User's Guide

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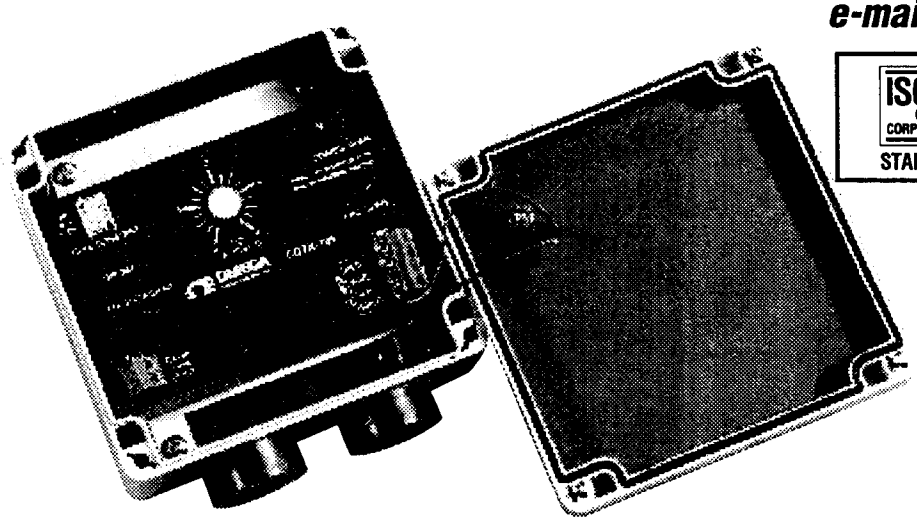

CDTX680 SERIES

CONTACTING CONDUCTIVITY TWO -WIRE TRANSMITTER

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OPERATING INSTRUCTION MANUAL

CDTX680 SERIES
Contacting Conductivity
Two-wire Transmitter

(non-indicating)

For Use With CDE680 Series Electrodes

HELPFUL IDENTIFIERS

In addition to information on installation and operation, this instruction manual may contain WARNINGS pertaining to user safety, CAUTIONS regarding possible instrument malfunction, and NOTES on important, useful operating guidelines.

A WARNING LOOKS LIKE THIS. ITS PURPOSE IS TO WARN YOU OF THE POTENTIAL FOR PERSONAL INJURY.

A CAUTION LOOKS LIKE THIS. ITS PURPOSE IS TO ALERT YOU TO POSSIBLE INSTRUMENT MALFUNCTION OR DAMAGE.

☞ ***NOTE:*** *A note looks like this. Its purpose is to alert you to important, useful operating information.*

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PART ONE - INTRODUCTION

SECTION 1
GENERAL INFORMATION

1.1 Instrument Capability

The CDTX680 series is a loop-powered two-wire transmitter that uses a CDE680 series enhanced performance contacting conductivity sensor to measure conductivity in solutions.

NOTE: *Because of the inherent measuring range limits of the CDTX680 Series transmitter, it can only be used with CDE680 series sensors that have a 0.05, 0.5, or 10.0 cell constant.*

The measuring range of this transmitter is factory-set to a user-specified range. However, it can be changed in the field if desired.

The transmitter can be powered by a 16-40 VDC

- Power supply, 24VDC recommended
- A recorder or indicator can be connected in the 4-20 mA loop).

The user interface includes an LED on the module that lights with the presence of loop current, sensor and power supply terminals, and controls and switches for range scaling. A NEMA 4X enclosure is included as standard.

The transmitter serial number is located on the top edge of the module, or just above the module on its mounting plate when equipped with this option. Refer to the model number and serial number for convenient identification should technical assistance be required.

1.2 Product Identification

The model numbers available are as follows:

CDTX-680-(*) Two-wire conductivity transmitter for use with the CDE680 series contacting electrodes.

