OPERATING MANUAL

PRO-series Model P3
pH/ORP Transmitter

(for pH and ORP 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

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 P3 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 1, 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 pH measurement operation using a GLI Differential pH sensor.** To measure ORP, or use a conventional combination electrode or specific features of the instrument, refer to the appropriate sections in this manual for instructions.

A. CONNECTING SENSOR/CONFIGURING SENSOR TYPE AND TEMPERATURE ELEMENT

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

Sensor Wire Colors	Connect to TB2
White	Terminal 1
- - - -	Terminal 2 (unused)
Inner Shield and Black	Terminal 3
Yellow	Terminal 4
Green	Terminal 5
- - - -	Terminal 6 (unused)
Red	Terminal 7
Outer Shield (see Note)	Earth Ground

NOTE: *For GLI Differential sensors with only one shield wire, always connect it to Terminal 3 on TB2.*

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

2. The transmitter is factory-set for use with a GLI Differential Technique pH sensor. To use another type of pH sensor or an ORP sensor, change the sensor type. For details, see PART THREE, Section 3.2, subheading “SELECT SENSOR Type.”

3. The transmitter is factory-set for automatic temperature compensation using the 300 ohm (NTC300) temperature element built into all GLI Differential sensors (except GLI 6006P4-2000 pure water pH sensor system which uses a PT 1000 RTD). To use a sensor with a different temperature element, or if you want fixed MANUAL temperature compensation, change the temperature element type. 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. CONFIGURING BUFFER TYPE/CALIBRATING THE TRANSMITTER

The transmitter must be calibrated so that measured values will correspond to actual process values. Before calibrating for the first time, select the buffer set you intend to use. Then, calibrate using the recommended “2 POINT BUFFER” method which provides the most accurate pH measurements.

1. The transmitter is factory-set for the common 4.00, 7.00, and 10.00 pH buffer set. To use DIN 19267 standard value buffers, change the buffer set. For details, see PART THREE, Section 3.2, subheading “SELECT BUFFER Set for pH Calibration.”

(continued on next page)

CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE TRANSMITTER -- (continued)

NOTE: *When using buffers that are not included in either of these buffer sets, use only the "2 POINT SAMPLE" method for calibration. Refer to that subheading in PART THREE, Section 4.2 for instructions.*

2. Immerse the sensor in the first buffer (preferably pH 7). **Important: Allow the sensor and buffer temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

   NOTE: *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** 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.*

   Calibration Tip! *If, at any time during calibration, the "2 POINT BUFFER: CONFIRM FAILURE?" screen appears, press **ENTER key** to confirm. Then, use the ⇧ **or** ⇩ **key** to select between "CAL: EXIT" or "CAL: REPEAT" and do <u>one</u> of the following:*

   - *With the "2 POINT BUFFER? (CAL: EXIT)" screen selected, press **ENTER key**. Then, after the "2 POINT BUFFER: CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).*
   - *With the "2 POINT BUFFER? (CAL: REPEAT)" screen selected, press **ENTER key** to repeat calibration of this point.*

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 

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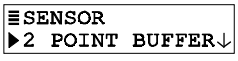
5. Press **ENTER key** again to display 

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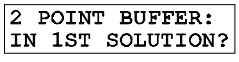
6. Press **ENTER key** again to display 

. With the sensor in the first buffer, press **ENTER key** again to confirm this.

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

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CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE ANALYZER -- (continued)

7. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like this `2 POINT BUFFER: PT1 = 7.00 pH` appears for 5 seconds to confirm calibration of this point.

   NOTE: *Any time the "PLEASE WAIT" screen appears during calibration you can manually complete calibration of the point by pressing the* ***ENTER key****. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in a less accurate calibration.*

8. After the `2 POINT BUFFER: IN 2ND SOLUTION?` screen appears, remove the sensor from the first buffer, rinse it with clean water, and immerse it in the second buffer (typically pH 4). Then press **ENTER key** to confirm this.

9. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like this `2 POINT BUFFER: PT2 = 4.00 pH` appears for 5 seconds to confirm calibration of this point.

10. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to gauge sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance.

11. Press **ENTER key** to end calibration ("2 POINT BUFFER: CONFIRM CAL OK?" screen appears).

12. Install the sensor into the process.

13. Press **ENTER key** to display the active measurement reading on the "2 POINT BUFFER: 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 "2 POINT BUFFER" calibration. The transmitter is now ready to measure pH.

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.

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PART ONE - INTRODUCTION

SECTION 1
GENERAL INFORMATION

1.1 Capability Highlights

Sensor Input

The transmitter can be used with any GLI Differential Technique pH or ORP sensor, or any conventional combination electrode. The transmitter accepts the common temperature compensator elements used in these sensors (NTC 300 ohm thermistor, Pt 1000 RTD or Pt 100 RTD).

MEASURE Screen

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

When Used as pH Transmitter	When Used as ORP Transmitter
• Measured pH • Measured temperature (°C or °F) • Measured pH and temperature • Measured analog output value (mA)	• Measured ORP • Measured analog output value (mA)

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

Four methods are available to calibrate the transmitter for pH. See PART THREE, Section 4.2 for details. For ORP calibration, refer to Section 4.3. The analog output loop can also be calibrated (Section 4.4).

Analog Output

The transmitter's isolated 4-20 mA analog output can be assigned to represent the measured pH or temperature. (When measuring ORP, the output only represents ORP.)

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.

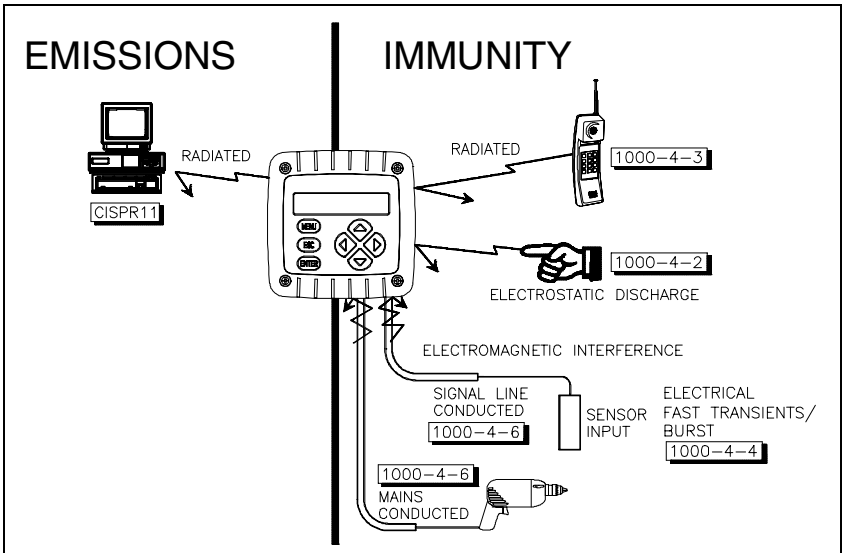


FIGURE 1-1 EMC Diagram

SECTION 2
SPECIFICATIONS

2.1 Operational

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

NOTE: *The measured pH 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.*

Measurement	Ranges
pH	-2.0 to 14.0 pH or -2.00 to 14.00 pH
ORP	-2100 to +2100 mV
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 230.0°F (-10.0 to +110.0°C) with selection for NTC 300 ohm thermistor, Pt 1000 ohm RTD or Pt 100 ohm RTD temperature element; or manually fixed at a user-set temperature; additional selectable temperature correction factors (ammonia, morpholine or user-defined pH/°C linear slope) available for pure water automatic compensation from 0.0-50.0°C

Sensor-to-Transmitter Distance:
- GLI Differential
  - Technique Sensor..... 3000 ft. (914 m) maximum
- Conventional Combination
  - Electrode with preamp ..... 985 ft. (300 m) maximum
- Conventional Combination
  - Electrode w/o preamp ..... 100 ft. (30 m) maximum with electrode cable capacitance of less than 30 pF per foot

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:
- 2 POINT BUFFER (for pH only)..... Automatic calibration and buffer recognition using two buffers from a selected buffer set*.

