User’s Guide

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CDTX-285X
Conductivity/Resistivity Sensor Electronics
The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.
1. Description

- CDTX-285X Series Conductivity/Resistivity Sensor Electronics provides either a two-wire 4 to 20 mA output.
- The 4 to 20 mA output models provide eight ranges for each electrode cell constant, plus the ability to invert each range.
- The EasyCal feature allows the devices to automatically recognize standard conductivity test solution values for simple field calibration.
- The Conductivity sensor provided with integral systems will have its custom cell constant information programmed into the electronics at the factory to provide a 2% sensor accuracy. See Section 8 for details.

2. Specifications

General
Compatible Electrodes .......... Omega Conductivity/Resistivity electrodes series CDCE-90 and CDE-285X
Temperature Compensation ...... PT-1000 RTD (2% per °C)
Pure Water Compensation ...... Auto-switching when using 0.01 cell and raw conductivity value < 0.5 μS

EasyCal:
Automatic recognition of the following conductivity values:
- 146.93 μS, 1408.8 μS, 12856 μS (@ 25 °C)
  (Test solutions per ASTM D1125-95)
- 10 μS, 100 μS, 200 μS, 500 μS, 1000 μS, 5000 μS, 10,000 μS, 50,000 μS, 100,000 μS (@ 25 °C)

Electrical
Power ...................................... 12 to 24 VDC (4 to 20 mA output)
  (Reverse polarity and short circuit protected)

Current Output:
Field-selectable ranges
Factory set span:
- 0.01 cell ....................... 4 to 20 mA = 0 to 100 μS
- 0.10 cell ....................... 4 to 20 mA = 0 to 1000 μS
- 1.0 cell ....................... 4 to 20 mA = 0 to 10,000 μS
- 10.0 cell ....................... 4 to 20 mA = 0 to 200,000 μS
- 20.0 cell ....................... 4 to 20 mA = 0 to 400,000 μS
Max. Loop Resistance .......... 50 Ω @ 12 VDC
  325 Ω @ 18 VDC
  600 Ω @ 24 VDC

Accuracy ................................ ±2% of output span
Resolution .............................. 7 μA
Update Rate ............................ <600 ms
Error Indication ...................... 22 mA

Environmental
Material .................................. PBT
Enclosure Rating ...................... NEMA 4X/IP65
Operating Temperature .......... -10 °C to 85 °C
  (14 °F to 185 °F)
Storage Temperature .............. -20 °C to 85 °C
  (-4 °F to 185 °F)
Relative Humidity ................. 0 to 95%, non-condensing
Shipping Weight .................... 0.75 kg (1.75 lb.)
3. CDTX-2850 Dimensions

CDTX-2850-IM Integral mount

CDTX-2850-RM Universal Mount

4. Conductivity Sensor Dimensions

5. Operating Range Chart
6. In-Line Installation

Most of the Conductivity/Resistivity electrodes used with the CDTX-285X can be installed into standard 3/4 in. (NPT or ISO 7-R 3/4) fittings.

The CDTX-285X models are designed for integral systems, where the electronics are attached directly to the sensor.

The preferred installation for in-line applications directs flow straight into the electrode. This configuration reduces the probability of entrapped air bubbles, and provides the best continuous sampling of the fluid content.

If the electrode is mounted vertically in a tee, do not recess the electrode orifices inside the tee. Mounting upside down may help prevent air entrapment.

An oversized tee or flow cell may be helpful for inline installations. At least 4 threads (ANSI B1.20.1) must be engaged to meet the pressure rating as published in the specifications.

Use the CDTX-285X-RM models for in-line installations where the electronics must be separated from the electrode. Conductivity electrodes with sanitary flange fittings must be installed using this option.

7. Submersible Installation

While the CDTX-285X and CDTX-2850-RM electronics cannot be submerged, either model will accommodate tank installation.

Select any electrode with a 5 m (15 ft.) cable. The cable may be cut to length, but it CANNOT BE EXTENDED.

The universal adapter included with CDTX-285X-RM models can be attached to the top of a tank or mounted to a surface near the tank.