Code (*)	Range	Cell Constant
10	0 to 10 uS	0.05
50	0 to 50 uS	0.05
100	0 to 100 uS	0.05
200	0 to 200 uS	0.05
500	0 to 500 uS	0.5
1000	0 to 1000 uS	0.5
2000	0 to 2000 uS	10.0
5000	0 to 5000 uS	10.0
10M	0 to 10 mS	10.0
20M	0 to 20 mS	10.0

SECTION 2
SPECIFICATIONS

2.1 Operational

Measuring Range ..... 0-5 to 0-20,000 microSiemens/cm, scaled to specified range

Ambient Conditions ..... -22 to +158°F (-30 to +70°C); 0-100% relative humidity, non-condensing

Sensor-to-Transmitter Distance ..... 100 ft. (30 m) maximum

Output Transmission Distance ..... Limited only by wire resistance and power supply voltage

Power Requirements ..... 16-40 VDC

Temperature Compensation ... Automatic, 32-212°F (0-100°C); adjustable slope from 0 to 4% per °C

2.2 Performance

Sensitivity ..... 0.1% of span

Stability ..... 0.1% of span per 24 hours, non-cumulative

Non-linearity ..... 0.5% of span

Repeatability ..... 0.1% of span or better

Temperature Drift ..... Zero: 0.05% of span per °C; Span: 0.05% of span per °C

Response Time ..... 2 seconds to 90% of value upon step change

Insertion Loss at 20 mA ..... 14.6 VDC (730 ohms maximum insertion loss in the 4-20 mA loop)

2.3 Mechanical

Enclosure ..... NEMA 4X; polycarbonate; surface mount

Net Weight ..... 1 lb. approximately

PART TWO - INSTALLATION

SECTION 1
UNPACKING

After unpacking, it is recommended to save the shipping carton and packing materials if the instrument must be stored or re-shipped. Inspect the equipment and packing materials for signs of shipping damage. If there is any evidence of damage, notify the transit carrier immediately.

SECTION 2
MECHANICAL REQUIREMENTS

2.1 Location

1. It is recommended to locate the transmitter as close as possible to the installed conductivity sensor. The maximum allowable distance between an installed sensor and the transmitter is 100 feet (30 m).

2. Mount the transmitter in a location that is:

   - Clean and dry where there is little or no vibration.
   - Protected from corrosive fluids.
   - Within ambient temperature limits (-22 to +158°F; -30 to +70°C).

