OPERATING MANUAL

PRO-series Model E3
Electrodeless Conductivity
Transmitter

(for conductivity, % concentration, and TDS measurement)

Worldwide Headquarters and Sales:

GLI International, Inc.
9020 West Dean Road
Milwaukee, Wisconsin 53224
U.S.A.

Phone: [414] 355-3601
Fax: [414] 355-8346
E-mail: info@gliint.com
Web: www.gliint.com

A2852 ISO 9001
GLI INTERNATIONAL, INC.

In the interest of improving and updating its equipment, GLI reserves the right to alter specifications to equipment at any time.

This operating manual and other GLI operating manuals are available on GLI's web site at gliint.com when viewed using Adobe's free Acrobat reader. To get this reader, link to Adobe through GLI's web site or visit Adobe's web site at adobe.com.

WARRANTY

GLI International, Inc. warrants the PRO-series Model E3 to be free from defects in material or workmanship for a period of 2 years (24 months) from the date of shipment of this product from our facility. A warranty claim will not be honored if defects are not reported within the warranty period, or if GLI International determines that defects or damages are due to normal wear, misapplication, lack of maintenance, abuse, improper installation, alteration, or abnormal conditions. GLI International's obligation under this warranty shall be limited to, at its option, replacement or repair of this product. The product must be returned to GLI International, freight prepaid, for examination. The product must be thoroughly cleaned and any process chemicals removed before it will be accepted for replacement or repair. GLI International's liability shall not exceed the cost of the product. Under no circumstances will GLI International be liable for any incidental or consequential damages, whether to person or property. GLI International will not be liable for any other loss, damage or expense of any kind, including loss of profits, resulting from the installation, use, or inability to use this product.

Declaration of Conformity

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: GLI International, Inc.

Manufacturer's Address: 9020 West Dean Road
P.O. Box 245022
Milwaukee, Wisconsin 53224, USA

declares that the products:

Product Names: PRO-series pH/ORP Transmitter
PRO-series Dissolved Oxygen Transmitter
PRO-series Electrodeless Conductivity Transmitter
PRO-series Contacting Conductivity Transmitter
PRO-series Flow Transmitter

Model Numbers: PRO-P3xxx, PRO-D3xxx, PRO-E3xxx, PRO-C3xxx, PRO-F3xxx

conforms to the following Product Specifications:

EMC: **EN 50081-2 : 1993**
Generic Emission Standard (Industrial Environment)

EN 55011 : 1998 / CISPR 11 : 1999		Group 1, Class A

EN 61000-6-2 : 1999
Generic Immunity Standard (Industrial Environment)

EN 61000-4-2 : 1995 -	ESD Immunity	4 kV CD, 8kV AD
EN 61000-4-3 : 1997 -	Radiated Immunity	10 V/m, 80% AM (1 kHz)
EN 61000-4-4 : 1995 -	EFT/B Immunity	1.0 kV Signal & Power Lines
EN 61000-4-6 : 1996 -	Conducted Immunity	10 V, 80% AM (1 kHz)

Supplementary Information:

The products herewith comply with the requirements of the following directives and carry the CE marking accordingly:

EMC Directive 89/336/EEC

Products were tested in typical configurations. Specific test configurations and results are published in L.S. Compliance's Test Report Numbers: 301140, 301222, 301256 and EMC Testing Wisconsin's Test Report Number 00340.

These devices comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

These devices comply with U.S. UL Standard 1604 (USL) and Canadian National Standard C22.2 No. 213-M1987 (CNL). All devices are UL Listed (Control Number 9NX6) and hold a Class I, Division 2, Groups A, B, C, and D Hazardous Locations rating.

For Compliance Information ONLY, contact:

Product Regulations Manager
GLI International
9020 West Dean Road
Milwaukee, Wisconsin 53224, USA

IMPORTANT SAFETY INFORMATION

Please read and observe the following:

- The transmitter can be located in a Class I, Division 2, Group A, B, C or D hazardous area.
- Since the transmitter is powered by only low DC voltage, it is completely safe to handle.
- Install the transmitter in accordance with relevant local codes and instructions contained in this operating manual. Also, note and comply with the transmitter's technical specifications and ratings.
- 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 158°F (70°C).
- Only qualified personnel should perform wiring or repairs, and only when the transmitter is not powered.

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.

WARNING:

A WARNING LOOKS LIKE THIS. IT WARNS YOU OF THE POTENTIAL FOR PERSONAL INJURY.

CAUTION:

A CAUTION LOOKS LIKE THIS. IT ALERTS YOU TO POSSIBLE INSTRUMENT MALFUNCTION OR DAMAGE.

☞ ***NOTE:*** *A note looks like this. It alerts you to important operating information.*

CONDENSED OPERATING INSTRUCTIONS

This manual contains details for all operating aspects of the instrument. The following condensed instructions are provided to assist you in getting the instrument started up and operating as quickly as possible. **These condensed instructions only pertain to basic conductivity measurement operation.** To measure % concentration or TDS, or to use specific features of the instrument, refer to the appropriate sections in this manual for instructions.

A. CONNECTING SENSOR/CONFIGURING TEMPERATURE ELEMENT TYPE

1. After properly mounting the transmitter (PART TWO, Section 2), connect the GLI electrodeless conductivity sensor, matching wire colors to terminals as indicated:

Sensor Wire Colors	Connect To TB2
White	Terminal 1
Blue	Terminal 2
Clear	Terminal 3
Black	Terminal 3
Red	Terminal 4
Yellow	Terminal 5
—	Terminal 6 (unused)
Green	Terminal 7

2. The transmitter is factory-set for automatic temperature compensation using the Pt 1000 ohm temperature element built into GLI electrodeless conductivity sensors. If you want fixed MANUAL temperature compensation, change the temperature element type to "MANUAL" and enter a temperature. For details, see PART THREE, Section 3.2, subheading "Select TEMP ELEMENT Type."

B. CONNECTING DC POWER

Refer to PART TWO, Section 3.2, 3.3, 3.4, or 3.5 to connect DC power to the transmitter.

C. CALIBRATING THE TRANSMITTER

The transmitter must be calibrated so that measured values will correspond to actual process values. Preferably, use the "COND CAL" calibration method to enter the known value of a properly prepared conductivity reference solution. (To calibrate with a sample of the process, use the "SAMPLE CAL" method to enter its known value determined by laboratory analysis or a comparison reading.)

Calibration Tip! Each electrodeless conductivity sensor has a unique zero point and span. Consequently, when calibrating a sensor for the first time, always zero it according to step 1. Zeroing provides the best possible measuring accuracy.

NOTE: *An in-progress calibration can always be aborted by pressing the **ESC key**. After the "ABORT: YES?" screen appears, do one of the following:*

- *Press **ENTER key** to abort. After the "CONFIRM ACTIVE?" screen appears, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).*
- *Use ⇧ **or** ⇩ **key** to choose "ABORT: NO?" screen, and press **ENTER key** to continue calibration.*

1. Zero the sensor if it is being calibrated for the first time. If not, disregard this step and perform steps 2 through 13.

Zeroing Tip! If the "ZERO: CONFIRM FAILURE?" screen appears at any time during zeroing, press **ENTER key** to confirm. Then, use the ⇧ **or** ⇩ **key** to select between "CAL: EXIT" or "CAL: REPEAT" and do one of the following:

(continued on next page)

CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE TRANSMITTER -- (continued)

- With "ZERO? (CAL: EXIT)" selected, press **ENTER key**. After the "ZERO: CONFIRM ACTIVE?" screen appears, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).
- With "ZERO? (CAL: REPEAT)" selected, press **ENTER key** to repeat zeroing.

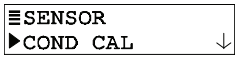
A. Make sure that the sensor is dry before zeroing.

B. Press **MENU key** to display a "MAIN MENU" screen. If the 

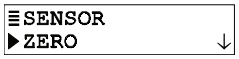
screen is not showing, use ⇧ **or** ⇩ **key** to display it.

C. Press **ENTER key** to display 

.

D. Press **ENTER key** again to display 

.

E. Press ⇩ **key** twice to display 

.

F. Press **ENTER key** to display the "ZERO: IN DRY AIR?" screen.

G. With the dry sensor held in air, press **ENTER key** again to start automatic zeroing. (During zeroing, the analog output is automatically "held" at the last measured value.)

H. After the "ZERO: CONFIRM CAL OK" screen appears, press **ENTER key** to end zeroing.

I. After the "ZERO: CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).

2. Prepare a reference solution that has a conductivity value within the measuring range that you set for the transmitter. For best accuracy, the value of the solution should be near the typical measured process value. For details on preparing a solution, refer to step 1 and TABLE E in PART THREE, Section 4.3, subsection "COND CAL Method."

3. Thoroughly rinse the clean sensor in de-ionized water. Then immerse the sensor in the prepared reference solution. **Important: Allow the sensor and solution temperatures to equalize.** Depending on their temperature differences, this may take up to 30 minutes.

NOTE: *Suspend the sensor to prevent it from touching the container.* ***Simply laying it into the container will produce calibration error.***

Calibration Tip! If the "COND CAL: CONFIRM FAILURE?" screen appears at any time during calibration, press **ENTER key** to confirm. Then, use the ⇧ **or** ⇩ **key** to select between "CAL: EXIT" or "CAL: REPEAT" and do one of the following:

- With "COND? (CAL: EXIT)" selected, press **ENTER key**. Then, after the "COND CAL: CONFIRM ACTIVE?" screen appears, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).
- With "COND? (CAL: REPEAT)" selected, press **ENTER key** to repeat calibration of the point.

(continued on next page)

CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE TRANSMITTER -- (continued)

4. Press **MENU key** to display `≡MAIN MENU ▶CALIBRATE ↓`.

5. Press **ENTER key** to display `≡CALIBRATE ▶SENSOR ↓`.

6. Press **ENTER key** again to display `≡SENSOR ▶COND CAL ↓`.

7. Press **ENTER key** again to display `SET REF TEMP? (25.0°C )`. The default 25°C reference temperature is suitable for most applications. For another reference, use **arrow keys** to adjust to a different temperature. In either case, press **ENTER key** to continue.

   NOTE: *During calibration, the analog output is automatically "held" at the last measured value.*

8. After a screen like `SET SLOPE? (2.00 %/°C )` appears, use **arrow keys** to adjust the slope value to match the known slope of the reference solution, and press **ENTER key** to enter it.

   NOTE: *Measured values are normally compensated using the configured temperature compensation method. However, during calibration the measured value is linearly compensated by the entered reference temperature and slope value of the reference solution.*

9. With the sensor in solution and the `COND CAL: SAMPLE READY?` screen displayed, press **ENTER key** to confirm. This active `XXXX uS/cm READING STABLE?` screen appears showing the measured reference solution value.

10. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static `COND CAL? (XXXX uS/cm )` screen appears showing the "last-measured" value.

11. Use **arrow keys** to adjust the "last-measured" value to exactly match the known value of the reference solution, and press **ENTER key** to it and complete calibration ("CONFIRM CAL OK?" screen appears).

12. Re-install the sensor into the process.

13. Press **ENTER key** to display the active measurement reading on the "CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "COND CAL" calibration. The transmitter is now ready to measure conductivity.

NOTE: *To change the display format of the MEASURE screen (for example from 0-2000 µS/cm to 0-2.000 mS/cm), refer to PART THREE, Section 3.2, subheading "Select DISPLAY FORMAT."*

D. COMPLETING TRANSMITTER CONFIGURATION

To further configure the transmitter to your application requirements, use the appropriate CONFIGURE screens to make selections and "key in" values. Refer to PART THREE, Section 3 for complete configuration details.

TABLE OF CONTENTS

PART ONE - INTRODUCTION

PART TWO - INSTALLATION

PART THREE - OPERATION

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

PART FOUR - SERVICE AND MAINTENANCE

TABLE OF CONTENTS (continued)

ILLUSTRATIONS

TABLES

PART ONE - INTRODUCTION

SECTION 1
GENERAL INFORMATION

1.1 Capability Highlights

Sensor Input

The transmitter can be used with any GLI Model 3700E-series electrodeless conductivity sensor. These sensors have a built-in Pt 1000 RTD temperature compensator element.

MEASURE Screen

The MEASURE screen (normal display mode) can provide different readouts of measured data. With the MEASURE screen displayed, press ⇦ **or** ⇨ **key** to show:

- Measured conductivity, % concentration or TDS
- Measured temperature (°C or °F)
- Measured conductivity, % concentration or TDS and temperature
- Measured analog output value (mA)
- Uncompensated conductivity corresponding to concentration read-out (only shown when transmitter is set to measure concentration)

Passcode-protected Access

For security, you can enable a passcode feature to restrict access to configuration and calibration settings to authorized personnel only. See PART THREE, Section 3.5 for details.

Calibration Methods

Because each sensor has a unique zero point and span, always ZERO the sensor in air when calibrating it for the first time (PART THREE, Section 4.2). Depending on the configured measurement (conductivity, % concentration or TDS), different methods are available for calibrating sensor span (see Section 4.3, 4.4 or 4.5 respectively). The analog output loop can also be calibrated (Section 4.6).

Analog Output

The transmitter's isolated 4-20 mA analog output can be assigned to represent one of these:

- Measured conductivity, % concentration or TDS
- Measured temperature.

Parameter values can be entered to define the endpoints at which the 4 mA and 20 mA analog output values are desired (range expand). For analog output setup details, see PART THREE, Section 3.4.

NOTE: *During calibration, the analog output is automatically held at the last measured value and, upon completion, returned to its active state.*

1.2 Transmitter Safety

The transmitter is completely safe to handle. Only low DC voltage is present.

NOTE: *The transmitter can be located in a Class 1, Div. 2 hazardous area.*

1.3 Retained Configuration Values

All user-entered configuration values are retained indefinitely, even if power is lost or turned off. The non-volatile transmitter memory does not require battery backup.

1.4 Transmitter Serial Number

A label with the transmitter model number, serial number, and build date is located between the terminal blocks.

1.5 EMC Conformance

The transmitter is designed to provide protection from most normally encountered electromagnetic interference. This protection exceeds U.S. standards and meets European IEC 1000 (EN 61000) series testing for electromagnetic and radio frequency emissions and immunity. Refer to Figure 1-1 and the specifications in Section 2.1 for more information.

