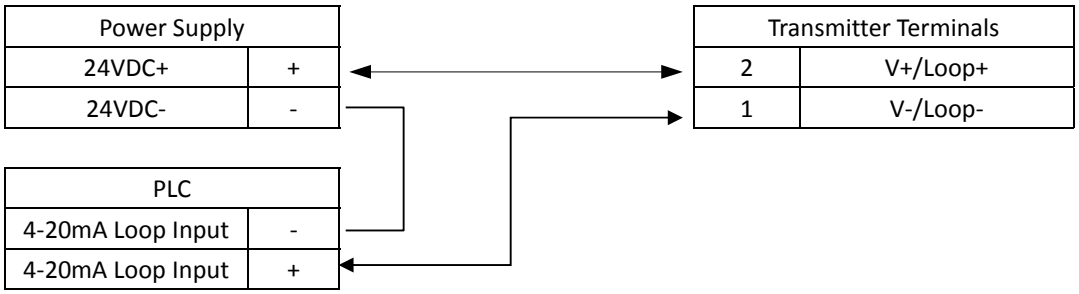


- ***Connection to a PLC with built-in power supply***

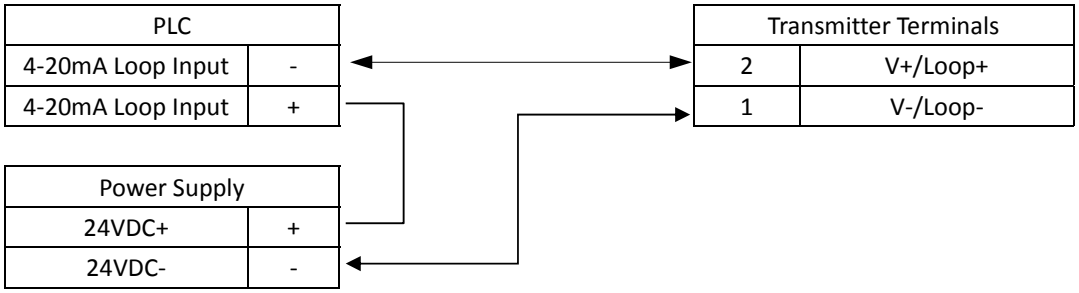


- ***Connection to a PLC with separate power supply***

Option A



Option B



4.2 Electrode Input Connections

CAUTION:

• As electrical noise may interfere with electrode signal, please do not route the electrode cable in a conduit containing AC power wiring.

Electrode Input	
Drive	Red
Ground	Black
Temp	Green
Temp	White

wire colors in table to left apply for all sensors except CS8000TC and CS615TC, CS620TC.