CAUTION: MOUNTING THE TRANSMITTER IN DIRECT SUNLIGHT MAY INCREASE THE AMBIENT TEMPERATURE ABOVE THE MAXIMUM LIMIT

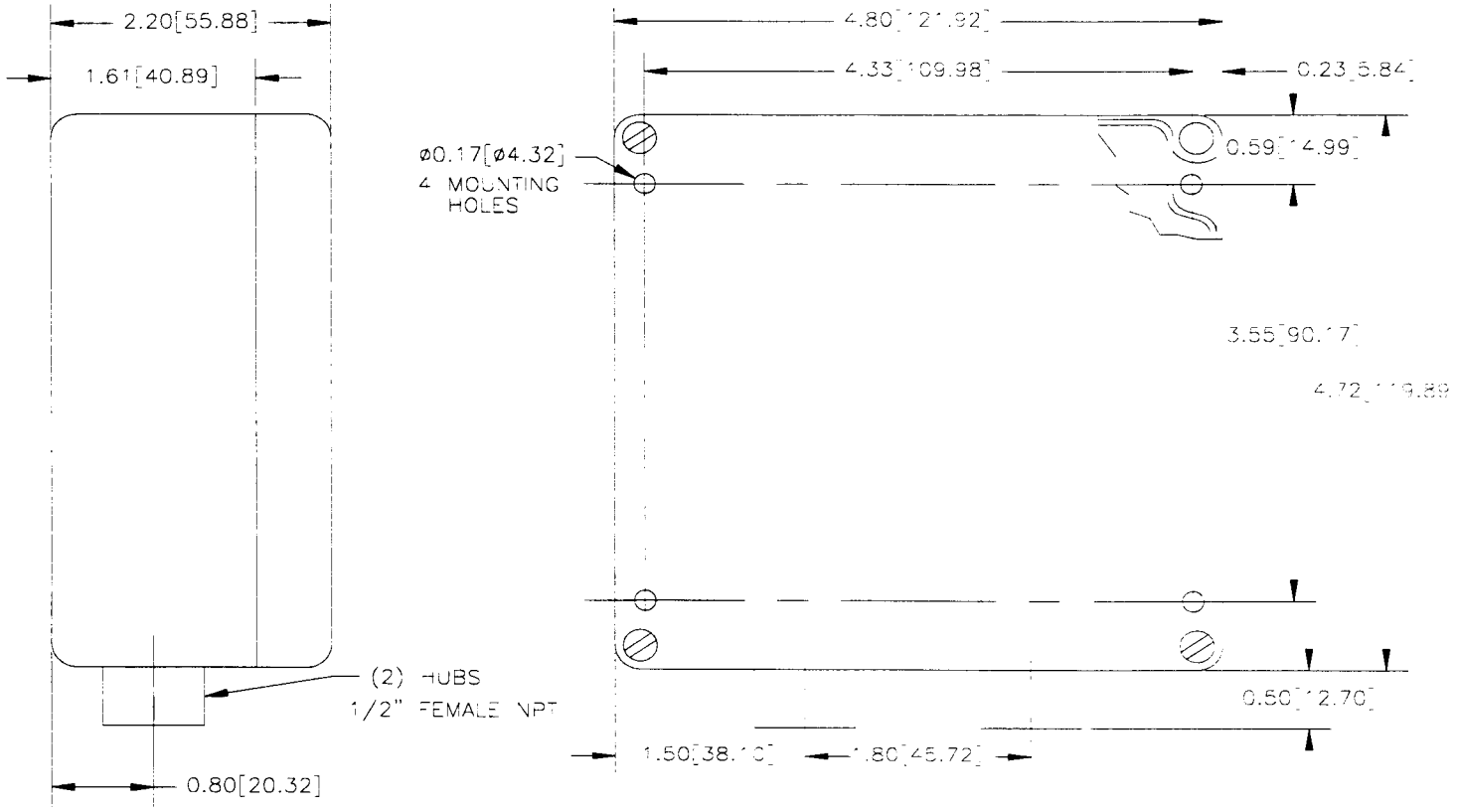
2.2 Mounting

Refer to Figure 2-1 for enclosure and mounting dimension details. Mount the enclosure on a flat surface such that the cover is removable when installed. If the enclosure is not used the transmitter can be surface mounted with double sided tape in any position.

2.3 Conduit Hole Requirements (for optional enclosure only)

Recommendation: Run all wiring to the transmitter in 1/2-inch, grounded metal conduits. If conduit is not used, install appropriate strain reliefs or cable grips and watertight locknuts into cable entry holes. Seal all unused cable entry holes with appropriate plugs.

NOTE: *Use NEMA 4 rated fittings and plugs to maintain the watertight integrity of the optional, NEMA 4X enclosure.*



NOTES: 1) DIMS ARE: INCHES [mm]

2) ENCLOSURE–POLYCARBONATE
HUBS–PVC

FIGURE 2-1 Enclosure Outline

SECTION 3
ELECTRICAL CONNECTIONS

3.1 Contacting Conductivity Sensor

Installation Tip! Route sensor and interconnect cable, if used, in 1/2-inch, grounded metal conduit to protect them from moisture, electrical noise, and mechanical damage.

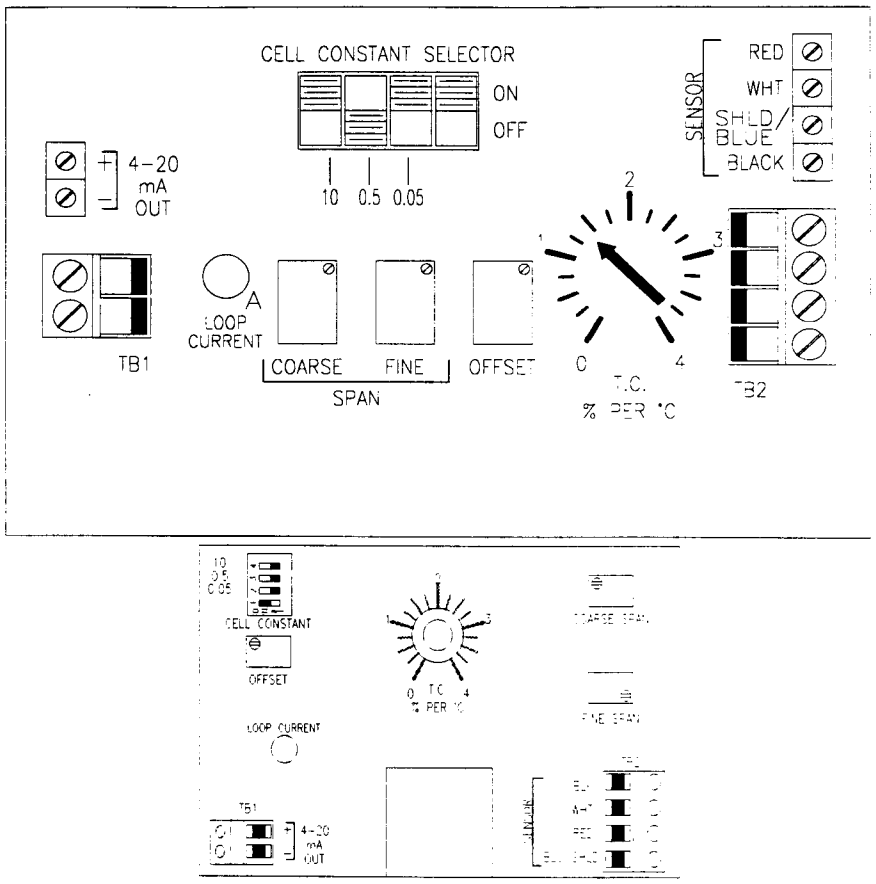
☞ ***NOTE:*** *Do not route sensor or interconnect cable in any conduit containing AC power wiring ("electrical noise" may interfere with the sensor signal).*