Adapt the CDTX-285X models to tank installations by attaching a clamp to the conduit.
8. Wiring 4 to 20 mA Output

- Maximum length of 4 to 20 mA loop is 300 meters (1000 ft)

9. Cell Constant Selection

Cell Constant Selection

- The CDTX-285X is shipped from the factory with the custom cell constant and temperature offset programmed into the single-input electronics. SW3 will be preset to "Custom cell constant".
- Switch banks SW3 and SW4 are used to select the cell constant of the electrode. The Dual Input model is illustrated. Single input models use only SW3.
- Make all switch settings before connecting power. Switch changes made with the power ON will take 15 to 20 seconds before becoming effective.
- Use SW3 #1-3 to select the cell constant for the first sensor.
- Use SW3 #4 to disable the PT1000 Temp Compensation function in the CDTX-285X (as required for USP applications). This disables the function for BOTH INPUTS.
- Use SW4 #1-3 to select the cell constant for the second sensor.
- Set SW4 #4 to OPEN to disable the second input.

<table>
<thead>
<tr>
<th>SW3 Cell Constant and Temp Compensation</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
<th>#4</th>
<th>For Cell Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>C</td>
<td>C</td>
<td>O</td>
<td></td>
<td>Custom</td>
</tr>
<tr>
<td>C</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td></td>
<td>0.01 cm⁻¹</td>
</tr>
<tr>
<td>O</td>
<td>C</td>
<td>O</td>
<td>O</td>
<td></td>
<td>0.1 cm⁻¹</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>O</td>
<td>O</td>
<td></td>
<td>1.0 cm⁻¹</td>
</tr>
<tr>
<td>O</td>
<td>O</td>
<td>C</td>
<td>O</td>
<td></td>
<td>10.0 cm⁻¹</td>
</tr>
<tr>
<td>C</td>
<td>O</td>
<td>C</td>
<td>O</td>
<td></td>
<td>20.0 cm⁻¹</td>
</tr>
</tbody>
</table>

#4: Open = Temp Comp ON  Closed = Temp Comp OFF

SW4: #1, #2 and #3 operate the same as SW3. #4 turns input 2 OFF when set to OPEN. (Open = Off, Closed = On)
10. Range Selection for 4 to 20 mA Output

- The Range selection switch bank (SW2) provides eight range selections for each cell constant. Each range can be inverted, making a total of 16 range options.
- Select a range from the table below and set SW2 as indicated.

Example (refer to shaded selections of chart):
- The electrode installed is the CDE-2852, with a 0.10 cell constant.
- The required output is 4 to 20 mA = 0 to 100 µS.
- Set SW2 switch bank to C-C-O-O.
- To invert range (4 to 20 mA = 100 to 0 µS), close switch #4.