Transmitter Terminals	
8	Drive
7	Ground
6	Temp
5	Shield

Electrode Input	
Drive	black
Ground	white
Temp	green
Temp	red

Wiring For CS615TC, CS615TC

Transmitter Terminals	
8	Drive
7	Ground
6	Temp
5	Shield

Drive	coax center
Ground	Coax braid
Temp	green
Temp	red

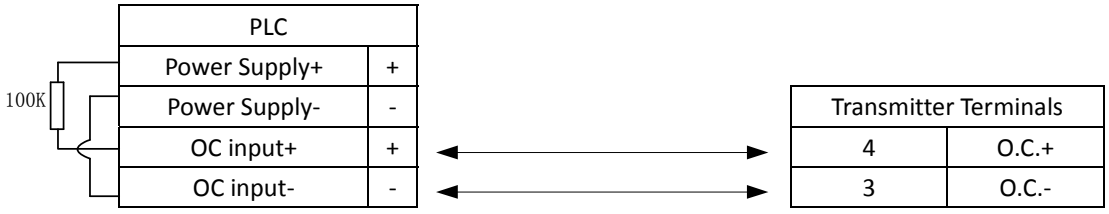
S855 cable used with CS8000TC

Transmitter Terminals	
8	Drive
7	Ground
6	Temp
5	Shield

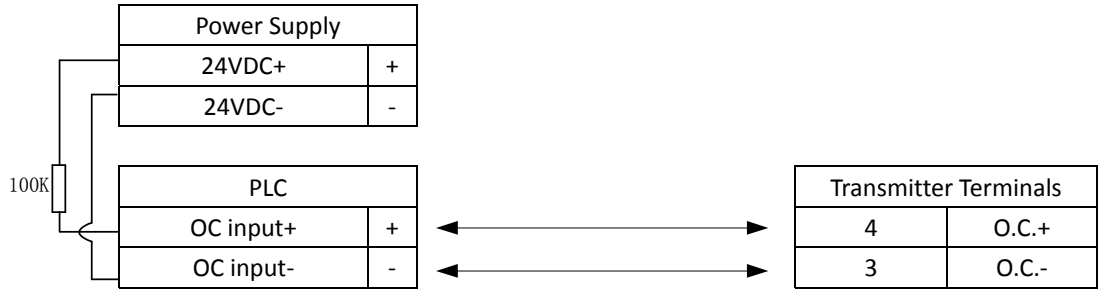
4.3 OC Output

4.3.1 Open Collector Output Connections

- ***Connection to a PLC with built-in power supply***

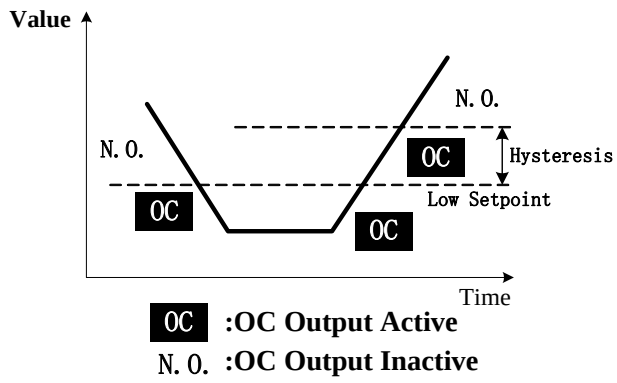


- ***Connection to a PLC, separate supply***



4.3.2 Open Collector Output Operation

The open collector output can be used as a switch or a warning that responds when the process value moves above or below a set point, or it can be used to generate a pulsing signal with a rate proportional to the process value. The output can be disabled if not used (select “OFF” in the OC OUTPUT menu). The “parameter” mentioned below can be either conductivity or temperature.

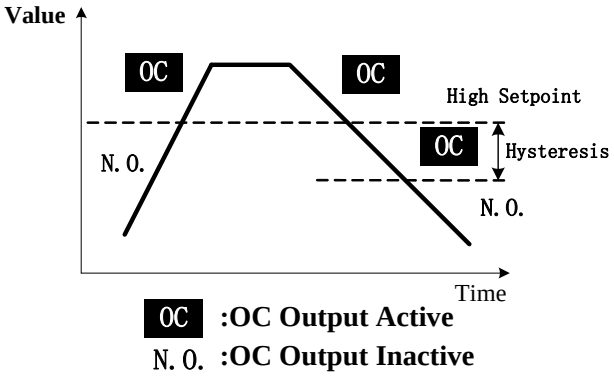


- **Low Mode:**

In this mode, the OC output is only active when the parameter is lower than a user set point. The output will be inactive when the parameter value is greater than the set point plus the hysteresis value.

- **High Mode:**

In this mode, the OC output is only active when the parameter value is higher than a user set point. The output will be inactive when the parameter value is smaller than the set point minus the hysteresis value.



- **Proportional Pulsing**

In this mode, the OC output will generate a pulse sequence at the rate defined by the setting in the OC OUTPUT menu.

In the following example, the starting point is 10μS/cm, the end point is 110μS/cm, and the maximum frequency is 200 pulses/min:

• The output will be 0 pulses/min when the conductivity value is less than 10μS/cm.

• The output will be 100 pulses/min when the conductivity value is 60μS/cm.