  NOTE: *When using buffers that are not included in either transmitter buffer set, use only the "2 POINT SAMPLE" method for calibration.*

  **Buffer Sets: 4.00, 7.00, and 10.00 or DIN 19267 standard (1.09, 4.65, 6.79, 9.23, and 12.75)*

- 1 POINT BUFFER (for pH only)..... Automatic calibration and buffer recognition using one buffer from a selected buffer set*.

  NOTE: *When using a buffer that is not included in either transmitter buffer set, use only the "1 POINT SAMPLE" method for calibration.*

- 2 POINT SAMPLE (for pH only)..... Enter two known sample values (determined by laboratory analysis or comparison reading) or two known pH buffer values

1 POINT SAMPLE (for pH or ORP)	Enter one known sample value (determined by laboratory analysis or comparison reading) or one known pH buffer value (or, for ORP measurement, one known reference solution value)
Analog Output	Isolated 4-20 mA output with 0.004 mA (12-bit) resolution

NOTE: *The output can be assigned to represent the measured pH or temperature (or ORP). 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 I, 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 performance specifications are typical at 25°C.

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. Depending on the sensor type, the maximum allowable distance between the sensor and transmitter is:

GLI Differential Technique Sensor	Conventional Combination Electrode **with** Preamp	Conventional Combination Electrode **without** Preamp
3000 feet (914 m)	985 feet (300 m)	*100 feet (30 m)

*An external GLI Model 714 preamp can be used to extend this distance to 3000 feet (914 m), but the preamp must be located within 100 feet (30 m) of the electrode.

☞ ***NOTE:*** *The transmitter is suitable for use 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.

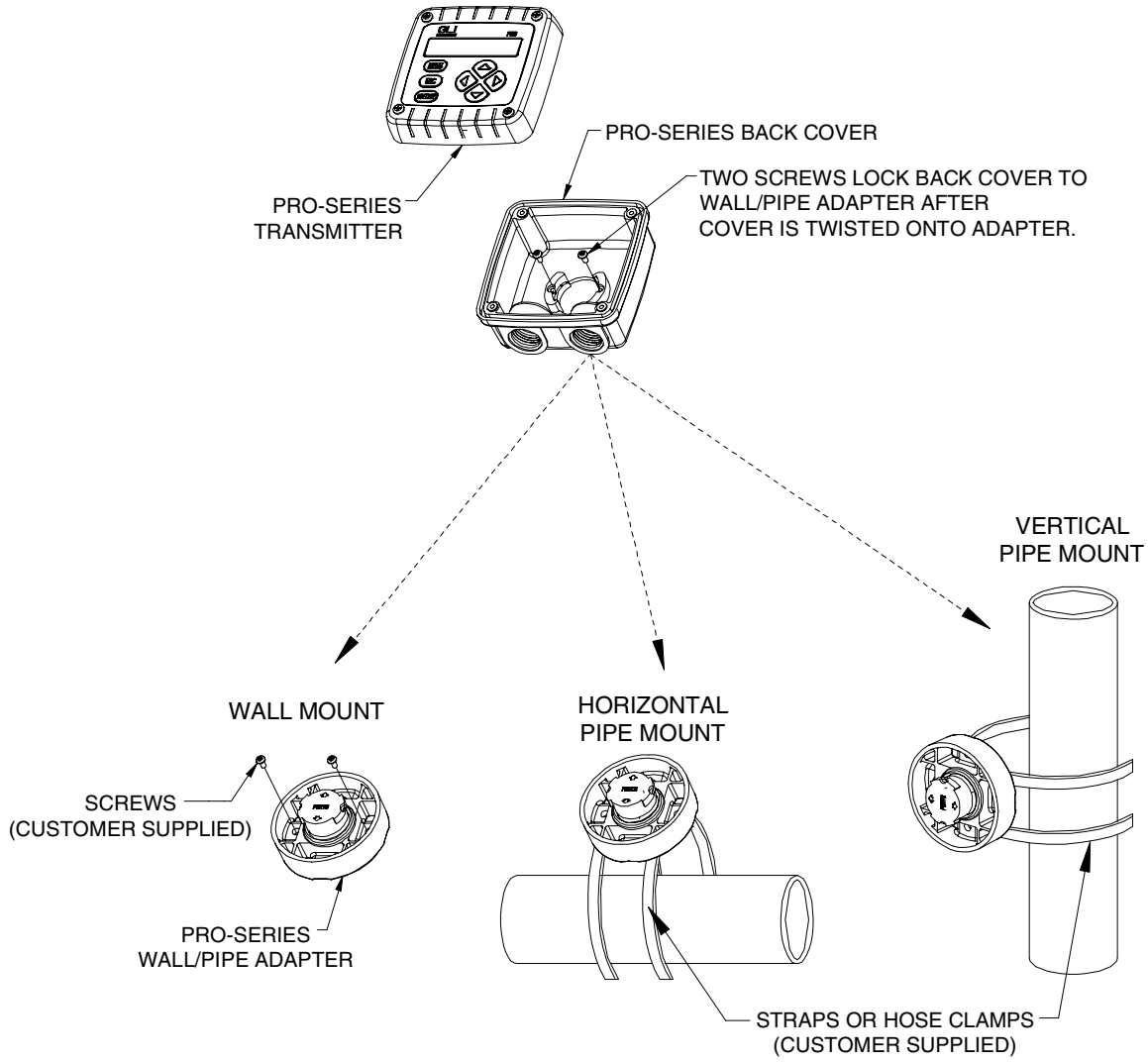


FIGURE 2-1 Wall and Pipe Mounting Details

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.*

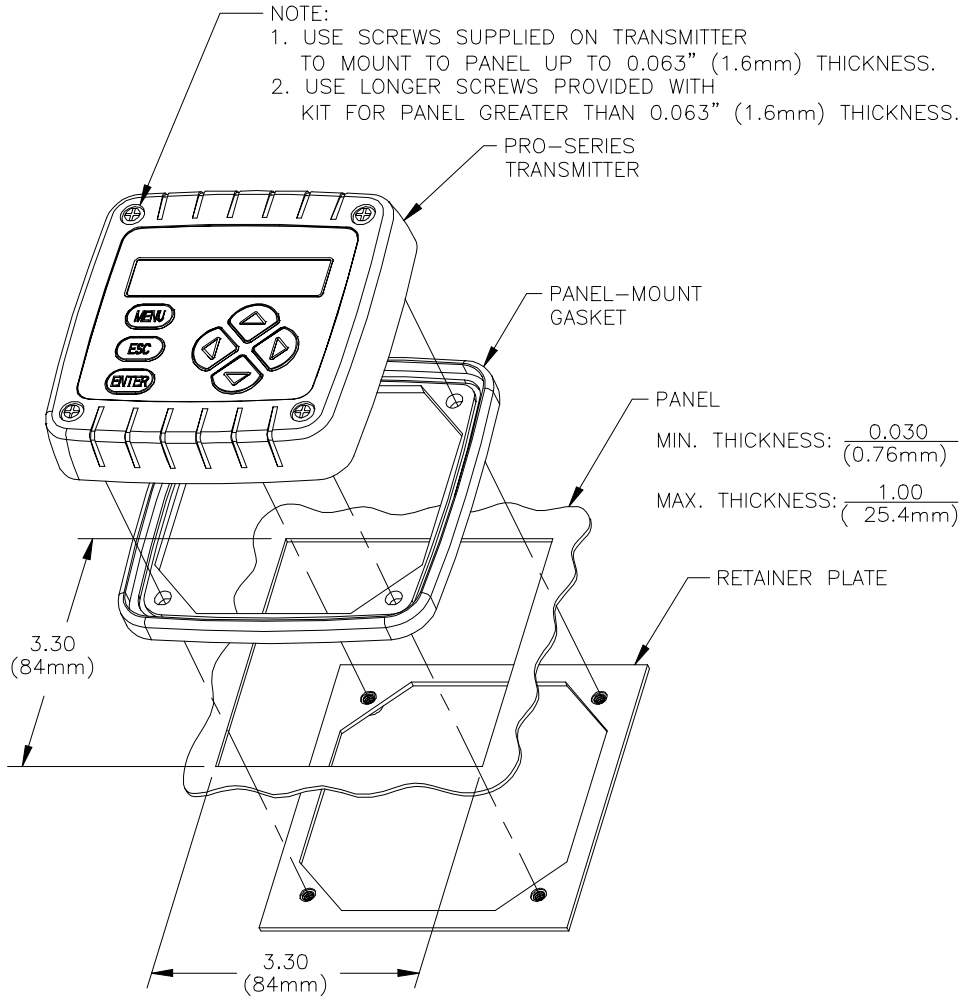


FIGURE 2-2 Panel Mounting Details

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.