<table>
<thead>
<tr>
<th>SW2 Switch Setting</th>
<th>0.01 Cell</th>
<th>0.10 Cell</th>
<th>1.0 Cell</th>
<th>10.0 Cell</th>
<th>20.0 Cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 #2 #3 #4</td>
<td>Resistivity Ranges in <strong>BOLD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C C C O</td>
<td>10 to 20 MΩ</td>
<td>0 to 2 µS</td>
<td>0 to 20 µS</td>
<td>0 to 200 µS</td>
<td>0 to 400 µS</td>
</tr>
<tr>
<td>C C C C</td>
<td><strong>20 to 10 MΩ</strong></td>
<td>2 to 0 µS</td>
<td>20 to 0 µS</td>
<td>200 to 0 µS</td>
<td>400 to 0 µS</td>
</tr>
<tr>
<td>O C C O</td>
<td><strong>2 to 10 MΩ</strong></td>
<td>0 to 5 µS</td>
<td>0 to 50 µS</td>
<td>0 to 500 µS</td>
<td>0 to 1000 µS</td>
</tr>
<tr>
<td>O C C C</td>
<td><strong>10 to 2 MΩ</strong></td>
<td>5 to 0 µS</td>
<td>50 to 0 µS</td>
<td>500 to 0 µS</td>
<td>1000 to 0 µS</td>
</tr>
<tr>
<td>C O C O</td>
<td><strong>0 to 2 MΩ</strong></td>
<td>0 to 10 µS</td>
<td>0 to 100 µS</td>
<td>0 to 1000 µS</td>
<td>0 to 2000 µS</td>
</tr>
<tr>
<td>C O C C</td>
<td><strong>2 to 0 MΩ</strong></td>
<td>10 to 0 µS</td>
<td>100 to 0 µS</td>
<td>1000 to 0 µS</td>
<td>2000 to 0 µS</td>
</tr>
<tr>
<td>O O C O</td>
<td><strong>0 to 1 µS</strong></td>
<td>0 to 50 µS</td>
<td>0 to 5 000 µS</td>
<td>0 to 5 000 µS</td>
<td>0 to 10 000 µS</td>
</tr>
<tr>
<td>O O C C</td>
<td><strong>1 to 0 µS</strong></td>
<td>50 to 0 µS</td>
<td>500 to 0 µS</td>
<td>5000 to 0 µS</td>
<td>10 000 to 0 µS</td>
</tr>
<tr>
<td>C C O O</td>
<td><strong>0 to 5 µS</strong></td>
<td>0 to 100 µS</td>
<td>0 to 1 000 µS</td>
<td>0 to 10 000 µS</td>
<td>0 to 20 000 µS</td>
</tr>
<tr>
<td>C C O C</td>
<td><strong>5 to 0 µS</strong></td>
<td>100 to 0 µS</td>
<td>1 000 to 0 µS</td>
<td>10 000 to 0 µS</td>
<td>20 000 to 0 µS</td>
</tr>
<tr>
<td>O C O O</td>
<td><strong>0 to 10 µS</strong></td>
<td>0 to 200 µS</td>
<td>0 to 2 000 µS</td>
<td>0 to 50 000 µS</td>
<td>0 to 100 000 µS</td>
</tr>
<tr>
<td>O C O C</td>
<td><strong>10 to 0 µS</strong></td>
<td>200 to 0 µS</td>
<td>2 000 to 0 µS</td>
<td>50 000 to 0 µS</td>
<td>100 000 to 0 µS</td>
</tr>
<tr>
<td>C O O O</td>
<td><strong>0 to 50 µS</strong></td>
<td>0 to 500 µS</td>
<td>0 to 5 000 µS</td>
<td>0 to 100 000 µS</td>
<td>0 to 200 000 µS</td>
</tr>
<tr>
<td>C O O C</td>
<td><strong>50 to 0 µS</strong></td>
<td>500 to 0 µS</td>
<td>5 000 to 0 µS</td>
<td>100 000 to 0 µS</td>
<td>200 000 to 0 µS</td>
</tr>
<tr>
<td>O O O O</td>
<td><strong>0 to 100 µS</strong></td>
<td>0 to 1 000 µS</td>
<td>0 to 10 000 µS</td>
<td>0 to 200 000 µS</td>
<td>0 to 400 000 µS</td>
</tr>
<tr>
<td>O O O C</td>
<td><strong>100 to 0 µS</strong></td>
<td>1000 to 0 µS</td>
<td>10 000 to 0 µS</td>
<td>200 000 to 0 µS</td>
<td>400 000 to 0 µS</td>
</tr>
</tbody>
</table>

**C = CLOSED**

**O = OPEN**

Switch #4 inverts the output: OPEN = 4 to 20 mA, CLOSED = 20 to 4 mA
11. Calibration

- All CDTX-285X Conductivity/Resistivity Sensor Electronics are factory calibrated for maximum out-of-the-box accuracy.
- The EasyCal feature allows calibration to be performed at the sensor.

The CDE-285X Conductivity sensors come with a certificate of calibration. This certificate provides information regarding the actual cell constant and temperature offset as tested and verified according to NIST standards. This information has been programmed into the CDTX-285X electronics as its default factory value. If required, the sensor can be recertified by contacting Omega.

a. SW2: 4 to 20 mA output range selection switch bank
b. Power and 4 to 20 mA output terminal block
c. SW3 and SW4: Electrode Cell Constant selection switch banks
d. D3: LED indicator
e. SW1: EasyCal Push-button
f. Conductivity Electrode connections

12. EasyCal

EasyCal is a single-point calibration system. During this procedure, if the measured value is within ±10% of any of the test values listed below, the CDE-285X will automatically recognize the test value and calibrate the output to that value.

Note:
The first step (Reset) is recommended each time an electrode is replaced, but is NOT necessary upon initial installation or periodic calibration.

1. **Reset** the CDE-285X to factory calibration: Set all switches on SW3 (and SW4 for dual input) to OPEN. Apply power, wait at least 3 seconds, then press and hold SW1 until the LED (D3) comes on steady then goes off again (approx. 10 seconds). When the LED goes off, release SW1; reset is complete. Reset SW3 and SW4 to the proper settings.

2. **Place** the electrode/sensor assembly into the conductivity test solution appropriate to your operating range. Shake the electrode to dislodge any air bubbles visible on the surface of the electrode.
   - 146.93 μS, 1408.8 μS, 12856 μS (per ASTM D1125-95)
   - 10 μS, 100 μS, 200 μS, 500 μS, 1000 μS, 5000 μS, 10,000 μS, 50,000 μS, 100,000 μS.
   - Allow at least 2 minutes for the electrode response to stabilize.