• The output will be 200 pulses/min when the conductivity value is greater than 110μS/cm.

5 Menu

The menu consists of a view menu and an editable menu. The menu has several levels, with the view menu being at the topmost level. You can loop within the same level menu items by pressing the **UP** or **DOWN** arrow keys, move to a lower level menu by pressing the **ENTER** key, and move to an upper level menu by pressing the **ESC** key. At any time, the system will return to the view menu (default display) if no key is pressed for 10 minutes.

During normal operation, the view menu is displayed. Use the **UP** or **DOWN** arrow keys to select the information you want displayed. The items will scroll in a continuous loop. System operations will not be interrupted during menu interaction.

5.1 View Menu

Display	Description
Default display：	
Cond μ S/cm **109.55** 28.2 ℃	Monitors the conductivity and temperature input from the electrode. The unit of conductivity or temperature is set in the calibration menu.
All displays below are temporary. The system will return to the default display if no keys are pressed in 10 minutes.	
4~20mA Output **4.08 mA**	Monitors the 4 to 20 mA loop output.

5.2 Editable Menu

5.2.1 Editing Procedure

Step 1. Press and hold the ENTER key for 3 seconds to enter Main Menu:

- If a password is required, enter the correct key code. The key code is entered by pressing the RIGHT-DOWN-UP-DOWN keys in sequence.
- The system will return to the view menu if no key is pressed for 10 minutes.

Step 2. Navigating the menu with the UP and DOWN keys.

Once the selected menu is highlighted, press **ENTER** to edit the menu.

- Only the highlighted item can be edited.
- No parameters will be saved if the **ESC** key is pressed, and the display will return to the previous menu.
- The system will return to the view menu if no activity occurs for 10 minutes.

Step 3. Press the ENTER key to save the new settings and return to Step 2.

NOTE：

- **ESC** *can be pressed at any time, and the system will exit the current level without saving.*
- *The edited value is effective immediately after pressing the* **ENTER** *key***.**
- *Repeat steps 2–3 as needed***.**

5.2.2 Main Menu

CALIBRATION >
OUTPUT>

OPTIONS >

Press the **UP** or **DOWN** arrow keys to navigate the three items. Press the **ENTER** key to enter the **CALIBRATION** menu, the **OUTPUT** menu, or the **OPTIONS** menu. Press the **ESC** key to return to the view menu.

5.2.3 Calibration Menu

Display		**Description**
Menu Item	*Next Level Menu*	
CELL> 1.00	Set Cell 01.00	Sets the cell constant of the conductivity electrode.
UNIT > μS/cm ℃	COND UNIT > μS/cm	Sets the unit of conductivity/resistivity. Options are: μS/cm, mS/cm, kΩcm, MΩcm, PPM.
	TEMP UNIT > ℃	Sets the unit of Temperature. Options are : ℃,℉.
TEMPERATURE > 20.0℃	Set Temperature +20.0 ℃	Sets the value of temperature.
CONDUCTIVITY > μS/cm	Set conductivity 9463.95 μS/cm	Sets the value of conductivity.
PPM FACTOR > 2.00	Set PPM Factor 2.00	Sets the PPM Factor. It can be any value from 0.01 to 99.99. The default value is 2.00.

5.2.4 Output Menu

Display		**Description**
Menu Item	*Next Level Menu*	
Output 4~20mA>	4~20mA Source> CONDUCTIVITY	Sets either conductivity or temperature as the source for the 4~20mA current loop output.
	Set 4~20mA>	Sets the minimum and maximum conductivity/temperature values for the 4~20mA current loop output.
OC Output >	OC SOURCE> CONDUCTIVITY	Selects conductivity or temperature as the source for the open collector output.
	OC MODE>	See 4.3.2 open collector output operation; selects

	PULSE	the OC mode and relative parameters.

The next two sections (5.2.4.1 and 5.2.4.2) use conductivity as an example, but all of the operations are the same for temperature.