Directly Wiring Sensor to 697C2 Transmitter (no interconnect cable)

Refer to Figure 2-2 and connect sensor cable wires to "SENSOR" terminals on TB2, matching colors as indicated. Always connect the outer shield wire (clear with black band) to a known earth ground, and the clear-only inner shield wire to the "SHLD/BLUE" terminal. Do not connect the shields together.

☞ ***NOTE:*** *When using the optional enclosure, the green ground-strap wire for interior shielding must remain connected to the "SHLD/BLUE" terminal after the sensor wires have been connected.*

Do not connect interior shielding of the optional enclosure to earth ground. Plastic fittings are purposely provided to prevent ground loops from occurring. Ground loops may cause measuring errors.



Transmitter with Non-isolated Output

Transmitter with Isolated Output

Figure 2-2 Location of Electrical Terminals and Transmitter Controls

Indirectly Wiring Sensor Using Interconnect Cable and Junction Box

- In the junction box, connect the sensor cable wires to the interconnect cable wires, including the inner and outer shield wires, by matching colors. Do not connect either shield wire to earth ground.

- At the transmitter, connect the interconnect cable wires to "SENSOR" terminals on TB2, matching colors as indicated. Always connect the outer shield wire (clear with black band) to a known earth ground, and the clear-only inner shield wire to the "SHLD/BLUE" terminal. Do not connect the shields together.

3.2 Power Supply

Connect the power supply to the "4-20 mA OUT" terminals on TB1, matching polarity as indicated.

3.3 Load Device (optional)

A recorder, display, or other load device may be connected in the 4-20 mA loop. Connect the load in series with the power supply and transmitter (see Figure 2-3). The maximum load (in ohms) that can be driven is dependent on the power supply voltage used to power the loop. This can be calculated using the following formula:

Max. Allowable Load (ohms) = (Pwr. Sup. Voltage - 14.6) x 50

Example: Suppose the power supply voltage is 24 VDC.

Max. Allowable Load = (24 - 14.6) x 50 or 470 ohms

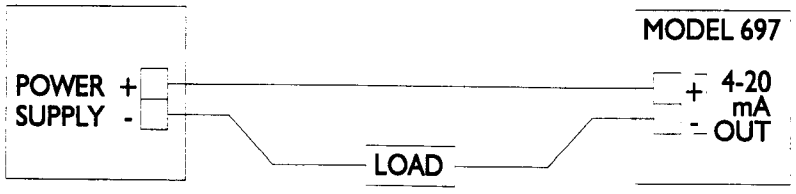


Figure 2-3 Wiring Arrangement for Load in 4-20 mA Loop

PART THREE - OPERATION

SECTION 1
THE USER INTERFACE

All switches and controls used for the CDTX680 operation are described in this section. Familiarize yourself with each item before operating the instrument.

☞ ***NOTE:*** *All controls, except the **T.C. % PER °C** control, are "20-turn" potentiometers that do not have mechanical stops at their adjustment range endpoints. To adjust these controls to an endpoint, slowly turn the adjustment screw in only one direction 20 complete turns, or until a "soft clicking" sound is heard.*

1.1 OFFSET Control

The **OFFSET** control compensates for sensor signal offset error. During calibration, this control is adjusted so that the transmitter output is 4.00 mA at the low endpoint of the measuring range. See Part Three, Section 2.5 for details.