3. **Press** and hold SW1 for approximately 8 to 10 seconds. During this time, the LED will come on steady then go back off. (If the LED blinks several times rapidly, the calibration was not successful. See the troubleshooting section).

Calibration is complete. Return the system to service.
13. Maintenance

- The CDTX-285X requires no periodic maintenance.
- Coatings on the electrode may cause slow response or drift.
- Clean metallic surfaces with a mild detergent and a non-abrasive brush or cotton swab.

14. Troubleshooting

<table>
<thead>
<tr>
<th>LED and Output Condition</th>
<th>Possible Causes</th>
<th>Suggested Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Out: LED off, current output is 22 mA</td>
<td>• SW3 and SW4 set to all OPEN (factory setting)</td>
<td>• Normal for new system</td>
</tr>
<tr>
<td></td>
<td>• No electrode installed</td>
<td>• Install electrode</td>
</tr>
<tr>
<td></td>
<td>• SW3 (and SW4) not set correctly</td>
<td>• Set SW3 and SW4 correctly</td>
</tr>
<tr>
<td></td>
<td>• System not ready</td>
<td>• Retry (recycle power)</td>
</tr>
<tr>
<td>During EasyCal, the LED blinks rapidly for 4 seconds</td>
<td>• Measured value of the test solution is outside the ±10% tolerance</td>
<td>• Use fresh test solutions and restart the calibration</td>
</tr>
<tr>
<td></td>
<td>• The electronics or the electrode is defective</td>
<td>• Replace the electronics or the electrode</td>
</tr>
<tr>
<td>After completing calibration procedure, the output values are inaccurate</td>
<td>• Insufficient time allowed for electrode stabilization during calibration procedure</td>
<td>• Recalibrate and wait at least 2 minutes after placing electrode in solution before pressing SW1</td>
</tr>
<tr>
<td></td>
<td>• Test solutions are contaminated</td>
<td>• Use fresh test solutions and restart the calibration</td>
</tr>
<tr>
<td></td>
<td>• EasyCal performed with temp comp OFF, then temp comp turned ON for measurement (or vice versa)</td>
<td></td>
</tr>
<tr>
<td>The output of the CDTX-285X indicates a value that is off by a factor of 10 (e.g. 10x, 100x the correct value)</td>
<td>• The cell constant selection on the CDTX-285X (SW3 or SW4) does not match the actual input</td>
<td>• Match the CDTX-285X switch settings to agree with the sensor being used</td>
</tr>
</tbody>
</table>
## 10. Ordering Information

<table>
<thead>
<tr>
<th>Mfr. Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDTX-2850-IM</td>
<td>2850 Sensor Electronics with 4 to 20 mA Output and ¾ inch adapter</td>
</tr>
<tr>
<td>CDTX-2850-RM</td>
<td>2850 Sensor Electronics with 4 to 20 mA and Universal adapter</td>
</tr>
<tr>
<td>CDTX-2851</td>
<td>Integral system with CDE-2851, 4 to 20 mA, 0.01 cell, NPT threads</td>
</tr>
<tr>
<td>CDTX-2852</td>
<td>Integral system with CDE-2852, 4 to 20 mA, 0.1 cell, NPT threads</td>
</tr>
<tr>
<td>CDTX-2853</td>
<td>Integral system with CDE-2853, 4 to 20 mA, 1.0 cell, NPT threads</td>
</tr>
<tr>
<td>CDTX-2854</td>
<td>Integral system with CDE-2854, 4 to 20 mA, 10.0 cell, NPT threads</td>
</tr>
<tr>
<td>CDTX-2851-ISO</td>
<td>Integral system with CDE-2851-ISO, 4 to 20 mA, 0.01 cell, ISO threads</td>
</tr>
<tr>
<td>CDTX-2852-ISO</td>
<td>Integral system with CDE-2852-ISO, 4 to 20 mA, 0.1 cell, ISO threads</td>
</tr>
<tr>
<td>CDTX-2853-ISO</td>
<td>Integral system with CDE-2853-ISO, 4 to 20 mA, 1.0 cell, ISO threads</td>
</tr>
<tr>
<td>CDTX-2854-ISO</td>
<td>Integral system with CDE-2854-ISO, 4 to 20 mA, 10.0 cell, ISO threads</td>
</tr>
</tbody>
</table>
WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 13 months from date of purchase. OMEGA’s WARRANTY adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that OMEGA’s customers receive maximum coverage on each product.

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RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA’S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:
1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:
1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA’s policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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