5.2.4.1 Set 4~20mA Details

Menu Item	Description
Set 4mA Output> 000200. μS	Sets the conductivity value for 4mA current loop output.
Set 20mA Output> 200000. μS	Sets the conductivity value for 20mA current loop output.

5.2.4.2 OC Output Details

Display		Description
Menu Item	*Next Level Menu*	
MIN ALARM	MIN SETPOINT> 0100.00 μS/cm	As described in 4.3.2, sets the minimum point for low mode. The OC output is active when the conductivity value is less than the set value.
	HYSTERESIS> 0020.00 μS/cm	As described in 4.3.2, sets the hysteresis value for low mode. The OC output is inactive when the conductivity value is greater than the sum of the minimum point and the hysteresis value.
MAX ALARM	MAX SETPOINT> 0100.00 μS/cm	As described in 4.3.2, sets the maximum point for high mode. The OC output is active when the conductivity value is greater than the set value.
	HYSTERESIS> 0020.00 μS/cm	As described in 4.3.2, sets the hysteresis for high mode. OC output is inactive when the conductivity value is less than the maximum point minus the hysteresis value. **Note: the hysteresis must be less than the maximum point.**
PULSE	RANGE> 000000. μS/cm → 200000 μS/cm	As described in 4.3.2, sets the start point and end point for pulse mode.
	PULSE RATE> 100 Pulse/min	As described in 4.3.2, sets the maximum pulse rate for pulse mode.

5.2.5 Option Menu

Display	Description
CONTRAST > Level 1	Adjusts the LCD contrast for optimal viewing. A setting of ***1 is the lowest contrast, while a setting of 5 is the highest.***
FILTER > 1S	Sets the time parameter for averaging input values. There are 8 options: 1S, 2S, 5S, 8S, 10S, 20S, 40S, and 60S. ***Note：Larger filter values mean more stable displays but longer response times. Please consider your system safety requirements.***
CONDUCTIVITY DECIMAL>	Sets the conductivity decimal. Six options are as below: X.XXXXX; XX.XXXX; XXX.XXX; XXXX.XX; XXXXX.X; XXXXXX.
LOOP ADJUST 4mA > 3.75	Adjusts the minimum current output to match the external current measurement. ***Adjustable from 3.70 mA to 5.00 mA.***
LOOP ADJUST 20mA > 21.00	Adjusts the maximum current output to match the external current measurement. ***Adjustable from 19.00 mA to 21.00 mA.***
TEST 4~20mA OUTPUT>	Press the **UP** and **DOWN** keys to manually select any output current value from 3.7 mA to 21.00 mA to test the current loop output. The value changes 0.01mA each time the **UP/DOWN** key is pressed. If the **UP/DOWN** key is pressed and held for more than 5 seconds, The value will be changed by 0.1mA continuously.
TEST OC OUTPUT>	Press the **UP** and **DOWN** keys to manually select the status of the open collector output.
PASSWORD MENU> OFF	Selects whether or not the password is needed to enter the Main Menu. ***Note: the password is input by pressing the RIGHT-DOWN-UP-DOWN arrow keys in sequence and cannot be changed.***
RESTORE FACTORY SETTINGS>	**Restores factory settings**. In order to do so, you must enter the correct key code. The key code is input by pressing the ***RIGHT-DOWN-UP-DOWN arrow keys in sequence.***

6 Calibration

CAUTION:

All calibration procedures must be performed by trained personnel. Incorrectly set parameters may go unnoticed, but will still change the measurement properties.