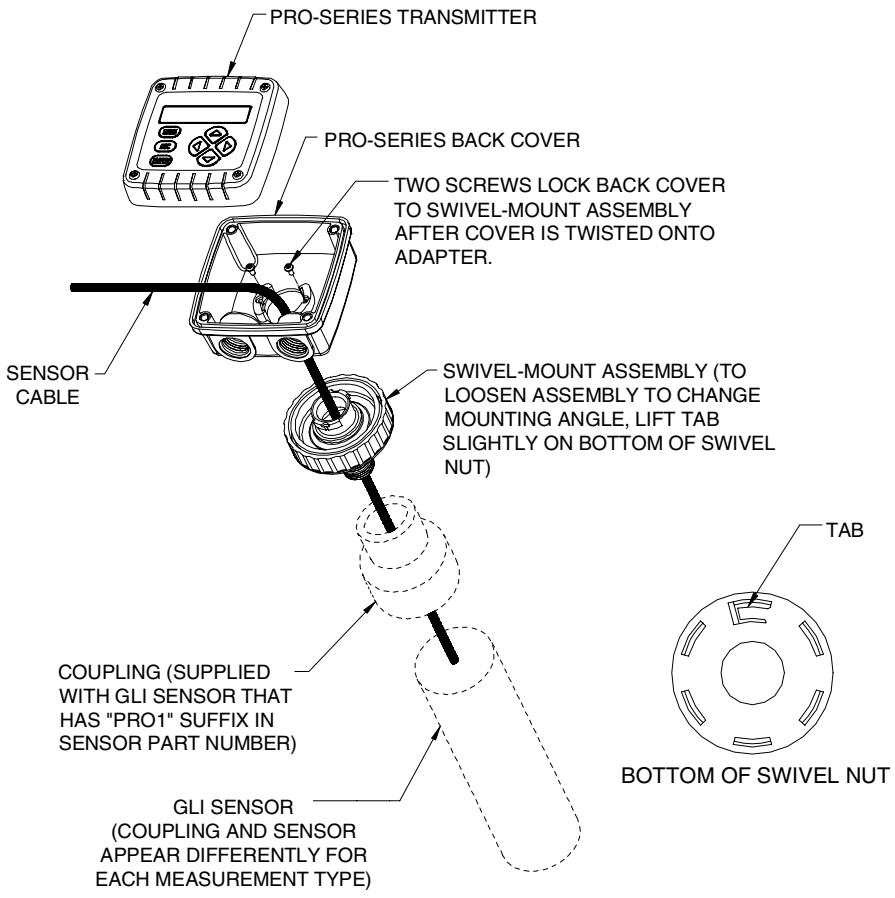


FIGURE 2-3 Integral Sensor Mounting Details

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).
   - ◆ Sensor Cable: Keep cable shields as short as possible. At the transmitter end, connect the outer shield to earth ground, and the inner shield to the SHIELD terminal. If sensor cable has one shield, connect it to the SHIELD terminal. In either case, clamp ferrite (Steward #28A2025-OAO, Fair-Rite Corp. #0431164281, or equivalent) on sensor cable.
   - ◆ 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).

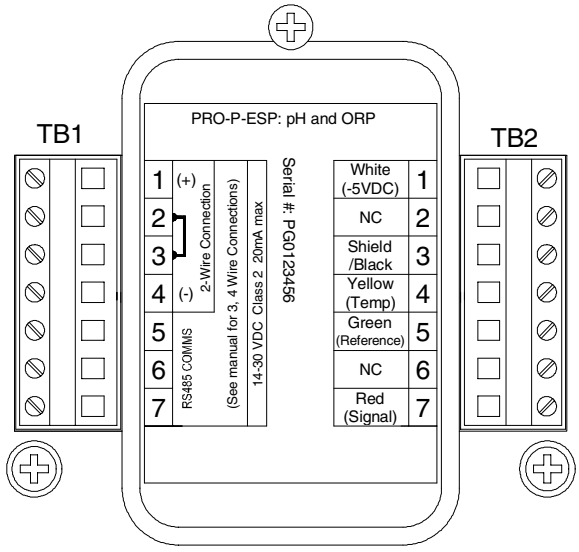


FIGURE 2-4 Transmitter Terminal Designations

3.1 pH or ORP 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.)

GLI Differential Technique Sensor

All GLI Differential Technique sensors have a built-in temperature element for automatic temperature compensation and for measuring process temperature.

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).*

Refer to Figure 2-5 and connect the sensor (or interconnect) cable wires as shown, matching colors as indicated.

NOTE: *For GLI Differential sensors with only one shield wire, always connect it to Terminal 3 on TB2.*

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

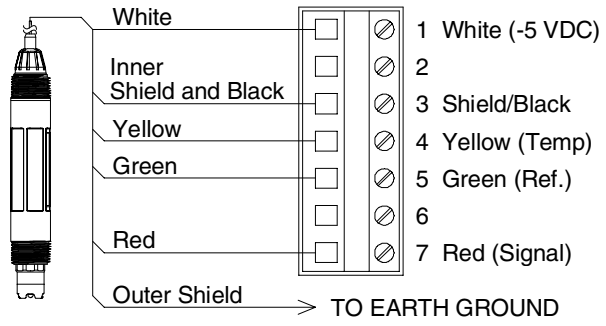


FIGURE 2-5
Connecting GLI Differential Technique Sensor

Conventional Combination Electrode

The electrode must be within 100 ft. (30 m) of the transmitter (985 ft./300 m for electrode with preamp). Refer to Figure 2-6 and directly connect the electrode's coaxial cable to the transmitter.

1. Connect the electrode's reference signal -- braided shield wire of coaxial cable (black insulated wire for GLI electrode) -- to Terminal 5 on TB2.

2. Connect the electrode's active signal -- center wire of coaxial cable (clear insulated wire for GLI electrode) -- to Terminal 7 on TB2.

3. Connect a jumper between Terminals 3 and 5 on TB2.

4. Connect the electrode's temperature element (typically white and red insulated wires for GLI electrode) to Terminals 3 and 4 on TB2, attaching either wire to either terminal.

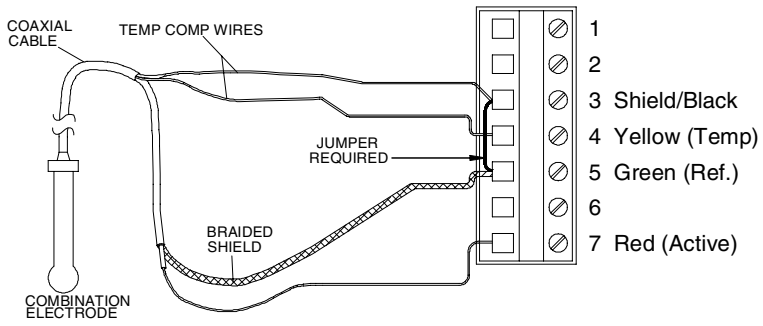


FIGURE 2-6
Connecting Conventional Combination Electrode

Conventional Combination Electrode with Ground Rod

Some applications require that an external ground rod be used with the combination electrode. The electrode must be within 100 ft. (30 m) of the transmitter (985 ft./300 m for electrode with preamp). Refer to Figure 2-7 and directly connect the electrode's coaxial cable to the transmitter.