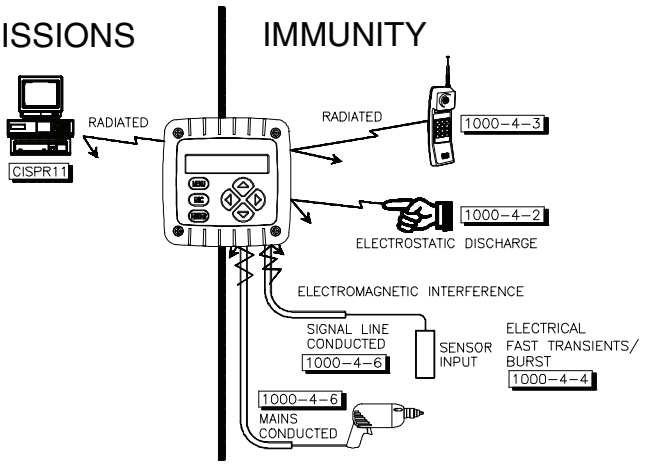


FIGURE 1-1 EMC Diagram

SECTION 2
SPECIFICATIONS

2.1 Operational

Display ..... Two-line by 16 character LCD

NOTE: *The measured value (conductivity, % concentration or TDS) and temperature can be displayed separately or shown together on a single screen. The corresponding 4-20 mA analog output value can also be shown. (When measuring concentration, the transmitter can also show a corresponding readout of uncompensated conductivity.)*

Measurement	Ranges
Conductivity	µS/cm: 0-200.0 or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0 or 0-2000 S/cm: 0-2.000
% Concentration	0-99.99% or 0-200.0%
TDS	0-9999 ppm
Temperature	-4.0 to 392.0°F or -20.0 to +200.0°C
Analog Output	4.00-20.00 mA

Ambient Conditions:

Operation	-4 to +140°F (-20 to +60°C); 0-95% relative humidity, non-condensing
Storage	-22 to +158°F (-30 to +70°C); 0-95% relative humidity, non-condensing

Temperature Compensation ..... Automatic from 14.0 to 392.0°F (-10.0 to +200.0°C) with selection for Pt 1000 ohm RTD temperature element, or manually fixed at a user-set temperature

NOTE: *The selected measurement (conductivity, % conc. or TDS) determines which of the following temperature compensation methods are available:*

Linear % per °C slope, built-in natural water temperature properties table, user-entered temperature table, or no compensation

Sensor-to-Transmitter Distance .. Maximum cable length is a function of the measuring range and allowable non-linearity. The following schedule is recommended:

Full-scale Range	Max. Length
200 to 2000 µS/cm	200 ft. (61 m)
2000 to 2,000,000 µS/cm	300 ft. (91 m)

NOTE: *When measuring % concentration, convert the transmitter full-scale value to conductivity to determine the maximum distance.*

Power Requirements (Class 2 Power Supply):

Two-wire Hookup	16-30 VDC
Three-wire Hookup	14-30 VDC (16 VDC min. with RS-485 comm.)
Four-wire Hookup	12-30 VDC (16 VDC min. with RS-485 comm.)

Calibration Methods:

Sensor ZERO (all measurements)	With the dry sensor in air, press keys to initiate automatic system zeroing

Conductivity Measurement:

COND CAL	Enter compensation reference temperature, and reference solution's known linear % per °C slope and value
SAMPLE CAL	Enter one sample value (determined by laboratory analysis or a comparison reading)

Concentration Measurement:
- CONC CAL ..... Enter one sample value (determined by laboratory analysis or a comparison reading)
- COND CAL ..... Enter compensation reference temperature, and reference solution's known linear % per °C slope and value

TDS Measurement:
- TDS CAL ..... Enter one sample value (determined by laboratory analysis or a comparison reading)

Analog Output ..... Isolated 4-20 mA output with 0.004 mA (12-bit) resolution

NOTE: *The output can be assigned to represent the measured value (conductivity, % concentration or TDS) or measured temperature. Parameter values can be entered to define the endpoints at which the 4 mA and 20 mA output values are desired (range expand). During calibration, the output is automatically held at the last measured value and, upon completion, returned to its active state.*

Maximum Loop Load ..... Dependent on power supply voltage, transmitter hookup arrangement, and wire resistance (see load resistance charts for respective hookup diagrams in PART TWO, Section 3.2, 3.3 or 3.4)

Memory (non-volatile) ..... All user settings are retained indefinitely without battery backup

Certifications:
- European Community EMC ..... Certified CE compliant for conducted and radiated emissions (EN 50081-2) and immunity (EN 61000-6-2)
- General Purpose ..... UL, C-UL, and FM
- Class 1, Div. 2 ..... UL, C-UL, and FM

2.2 Transmitter Performance (Electrical, Analog Outputs)

Accuracy* ..... ± 0.1% of span
Sensitivity* ..... ± 0.05% of span
Repeatability* ..... ± 0.05% of span
Temperature Drift* ..... Zero and Span: ± 0.02% of span per °C
Response Time ..... 1-60 seconds to 90% of value upon step change (with sensor filter setting of zero)

**These typical performance specifications are:*

1. *Based on 25°C with conductivity of 500 µS/cm and higher. Consult GLI for applications in which conductivities are less than 500 µS/cm.*
2. *Derated above 100°C to the maximum displayed temperature of 200°C. Consult GLI for details.*
3. *Radio frequency fields in the 700-800 MHz range can cause inaccurate results.*

2.3 Mechanical

Enclosure ..... Polycarbonate; NEMA 4X general purpose; choice of included mounting hardware

Mounting Configurations ..... Panel, wall, pipe or integral sensor mounting

Dimensions ..... With Back Cover:
3.75 in. W x 3.75 in. H x 2.32 in. D
(95 mm W x 95 mm H x 60 mm D)
Without Back Cover for Panel Mount:
3.75 in. W x 3.75 in. H x 0.75 in. D
(95 mm W x 95 mm H x 19 mm D)

Net Weight ..... 10 oz. (280 g) approximately

PART TWO - INSTALLATION

SECTION 1
UNPACKING

Unpack and examine the equipment even if you do not use it immediately. If there is evidence of damage, notify the transit carrier immediately. **Recommendation: Save the shipping carton and packing materials in case the instrument must be stored or re-shipped.**

SECTION 2
MECHANICAL REQUIREMENTS

2.1 Location

1. It is recommended to locate the transmitter as close as possible to the installed sensor. The maximum allowable distance between an installed sensor and the transmitter depends upon the full-scale value you set for the transmitter measuring range:

200-2000 µS/cm Full-scale Value	2000-2,000,000 µS/cm Full-scale Value
200 feet (61 m) max.	300 feet (91 m) max.

NOTE: *When measuring % concentration, convert the transmitter full-scale value to conductivity to determine the maximum distance.*

The transmitter can be located in a Class 1, Div.2 hazardous area.

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 (-4 to +140°F or -20 to +60°C).

CAUTION:

EXPOSING THE TRANSMITTER TO DIRECT SUNLIGHT MAY INCREASE THE OPERATING TEMPERATURE ABOVE ITS SPECIFIED LIMIT, AND DECREASE DISPLAY VISIBILITY.

2.2 Wall and Pipe Mounting

Figure 2-1 illustrates how to wall or pipe mount the transmitter using the supplied GLI hardware kit. Determine the mounting method, and attach the hardware as shown.

1. Fasten the wall/pipe adapter to the wall or pipe.
2. Using a blunt tool, open both cable entry knockout holes in the back cover.
3. Insert-and-twist the back cover onto the installed wall/pipe adapter, and tighten its two screws to lock back cover onto the adapter.
4. Attach transmitter to back cover using its four captive screws.

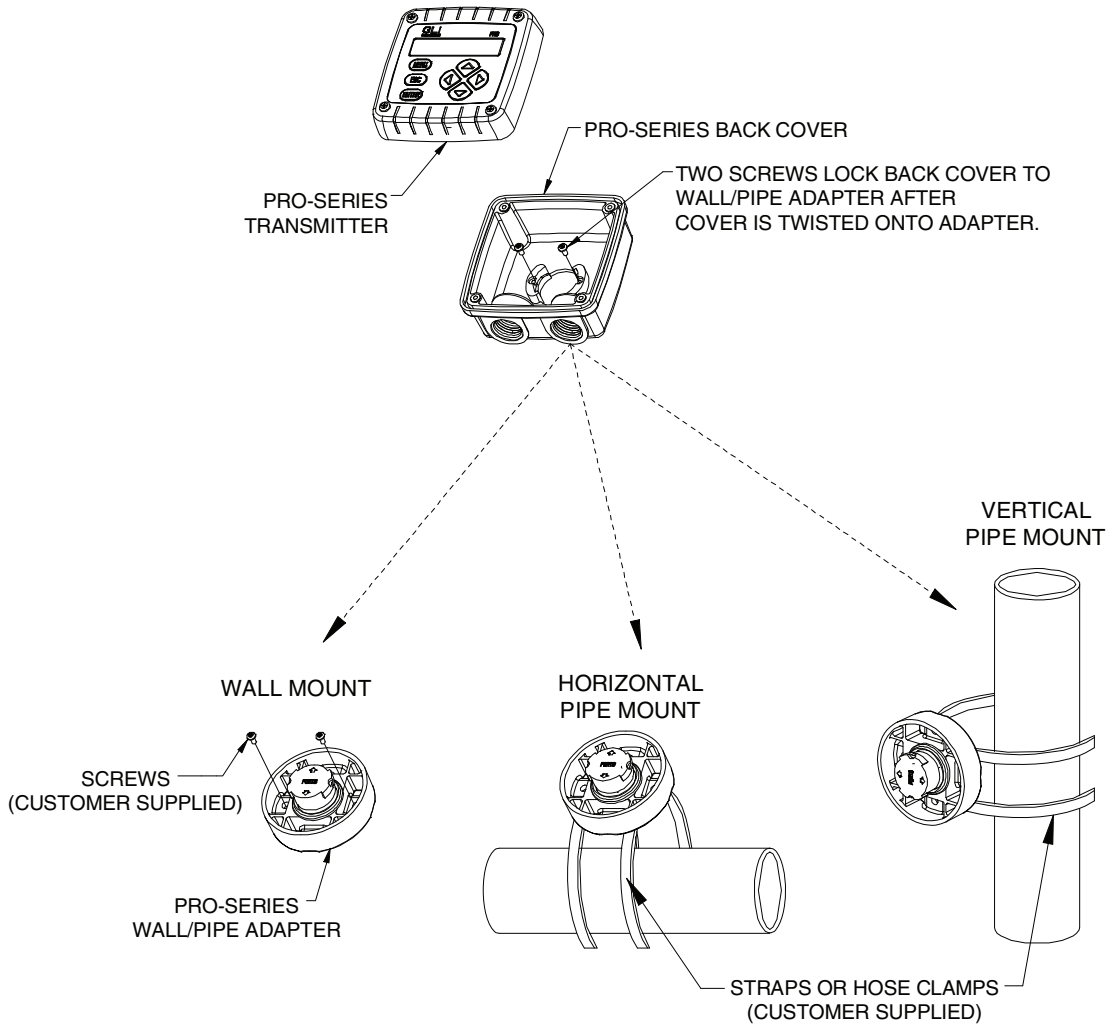


FIGURE 2-1 Wall and Pipe Mounting Details

2.3 Panel Mounting

Figure 2-2 illustrates how to panel mount the transmitter using the supplied GLI panel mount hardware kit.

1. Cut a 3.30-inch (84 mm) square cutout hole in panel.
2. Position panel-mount gasket over cutout in front of panel, and place retainer plate behind panel with its four threaded inserts facing away from back of panel.
3. Attach transmitter to retainer plate using its four captive screws.

NOTE: *If panel is too thick, remove captive screws from transmitter, and use longer screws provided in hardware kit.*

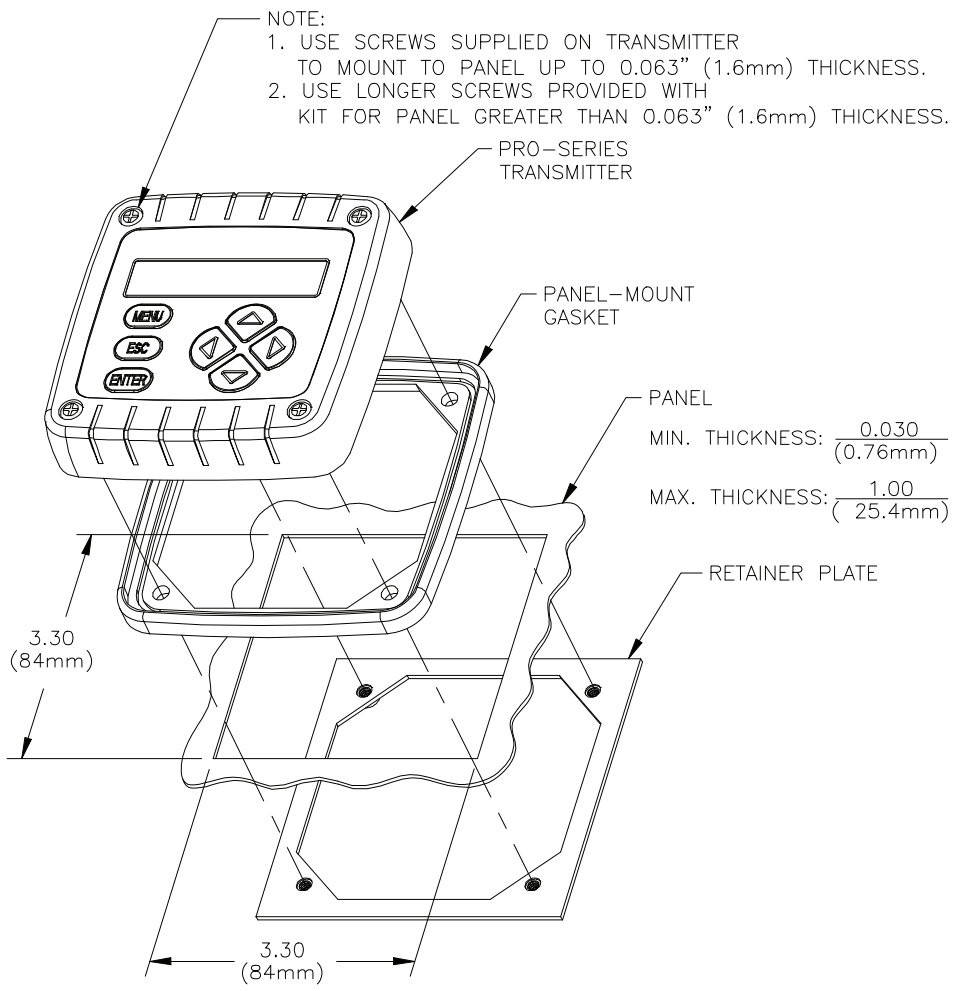


FIGURE 2-2 Panel Mounting Details

2.4 Integral Sensor Mounting

Figure 2-3 illustrates how to integrally mount the transmitter onto a sensor using the supplied GLI mounting hardware kit.

1. Using a blunt tool, open knockout hole in bottom of swivel ball for routing the sensor cable.

2. Attach swivel-mount assembly onto back end of sensor using coupling provided with GLI sensor (only sensors with “PRO1” suffix in their part number) or an appropriately-sized coupling that you provide.

3. Insert-and-twist the back cover onto the installed swivel-mount assembly. Tighten its two screws to lock the back cover onto the swivel-mount assembly.