1.2 FINE/COARSE SPAN Controls

The **FINE SPAN** control compensates for sensor signal span error. During calibration, the **COARSE SPAN** control is adjusted so that the transmitter output approximately corresponds to a specific value with the sensor in a known conductivity reference solution. The **FINE SPAN** control readjusts the transmitter output exactly. See Part Three, Section 2.6 for details.

1.3 CELL CONSTANT SELECTOR Switches

This block of four individual ON/OFF slide switches sets the transmitter to operate with the specific cell constant of the sensor it is being used with. See the matrix below for the switch positions corresponding to the desired cell constant.

For Sensor with a Cell Constant of:	**CELL CONSTANT SELECTOR** Switches			
	No. 4	No. 3	No. 2	No. 1
10	On	Off	Off	Off
0.5	Off	On	Off	Off
0.05	Off	Off	On	Off

☞ ***NOTE:*** *The switch corresponding to the cell constant must always be in the "on" position. All other switches must be in the "off" position. Example: The switch settings shown in Figure 2-2 for the transmitter version with non-isolated output are set for a 0.5 cell constant.*
Only change switch positions when changing to a sensor with a different cell constant.

1.4 T.C. % PER °C Control

This control sets the amount of linear temperature compensation (0.0-4%) applied to the measurement system.

1.5 LOOP CURRENT Indicator (red)

This indicator lights whenever the transmitter is powered and operating.

NOTE: *The light intensity of the indicator varies as loop current varies; it glows brighter as loop current increases.*

SECTION 2

CALIBRATING/MODIFYING MEASURING RANGE

Calibrate the instrument at initial startup, and periodically thereafter, with a conductivity reference solution to maintain measurement accuracy.

Recommendation: Establish a scheduled maintenance program to keep the sensor clean and the instrument calibrated. The time period between scheduled maintenance (days, weeks, etc.) is affected by the characteristics of the process solution and can only be determined by operating experience. For example, a sensor operating in a solution containing oil and/or grease will require more frequent cleaning compared with a sensor operating in a cleaner solution.

The procedure to calibrate the transmitter or to establish a new measuring range is divided into subsection categories 2.1 through 2.6. This procedure requires a digital milliammeter, a clean sensor, and a freshly prepared conductivity reference solution.

Connecting Milliammeter

Connnect a digital milliammeter in series with the power supply and transmitter to monitor the loop current. Refer to Figure 3-1 below for details.

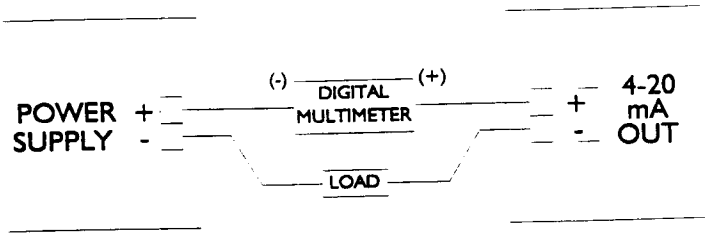


FIGURE 3-1 Milliammeter Connections for Calibration

2.2 Initial Control Settings

Before calibrating the instrument, place the following controls and switches to these settings:

Control	Setting
OFFSET control	Do not set now*
COARSE SPAN control	Do not set now*
FINE SPAN control	Mid-range**
CELL CONSTANT SELECTOR switches	See Section 1.3
T.C. % PER °C control	See Section 2.3

* This control will be correctly set later in the calibration procedure.

** To set this control to its mid-range position, turn it in one direction 20 complete turns (or until a soft clicking sound is heard). Then turn it 10 complete turns in the opposite direction.

2.3 Setting Temperature Compensation Factor

Most aqueous solutions contain many contaminants. The temperature compensation factor for general applications is typically 2.0% per °C (factory-set value). If desired, specifically set the **T.C. % PER °C** control to a temperature compensation factor for your application requirements. Use the "approximate method" or, for highest accuracy, the "process matching method."

Approximate Method (moderately accurate)

If the composition of the process is known and consists of only one component, set the temperature compensation factor to a value other than the factory setting of 2.0% per°C.

Table A below lists factors for some of the common process solution contaminants. After setting the control, proceed with Section 2.4.