6.1 Wet Calibration (1 Point Sample Method)

The “wet” calibration method requires the user to immerse the electrode into a properly prepared conductivity reference solution of known value, or to keep the electrode installed in the process while obtaining a process sample. When keeping the electrode installed, determine the process value through a laboratory analysis of comparable reading. In either case, enter the correct reference solution or sample conductivity value. The procedure is as follows:

- **Step 1**: Make sure the electrode is clean, and then immerse the electrode into solution. Stir electrode in solution to ensure no bubbles.
- **Step 2**: Wait for the temperature to stabilize. Depending on how great the temperature difference is, ***this may take up to 30 seconds***.
- **Step 3**: Set the temperature to the value reading from a precision thermometer.
- **Step 4:** Set the conductivity to a value, which is either from a solution or read from a precise instrument.
- **Step 5:** Place the electrode into a second different value solution, and verify the linearity. If the transmitter does not display the correct value (temperature ± 0.5℃, conductivity ±2% of reading), contact Sensorex technical support.

6.2 Dry Calibration (Simulates the Conductivity and Temperature)

The Dry Calibration method requires the user to simulate the conductivity and temperature by using precise fixed resistors (± 0.1%). The calibration procedure is as follows.

6.2.1 Temperature Simulation

The temperature input to the CX105 is a PT-1000 RTD, where 1000 Ohms (Ω) is equal to 0 ℃ and a change of 3.85 Ω equals to 1℃ difference. (1000 Ω = 0 ℃, 1096 Ω = 25 ℃)

- Step 1: Connect a resistor (1000 Ω to 1096 Ω) between the "Temp" and “Ground" terminals.
- Step 2: Set the temperature in the same manner as the wet calibration procedure.
- Step 3: Connect a different value resistor to the "Temp" and “Ground" terminals, and verify

the linearity. If the transmitter displays an incorrect value (±0.5℃),contact Sensorex technical support.

6.2.2 Conductivity Simulation

The following formulas will be useful for the user to simulate the conductivity and verify the results and linearity.

$$\text{resistance} = \frac{\text{cell constant}}{\text{conductivity}} \quad \text{e.g. } \frac{1.00\text{cell}}{0.000010\text{simens}} = 100\text{k}\Omega$$

$$\text{conductivity} = \frac{\text{cell constant}}{\text{resistance}} \quad \text{e.g. } \frac{1.00\text{cell}}{100\text{k}\Omega} = 0.000010\text{simens}$$

- Step1: Connect a precise resistor between the "Drive" and “Ground" terminals.
- Step 2: Set the conductivity in the same manner as the wet calibration procedure.
- Step 3: Connect a different value resistor to the "Drive" and “Ground" terminals, and verify the linearity. If the transmitter displays an incorrect value (±2% of reading), contact Sensorex technical support.

6.3 Parts per Million (PPM) Factor

When the unit in the calibration menu is PPM, the following information is useful. The PPM factor is a value between 0.01 and 99.99, and the default value is 2.00.
The formulas are:

$$\text{PPM Factor} = \frac{\text{solution conductivity}(\mu\text{S/cm})}{\text{TDS(PPM)}}$$

$$\text{TDS(PPM)} = \frac{\text{solution conductivity}(\mu\text{S/cm})}{\text{PPM Factor}}$$

TDS: Total Dissolved Solids.
For example：
When the solution conductivity = 1000μS/cm and TDS = 500ppm(mg/L), the PPM Factor is 2.00.

7 Troubleshooting

Display	Possible Cause	Suggestions
Value Too Large (or Small)!	During temperature calibration, the entered value is more than 25 degree away from the detected value.	1. Check the sensor and repeat the calibration procedure. 2. Enter appropriate values.
Cell Can NOT Be Zero!	Cell value is set to zero.	Cell value cannot be set to zero, please set a value larger than zero.
HYSTERESIS Too Large	The HYSTERESIS is larger than the MAX SETPOINT	Set the HYSTERSIS to a smaller value than MAX SETPOINT.

Wrong Password	The password is wrong.	Enter the correct password.

8 Ordering information

Part No.	Description
CX105	Conductivity/Resistivity Transmitter
AR100-11	Mounting Bracket for Transmitter, Panel Mount (included with CX105, order when lost or damaged)
AR100-15	Transmitter Gasket (included with CX105, order when lost or damaged)
AR100-17	Mounting Kit for Transmitter, Field Mount (included with CX105, order when lost or damaged)