Connect the electrode and temperature element wires in the same way as described in the previous "Conventional Combination Electrode" subheading -- and also connect the ground rod wire to Terminal 3 on TB2.

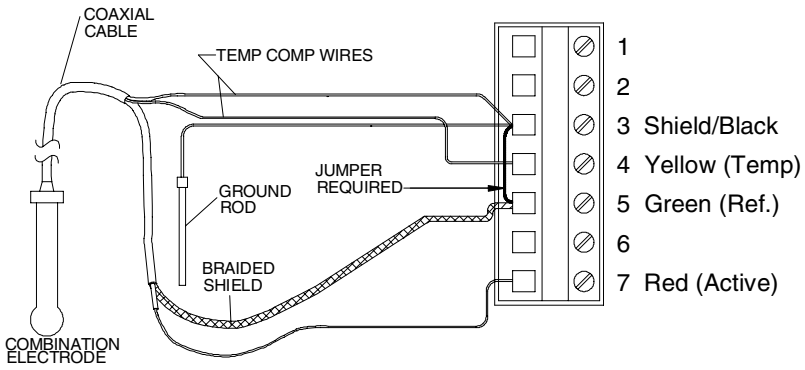


FIGURE 2-7
Connecting Conventional Combination Electrode with Ground Rod

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 2-8 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.

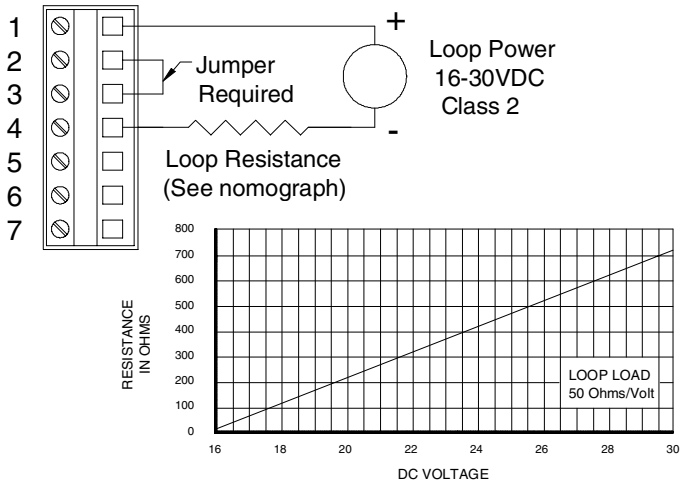


FIGURE 2-8
Two-wire Hookup

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.

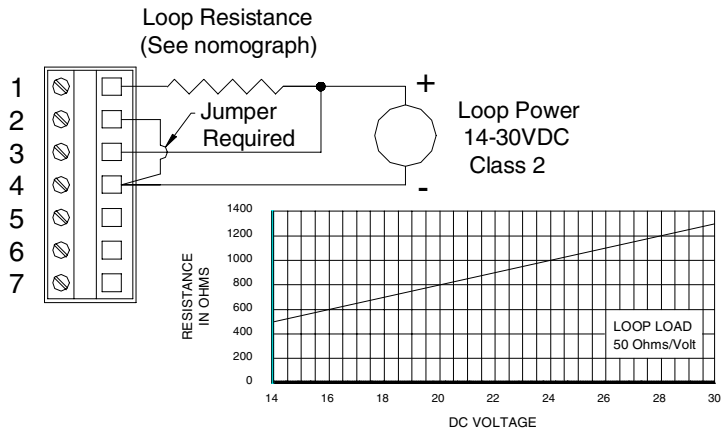


FIGURE 2-9
Three-wire Hookup -- Load Sinking

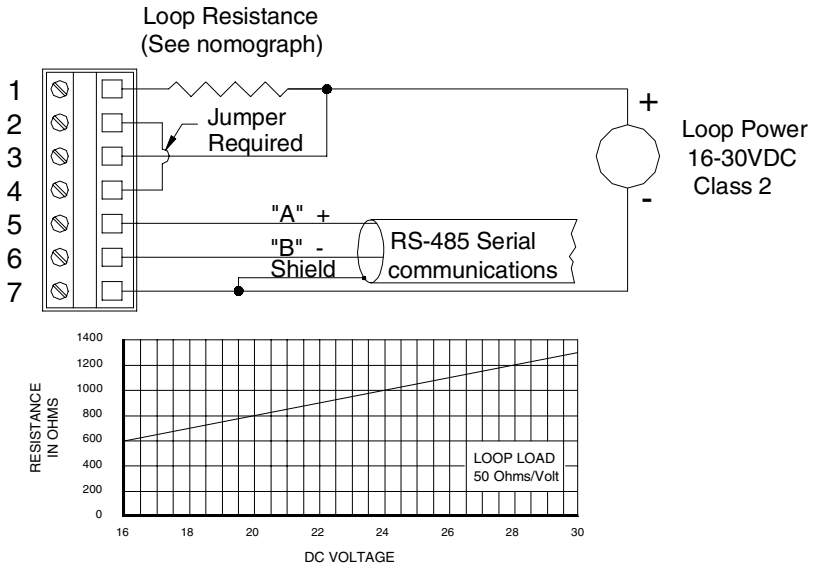


FIGURE 2-10
Three-wire Hookup -- Load Sinking with RS-485 Serial Communication

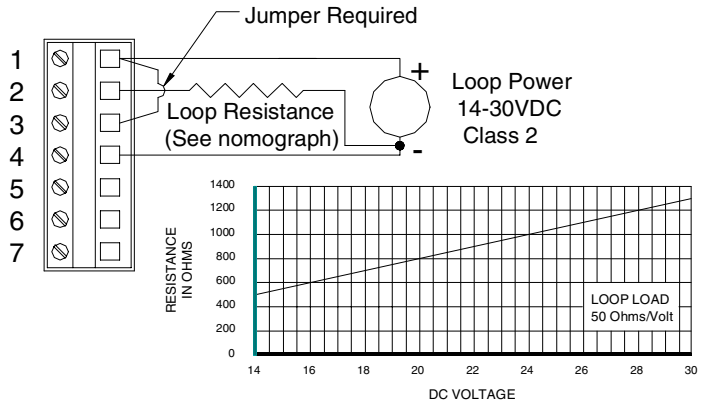


FIGURE 2-11
Three-wire Hookup -- Load Sourcing

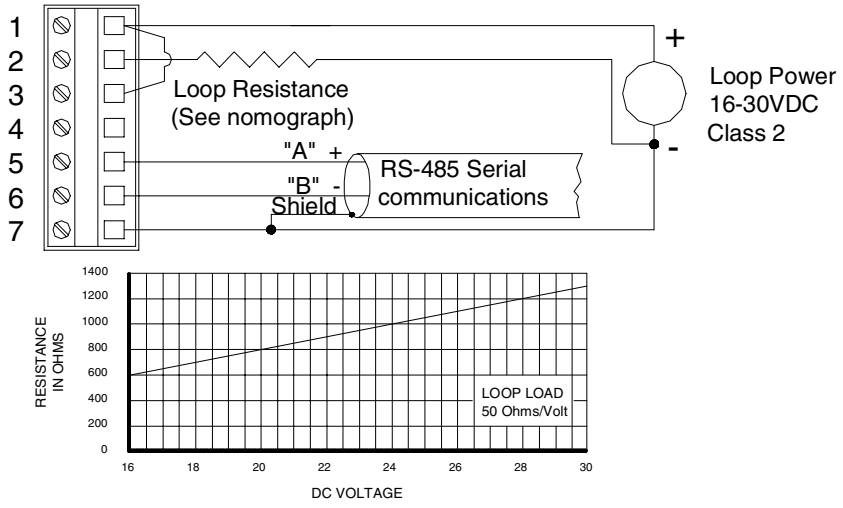


FIGURE 2-12
Three-wire Hookup -- Load Sourcing with RS-485 Serial Communication

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.