Table A -- SETTING FOR T.C. % PER °C CONTROL

Type of Process Solution Contaminant		Setting
Bases	sodium hydroxide	1.9
	sodium carbonate	2.5
	ammonia	1.4
Acids	hydrochloric	1.5
	sulfuric	1.5
	nitric	1.5
	phosphoric	1.1
Salts	sodium chloride	2.1
	sodium sulfate	2.4
	sodium nitrate	2.2
	potassium chloride	2.0

Process Matching Method (highly accurate)

1. Rinse the sensor with distilled water and place it in a sample of process solution that is at 25°C (ambient temperature). Note the milliammeter reading.

2. Increase the temperature of the same sample of process solution to 50°C. Adjust the **T.C. % PER °C** control until the milliammeter indicates the noted reading in step 1. After setting the control, proceed with Section 2.4.

2.4 Preparing Conductivity Reference Solutions

For best calibration accuracy, use a conductivity reference solution with a value close to the normal process value or between 80 and 100% of the full measuring range. Prepare the conductivity reference solution using your normal method, or by adding the listed grams of pure, dried sodium chloride (NaCl) shown in Table B to one liter of high purity, de-ionized, CO_2-free water at 25°C to obtain the listed conductivity. Solutions of lower conductivity can be made by dilution using distilled water.

Table B -- CONDUCTIVITY CALIBRATION REFERENCE SOLUTIONS

Grams Salt Added To Distilled Water	Desired Solution Value		
	µS/cm	mS/cm	ppm (NaCl)*
0.05	100	0.10	50
0.10	200	0.20	100
0.25	500	0.50	250
0.50	1000	1.00	500
1.01	2000	2.00	1010
1.53	3000	3.00	1530
2.06	4000	4.00	2060
2.61	5000	5.00	2610
4.34	8000	8.00	4340
5.56	10,000	10.00	5560
11.59	20,000	20.00	11,590

*When using a ppm measuring range for compounds other than NaCl, consult an appropriate chemistry handbook for reference solution information.

2.5 Adjusting OFFSET Control

Make sure that the sensor is dry before starting. Holding the sensor in air, adjust the **OFFSET** control until the milliammeter exactly indicates "4.00 mA." Proceed with Section 2.6.

2.6 Adjusting SPAN Controls

When the sensor is placed in a conductivity reference solution, the transmitter provides a mA output value corresponding to the solution value. Transmitters with different measuring ranges provide different mA output values for the same conductivity reference solution.

1. **Determining Transmitter Output Value:** When using a reference solution with a value equal to the high endpoint of the measuring range, the transmitter output value

should always be "20.00 mA." If the reference solution value is not equal to the high endpoint of the measuring range, calculate the transmitter output value for that solution by using the following equation:

mA = 4 + (16 x Reference Solution Value ÷ Measuring Range High Endpoint)

Example: Suppose the transmitter measuring range is 0-10,000 µS/cm, and the reference solution value is 8,000 µS/cm. The calculated mA value would be:

mA = 4 + (16 x 8,000 ÷ 10,000) or
mA = 4 + (16 x 0.8) or
mA = 4 + (12.8) or 16.8 mA

2. **Immersing Sensor:** Thoroughly rinse the clean sensor in de-ionized water. Then immerse the sensor in the conductivity reference solution. **Important:** Allow the sensor and solution temperatures to equalize. Depending on their temperature differences, this may take several minutes.

3. **Adjusting SPAN Controls:** Adjust the **COARSE SPAN** control until the milliammeter approximately indicates "20.00 mA" (or the proper mA value calculated in step 1). Now adjust the **FINE SPAN** control until the milliammeter exactly indicates "20.00 mA" (or the calculated mA value).

This completes calibration (or modifying the transmitter measuring range).

PART FOUR - SERVICE AND MAINTENANCE

SECTION 1
GENERAL INFORMATION

1.1 Inspecting Sensor Cable

If a measurement problem exists and you suspect the sensor cable, inspect it for physical damage. If an interconnect cable is used, disconnect it at both ends and check its wires for internal shorts using an ohmmeter.

1.2 Checking System Periodically

Depending on application conditions, system calibration should be performed periodically to maintain measurement accuracy.

SECTION 2
PRESERVING MEASUREMENT ACCURACY

2.1 Keeping Sensor Clean

To maintain measurement accuracy, periodically clean the sensor. Operating experience will help you determine when to clean the sensor. Use the recommended procedure described in the sensor operating instruction manual.