☞ ***NOTE:*** *To change mounting angle, loosen swivel-mount assembly by lifting tab on bottom of swivel nut. Position to desired angle and re-tighten swivel nut.*

4. Attach transmitter to back cover using its four captive screws.

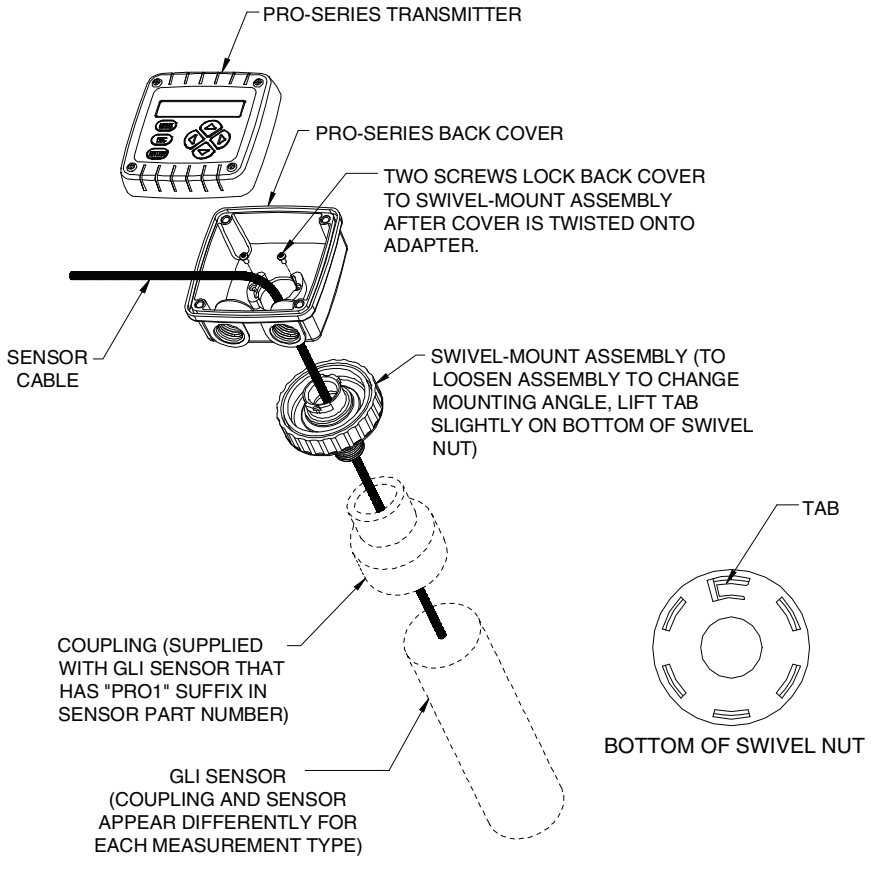


FIGURE 2-3 Integral Sensor Mounting Details

SECTION 3
ELECTRICAL CONNECTIONS

Figure 2-4 shows the terminal block arrangement and terminal designations for the transmitter.

☞ ***NOTE:*** *All terminals are suitable for single wires up to 14 AWG (2.5 mm^2).*

☞ **Wiring Tip!** To comply with European Community (CE) electromagnetic compatibility requirements, follow these general wiring guidelines:

1. Locate transmitter as far as possible from motors and other non-CE certified devices with excessive electromagnetic emissions.
2. Use GLI-specified ferrites and cables. Failure to do so may eliminate compliance. **Locate all ferrites as close as possible to the transmitter.**
   - ◆ DC Power Supply Cable (GLI 1W0980 two-conductor plus shield): Connect cable shield to earth ground at the supply end. Loop cable 2-1/2 times through ferrite (Steward #28B0686-200, Fair-Rite Corp. #2643665702 or equivalent).
   - ◆ Analog mA Output Cable (four-wire hookup only -- GLI 1W0980 two-conductor plus shield): Connect cable shield to earth ground at the supply end. Loop cable 2-1/2 times through ferrite (Steward #28B0686-200, Fair-Rite Corp. #2643665702, or equivalent).

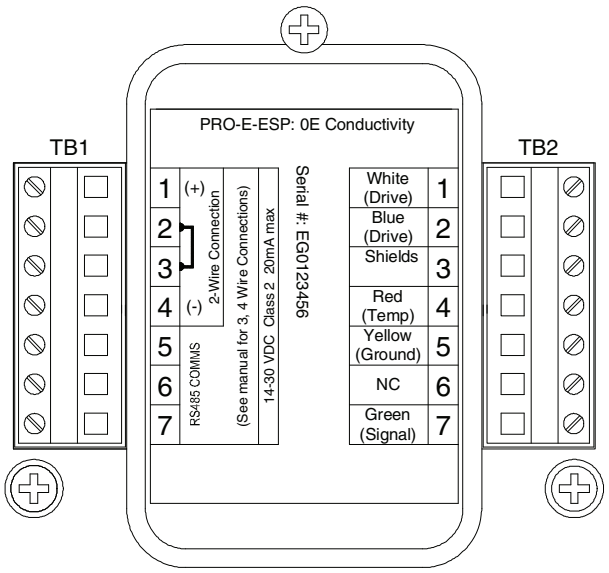


FIGURE 2-4 Transmitter Terminal Designations

3.1 GLI Electrodeless Conductivity Sensor

Depending on how transmitter is mounted, route the sensor (or interconnect) cable into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through left side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB2 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through swivel ball knockout hole and center hole in back cover. (Do not open left side cable entry knockout hole in back cover.)

☞ **Wiring Tip!** Route the sensor cable in 1/2-inch, grounded metal conduit to protect it from moisture, electrical noise, and mechanical damage.

For installations where the distance between sensor and transmitter exceeds the sensor cable length, indirectly connect the sensor to the transmitter using a junction box and interconnect cable.

☞ ***NOTE:*** *Do not route the sensor cable in any conduit containing AC or DC power wiring ("electrical noise" may interfere with the sensor signal). Also, always re-calibrate the system when the cable length between sensor and transmitter changes.*

Refer to Figures 2-5 and 2-5A and connect the sensor (or interconnect) cable wires as shown, matching colors as indicated. (Terminal 6 is unused.)

NOTE: *For systems not requiring CE compliance and lacking an earth ground, connect the outer shield to Terminal 3 on TB2.*

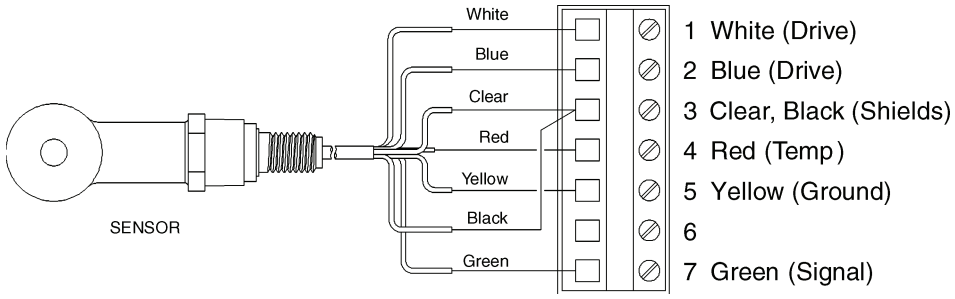


FIGURE 2-5 Connecting GLI Electrodeless Conductivity Sensor

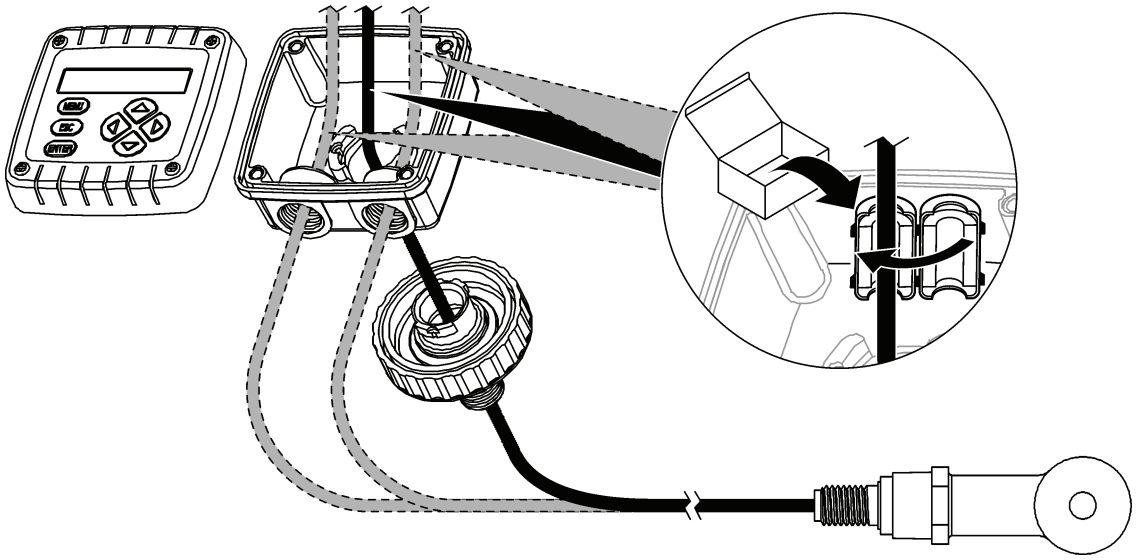


FIGURE 2-5A Install ferrite

This page left intentionally blank

3.2 Two-wire Hookup

In a two-wire hookup, at least 16 VDC is required for operation. A load device can be connected in the current loop (see Figure 2-6 for details).

Depending on how the transmitter is mounted, route the DC power/analog output wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover).

☞ **Wiring Tip!** Use high quality, shielded instrumentation cable.

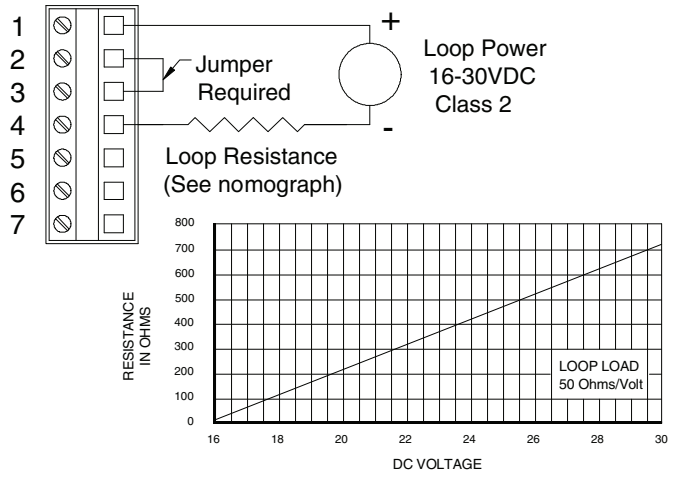


FIGURE 2-6
Two-wire Hookup

3.3 Three-wire Hookups

In a three-wire hookup, the transmitter can be wired four ways depending on load “sinking” or “sourcing” and whether or not RS-485 serial communication is used. At least 14 VDC is required for operation (16 VDC with serial communication). When using RS-485, consult GLI for Command Set.

Depending on how the transmitter is mounted, route the DC power, analog output, and RS-485 serial communication wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover).

Wiring Tip! Use high quality, shielded instrumentation cable.

Refer to the three-wire hookup that meets your application requirements, and connect the transmitter accordingly.

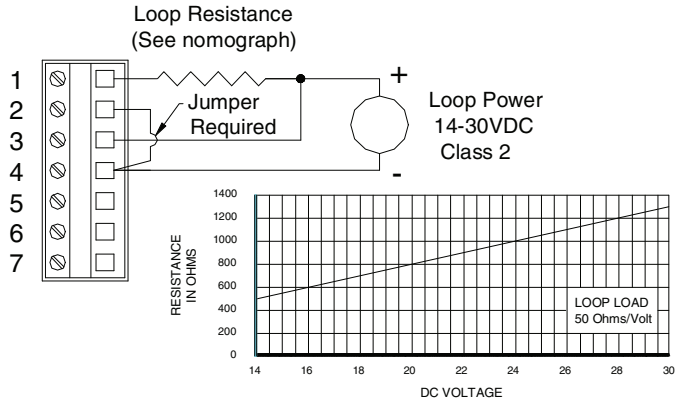


FIGURE 2-7
Three-wire Hookup -- Load Sinking

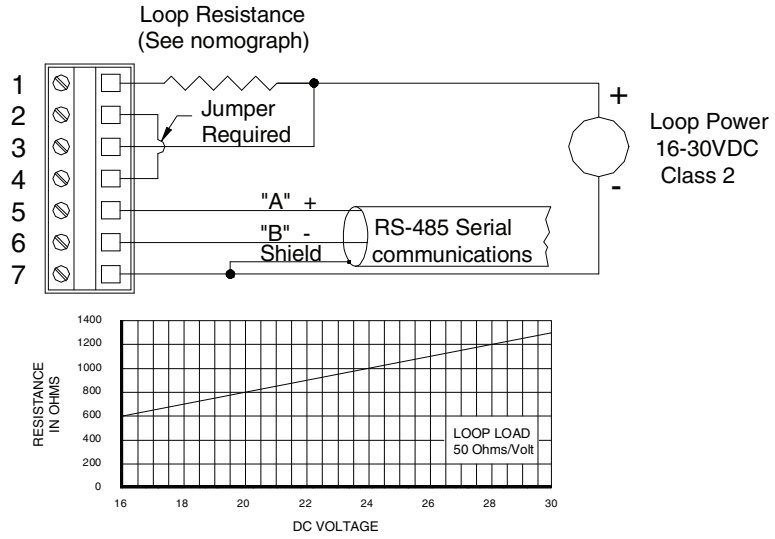


FIGURE 2-8
Three-wire Hookup -- Load Sinking with RS-485 Serial Communication

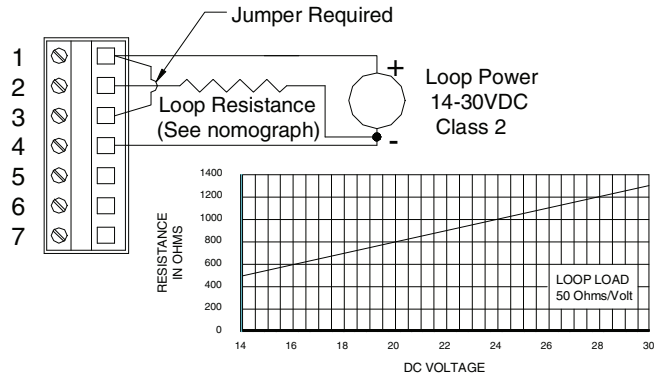


FIGURE 2-9
Three-wire Hookup -- Load Sourcing

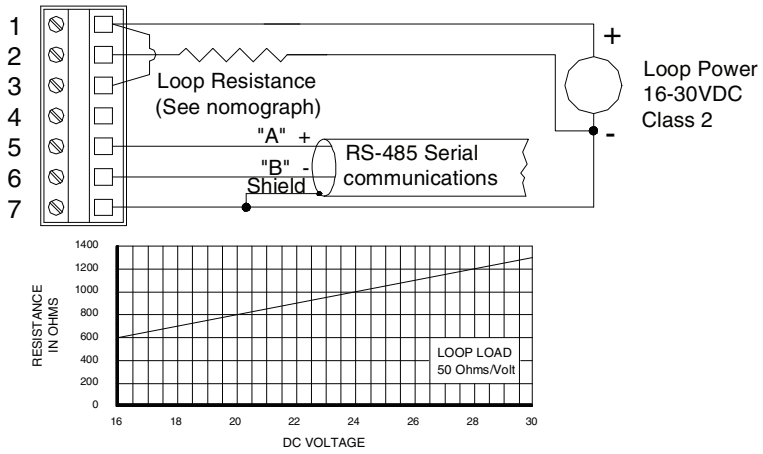


FIGURE 2-10
Three-wire Hookup -- Load Sourcing with RS-485 Serial Communication

3.4 Four-wire Hookups

In a four-wire hookup, the transmitter can be wired two ways depending on whether or not RS-485 serial communication is used. At least 12 VDC is required for operation (16 VDC with serial communication). When using RS-485, consult GLI for Command Set.

Depending on how the transmitter is mounted, route the DC power, analog output, and RS-485 serial communication wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.

- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover).

Wiring Tip! Use high quality, shielded instrumentation cable.

Refer to the four-wire hookup that meets your application requirements, and connect the transmitter accordingly.