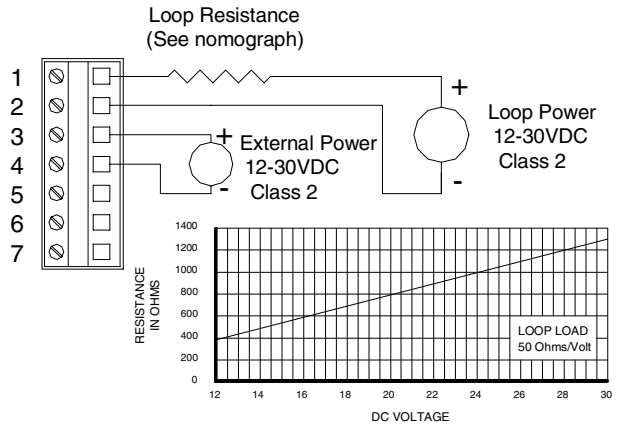


FIGURE 2-13
Four-wire Hookup without RS-485 Serial Communication

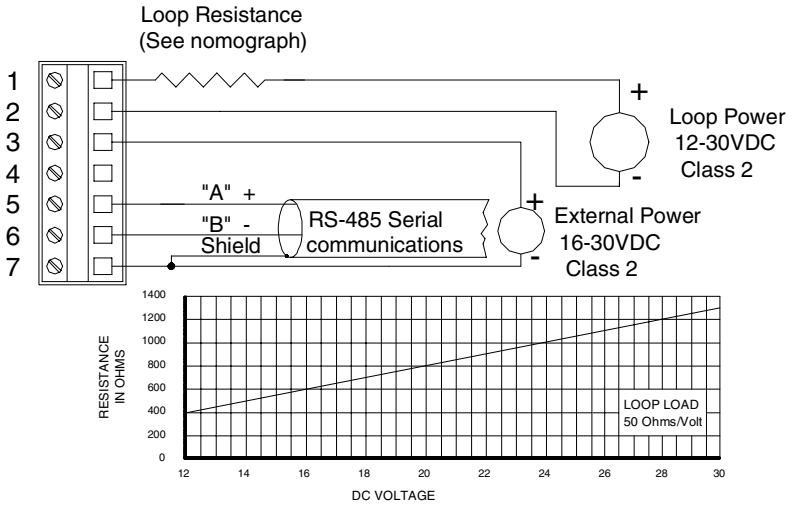


FIGURE 2-14
Four-wire Hookup with RS-485 Serial Communication

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.

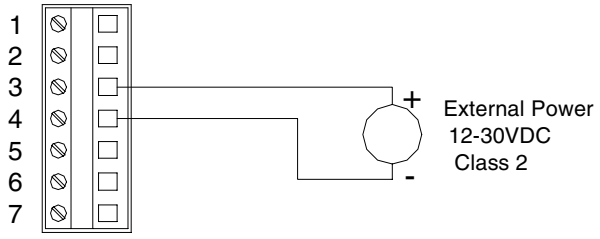


FIGURE 2-15
Monitor Mode Hookup (without Current Loop) -- without RS-485 Serial Communication

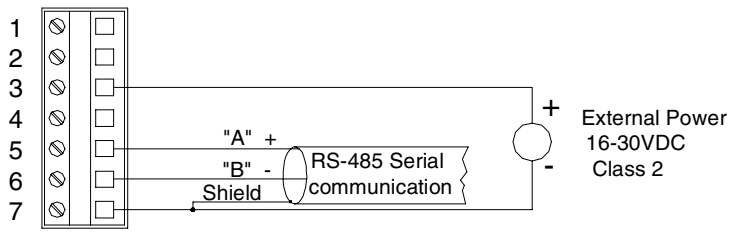


FIGURE 2-16
Monitor Mode Hookup (without Current Loop) -- with RS-485 Serial Communication

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 pH (or ORP). Pressing the ⇨ **key** sequentially scrolls through these other measurement readouts:
  - ✓ Measured process temperature
  - ✓ Measured pH and temperature

  } not provided when using transmitter to measure ORP
  - ✓ Measured analog output mA value

- **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 the "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.

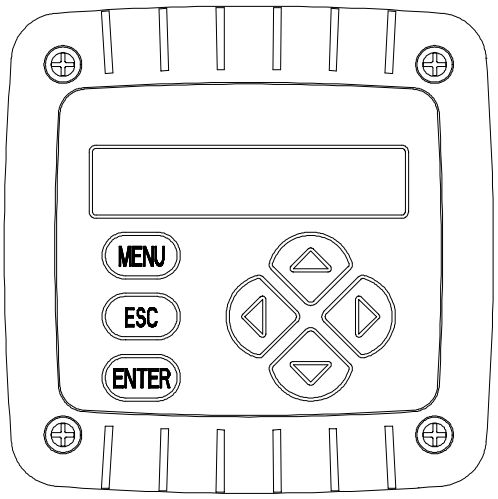
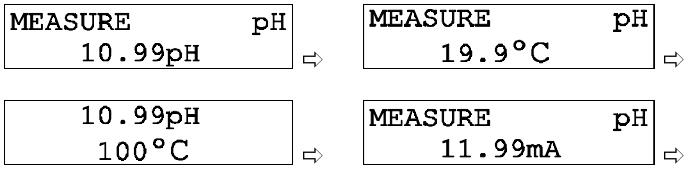


FIGURE 3-1 Transmitter Keypad

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.

When using the transmitter to measure pH, 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:



☞ ***NOTE:*** *If pure water temperature compensation was selected (PART THREE, Section 3.2, subheading "Select PURE H2O COMP") the MEASURE screen will show an asterisk after the pH reading to indicate it is being applied.*

When using the transmitter to measure ORP, only two readouts are shown: measured mV and the mA output. The two screens showing temperature are not available.

☞ ***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 "PH" 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

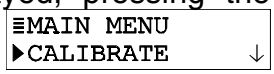
The transmitter menu tree is divided into three main branches: CALIBRATE, CONFIGURE, and TEST/MAINT. Each main branch is structured similarly in layers with top-level screens, related lower-level submenu screens and, in many cases, sub-submenu screens.

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.