2.2 Keeping Transmitter Calibrated

Depending on the circumstances of the application, periodically calibrate the transmitter using the procedures described in Part Three, Section 2 to maintain measurement accuracy.

Maintenance Tip! Upon startup, frequently check the system until operating experience can determine the optimum time between calibrations that provides acceptable measurement results.

2.3 Avoiding Electrical Interference

Do not run the sensor cable (and interconnect cable, if used) in the same conduit with AC power wiring.

Maintenance Tip! Excess cable should not be coiled near motors or other equipment that may generate electrical or magnetic fields. Cut cables to proper length during installation to avoid unnecessary inductive pickup ("electrical noise" may interfere with sensor signal).

SECTION 3
TROUBLESHOOTING

3.1 Checking System Elements to Isolate the Problem

A few simple checks can determine if the measuring system is operating properly. This section is intended to isolate the problem to a particular element of the system, and provide recommendations on corrective action. The typical measuring system consists of four elements:

- Sensor
- Transmitter
- 4-20 mA Signal Transmission Cable
- Power Supply

Table C lists common symptoms, their probable cause(s), and recommended action to correct the problem:

Table C -- TROUBLESHOOTING COMMON PROBLEMS

Common Symptoms	Probable Cause	Recommended Corrective Action
Transmitter does not provide any output (**LOOP CURRENT** indicator does not light).	Improper electrical connections from the power supply to the transmitter.	Verify electrical connections from the power supply to the transmitter. Correct wiring as needed.
	No voltage or incorrect voltage is applied to the transmitter. Voltage should be between 16 and 40 VDC.	Verify and/or apply power to the power supply. If power is applied and incorrect voltages persists, contact the supplier of the power supply.
	Inoperative transmitter.	Contact our Customer Service Department.
The 4-20 mA loop current stays at a value between 2.00 mA and 4.00 mA.	Improper electrical connections from the sensor.	Check electrical connections from the sensor to the transmitter. Correct wiring as needed.
	Inoperative sensor or transmitter.	Contact our Customer Service Department.
The 4-20 mA loop current stays at or above 20.00 mA.	Improper electrical connections from the sensor.	Check electrical connections from the sensor to the transmitter. Correct wiring as needed.
	Measured conductivity value is above the high endpoint of the transmitter measuring range.	Check the process conductivity value using a portable meter. Also check the transmitter **CELL CONSTANT SELECTOR** switches. Change the transmitter switch setting if necessary (see Part Three, Section 2 for details).
	Transmitter is improperly calibrated.	Recalibrate the transmitter (see Part Three, Section 2 for details).
	Inoperative sensor or transmitter.	Contact our Customer Service Department.
Transmitter output value remains unchanged as process value changes.	Inoperative sensor.	Contact our Customer Service Department.

Table C -- TROUBLESHOOTING COMMON PROBLEMS (continued)		
Common Symptoms	Probable Cause	Recommended Corrective Action
The 4-20 mA loop has unexpected accuracy errors.	Sensor requires maintenance.	Perform sensor maintenance (see sensor operating instruction manual).
	Transmitter is not correctly calibrated.	Recalibrate the transmitter (see Part Three, Section 2 for details).
	Inoperative sensor.	Contact our Customer Service Department.
The 4-20 mA loop has unexpected stability errors.	Moisture and/or corrosion exists on the electrical connections.	Check all electrical connections. Remove any moisture and corrosion.
	Electrical noise exists.	Verify that installed electrical wiring complies with instructions in Part Two, Section 3.
	Sensor requires maintenance.	Perform sensor maintenance (see sensor operating instruction manual).
	Inoperative sensor or transmitter.	Contact our Customer Service Department.