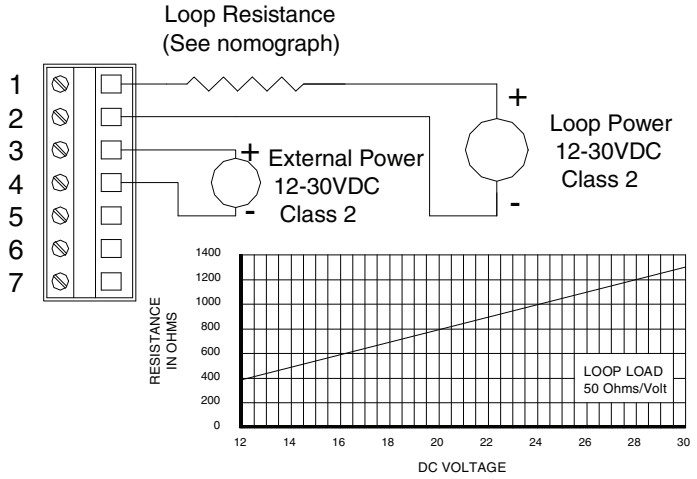


FIGURE 2-11
Four-wire Hookup without RS-485 Serial Communication

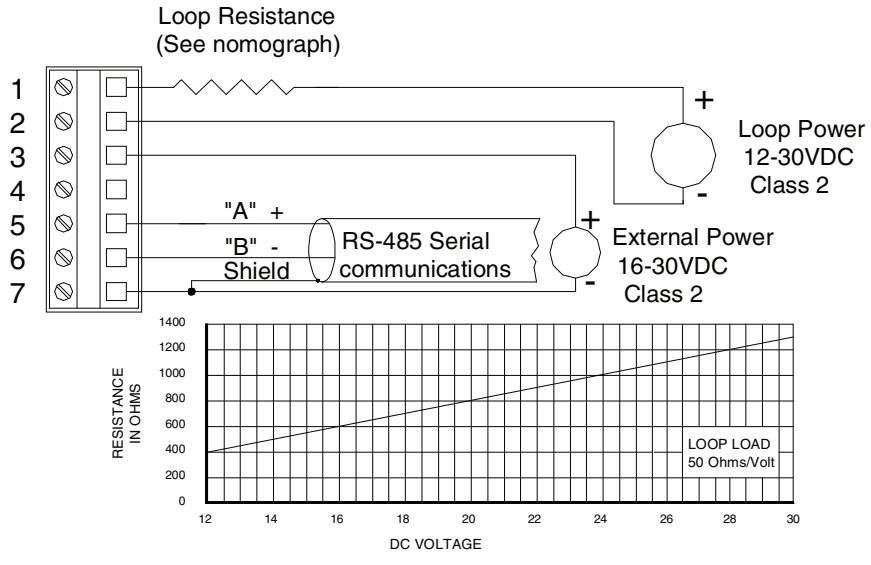


FIGURE 2-12
Four-wire Hookup with RS-485 Serial Communication

3.5 Monitor Mode Hookups (without current loop)

The transmitter can be wired two ways in a monitor mode hookup (without current loop), depending on whether or not RS-485 serial communication is used. At least 12 VDC is required for operation (16 VDC with serial communication). When using RS-485, consult GLI for Command Set.

Depending on how the transmitter is mounted, route the DC power and RS-485 serial communication wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover).

☞ **Wiring Tip!** Use high quality, shielded instrumentation cable.

Refer to the monitor mode hookup that meets your application requirements, and connect the transmitter accordingly.

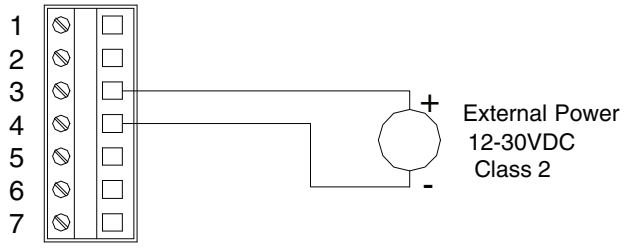


FIGURE 2-13
Monitor Mode Hookup (without Current Loop) -- without RS-485 Serial Communication

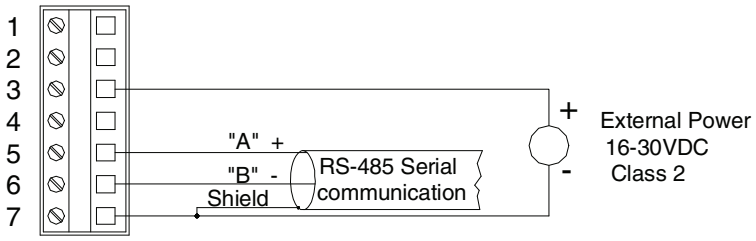


FIGURE 2-14
Monitor Mode Hookup (without Current Loop) -- with RS-485 Serial Communication

PART THREE - OPERATION

SECTION 1
USER INTERFACE

The user interface consists of a two-line LCD display and a keypad with **MENU**, **ENTER**, **ESC**, ⇦, ⇨, ⇧, **and** ⇩ **keys**.

1.1 Display

By using the keypad, you can display three types of screens:

- **MEASURE Screens:** The normal display mode shows the measured value (conductivity, % concentration or TDS). Pressing the ⇨ **key** sequentially scrolls through these other measurement readouts:
  - ✓ Measured process temperature
  - ✓ Measured value and temperature
  - ✓ Measured analog output mA value
  - ✓ Uncompensated conductivity corresponding to % concentration readout (only shown when transmitter is set to measure concentration)
- **MENU Screens:** These top-level and lower-level (sub-menu) screens within the three main branches of the menu tree are used to access edit/selection screens for configuration. (EXIT screens at the end of each menu branch enable you to move up one level in the menu tree by pressing the **ENTER key**. This is functionally the same as pressing the **ESC key**.)
- **Edit/Selection Screens:** These screens enter values/ choices to calibrate, configure, and test the transmitter.

1.2 Keypad

The keypad enables you to move throughout the transmitter menu tree. The keys and their related functions are:

1. **MENU key:** Pressing this key with the MEASURE screen displayed shows the "MAIN MENU ▶ CALIBRATE" screen. To display the CONFIGURE or TEST/MAINT top-level main branch screen, press the ⇩ **key**. Pressing the **MENU key** with a menu screen displayed always shows the top-level screen in that branch. (Pressing the **MENU key** also "aborts" the procedure to change values or selections.)

2. **ENTER key:** Pressing this key does two things; it displays submenu and edit/selection screens, and it enters (saves) configuration values/selections.

3. **ESC key:** Pressing this key always takes the display up one level in the menu tree. (Example: With any "MAIN MENU" screen displayed, pressing the **ESC key** once takes the display up one level to the MEASURE screen.) The **ESC key** can also "abort" the procedure to change a value or selection.

4. ⇦ **and** ⇨ **keys:** Depending on the type of displayed screen, these keys do the following:

   - MEASURE Screen: Changes readout (in continuous loop sequence) to show different measurements.
   - Menu Screens: These keys are non-functional.
   - Edit/Selection Screens: Moves cursor left or right to select digit for adjustment with ⇧ **and** ⇩ **keys**.

5. ⇧ **and** ⇩ **keys:** Depending on the type of displayed screen, these keys do the following:

   - MEASURE Screen: These keys are non-functional.
   - Menu Screens: Moves up or down respectively between other same-level menu screens.
   - Edit/Selection Screens: Adjusts selected digit value up or down, or moves up or down between choices.

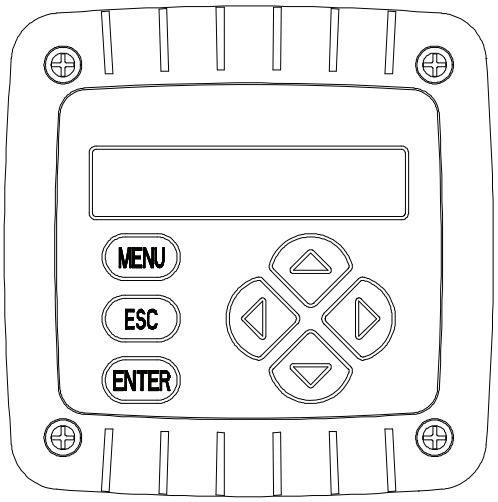
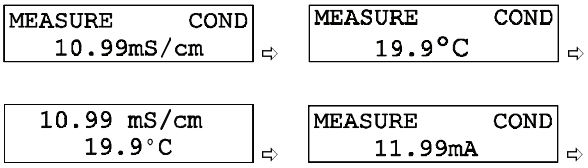


FIGURE 3-1 Transmitter Keypad

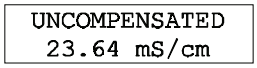
1.3 MEASURE Screen (normal display mode)

The MEASURE screen is normally displayed. Pressing the **MENU key** temporarily replaces the MEASURE screen with the top-level "MAIN MENU ▶ CALIBRATE" branch selection screen. Using the keypad, you can then display other screens to calibrate, configure or test the transmitter. **If the keypad is not used within 30 minutes, except during calibration or while using specific transmitter test/ maintenance functions, the display will automatically return to the MEASURE screen.** To display the MEASURE screen at any time, press the **MENU key** once and then press the **ESC key** once.

The MEASURE screen can show four different readout versions. To select between them, in continuous loop sequence, press the ⇦ **or** ⇨ **key**. These are examples of the different versions:



When set to measure concentration, the transmitter can also show an uncompensated conductivity reading corresponding to the measured concentration, as illustrated by this example:



☞ ***NOTE:*** *When the transmitter returns to its normal MEASURE screen mode, the appearing readout is always the version last selected.*

Note that three MEASURE screen readout examples show the factory-default "COND" notation on their top lines, illustrating the transmitter notation feature. To create your own notation, refer to PART THREE, Section 3.2, subheading "ENTER NOTE (top line of MEASURE screen)."

When the measured value is beyond the transmitter measuring range, a series of " + " or " - " screen symbols appear, respectively indicating that the value is above or below range.

SECTION 2
MENU STRUCTURE

The transmitter menu tree is divided into three main branches: CALIBRATE, CONFIGURE, and TEST/MAINT. Each main branch is structured similarly in layers with top-level screens, related lower-level submenu screens and, in many cases, sub-submenu screens.

Each layer contains an EXIT screen to return the display up one level to the previous layer of screens.

☞ **Menu Structure Tip!** For operating convenience, the layers within each main branch are organized with the most frequently used function screens at their beginning, rather than the function screens used for initial startup.

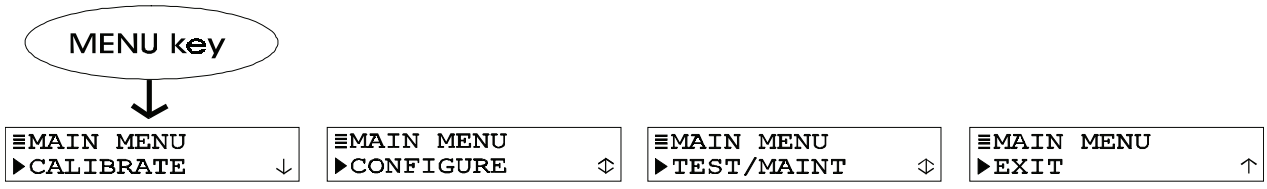
2.1 Displaying Main Branch Selection Screens

1. With the MEASURE screen displayed, pressing the **MENU key** always shows the

```
≣MAIN MENU
▶CALIBRATE        ↓
```

branch selection screen. (Pressing the **MENU key** with any other type of screen displayed always returns the display to the top of that respective menu branch).

2. Press ⇩ **and** ⇧ **keys** to select between the three MAIN MENU branch selection screens (CALIBRATE, CONFIGURE or TEST/MAINT), or the EXIT screen:

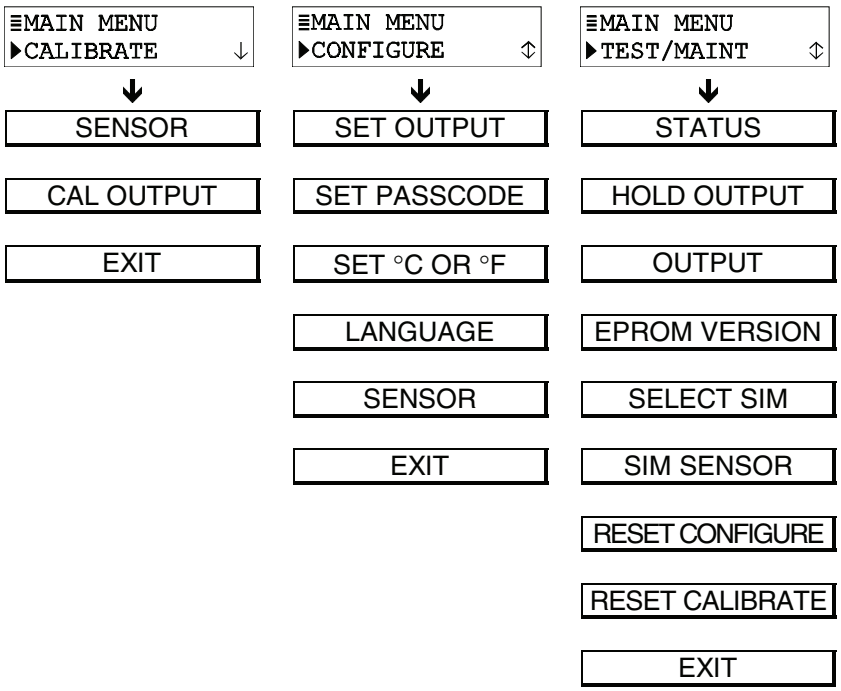


3. With the desired MAIN MENU branch selection screen displayed, press **ENTER key** to display the first top-level menu screen within that branch.

2.2 Displaying Top-level Menu Screens

With the first top-level menu screen of the desired main branch displayed, use the ⇩ **and** ⇧ **keys** to scroll through other top-level screens to access a desired screen.

The top-level menu screens for each main branch are:



☞ **Menu Structure Tip!** A menu screen with a horizontal bar symbol (≡) at the start of its first line indicates there is a related submenu or edit/selection screen.

A menu screen with a ▶ symbol at the start and a "↓" symbol at the end of its second line indicates that you can select other screens within the same layer by pressing the ⇩ **key**. A "↕" symbol at the end of the second line indicates that you can move up or down between screens by respectively pressing the ⇧ **or** ⇩ **key**. When a "↑" symbol appears, it indicates you have reached the end of the screens in that layer. You can select previous screens using the ⇧ **key**.

2.3 Displaying Submenu Screens

After selecting a top-level menu screen, press the **ENTER key** to display a related submenu or edit/selection screen:

- **Submenu Screens** are usually linked to other related same-level screens. Pressing the ⇩ **key** displays these other related submenu screens.

  Example: With this submenu screen displayed:

  ```
  ≣SET OUTPUT
  ▶SET PARAMETER ↓
  ```

  pressing the ⇩ **key** displays this related, same-level submenu screen:

  ```
  ≣SET OUTPUT
  ▶SET 4mA VALUE ↕
  ```

- **Edit/Selection Screens** always have a first line ending with a "?". Pressing the ⇩ **or** ⇧ **key** changes the value/ choice enclosed by parenthesis (second line on screen).

  Example: With this submenu screen displayed:

  ```
  SET °C OR °F?
  (°C              )
  ```

  pressing the ⇩ **key** displays this related choice:

  ```
  SET °C OR °F?
  (°F              )
  ```

2.4 Adjusting Edit/Selection Screen Values

Use **arrow keys** to edit/change the value/choice enclosed by parenthesis (examples shown above and below).

```
SET PARAMETER?
(SENSOR          )
```

```
SET 4mA VALUE?
(10.22 uS/cm     )
```

A choice can be changed by simply using the ⇧ **and** ⇩ **keys**. Numerical values can be adjusted using the ⇦ **and** ⇨ **keys** to select a digit, and ⇧ **and** ⇩ **keys** to adjust its value.