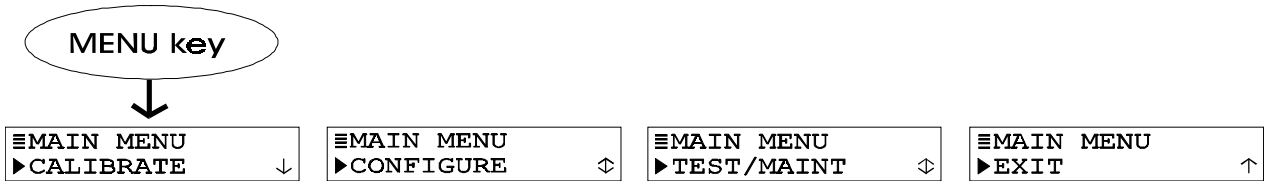
2.1 Displaying Main Branch Selection Screens

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



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:

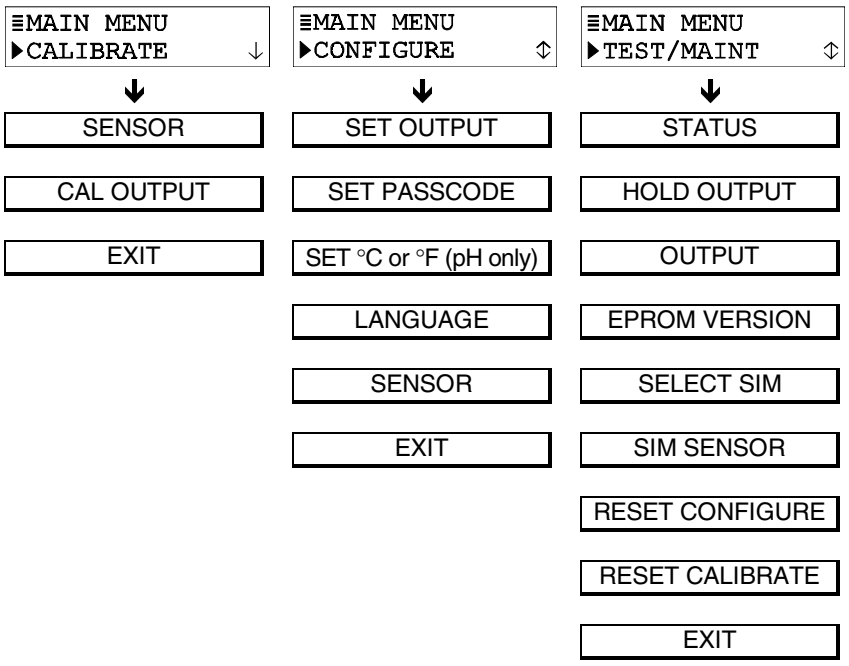


3. With the desired MAIN MENU branch selection screen displayed, press **ENTER key** to display the first top-level menu screen within that branch.

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 menu 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?
(12.33 pH        )
```

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 `≡MAIN MENU ▶CONFIGURE ⇕` screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display `≡CONFIGURE ▶SET OUTPUT ↓` .

3. Press ⇩ **key** until `≡CONFIGURE ▶LANGUAGE ⇕` screen appears.

4. Press **ENTER key** to display `LANGUAGE? (ENGLISH )` . 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 sensor used with it, and other related items such as the display format, desired buffer set for calibration, temperature element, input signal filtering, etc.

SELECT SENSOR Type

1. With the `≡CONFIGURE ▶LANGUAGE ⇕` screen displayed, press ⇩ **key** <u>once</u> to display `≡CONFIGURE ▶SENSOR ⇕` .

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

3. Press **ENTER key** again to display a screen like
```
SELECT SENSOR?
(DIFF pH       )
```
. Use ⇩ **and** ⇧ **keys** to select the type of sensor to be used with the transmitter, and press **ENTER key** to enter it:

   - **DIFF pH:** Selects GLI Differential pH sensor.
   - **COMBINATION pH:** Selects conventional combination pH electrode.
   - **ORP:** Selects ORP sensor (either a GLI Differential ORP sensor or a conventional combination ORP electrode).

WARNING:

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

Select DISPLAY FORMAT

When using the transmitter to measure ORP, this function is not provided. (The ORP display format is fixed to show mV values as only whole numbers.) For pH measurement, select the desired display format (XX.XX or XX.X) for the MEASURE screen. This format setting has no effect on edit/selection screens, which always show pH values in a XX.XX format.

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

2. Press **ENTER key** to display a screen like
```
DISPLAY FORMAT?
(XX.XX pH      )
```
. Use ⇩ **and** ⇧ **keys** to select the desired format (XX.XX or XX.X), and press **ENTER key** to enter it.

SELECT BUFFER Set for pH Calibration

When using the transmitter to measure ORP, this function is not provided. For pH measurement, configure the transmitter to use one of these buffer sets for pH calibration:

- 4.00, 7.00, and 10.00
- DIN 19267 Standard (1.09, 4.65, 6.79, 9.23, and 12.75)

☞ ***NOTE:*** *When using buffers that are not included in either of the transmitter buffer sets, disregard selecting the buffer set. In this case, use only the "1 (or) 2 POINT SAMPLE" method for pH calibration.*

The transmitter automatically recognizes pH values from the selected buffer set and uses its associated built-in table of pH-versus-temperature values to improve measurement accuracy. To select a buffer set:

1. With the `≡SENSOR ▶DISPLAY FORMAT⇳` screen displayed, press ⇩ **key** <u>once</u> to display `≡SENSOR ▶SELECT BUFFER ⇳`.

2. Press **ENTER key** to display a screen like `SELECT BUFFER? (4,7,10 )`. Use ⇩ **and** ⇧ **keys** to select a buffer set (4, 7, 10 or DIN 19267) for use during calibration, and press **ENTER key** to enter it.

Select PURE H2O COMP (only for special applications)

When using the transmitter to measure ORP, this function is not provided. When measuring pH in solutions with the weakly dissociating electrolytes ammonia or morpholine, built-in tables provide a correction factor for pure water temperature compensation. This special compensation is specifically for use in power plant applications. It adds an associated temperature-dependent offset, from the selected table, to the measured pH. If custom compensation is required for pure water applications, a "user-defined" pH/°C linear slope factor can be applied to the measured pH.

☞ ***NOTE:*** *The selected pure water temperature compensation is limited to 50°C. If the process temperature is higher, the offset corresponding to 50°C is used.*

1. With the `≡SENSOR ▶SELECT BUFFER ⇳` screen displayed, press ⇩ **key** <u>once</u> to display `≡SENSOR ▶PURE H2O COMP ⇳`.

2. Press **ENTER key** to display `≡PURE H2O COMP ▶SELECT TYPE ↓`.

3. Press **ENTER key** again to display a screen like `PURE H2O COMP? (NONE )`. Use ⇩ **and** ⇧ **keys** to select the desired pure water temperature compensation (NONE, AMMONIA, MORPHOLINE or USER DEFINED), and press **ENTER key** to enter it.

4. If "USER DEFINED" was selected, you must set the specific pH/°C linear slope:

   A. With the `≡PURE H2O COMP ▶SELECT TYPE ↓` screen displayed, press ⇩ **key** once to display `≡PURE H2O COMP ▶SET SLOPE ⇳`.

   B. Press **ENTER key** to display a screen like `SET SLOPE? (0.0000 pH/°C )`. Use **arrow keys** to adjust to a desired slope, and press **ENTER key** to enter it.

☞ ***NOTE:*** *The MEASURE screen will show an asterisk after the pH reading to indicate pure water temperature compensation was selected and is being applied.*

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 ▶PURE H2O COMP ⇳` 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 “PH.” 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?
   ([P]H            )
   ```
   . 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

When using the transmitter to measure ORP, this function is not provided since ORP measurement does not require temperature compensation. When measuring pH, configure the transmitter for either automatic temperature compensation (by defining the sensor’s built-in temperature element or an external element) or fixed MANUAL temperature compensation. When using MANUAL you must determine and enter a specific temperature.

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

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 a screen like SELECT TYPE? / (NTC 300) . Use ⇩ **and** ⇧ **keys** to select the type of temperature element used with the pH sensor to compensate the measurement, and press **ENTER key** to enter it:

   - **NTC300:** Selects automatic temperature compensation using only a NTC 300 ohm thermistor temperature element (in all GLI Differential pH sensors -- except Model 6006P4-2000 pure water pH sensor systems which use a Pt 1000 RTD).
   - **PT1000:** Selects automatic temperature compensation using only a Pt 1000 RTD temperature element.
   - **PT100:** Selects automatic temperature compensation using only a Pt 100 RTD temperature element.
   - **MANUAL:** For pH measurement only -- selects fixed manual temperature compensation (disregards temperature element -- see step 4).

4. If “MANUAL” was selected, you must set the specific manual temperature compensation value:

   A. With the ≣TEMP ELEMENT / ▶SELECT TYPE ↓ screen displayed, press ⇩ **key** <u>once</u> 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.