3.3 Customer Assistance

If you need spare parts, assistance in troubleshooting, or repair service, please contact Omega's Customer Service Department at –1-800-622-2388 Ext: 2208

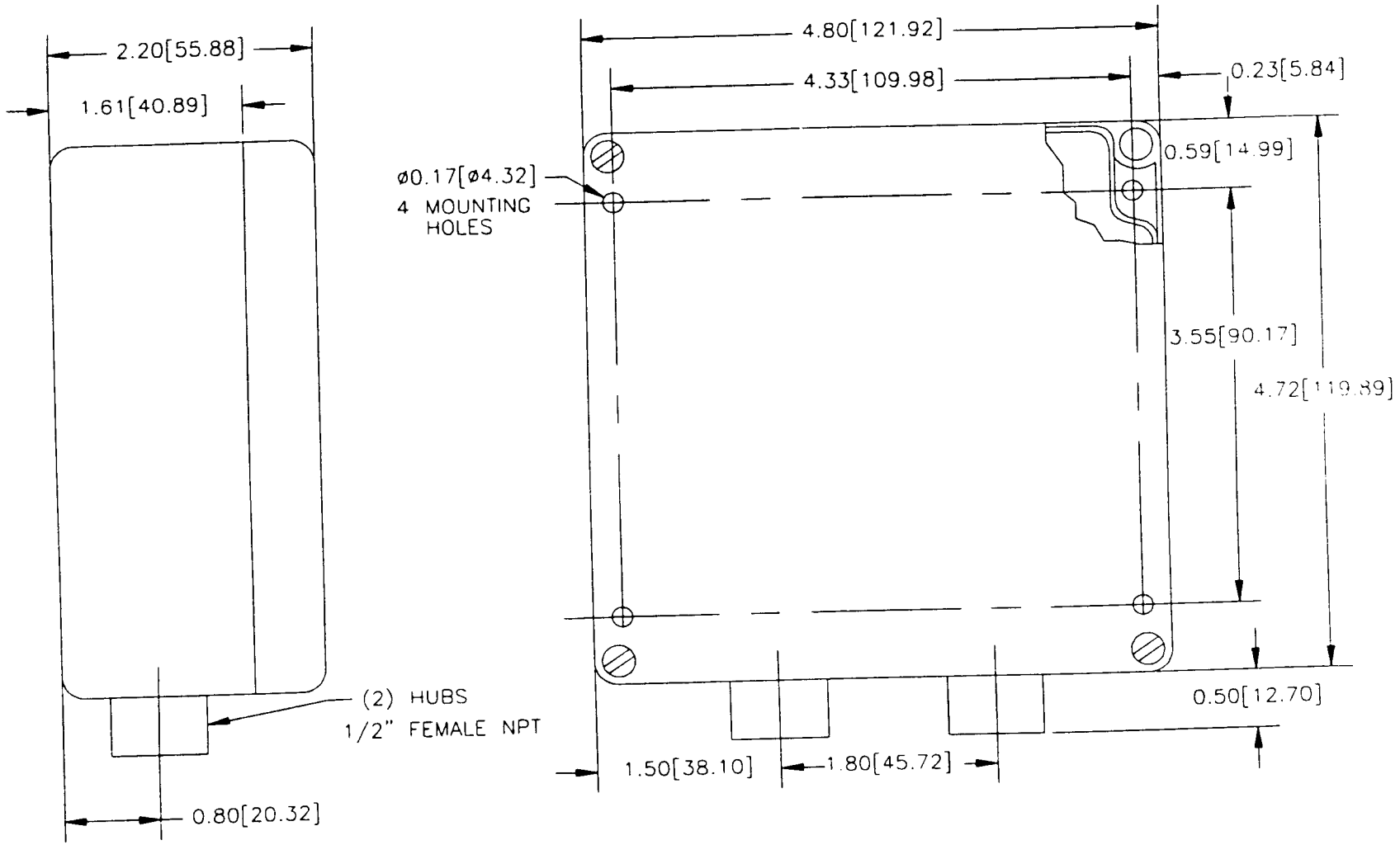
When ordering spare or replacement parts, be sure to use the complete part number.

All transmitters returned for repair must be freight prepaid and include the following information:

1. A clearly written description of the malfunction.
2. Name of person to contact and the phone number they can be reached.
3. Proper return address for shipping transmitter(s) back. Include preferred shipping method (UPS, Federal Express, ect.) if applicable.
4. A purchase order if the transmitter is out of warranty to cover cost of repair.

NOTE: If the transmitter is damaged during return shipment because of inadequate packing, the customer is responsible for any resulting repair costs. (**Recommendation**: Use the original shipping carton or an equivalent.

Also, Omega will not accept transmitters returned for repair or replacement unless they are thoroughly cleaned.



NOTES: 1) DIMS ARE: INCHES [mm]

2) ENCLOSURE–POLYCARBONATE
HUBS–PVC