2.5 Entering (Storing) Edit/Selection Screen Values/Choices

With the desired value/choice displayed, press the **ENTER key** to enter (store) it into the non-volatile transmitter memory. The previous screen will then re-appear.

☞ ***NOTE:*** *You can always press the **ESC key** to abort saving a new setting. The original setting will be retained.*

SECTION 3
TRANSMITTER CONFIGURATION

☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to enter a configuration setting.*

3.1 Selecting LANGUAGE to Operate Transmitter

The transmitter is normally equipped to display screens in English and Spanish (Español). However, another language such as French (Français), German (Deutsche), etc. may be substituted for Spanish. The transmitter is factory-set for English. To select the other language:

1. Press **MENU key** to display a "MAIN MENU" screen. If the

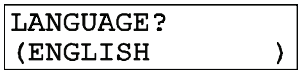

screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display


.

3. Press ⇩ **key** until


screen appears.

4. Press **ENTER key** to display


. Use ⇩ **or** ⇧ **key** to select a language, and press **ENTER key** to enter it.

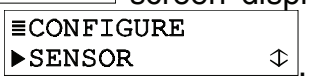
☞ ***NOTE:*** *After a language is selected and entered, all screens are displayed in that language.*

3.2 Configuring Sensor Characteristics

The transmitter must be configured to define the characteristics of the sensor including its temperature element type and "T" factor, and other related items such as selecting the measurement and its format, temperature compensation, input signal filtering, etc.

SELECT MEASURE (conductivity, concentration or TDS)

1. With the


screen displayed, press ⇩ **key** <u>once</u> to display


.

2. Press **ENTER key** to display `≡SENSOR ▶SELECT MEASURE↓`.

3. Press **ENTER key** again to display a screen like `SELECT MEASURE? (CONDUCTIVITY )`. Use ⇩ **and** ⇧ **keys** to select the desired measurement (conductivity, concentration or TDS), and press **ENTER key** to enter it.

☞ ***NOTE:*** *If concentration was selected, measured conductivity must be converted to % concentration by selecting a BUILT-IN chemical concentration table or creating a USER-DEFINED table. See "CONFIG CONC" subheading for details.*

WARNING:

CHANGING THE MEASUREMENT AUTOMATICALLY REPLACES ALL USER-ENTERED CONFIGURATION VALUES WITH FACTORY-DEFAULTS.

Select DISPLAY FORMAT

After choosing the measurement, select the desired display format for the MEASURE screen. The selected units and resolution will also appear on all applicable edit/selection menu screens.

1. With the `≡SENSOR ▶SELECT MEASURE↓` screen displayed, press ⇩ **key** once to display `≡SENSOR ▶DISPLAY FORMAT↕`.

2. Refer to the selected measurement category below and follow its steps:

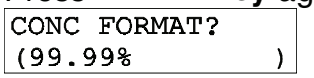
CONDUCTIVITY Display Format

Press **ENTER key** to display a screen like `DISPLAY FORMAT? (200.0 uS/cm )`. Use ⇩ **and** ⇧ **keys** to select a format (2000 µS/cm, 200.0 µS/cm, 2.000 mS/cm, 20.00 mS/cm, 200.0 mS/cm, 2000 mS/cm, or 2.000 S/cm), and press **ENTER key** to enter it.

CONCENTRATION Display Format

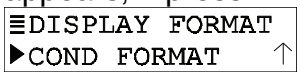
A. Press **ENTER key** to display 

.

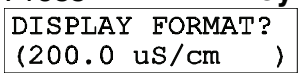
B. Press **ENTER key** again to display a screen like 

. Use ⇩ **and** ⇧ **keys** to select a format (99.99% or 200.0%), and press **ENTER key** to enter it.

C. After the 

screen re-appears, press ⇩ **key** once to display 

to format the uncompensated conductivity MEASURE screen readout (and select conductivity range for USER-DEFINED table, if used).

D. Press **ENTER key** to display a screen like 

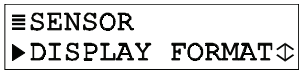
. Use ⇩ **and** ⇧ **keys** to select a format (same choices previously described for conductivity), and press **ENTER key** to enter it.

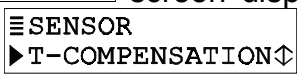
TDS Display Format

Display format configuration for TDS is always 0-9999 ppm. Consequently, there is no display format screen.

Select Temperature COMPENSATION

Configure the required type of temperature compensation for the selected measurement.

1. With the 

screen displayed, press ⇩ **key** once to display 

.

2. Press **ENTER key** to display a screen like 

. Use ⇩ **and** ⇧ **keys** to select the type of compensation, and press **ENTER key** to enter it:

   - **LINEAR:** Recommended for most aqueous solutions

- **NATURAL WATER (not available for TDS measurement):** Built-in temperature properties table only for special applications -- consult factory)
- **TEMP TABLE:** User-defined temperature table
- **NONE:** Measurement values are not compensated

☞ ***NOTE:*** *LINEAR is the factory default for temperature compensation with a 2.00% per °C slope and 25.0°C reference temperature. This provides the best results for most aqueous solutions. To enter different slope and reference temperature values for an uncommon solution, refer to subheading "CONFIG LINEAR or CONFIG T-TABLE Temperature Compensation" for details.*

CONFIG CONC or CONFIG TDS Measurement (configuration not needed for conductivity)

Only when CONCENTRATION or TDS is selected must the transmitter be further configured. If CONDUCTIVITY was selected, disregard this subsection -- no measurement configuration is needed.

CONCENTRATION Measurement Setup

Configure the transmitter with an appropriate table to convert measured conductivity into displayed % concentration. If one of the transmitter's BUILT-IN chemical concentration tables matches the solution being measured, simply select that table. If not, you must create a USER-DEFINED concentration table for the solution being measured.

Selecting BUILT-IN Chemical Concentration Table

1. With the
```
≣SENSOR
▶T-COMPENSATION⇳
```
screen displayed, press ⇩ **key** once to display
```
≣SENSOR
▶CONFIG CONC    ⇳
```
.

2. Press **ENTER key** to display
```
≣CONFIG CONC
▶SELECT TYPE    ↓
```
.

3. Press **ENTER key** again to display
```
SELECT TYPE?
(BUILT-IN       )
```
. BUILT-IN configures transmitter to use one of the built-in chemical concentration tables. (If screen shows USER-DEFINED, use ⇩ **and** ⇧ **keys** to select BUILT-IN.)

4. With "BUILT-IN" displayed, press **ENTER key**.

5. After the ≣CONFIG CONC / ▶SELECT TYPE ↓ screen re-appears, press ⇩ **key** <u>once</u> to display ≣CONFIG CONC / ▶SET BUILT-IN ⇳ .

6. Press **ENTER key** to display a chemical table selection screen like SET CHEMICAL? / (NaOH 0-16%) . Use ⇩ **and** ⇧ **keys** to select the chemical concentration table that matches your solution, and press **ENTER key** to enter it:

TABLE A -- BUILT-IN Chemical Concentration Tables

Solution	Concentration	°C Range	Solution	Concentration	°C Range
NaOH	0-16%	0-100°C	H_2SO_4	40-80%	0-115°C
$CaCl_2$	0-22%	15-55°C	H_2SO_4	93-99%	0-115°C
HNO_3	0-28%	0-50°C	H_3PO_4	0-40%	0-75°C
HNO_3	36-96%	0-50°C	HCl	0-18%	0-65°C
H_2SO_4	0-30%	0-115°C	HCl	22-36%	0-65°C

Creating USER-DEFINED Concentration TABLE

If the solution being measured does not match any BUILT-IN chemical table, create a USER-DEFINED table to convert measured conductivity into displayed % concentration.

☞ ***NOTE:*** *A USER-DEFINED table must contain <u>at least two</u> data points (Pt. 1 and Pt. 2) but can have up to ten. (More points improve measuring accuracy.) Each point must have a conductivity value coordinate (shown as X) and a corresponding % concentration value coordinate (shown as Y). The conductivity values and range are shown in units selected by the "DISPLAY COND FORMAT" screen. Conductivity values for each successive data point <u>must increase</u>. Concentration values, shown in their selected 99.99% or 200.0% display format, must be different from each other and always entered in order (increasing or decreasing). The table must be monotonic; that is, as conductivity values increase, concentration values must always increase or decrease.*

The default USER-DEFINED concentration table is:

Data Point	*Conductivity Value (X coordinate)*	*% Concentration Value (Y coordinate)*
Pt. 1	*0 µS/cm*	*0.00%*
Pt. 2	*2000 µS/cm*	*99.99%*

To create your own USER-DEFINED table, edit this default table and, if needed, add more points.

Recommendation: Before entering values, plan ahead and determine the conductivity and corresponding % concentration values for each data point in your table. Use TABLE B to conveniently organize and note your specific table entry values:

TABLE B -- Values for USER-DEFINED Concentration Table

Data Point	Conductivity Value	% Concentration Value	Data Point	Conductivity Value	% Concentration Value
Pt. 1			Pt. 6		
Pt. 2			Pt. 7		
Pt. 3			Pt. 8		
Pt. 4			Pt. 9		
Pt. 5			Pt. 10		

☞ ***NOTE:*** *If the transmitter is calibrated, you can use the <u>uncompensated</u> conductivity MEASURE screen to determine corresponding conductivity values.*

1. With the `≣SENSOR ▶T-COMPENSATION⇳` screen displayed, press ⇩ **key** <u>once</u> to display `≣SENSOR ▶CONFIG CONC ⇳`.

2. Press **ENTER key** to display `≣CONFIG CONC ▶SELECT TYPE ↓`.

3. Press **ENTER key** again to display `SELECT TYPE? (BUILT-IN )`. Use ⇩ **or** ⇧ **key** to select "USER-DEFINED," which configures the transmitter to use the special concentration table you create.

4. With "USER-DEFINED" displayed, press **ENTER key**.

5. After the `≣CONFIG CONC ▶SELECT TYPE ↓` screen re-appears, press ⇩ **key** <u>once</u> to display `≣CONFIG CONC ▶USER DEFINED ⇳`.

6. Press **ENTER key** to display a screen like `POINT 1 X DATA ▶ 0 mS/cm`. Using this screen and other similar data point screens, enter data to create your table:

☞ ***NOTE:*** *To switch between X and Y coordinate screens of a data point, use ⇨ **and** ⇦ **keys**. To move between data points of an X or Y coordinate, se ⇩ **and** ⇧ **keys**.*

A. Press **ENTER key** to display a screen like
```
X VALUE?
(    0 mS/cm     )
```
. Use **arrow keys** to adjust the Point 1 conductivity value to an appropriate value, and press **ENTER key** to enter it.

B. Press ⇨ **key** once to display
```
POINT 1 Y DATA ◀
      0.00%
```
.

C. Press **ENTER key** to display
```
Y VALUE?
(      0.00%      )
```
. Use **arrow keys** to adjust the Point 1 % concentration value to correspond with the Point 1 conductivity value, and press **ENTER key** to enter it.

D. Press ⇩ **key** once and ⇦ **key** once to display a screen like
```
POINT 2 X DATA ▶
    2 mS/cm
```
.

E. Repeat steps 6A through 6D to enter the conductivity and corresponding % concentration values for each remaining data point in the table.

F. After all X and Y coordinate values are entered for each data point in the table, press **ESC key** once to display
```
USER DEFINED
EXIT TABLE?
```
.

G. Press **ENTER key** to display
```
USER DEFINED
SAVE CHANGES?
```
.

H. Press **ENTER key** again to save the table.

☞ ***NOTE:*** *If the table contains unacceptable coordinate values, the display shows a "CONFIRM FAILURE" message. Pressing **ENTER key** displays the unacceptable coordinate(s).*

TDS Measurement Setup

Define the conductivity-to-TDS conversion factor:

1. With the ≣SENSOR ▶T-COMPENSATION⇳ screen displayed, press ⇩ **key** <u>once</u> to display ≣SENSOR ▶CONFIG TDS ⇳ .

2. Press **ENTER key** to display ≣CONFIG TDS ▶SELECT FACTOR ↓ .

3. Press **ENTER key** again to display SELECT FACTOR? (NaCl) . Use ⇩ **and** ⇧ **keys** to select a conversion factor, and press **ENTER key** to enter it:
   - **NaCl:** Built-in NaCl conductivity-to-TDS conversion factor.
   - **USER DEFINED:** Conductivity-to-TDS conversion factor set by user (see step 4).

4. If "USER DEFINED" was selected, you must set a conductivity-to-TDS conversion factor:

   A. With the ≣CONFIG TDS ▶SELECT FACTOR ↓ screen displayed, press ⇩ **key** <u>once</u> to display ≣CONFIG TDS ▶SET FACTOR ⇳ .

   B. Press **ENTER key** to display a screen like SET FACTOR? (0.49 ppm/uS) . Use **arrow keys** to adjust to a desired conductivity-to-TDS conversion factor, and press **ENTER key** to enter it.

   C. After the ≣CONFIG TDS ▶SET FACTOR ⇳ screen re-appears, press **ESC key** <u>once</u> to return to the ≣SENSOR ▶CONFIG TDS ⇳ screen.

CONFIG LINEAR or CONFIG T-TABLE Temperature Compensation (configuration not needed for other compensation methods)

Only when LINEAR or TEMP TABLE is the selected temperature compensation, must the transmitter be further configured. If the built-in NATURAL WATER properties table or NONE was selected, disregard this subsection -- no compensation configuration is needed.

LINEAR Compensation Setup

Factory defaults for LINEAR compensation are 2.00%/°C slope and 25.0°C reference temperature. **These values are appropriate for most aqueous solutions.** Use chemical handbook tables to find values for uncommon solutions. To enter different values:

1. With the `≣SENSOR ▶T-COMPENSATION⇳` or `≣SENSOR ▶CONFIG TDS ⇳` or `≣SENSOR ▶CONFIG LINEAR ⇳` screen displayed, press ⇩ **key** until screen appears.

2. Press **ENTER key** to display `≣CONFIG LINEAR ▶SET SLOPE ↓` .

3. Press **ENTER key** again to display a screen like `SET SLOPE? (2.00 %/°C )` . Use **arrow keys** to adjust to a desired slope, and press **ENTER key** to enter it.

4. After the `≣CONFIG LINEAR ▶SET SLOPE ↓` screen re-appears, press ⇩ **key** <u>once</u> to display `≣CONFIG LINEAR ▶SET REF TEMP ⇳` .

5. Press **ENTER key** to display a screen like `SET REF TEMP? (25.0°C )` . Use **arrow keys** to adjust to a desired reference temperature, and press **ENTER key** to enter it.

6. After the `≣CONFIG LINEAR ▶SET REF TEMP ⇳` screen re-appears, press **ESC key** <u>once</u> to return to the `≣SENSOR ▶CONFIG LINEAR ⇳` screen.

TEMP TABLE Compensation Setup

When special temperature compensation is required, you can create your own temperature table to define the temperature compensation curve.