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

When using the transmitter to measure ORP, this function is not provided. When measuring pH, the temperature can also be displayed. The MEASURE screen can be set to display temperature values in °C or °F. In either case, display resolution for measured temperature is always “XX.X.”

1. With the ≣TEMP ELEMENT ▶SELECT TYPE ↓ or ≣TEMP ELEMENT ▶SET MANUAL ⇳ screen displayed, press **ESC key** <u>twice</u> to display ≣CONFIGURE ▶SENSOR ⇳ .

2. Press ⇧ **key** -- not ⇩ **key** -- <u>twice</u> to display ≣CONFIGURE ▶SET °C OR °F ⇳ .

3. Press **ENTER key** to display a screen like SET °C OR °F? (°C) . 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)

When using the transmitter to measure ORP, this function is not provided. (The output always represents the measured ORP.) When measuring pH, the output can be assigned to represent the SENSOR (measured pH) 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, 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? / (7.00 pH) . 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? / (12.33 pH) . 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** <u>once</u> 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.

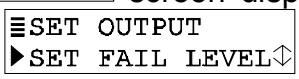
SET FAIL LEVEL Mode (off, 4 mA or 20 mA)

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 

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

.

2. Press **ENTER key** to display 

. 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)

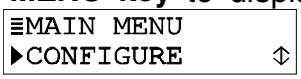
The transmitter has a passcode feature to restrict access to configuration settings and calibration to only authorized personnel.

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

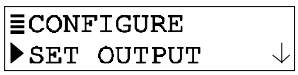
- **ENABLED:** With the passcode feature enabled, all configuration settings can be displayed -- but they cannot be changed -- and the CALIBRATE and TEST/MAINT menus cannot be accessed without the passcode. When you attempt to change a setting in the CONFIGURE menu by pressing the **ENTER key**, a displayed 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 

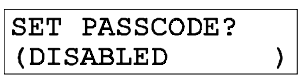
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

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

TABLE A -- 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 SENSOR?	DIFF pH, COMB pH or ORP	DIFF pH	
DISPLAY FORMAT?	pH: XX.XX pH or XX.X pH ORP: Fixed at XXXX mV	pH: XX.XX pH ORP: XXXX mV	
SELECT BUFFER?	pH: 4, 7, 10 or DIN 19267 ORP: Screen not applicable/provided.	pH: 4, 7, 10 ORP: Not applicable	
PURE H2O COMP SELECT TYPE?	pH: NONE, AMMONIA MORPHOLINE or USER DEFINED ORP: Screen not applicable/provided.	pH: NONE ORP: Not applicable	
SET FILTER?	0-60 seconds	0 seconds	
ENTER NOTE?	pH: Replace PH with up to eight characters ORP: Replace ORP with up to eight characters	pH: PH ORP: ORP	
TEMP ELE: SELECT TYPE?	pH: NTC300, PT1000, PT100 or MANUAL ORP: Screen not applicable/provided.	pH: NTC300 ORP: Not applicable	
TEMP ELE: SET MANUAL?	pH: 0.0-100.0°C ORP: Screen not applicable/provided.	pH: 25.0°C ORP: Not applicable	
TEMPERATURE Display Setting			
SET °C OR °F?	pH: °C or °F ORP: Screen not applicable/provided.	pH: °C ORP: Not applicable	
OUTPUT Settings			
SET PARAMETER?	pH: SENSOR or TEMPERATURE ORP: Screen not applicable/provided.	pH: SENSOR ORP: Not applicable	
SET 4mA VALUE?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	pH: 0.00 pH ORP: 0 mV TEMP: 0.0°C or 32.0°F	
SET 20mA VALUE?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	pH: 14.00 pH ORP: +2100 mV TEMP: 200.0°C or 392.0°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?	pH: SENSOR or TEMPERATURE ORP: Screen not applicable/provided.	pH: SENSOR ORP: Not applicable	
SIM SENSOR?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	Present measured value of sensor's selected parameter (pH, ORP or temperature)	

SECTION 4
TRANSMITTER CALIBRATION

4.1 Important Information

Four methods are available for pH calibration (Section 4.2). To calibrate ORP, use only the 1-POINT SAMPLE method described in Section 4.3. The analog output loop can also be calibrated (Section 4.4).

Calibrate Periodically

To maintain best measurement accuracy, periodically calibrate the transmitter. Performance of the pH or ORP sensor slowly degrades over time, eventually causing inaccurate readings. The time period between calibrations, and the rate of system 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 transmitter calibrated. The daily, 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.

Temperature-corrected pH Measurement

The transmitter is factory-calibrated for accurate temperature measurement. It will provide pH readings that are automatically corrected for temperature changes when the transmitter:

- Receives a temperature signal from a pH sensor that has a built-in temperature element (all GLI Differential sensors) or from an external temperature element.
- Has been correctly set for the type of temperature element being used for automatic compensation.

☞ ***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.*

Calibration Tip! If a "CONFIRM FAILURE?" screen appears during 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**. 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 calibration of the point.

4.2 pH Calibration

Based on convenience and your application requirements, use one of the four methods provided for pH calibration.

CAUTION:

WHEN USING A NEW SENSOR OR REPLACING THE STANDARD CELL SOLUTION AND SALT BRIDGE ON AN EXISTING GLI DIFFERENTIAL SENSOR, ALWAYS PERFORM A "RESET CALIBRATE" USING THE TEST/MAINT MENU (PART THREE, SECTION 5.8) BEFORE CALIBRATING.

NOTE: *When calibrating a sensor for the first time, always use a two-point method for best accuracy.*

2 POINT BUFFER Method

This recommended method requires two buffers, typically pH 7 and pH 4. (pH 10 buffer is also readily available but is not as stable, particularly at extreme temperatures.) This method automatically recognizes buffers from the selected buffer set. **Therefore, you must use buffers that match values in the buffer set** (see PART THREE, Section 3.2, subheading "SELECT BUFFER Set for pH Calibration" for details.)

NOTE: *When using buffers that are not included in either of the transmitter buffer sets, disregard this calibration method. Instead, use only the "2 POINT SAMPLE" calibration method.*

1. Immerse the sensor in the first pH buffer (preferably pH 7). **Important: Allow the sensor and buffer temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

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
▶2 POINT BUFFER↓
```
.

5. Press **ENTER key** again to display
```
2 POINT BUFFER:
IN 1ST SOLUTION?
```
. With the sensor in the first buffer, press **ENTER key** again to confirm this.

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

6. While the
```
2 POINT BUFFER:
PLEASE WAIT
```
screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like
```
2 POINT BUFFER:
PT1 = 7.00 pH
```
appears for 5 seconds to confirm calibration of this point.

☞ ***NOTE:*** *Any time the "PLEASE WAIT" screen appears during calibration you can <u>manually</u> complete calibration of the point by pressing the **ENTER key**. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in a less accurate calibration.*

7. After the
```
2 POINT BUFFER:
IN 2ND SOLUTION?
```
screen appears, remove the sensor from the first buffer, rinse it with <u>clean</u> water, and immerse it in the second buffer (typically 4 pH). Then press **ENTER key** to confirm this.

8. While the
```
2 POINT BUFFER:
PLEASE WAIT
```
screen is displayed, the

transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like

```
2 POINT BUFFER:
PT2 = 4.00 pH
```

appears for 5 seconds to confirm calibration of this point.

9. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

10. Press **ENTER key** to end calibration ("2 POINT BUFFER: CONFIRM CAL OK?" screen appears).

11. Re-install the sensor into the process.

12. Press **ENTER key** to display the active measurement reading on the "2 POINT BUFFER: 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 "2 POINT BUFFER" calibration.

1 POINT BUFFER Method

This method is similar to the 2 POINT BUFFER method except that only one buffer is used to calibrate one point. This method also automatically recognizes buffers from the buffer set you selected. Therefore, you must use a buffer that matches a value in the buffer set. (See PART THREE, Section 3.2, subheading "SELECT BUFFER Set for pH Calibration" for selection details.)

NOTE: *When using a buffer that is not included in either of the transmitter buffer sets, disregard this calibration method. Instead, use only the "1 POINT SAMPLE" calibration method.*

1. Immerse the sensor in the pH buffer. **Important: Allow the sensor and buffer temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

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
▶2 POINT BUFFER↓
```
.