☞ ***NOTE:*** *The TEMP TABLE must contain at least two data points (Pt. 1 and Pt. 2) but can have up to ten. (More points improve temperature compensation accuracy.) Each point must have a temperature value coordinate (shown as X) and a corresponding ratio coordinate (shown as Y). Temperature values must be between 0.0 and 200.0°C (or 32.0 and 392.0°F). Each entered temperature value must be different from all others. Entered ratios, which are unit-less, must be between 0.00 and 99.99 and can have the same value.*

Use this equation to calculate the ratio value for each corresponding temperature value:

$$\text{Ratio Value (for each corresponding temperature)} = \frac{\text{Cond. Value at Ref. Temp.}}{\text{Cond. Value at Noted Temp.}}$$

Example: *Suppose the uncompensated or raw conductivity values are 100 mS/cm at a 25°C reference temperature, 120 mS/cm at 50°C, and 70 mS/cm at 15°C. Using this equation, ratio values for each of the corresponding temperatures are:*

For 25°C, ratio value = 100 ÷ 100 or 1.00
For 50°C, ratio value = 100 ÷ 120 or 0.83
For 15°C, ratio value = 100 ÷ 70 or 1.43

The default TEMP TABLE is:

Data Point	Temperature Value (X coordinate)	Corresponding Ratio Value (Y coordinate)
Pt. 1	0.0°C	1.00
Pt. 2	100.0°C	1.00

To create your own TEMP TABLE, edit this default table and, if needed, add more data points.

Recommendation: Before entering values, plan ahead and determine the temperature and ratio values for each data point in your table. Use TABLE C to conveniently organize and note your specific table entry values:

TABLE C -- Values for TEMP TABLE							
Data Point	°C Temp. (X)	Raw Cond.Value	Ratio Value (Y)	Data Point	°C Temp. (X)	Raw Cond. Value	Ratio Value (Y)
Pt. 1				Pt. 6			
Pt. 2				Pt. 7			
Pt. 3				Pt. 8			
Pt. 4				Pt. 9			
Pt. 5				Pt. 10			

1. With the
```
≣SENSOR
▶T-COMPENSATION⇳
```
or
```
≣SENSOR
▶CONFIG TDS      ⇳
```
screen displayed, press ⇩ **key** until
```
≣SENSOR
▶CONFIG T-TABLE⇳
```
screen appears.

2. Press **ENTER key** to display a screen like
```
POINT 1 X DATA ▶
     0.0°C
```
. Using this screen and other similar data point screens, enter data to create your table:

NOTE: *To switch between X and Y coordinate screens of a data point, use ⇨* ***and*** *⇦* ***keys****. To move between data points of an X or Y coordinate, use ⇩* ***and*** *⇧* ***keys****.*

A. Press **ENTER key** to display a screen like
```
X VALUE?
(     0.0°C      )
```
. Use **arrow keys** to adjust the Point 1 temperature to an appropriate value, and press **ENTER key** to enter it.

B. Press ⇨ **key** <u>once</u> to display
```
POINT 1 Y DATA ◀
     1.00
```
.

C. Press **ENTER key** to display
```
Y VALUE?
(      1.00      )
```
. Use **arrow keys** to adjust the Point 1 ratio to match the calculated value corresponding to the Point 1 temperature, and press **ENTER key** to enter it.

D. Press ⇩ **key** <u>once</u> and ⇦ **key** <u>once</u> to display
```
POINT 2 X DATA ▶
     100.0°C
```
.

E. Repeat steps 2A through 2D to enter the temperature and corresponding calculated ratio values for each remaining data point in the table.

F. After all X and Y coordinate values are entered for each data point in the table, press **ESC key** once to display
```
CONFIG T-TABLE
EXIT TABLE?
```
.

G. Press **ENTER key** to display
```
CONFIG T-TABLE
SAVE CHANGES?
```
.

H. Press **ENTER key** again to save the table.

☞ ***NOTE:*** *If the table contains unacceptable coordinate values, the display shows a "CONFIRM FAILURE" message. Pressing **ENTER key** displays the unacceptable coordinate(s).*

SET FILTER Time

A time constant (in seconds) can be set to filter or "smooth out" the sensor signal. A minimum value of "0 seconds" has no smoothing effect. A maximum value of "60 seconds" provides maximum smoothing. Deciding what sensor signal filter time to use is a compromise. The higher the filter time, the longer the sensor signal response time will be to a change in the actual process value.

1. With the
```
≣SENSOR
▶CONFIG LINEAR ⇳
```
or
```
≣SENSOR
▶CONFIG T-TABLE⇳
```
screen displayed, press ⇩ **key** once to display
```
≣SENSOR
▶SET FILTER    ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET FILTER?
(0 SECONDS     )
```
. Use **arrow keys** to adjust to a desired filter time, and press **ENTER key** to enter it.

ENTER NOTE (top line of MEASURE screen)

The top line of the MEASURE screen readouts that separately show the measurement, temperature, and analog output values are factory set to read "COND." This notation can be changed, for example, to "BASIN 1" to tailor the transmitter MEASURE screen to the application. The top line would then be "MEASURE BASIN 1." The notation is limited to eight characters which can be a combination of capital letters A through Z, numbers 0 through 9, spaces, # symbols, hyphens, and periods.

1. With the
```
≣SENSOR
▶SET FILTER      ⇳
```
screen displayed, press ⇩ **key** <u>once</u> to display
```
≣SENSOR
▶ENTER NOTE      ⇳
```
.

2. Press **ENTER key** to display
```
ENTER NOTE?
([C]OND          )
```
. Create the desired notation on the second line:

   A. Starting with extreme left character position, use ⇧ **and** ⇩ **keys** to select the desired first character.

   B. Press ⇨ **key** <u>once</u> to select the next character, and use ⇧ **and** ⇩ **keys** to select its desired character.

   C. Repeat procedure until desired notation is displayed.

3. Press **ENTER key** to enter the displayed notation.

Select TEMP ELEMENT Type

The temperature element type is factory-set to “PT1000” for automatic temperature compensation (defines built-in temperature element in GLI electrodeless conductivity sensors).

☞ ***NOTE:*** *When “PT1000” is selected but the element is not connected to the transmitter, a “WARNING: CHECK STATUS” message will appear. To prevent or clear this message, connect the element or select “MANUAL.”*

To configure the transmitter for fixed MANUAL temperature compensation you must select “MANUAL” and enter a specific temperature:

1. With the
```
≣SENSOR
▶ENTER NOTE      ⇳
```
screen displayed, press ⇩ **key** <u>once</u> to display
```
≣SENSOR
▶TEMP ELEMENT    ⇳
```
.

2. Press **ENTER key** to display
```
≣TEMP ELEMENT
▶SELECT TYPE     ↓
```
.

3. Press **ENTER key** again to display `SELECT TYPE? (PT1000 )`. Use ⇩ **key** to select "MANUAL" for fixed manual temperature compensation, and press **ENTER key** to enter it:

4. Now determine and enter a specific manual temperature compensation value:

   A. With the `≣TEMP ELEMENT ▶SELECT TYPE ↓` screen displayed, press ⇩ **key** once to display `≣TEMP ELEMENT ▶SET MANUAL ⇳`.

   B. Press **ENTER key** to display a screen like `SET MANUAL? (25.0°C )`. Use **arrow keys** to adjust to a desired temperature for fixed MANUAL compensation, and press **ENTER key** to enter it.

SET T FACTOR (sensor's GLI-certified "T" factor)

GLI tests each sensor to provide a unique, certified temperature T FACTOR because:

- Temperature greatly affects conductivity measurement accuracy.
- The inherent ohm value of the Pt 1000 RTD temperature element varies slightly from sensor to sensor, affecting temperature measurement accuracy.

By entering the sensor's unique T FACTOR, the transmitter will provide the highest possible measuring accuracy for both temperature and conductivity.

1. With the `≣TEMP ELEMENT ▶SELECT TYPE ↓` screen displayed, press ⇩ **key** once to display `≣TEMP ELEMENT ▶SET T FACTOR ⇳`.

2. Press **ENTER key** to display a screen like `SET T FACTOR? (1000.0 OHMS )`. Use **arrow keys** to adjust the displayed value to exactly match the sensor's GLI-certified T FACTOR, and press **ENTER key** to enter it.

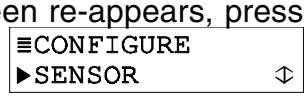
SPECIAL CASE -- ALTERED SENSOR CABLE LENGTH

Changing the standard 20 ft. (6 m) sensor cable length, by shortening it or adding an interconnect cable, affects temperature measuring accuracy. The GLI-certified T FACTOR is based on standard cable length. To compensate for altered cable length measuring error, change the certified T FACTOR entry:

- Shortened Sensor Cable: To increase the transmitter temperature reading to match the known solution temperature, decrease the T FACTOR by 3.85 ohms for each °C difference.
- Added Interconnect Cable: To decrease the transmitter temperature reading to match the known solution temperature, increase the T FACTOR by 3.85 ohms for each °C difference.

Example: Suppose the known solution temperature is 50°C and the transmitter reads 53°C due to interconnect cable resistance. Multiply the 3°C difference by 3.85 ohms to get 11.55. Then increase the sensor T FACTOR by adding 11.55 to it and entering that value. If, due to a shortened sensor cable, the transmitter was reading 3°C less than the known solution temperature you would decrease the sensor T FACTOR by subtracting 11.55 from it.

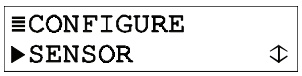
3. After the 

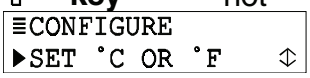
screen re-appears, press **ESC key** twice to return to the 

screen.

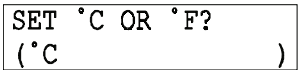
3.3 SET °C OR °F (temperature display format)

The MEASURE screen can be set to display temperature values in °C or °F. In either case, the display resolution for measured temperature is always "XX.X."

1. With the 

screen displayed, press ⇧ **key** -- not ⇩ **key** -- twice to display 

.

2. Press **ENTER key** to display a screen like 

. Use ⇩ **and** ⇧ **keys** to select the displayed temperature units (°C or °F), and press **ENTER key** to enter it.

3.4 Configuring Analog Output

The transmitter provides an isolated 4-20 mA analog output. During normal measurement operation, the output is active but can be held at the last measured value for up to 30 minutes by using the "HOLD OUTPUT" function in the TEST/MAINT menu. (See PART THREE, Section 5.2 for details.) During calibration, the output is automatically held at the last measured value and, upon completion, returned to its active state.

SET PARAMETER (representation)

The output can be assigned to represent the SENSOR (measured conductivity, % concentration or TDS) or measured TEMPERATURE.

1. With the ≣CONFIGURE ▶SET °C OR °F ⇕ screen displayed, press ⇧ **key** -- not ⇩ **key** -- <u>twice</u> to display ≣CONFIGURE ▶SET OUTPUT ↓.

2. Press **ENTER key** to display ≣SET OUTPUT ▶SET PARAMETER ↓ .

3. Press **ENTER key** again to display SET PARAMETER? (SENSOR) . Use ⇩ **and** ⇧ **keys** to select the parameter the output will represent, and press **ENTER key** to enter it.

SET 4 mA and 20 mA VALUES (range expand)

Parameter values can be set to define the endpoints at which the 4 mA and 20 mA analog output values are desired.

1. With the ≣SET OUTPUT ▶SET PARAMETER ↓ screen displayed, press ⇩ **key** <u>once</u> to display ≣SET OUTPUT ▶SET 4mA VALUE ⇕ .

2. Press **ENTER key** to display a screen like SET 4mA VALUE? (10.22 mS/cm) . Use **arrow keys** to set the value at which 4 mA is desired, and press **ENTER key** to enter it.

3. After the ≣SET OUTPUT ▶SET 4mA VALUE ⇕ screen re-appears, press ⇩ **key** <u>once</u> to display ≣SET OUTPUT ▶SET 20mA VALUE⇕ .

4. Press **ENTER key** to display a screen like

SET 20mA VALUE?
(19.99 mS/cm)

. Use **arrow keys** to set the value at which 20 mA is desired, and press **ENTER key** to enter it.

☞ ***NOTE:*** *If the same values are set for 4 mA and 20 mA, the output automatically goes to and remains at 20 mA.*

SET FILTER Time

A time constant (in seconds) can be set to filter or "smooth out" the analog output signal. A minimum value of "0 seconds" has no smoothing effect. A maximum value of "60 seconds" provides maximum smoothing. Deciding what output filter time to use is a compromise. The higher the filter time, the longer the analog output signal response time will be to a change in the measured value.

1. With the ≣SET OUTPUT / ▶SET 20mA VALUE⇳ screen displayed, press ⇩ **key** once to display ≣SET OUTPUT / ▶SET FILTER ⇳.

2. Press **ENTER key** to display a screen like SET FILTER? / (0 SECONDS). Use **arrow keys** to adjust to a desired filter time, and press **ENTER key** to enter it.

SET FAIL LEVEL Mode (off, 4 mA or 20 mA)

When a "WARNING CHECK STATUS" message appears, indicating that a system problem may exist, the analog output can be set to respond in one of three ways:

- **OFF:** Output remains active.
- **4mA:** Output automatically goes to and remains at 4 mA.
- **20mA:** Output automatically goes to and remains at 20 mA.

To SET FAIL LEVEL mode to suit your application:

1. With the ≣SET OUTPUT / ▶SET FILTER ⇳ screen displayed, press ⇩ **key** once to display ≣SET OUTPUT / ▶SET FAIL LEVEL⇳.

2. Press **ENTER key** to display SET FAIL LEVEL? / (OFF). Use ⇧ **and** ⇩ **keys** to select a response mode (OFF, 4mA or 20mA), and press **ENTER key** to enter it.

3.5 SET PASSCODE (feature enabled or disabled)

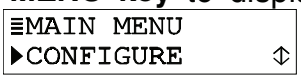
The transmitter has a passcode feature to restrict access to configuration settings and calibration to only authorized personnel.

- **DISABLED:** With the passcode feature disabled, all configuration settings can be displayed and changed, and the transmitter can be calibrated.

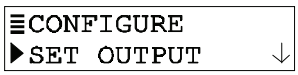
- **ENABLED:** With the passcode feature enabled, all configuration settings can be displayed -- but they cannot be changed -- and the CALIBRATE and TEST/MAINT menus cannot be accessed without the passcode. When you attempt to change a setting in the CONFIGURE menu by pressing the **ENTER key**, a displayed notification requests passcode entry. A valid passcode entry saves the changed setting and returns the display to the "MAIN MENU" branch selection screen. An incorrect passcode entry causes the display to momentarily show an error notification before returning to the "MAIN MENU" branch selection screen. There is no limit on attempts to enter a valid passcode.

The passcode is factory set to "**3 4 5 6**." It cannot be changed.

To enable or disable the passcode feature:

1. Press **MENU key** to display a "MAIN MENU" screen. If the 

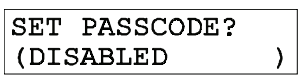
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display 

.

3. Press ⇩ **key** once to display 

.

4. Press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to select the desired passcode mode (DISABLED or ENABLED), and press **ENTER key** to enter it.

3.6 Configuration Setting Summary

TABLE D lists all configuration settings and their entry ranges/choices and factory defaults, categorized by basic functions.

TABLE D -- Transmitter Configuration Settings (Ranges/Choices and Defaults)

Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
LANGUAGE Setting			
LANGUAGE?	ENGLISH and SPANISH (French, German, etc. may be substituted for Spanish)	ENGLISH	
SENSOR Settings			
SELECT MEASURE?	CONDUCTIVITY, CONCENTRATION or TDS	CONDUCTIVITY	
DISPLAY FORMAT? (full scale value)	CONDUCTIVITY: µS/cm: 200.0, or 2000 mS/cm: 2.000, 20.00, 200.0 or 2000 S/cm: 2.000 CONCENTRATION: 99.99% or 200.0% TDS: 9999 ppm	CONDUCTIVITY: 200.0 mS/cm CONCENTRATION: 99.99% TDS: 9999 ppm	
T-COMPENSATION?	LINEAR, NATURAL WATER, TEMP TABLE or NONE	LINEAR at 2.00% per °C with 25.0°C reference temperature	
CONFIG CONC: SELECT TYPE?	BUILT-IN or USER-DEFINED	BUILT-IN	
CONFIG CONC: SET CHEMICAL?	NaOH 0-16%, $CaCl_2$ 0-22%, HNO_3 0-28%, HNO_3 36-96%, H_2SO_4 0-30%, H_2SO_4 40-80%, H_2SO_4 93-99%, H_3PO_4 0-40%, HCl 0-18% or HCl 23-36%	Built-in NaOH 0-16% chemical concentration table	
CONFIG CONC: USER DEFINED?	Edit default table by entering up to 10 data points with conductivity X coordinates and corresponding concentration Y coordinates	Two point default conc. table: Pt. 1: X = 0 µS/cm; Y = 0.00% Pt. 2: X = 2000 µS/cm; Y = 99.99%	
CONFIG TDS: SELECT FACTOR?	NaCl or USER DEFINED	NaCl	
CONFIG TDS: SET FACTOR?	0.01-99.99 ppm/µS	0.49 ppm/µS	
CONFIG LINEAR: SET SLOPE?	0-4.00% per °C	2.00% per °C	
CONFIG LINEAR: SET REF TEMP?	0-200.0°C or 32-392.0°F	25.0°C or 77.0°F	
CONFIG T-TABLE?	Edit default table by entering up to 10 data points with temperature X coordinates and corresponding ratio Y coordinates (0-99.99)	Two point default temp. table: Pt. 1: X = 0.0°C; Y = 1.00 Pt. 2: X = 100.0°C; Y = 1.00	
SET FILTER?	0-60 seconds	0 seconds	
ENTER NOTE?	Replace COND with up to eight characters	COND	
TEMP ELEMENT: SELECT TYPE?	PT1000 or MANUAL	PT1000	

(TABLE D continued on next page.)

TABLE D -- Transmitter Configuration Settings (Ranges/Choices and Defaults) -- continued

Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
SENSOR Settings (continued)			
TEMP ELEMENT: SET T FACTOR?	950-1050 ohms	1000 ohms	
TEMP ELEMENT: SET MANUAL?	0.0-200.0°C	25.0°C	
TEMPERATURE Display Setting			
SET °C OR °F?	°C or °F	°C	
OUTPUT Settings			
SET PARAMETER?	SENSOR or TEMPERATURE	SENSOR	
SET 4mA VALUE?	CONDUCTIVITY: µS/cm: 0-200.0, or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0 or 0-2000 S/cm: 0-2.000 CONCENTRATION: 0-99.99% or 0-200.0% TDS: 0-9999 ppm TEMPERATURE: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: µS/cm: 0 mS/cm: 0 S/cm: 0 CONC: 0.00% or 0.0% TDS: 0 ppm TEMPERATURE: 0.0°C or 32.0°F	
SET 20mA VALUE?	CONDUCTIVITY: µS/cm: 0-200.0 or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0 or 0-2000 S/cm: 0-2.000 CONCENTRATION: 0-99.99% or 0-200.0% TDS: 0-9999 ppm TEMPERATURE: -20.0 to +200.0°C or -4.0 to 392.0°F	CONDUCTIVITY: µS/cm: 200.0 or 2000 mS/cm: 2.000, 20.00, 200.0 or 2000 S/cm: 2.000 CONC: 99.99% or 200.0% TDS: 9999 ppm TEMPERATURE: 100.0°C or 212.0°F	
SET FILTER?	0-60 seconds	0 seconds	
SET FAIL LEVEL?	OFF, 4 mA or 20 mA	OFF	
PASSCODE Setting			
SET PASSCODE?	DISABLED or ENABLED	DISABLED	
TEST/MAINT Simulation Function Settings			
SELECT SIM?	SENSOR or TEMPERATURE	SENSOR	
SIM SENSOR?	CONDUCTIVITY: µS/cm: 0-200.0, or 0-2000 mS/cm: 0-2.000, 0-20.00, 0-200.0 or 0-2000 S/cm: 0-2.000 CONCENTRATION: 0-99.99% or 0-200.0% TDS: 0-9999 ppm TEMPERATURE: -20.0 to +200.0°C or -4.0 to 392.0°F	Present measured value of selected parameter	

SECTION 4
TRANSMITTER CALIBRATION

4.1 Important Information

Each electrodeless conductivity sensor has a unique zero point and span. Consequently, **always zero the sensor when calibrating it <u>for</u> <u>the</u> <u>first</u> <u>time</u>** (Section 4.2). Zeroing provides the best possible measuring accuracy. After zeroing, calibrate for sensor span using one of the available methods, and periodically thereafter to maintain best measurement accuracy. Over time, some processes such as heavy slurries may plug the sensor hole, causing minor measurement errors. The time between calibrations, and the rate of measurement drift can vary considerably with each application and its specific conditions.

☞ **Calibration Tip!** Establish a maintenance program to keep the sensor relatively clean and the measuring system calibrated. The weekly or monthly intervals between performing maintenance will be influenced by the characteristics of the process solution, and can only be determined by operating experience.

Since the inherent ohm value of each sensor's Pt 1000 RTD temperature element varies slightly, GLI tests each element to provide a unique, GLI-certified temperature T FACTOR shown on a label attached to the sensor cable. If this factor was not previously entered during configuration in Section 3.2, subheading "SET T FACTOR," **<u>enter</u> <u>it</u> <u>now</u> <u>before</u> <u>zeroing</u> <u>or</u> <u>calibrating</u>** to provide the best possible measuring accuracy.

☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to calibrate the transmitter.*

An in-progress calibration can always be aborted by pressing the ESC key. *After the "ABORT: YES?" screen appears, do <u>one</u> of the following:*

- *Press **ENTER key** to abort. After the "CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).*
- *Press ⇧ **or** ⇩ **key** to choose "ABORT: NO?" screen, and press **ENTER key** to continue calibration.*

In addition to zeroing and calibrating sensor span, the analog output loop can also be calibrated. Refer to Section 4.6 for details.

☞ **Zeroing/Calibration Tip!** If a "CONFIRM FAILURE?" screen appears during zeroing or calibration, press **ENTER key** to confirm. Then, use ⇧ **or** ⇩ **key** to select between "CAL: EXIT" or "CAL: REPEAT" and do one of the following:

- With "(CAL: EXIT)" selected, press **ENTER key**. Then, after the "CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).
- With "(CAL: REPEAT)" selected, press **ENTER key** to repeat zeroing or calibration.

4.2 ZERO Procedure (first-time sensor calibration only)

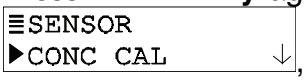
Zero the sensor if it is being calibrated for the first time. If not, disregard this subsection and proceed with calibrating the sensor span (Section 4.3, 4.4 or 4.5).

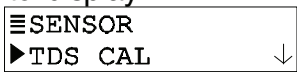
☞ ***NOTE:*** *When using a new sensor, always perform a "RESET CALIBRATE" using the TEST/MAINT menu (PART THREE, Section 5.8) before zeroing and calibrating.*

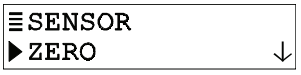
1. Make sure that the sensor is dry before zeroing.
2. Press **MENU key** to display a "MAIN MENU" screen. If the 

screen is not showing, use ⇩ **or** ⇧ **key** to display it.
3. Press **ENTER key** to display 

.
4. Press **ENTER key** again to display 

, 

, or 

(displayed screen depends on selected measurement).
5. Press ⇩ **key** twice to display 

.
6. Press **ENTER key** to display the "ZERO: IN DRY AIR?" screen.

7. With the dry sensor held in air, press **ENTER key** again to start automatic zeroing.

NOTE: *During zeroing, the analog output is automatically "held" at the last measured value.)*

8. After the "ZERO: CONFIRM ZERO OK" screen appears, press **ENTER key** to end zeroing.

9. After the "ZERO: CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).

This completes zeroing the sensor.

4.3 Conductivity Calibration

After zeroing the sensor (first-time sensor calibration only), calibrate the sensor span using one of these methods:

- **COND CAL Method:** This method requires removing the sensor from the process, immersing it into a conductivity reference solution, and entering a reference for temperature compensation, and the known linear % per °C slope and conductivity value of the reference solution.
- **SAMPLE CAL Method:** This method allows keeping the sensor installed in the process, but requires you to obtain a process sample, determine its value by laboratory analysis or comparison reading, and enter that value.

COND CAL Method

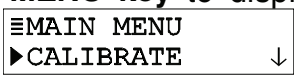
1. Prepare the conductivity reference solution using your normal method. Its value should be near the typical measured process value for best accuracy. When the value is relatively low (between 200 and 100,000 microSiemens/cm), the data in TABLE E on the next page can be used to prepare the reference solution. Add the listed grams of pure, dried NaCl to one liter of high purity, de-ionized, CO_2-free water that is 25°C to obtain the listed conductivity. Solution conductivity can be decreased by dilution with de-ionized water.

TABLE E -- Conductivity Reference Solutions			
Desired Solution Value			Grams NaCl
µS/cm	mS/cm	ppm (NaCl)*	To Be Added
200	0.20	100	0.10
500	0.50	250	0.25
1000	1.00	500	0.50
2000	2.00	1010	1.01
3000	3.00	1530	1.53
4000	4.00	2060	2.06
5000	5.00	2610	2.61
8000	8.00	4340	4.34
10,000	10.00	5560	5.56
20,000	20.00	11,590	11.59
50,000	50.00	31,950	31.95
100,000	100.00	72,710	72.71

*When using ppm measuring scale for compounds other than NaCl, refer to appropriate chemistry handbook for reference solution formulation.

2. Thoroughly rinse the clean sensor in de-ionized water. Then immerse the sensor in the prepared reference solution. **Important: Allow the sensor and solution temperatures to equalize.** Depending on their temperature differences, this may take up to 30 minutes.

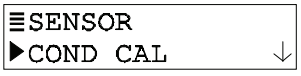
☞ ***NOTE:*** *Suspend the sensor to prevent it from touching the container.* ***Simply laying it into the container will produce calibration error.*** *If the sensor is tee-mounted, use a smaller container. Ideally, convert a tee of the same size and material as the mounting tee into a calibration container by sealing two of its ends.*

3. Press **MENU key** to display a "MAIN MENU" screen. If the 

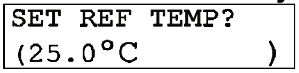
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

4. Press **ENTER key** to display 

.

5. Press **ENTER key** again to display 

.

6. Press **ENTER key** again to display a screen like 

. **The default 25°C reference temperature is suitable for most applications.** For another reference, use **arrow keys** to adjust to a different temperature. In either case, press the **ENTER key**.

☞ ***NOTE:*** *During calibration, the analog output is automatically "held" at the last measured value.*

7. After a screen like
```
SET SLOPE?
(2.00 %/°C     )
```
appears, use **arrow keys** to adjust the slope value to match the known slope of the reference solution, and press **ENTER key** to enter the value.

☞ ***NOTE:*** *Measured values are normally compensated using the configured temperature compensation method. However, during calibration the measured value is linearly compensated by the entered reference temperature and slope value of the reference solution.*

8. With the sensor in solution and the
```
COND CAL:
SAMPLE READY?
```
screen displayed, press **ENTER key** to confirm. This active
```
XXXX uS/cm
READING STABLE?
```
screen appears showing the measured reference solution value.

9. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static
```
COND CAL?
(XXXX uS/cm    )
```
screen appears showing the "last measured" value.

10. Use **arrow keys** to adjust the "last-measured" value to exactly match the known value of the reference solution.

11. Press **ENTER key** to enter the value and complete calibration ("CONFIRM CAL OK?" screen appears).

12. Re-install the sensor into the process.

13. Press **ENTER key** to display the active measurement reading on the "CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes COND CAL calibration.

SAMPLE CAL Method

The "SAMPLE CAL" method enables the sensor to remain installed in the process.

1. Obtain a sample of the process solution and determine its value using laboratory analysis or a recently calibrated portable meter.

2. Press **MENU key** to display a "MAIN MENU" screen. If the ≡MAIN MENU / ▶CALIBRATE ↓ screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display ≡CALIBRATE / ▶SENSOR ↓ .

4. Press **ENTER key** again to display ≡SENSOR / ▶COND CAL ↓ .

5. Press ⇩ **key** once to display ≡SENSOR / ▶SAMPLE CAL ⇳ .

6. Press **ENTER key** to display SAMPLE CAL: / SAMPLE READY? . With the sensor in the process, press **ENTER key** again to confirm. This active XXXX uS/cm / READING STABLE? screen appears showing the measurement reading.

NOTE: *During calibration, the analog output is automatically "held" at the last measured value.*

7. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static SAMPLE CAL? / (XXXX uS/cm) screen appears showing the "last measured" value.

8. Use **arrow keys** to adjust the displayed value to exactly match the known value of the process sample.

9. Press **ENTER key** to enter the value and complete calibration ("CONFIRM CAL OK?" screen appears).

10. Press **ENTER key** again to display the active measurement reading on the "CONFIRM ACTIVE?" output status screen. When the reading corresponds to the

actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes SAMPLE CAL calibration.

4.4 % Concentration Calibration

After zeroing the sensor (first-time sensor calibration only), calibrate the sensor span using one of these methods:

- **CONC CAL Method:** This method requires you to immerse the sensor into a prepared % concentration reference solution of known value, or to keep the sensor installed in the process while obtaining a process sample. When keeping the sensor installed, determine the process value by laboratory analysis or comparison reading. In either case, enter the known reference solution or sample % concentration value.
- **COND CAL Method:** This method requires removing the sensor from the process, immersing it into a conductivity reference solution, entering a reference for temperature compensation temperature, and entering the known linear % per °C slope and conductivity value of the reference solution. The conductivity reference solution should have an equivalent, uncompensated value that corresponds with the normal % concentration value of the process.

CONC CAL Method

1. Depending on the situation, do one of the following:

   ■ When Keeping Sensor Installed:

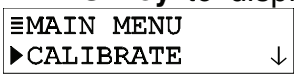
   Obtain a sample of the process solution and determine its value using laboratory analysis or a recently calibrated portable meter.

   ■ When Immersing Sensor in Reference Solution:

   A. Prepare a % concentration reference solution using your normal method. **To achieve accurate calibration, the reference solution must have the same chemical composition as the process.** Also, its value should be near the typical measured process value.

B. Thoroughly rinse the clean sensor in de-ionized water. Then immerse the sensor in the prepared reference solution. **Important: Allow the sensor and solution temperatures to equalize.** Depending on their temperature differences, this may take up to 30 minutes.

☞ ***NOTE:*** *Suspend the sensor to prevent it from touching the container.* ***Simply laying it into the container will produce calibration error.*** *If the sensor is tee-mounted, use a smaller container. Ideally, convert a tee of the same size and material as the mounting tee into a calibration container by sealing two of its ends.*

2. Press **MENU key** to display a "MAIN MENU" screen. If the 

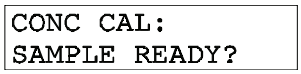
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

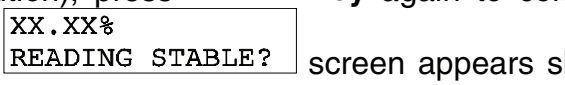
3. Press **ENTER key** to display 

.

4. Press **ENTER key** again to display 

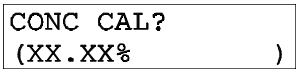
.

5. Press **ENTER key** to display 

. With the sensor in the process (or % concentration reference solution), press **ENTER key** again to confirm. This active 

screen appears showing the measurement reading.

☞ ***NOTE:*** *During calibration, the analog output is automatically "held" at the last measured value.*

6. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static 

screen appears showing the "last measured" value.

7. Use **arrow keys** to adjust the displayed value to exactly match the known value of the process sample (or % concentration reference solution).

8. Press **ENTER key** to enter the value and complete calibration ("CONFIRM CAL OK?" screen appears).

9. If the sensor was immersed in a reference solution, reinstall the sensor into the process.

10. Press **ENTER key** to display the active measurement reading on the "CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes CONC CAL calibration.

COND CAL Method

When the transmitter is set to measure % concentration but you want to calibrate using a conductivity reference solution, please refer to Section 4.3, subsection "COND CAL Method" and follow steps 1 through 13.

4.5 TDS Calibration

When the transmitter is set to measure TDS, only the "TDS CAL" method is available to calibrate sensor span. This method requires you to immerse the sensor into a properly prepared TDS reference solution of known ppm value, or to keep the sensor installed in the process while obtaining a process sample. In either case, enter the known reference solution or sample ppm value.

1. Depending on the situation, do one of the following:

   - When Keeping Sensor Installed:

     Obtain a sample of the process solution and determine its value using laboratory analysis or a recently calibrated portable meter.

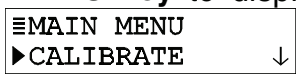
   - When Immersing Sensor in Reference Solution:

     A. Prepare a TDS reference solution using your normal method. **To achieve accurate calibra-**

tion, the reference solution must have the same chemical composition as the process. Also, its value should be near the typical measured process value. When the value is between 100 and 72,710 ppm NaCl, the data in step 1 and TABLE E of Section 4.3, subsection "COND CAL Method" can be used to prepare the reference solution.

B. Thoroughly rinse the clean sensor in de-ionized water. Then immerse the sensor in the prepared reference solution. **Important: Allow the sensor and solution temperatures to equalize.** Depending on their temperature differences, this may take up to 30 minutes.

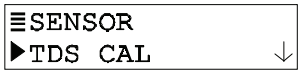
☞ ***NOTE:*** *Suspend the sensor to prevent it from touching the container.* ***Simply laying it into the container will produce calibration error.*** *If the sensor is tee-mounted, use a smaller container. Ideally, convert a tee of the same size and material as the mounting tee into a calibration container by sealing two of its ends.*

2. Press **MENU key** to display a "MAIN MENU" screen. If the 

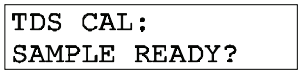
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

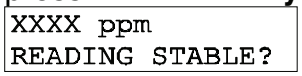
3. Press **ENTER key** to display 

.

4. Press **ENTER key** again to display 

.

5. Press **ENTER key** to display 

. With the sensor in the process (or reference solution), press **ENTER key** again to confirm. This active 

screen appears showing the measurement reading.

☞ ***NOTE:*** *During calibration, the analog output is automatically "held" at the last measured value.*

6. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static
```
TDS CAL?
(XXXX ppm      )
```
screen appears showing the "last measured" value.

7. Use **arrow keys** to adjust the displayed value to exactly match the known value of the process sample (or TDS reference solution).

8. Press **ENTER key** to enter the value and complete calibration ("CONFIRM CAL OK?" screen appears).

9. If the sensor was immersed in a reference solution, re-install the sensor into the process.

10. Press **ENTER key** again to display the active measurement reading on the "CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes TDS CAL calibration.

4.6 Analog Output Calibration

The transmitter analog output is factory-calibrated. However, it can be re-calibrated if desired.

NOTE: *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to calibrate the analog output.*

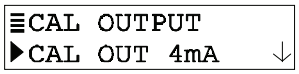
Also, the transmitter adjustment range for output values during calibration is ± 2 mA.

1. Press **MENU key** to display a "MAIN MENU" screen. If the
```
≡MAIN MENU
▶CALIBRATE      ↓
```
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

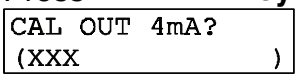
2. Press **ENTER key** to display
```
≡CALIBRATE
▶SENSOR         ↓
```
.

3. Press ⇩ **key** once to display 

.

4. Press **ENTER key** to display 

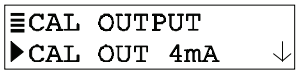
.

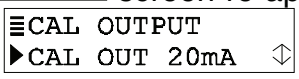
5. Press **ENTER key** again to display a screen like 

. The displayed value is “counts” -- not mA -- that dynamically change as the output is adjusted.

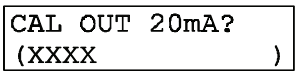
6. Connect a calibrated digital multimeter in series with the loop load to measure the actual minimum mA output in the loop.

7. Use **arrow keys** to adjust the minimum output value to read exactly “4.00 mA” on the digital multimeter -- not the transmitter display, and press **ENTER key** to complete calibration of the minimum endpoint value.

8. After the 

screen re-appears, press ⇩ **key** once to display 

.

9. Press **ENTER key** to display a screen like 

. Once again the displayed value is “counts” -- not mA -- that dynamically change as the output is adjusted.

10. Now measure the actual maximum mA output in the loop with the digital multimeter.

11. Use **arrow keys** to adjust the maximum output value to read exactly “20.00 mA” on the digital multimeter -- not the transmitter display, and press **ENTER key** to complete calibration of the maximum endpoint value.

This completes analog output calibration.

SECTION 5
TEST/MAINTENANCE

The transmitter has TEST/MAINT menu screens to:

- Check operating status of the transmitter and sensor.
- Hold analog output at its last measured value.
- Provide analog output test signal to confirm operation of connected device.
- Identify transmitter firmware EPROM version.
- Simulate a measurement or temperature signal to exercise the measurement loop.
- Reset configuration -- not calibration -- values to defaults.
- Reset calibration -- not configuration -- values to defaults.

☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to use the TEST/MAINT menu screens.*

5.1 STATUS Check (transmitter and sensor)

The system diagnostic capabilities of the transmitter enable you to check the operating status of the transmitter and sensor. The MEASURE screen will flash the "WARNING CHECK STATUS" message when a system diagnostic "fail" condition has been detected. To determine the condition causing the warning, display the "STATUS" screens.

1. Press **MENU key** to display a "MAIN MENU" screen. If the 

screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display 

.

3. Press **ENTER key** again to display "STATUS: ANALYZER OK" screen. This screen confirms that the transmitter is operating properly. If "FAIL" appears, it may mean:
   - Analog-to-digital converter not responding.
   - Internal serial communications failure.

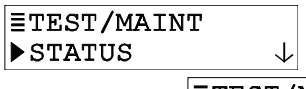
4. Press **ENTER key** once to view "STATUS: SENSOR OK" screen. If "FAIL" appears, it indicates that the sensor cable wires or terminals are shorted.

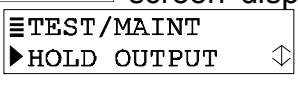
5. Press **ENTER key** once to view the "STATUS: TEMP OK" screen. If "FAIL" appears, it indicates that the PT1000 RTD temperature element in the sensor is inoperative, disconnected or incorrectly wired.

6. To end status checking, press **ESC key** or **ENTER key** (display returns to previous level of TEST/MAINT menu branch).

5.2 HOLD OUTPUT

The HOLD OUTPUT function conveniently holds the analog output at its last measured value for up to 30 minutes to suspend operation of any connected device.

1. With the 

screen displayed, press ⇩ **key** once to display 

.

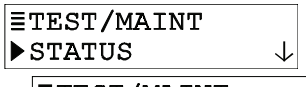
2. Press **ENTER key** to immediately hold the analog output ("HOLD OUTPUT: ENTER TO RELEASE" screen appears, acknowledging hold is applied).

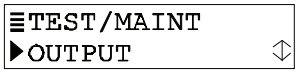
NOTE: *If the keypad is not used within 30 minutes, the analog output will automatically change back to its active state and the display will return to the MEASURE screen.*

3. To release the hold at any time and return the analog output back to its "active" state, press **ENTER key** (display returns to previous level of TEST/MAINT menu branch).

5.3 OUTPUT Test Signal

The OUTPUT function provides an analog output test signal of a desired mA value to confirm operation of a connected device.

1. With the 

screen displayed, press ⇩ **key** until 

screen appears.

2. Press **ENTER key** to display a screen like
```
OUTPUT?
(XX.XXmA          )
```
.

NOTE: *The mA output test signal is now active. Its value is shown on this screen.*

3. Use **arrow keys** to adjust the displayed value to obtain the desired mA test signal.

4. To remove the output test signal and return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.4 Firmware (EPROM VERSION) Check

The EPROM VERSION function checks the version of firmware used in the transmitter.

1. With the
```
≣TEST/MAINT
▶STATUS           ↓
```
screen displayed, press ⇩ **key** until
```
≣TEST/MAINT
▶EPROM VERSION    ⇕
```
screen appears.

2. Press **ENTER key** to view the EPROM version screen.

3. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.5 SELECT SIM Measurement

The SELECT SIM function selects a type of simulated measurement. It is used in conjunction with the SIM SENSOR function (Section 5.6) to simulate a measured value, making the analog output respond accordingly.

1. With the
```
≣TEST/MAINT
▶STATUS           ↓
```
screen displayed, press ⇩ **key** until
```
≣TEST/MAINT
▶SELECT SIM       ⇕
```
screen appears.

2. Press **ENTER key** to display a screen like
```
SELECT SIM?
(SENSOR           )
```
. Use ⇩ **and** ⇧ **keys** to select the type of simulated measurement, and press **ENTER key** to enter it:

- **SENSOR:** Selects simulated measurement to be the configured measurement (conductivity, % concentration or TDS).
- **TEMPERATURE:** Selects simulated measurement to be temperature.

5.6 SIM SENSOR Setting

After selecting the type of simulated measurement (Section 5.5), use the SIM SENSOR function to set the desired simulation value.

1. With the
```
≣TEST/MAINT
▶SELECT SIM      ⇳
```
screen displayed, press ⇩ **key** once to display
```
≣TEST/MAINT
▶SIM SENSOR      ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SIM SENSOR?
(XXXX mS/cm     )
```
.

☞ ***NOTE:*** *The analog output signal is now active. It has a mA value that corresponds to the measurement value shown on this screen.*

3. Use **arrow keys** to adjust the displayed simulation value to the desired value.

4. To remove the simulated output and return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.7 RESET CONFIGURE Values to Factory Defaults

The RESET CONFIGURE function resets stored configuration settings (all at the same time) -- **but not calibration settings** -- to their factory-set defaults shown in TABLE D.

☞ ***NOTE:*** *Resetting configuration values also excludes the SELECT MEASURE function (conductivity, % concentration or TDS) which remains as is until you change it.*

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶RESET CONFIGURE screen appears.

2. Press **ENTER key** to display the "RESET CONFIGURE: ARE YOU SURE?" screen, asking if you really intend to perform this extreme action. (To abort this procedure, press **ESC key** now.)

3. Press **ENTER key** to reset stored configuration settings -- **not calibration settings** -- to factory defaults. The "RESET CONFIGURE: DONE" screen appears, acknowledging that reset has occurred.

4. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.8 RESET CALIBRATE Values to Factory Defaults

The RESET CALIBRATE function resets all stored calibration settings -- **but not configuration settings** -- to factory-set defaults.

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶RESET CALIBRATE screen appears.

2. Press **ENTER key** to display the "RESET CALIBRATE: ARE YOU SURE?" screen, asking if you really intend to perform this extreme action. (To abort this procedure, press **ESC key** now.)

3. Press **ENTER key** to reset all stored calibration settings -- **not configuration settings** -- to factory defaults. The "RESET CALIBRATE: DONE" screen appears, acknowledging that reset has occurred.

4. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

PART FOUR - SERVICE AND MAINTENANCE

SECTION 1
GENERAL INFORMATION

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

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 (typically, monthly intervals). Use the recommended cleaning procedure described in the GLI electrodeless conductivity sensor operating manual.

2.2 Keeping Transmitter Calibrated

Depending on application circumstances, periodically calibrate the transmitter 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.

Calibrate the transmitter using a method described in PART THREE, Section 4.3, 4.4 or 4.5. Calibrating with old, contaminated or diluted reference solution may cause measurement errors. **Do not reuse reference solutions.** Note that the value of a reference solution changes as its temperature changes. Therefore, always allow the temperatures of the sensor and reference solution to equalize while calibrating.

2.3 Avoiding Electrical Interference

Recommendation: Do not run sensor cable (and interconnect cable, if used) in same conduit with AC or DC power.

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 the sensor signal).

SECTION 3
TROUBLESHOOTING

When experiencing problems, try to determine the primary measurement system component causing the problem (sensor, transmitter or interconnect cable, if used).

3.1 Checking Electrical Connections

1. Verify that adequate DC voltage exists at the appropriate transmitter TB1 terminals.
2. Check all transmitter wiring to ensure proper connections.

3.2 Verifying Sensor Operation

To verify sensor operation, refer to the procedure in the troubleshooting section of the sensor operating manual. Or replace the suspect sensor with a known new or working sensor and perform calibration.

3.3 Verifying Transmitter Operation

1. After disconnecting DC power and the sensor from the transmitter, connect a 1000 ohm resistor between Terminals 4 (red) and 5 (yellow) on TB2.
2. Connect a 100,000 ohm resistor between Terminals 1 (white) and 7 (green) on TB2.
3. Reconnect DC power to the transmitter.
4. Verify that the transmitter conductivity reading is between 5.00 and 50.00 mS/cm. Also, verify that the temperature reading is between -10 and +10°C.

If these readings are achieved, the transmitter is operating properly, but the interconnect cable (if used) may be faulty.

3.4 Verifying Interconnect Cable Integrity

1. Disconnect DC power from the transmitter. Reconnect the sensor directly to the transmitter (purposely bypassing the interconnect cable and junction box, if used).
2. Place the sensor in a container of saturated salt water that is at room temperature.
3. Reconnect DC power to the transmitter.
4. Verify that the transmitter conductivity reading is between 150 and 350 mS/cm. If the reading is achieved, the interconnect cable and/or junction box connections are probably faulty. Use a digital multimeter to check the interconnect cable for shorted or open wires.

SECTION 4
TRANSMITTER REPAIR/RETURN

4.1 Customer Assistance

If you need assistance in troubleshooting or repair service, please contact your local GLI representative, or GLI Customer Service at:

GLI International, Inc.
9020 West Dean Road
Milwaukee, WI 53224

Phone: [800] 543-8907
Fax: [414] 355-8346
E-mail: info@gliint.com

— GLI CUSTOMER SERVICE HOURS —

	Eastern Std. Time	Central Std. Time	Mountain Std. Time	Pacific Std. Time
Monday through Thursday	8:30 a.m. to 5:30 p.m.	7:30 a.m. to 4:30 p.m.	6:30 a.m. to 3:30 p.m.	5:30 a.m. to 2:30 p.m.
Friday	8:30 a.m. to 4:00 p.m.	7:30 a.m. to 3:00 p.m.	6:30 a.m. to 2:00 p.m.	5:30 a.m. to 1:00 p.m.

4.2 Repair/Return Policy

Call GLI Customer Service before returning a transmitter for repair. Many problems can be diagnosed and resolved over the telephone. GLI will issue a Return Material Authorization (RMA) number for a transmitter being returned. **All returned transmitters must be freight prepaid and include:**

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

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

Also, GLI will not accept transmitters returned for repair or replacement unless they are thoroughly cleaned and all process material is removed.