5. Press ⇩ **key** <u>once</u> to display
```
≡SENSOR
▶1 POINT BUFFER⇕
```
.

6. Press **ENTER key** to display
```
1 POINT BUFFER:
SAMPLE READY?
```
. With the sensor in the buffer, press **ENTER key** to confirm this.

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

7. While the
```
1 POINT BUFFER:
PLEASE WAIT
```
screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates the point. Thereafter, a screen like
```
1 POINT BUFFER:
PT = 7.00 pH
```
appears for 5 seconds to confirm calibration of the point.

☞ ***NOTE:*** *Any time the "PLEASE WAIT" screen appears during calibration, you can <u>manually</u> complete calibration of the point by pressing the **ENTER key**. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in a less accurate calibration.*

8. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the

slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

9. Press **ENTER key** to end calibration ("1 POINT BUFFER: CONFIRM CAL OK?" screen appears).

10. Re-install the sensor into the process.

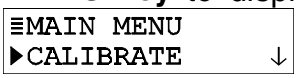
11. Press **ENTER key** to display the active measurement reading on the "1 POINT BUFFER: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "1 POINT BUFFER" calibration.

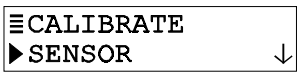
2 POINT SAMPLE Method

This method requires you to enter the known pH values of two process samples (or two pH buffers). Determine sample values using laboratory analysis or comparison readings.

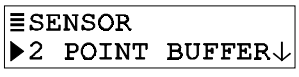
1. Immerse the sensor in the first solution (sample or buffer). **Important: Allow the sensor and sample temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

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

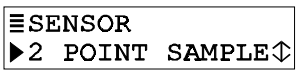
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display 

.

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

.

5. Press ⇩ **key** twice to display 

.

6. Press **ENTER key** to display `2 POINT SAMPLE: IN 1ST SOLUTION?` . With the sensor in the first sample, press **ENTER key** again to confirm this. This active `2 POINT SAMPLE: PT1 = X.XX pH` screen appears showing the measurement reading.

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 `2 POINT SAMPLE? (X.XX pH )` screen appears showing the "last" measured value.

8. Determine the pH value of the first solution. For a sample, use laboratory analysis or a calibrated portable pH meter. (When using a pH buffer, refer to the table on the buffer bottle to find the exact pH value corresponding to the temperature of the buffer.)

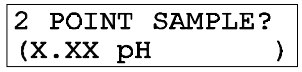
9. With the static `2 POINT SAMPLE? (X.XX pH )` screen displayed, use **arrow keys** to adjust the displayed value to exactly match the known pH value of the first solution (sample or buffer). Then press **ENTER key** to enter it, completing calibration of the first point.

10. After the `2 POINT SAMPLE: IN 2ND SOLUTION?` screen appears, remove the sensor from the first solution, and rinse it with clean water.

11. Immerse the sensor in the second solution, and press **ENTER key** to confirm. This active `2 POINT SAMPLE: PT2 = X.XX pH` screen appears showing the measurement reading.

12. 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 `2 POINT SAMPLE? (X.XX pH )` screen appears showing the "last" measured value.

13. Determine the pH value of the second solution.

14. With the static 

screen displayed, use **arrow keys** to adjust the displayed value to exactly match the known pH value of the second solution. Then press **ENTER key** to enter it, completing calibration of the second point.

15. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

16. Press **ENTER key** to end calibration ("2 POINT SAMPLE: CONFIRM CAL OK?" screen appears).

17. Re-install the sensor into the process.

18. Press **ENTER key** to display the active measurement reading on the "2 POINT SAMPLE: 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 "2 POINT SAMPLE" calibration.

1 POINT SAMPLE Method

This method is similar to the 2 POINT SAMPLE method except that only one sample (or buffer) is used to calibrate one point. This method requires you to enter the known pH value of the sample (or pH buffer). Determine the sample value using laboratory analysis or a comparison reading.

1. Immerse the sensor in the sample (or buffer). **Important: Allow the sensor and sample temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

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 ▶2 POINT BUFFER↓.

5. Press ⇩ **key** three times to display ≡SENSOR ▶1 POINT SAMPLE⇕.

6. Press **ENTER key** to display 1 POINT SAMPLE: SAMPLE READY?. With the sensor in the sample, press **ENTER key** to confirm this. This active 1 POINT SAMPLE: PT = X.XX pH screen appears showing the measurement reading.

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 1 POINT SAMPLE? (X.XX pH) screen appears showing the "last" measured value.

8. Determine the pH value of the sample using laboratory analysis or a calibrated portable pH meter. (When using a pH buffer, refer to the table on the buffer bottle to find the exact pH value corresponding to the temperature of the buffer.)

9. With the static 1 POINT SAMPLE? (X.XX pH) screen displayed, use **arrow keys** to adjust the displayed value to exactly match the known pH value of the sample (or buffer). Then press **ENTER key** to enter it, completing calibration of the point.

10. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to

improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

11. Press **ENTER key** to end calibration ("1 POINT SAMPLE: 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 "1 POINT SAMPLE: 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 "1 POINT SAMPLE" calibration.

4.3 ORP Calibration

Calibrate for ORP measurement using only this "1 POINT SAMPLE" method.

CAUTION:

WHEN USING A NEW SENSOR OR REPLACING THE STANDARD CELL SOLUTION AND SALT BRIDGE ON AN EXISTING GLI DIFFERENTIAL SENSOR, ALWAYS PERFORM A "RESET CALIBRATE" USING THE TEST/MAINT MENU (PART THREE, SECTION 5.8) BEFORE CALIBRATING.

NOTE: *A two-point calibration method is purposely excluded since it could provide bad results. Immersing the sensor into one reference solution and then into the other could contaminate electrochemical components of the sensor.*

The "1 POINT SAMPLE" method requires you to enter the known mV value of a sample (or reference solution).

Determine the sample mV value using laboratory analysis or a comparison reading.

1. Immerse the sensor in the sample (or reference solution).

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
▶1 POINT SAMPLE     ↓
```
.

5. Press **ENTER key** again to display
```
1 POINT SAMPLE:
SAMPLE READY?
```
. With the sensor in the sample (or reference solution), press **ENTER key** to confirm this. This <u>active</u>
```
1 POINT SAMPLE:
PT = XXXX mV
```
screen appears showing the measurement reading.

6. Wait for the reading to stabilize. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this <u>static</u>
```
1 POINT SAMPLE?
(XXXX mV            )
```
screen appears showing the "last" measured value.

7. If not using an ORP reference solution, determine the mV value of the sample using laboratory analysis or a calibrated portable ORP meter.

8. With the <u>static</u>
```
1 POINT SAMPLE?
(XXXX mV            )
```
screen displayed, use **arrow keys** to adjust the displayed value to exactly match the <u>known</u> mV value of the sample (or reference solution). Then press **ENTER key** to enter it, completing calibration of the point.

9. Press **ENTER key** again to end calibration ("1 POINT SAMPLE: CONFIRM CAL OK?" screen appears).

10. Re-install the sensor into the process.

11. Press **ENTER key** to display the <u>active</u> measurement

reading on the "1 POINT SAMPLE: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).

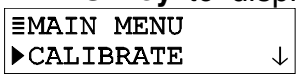
This completes ORP calibration.

4.4 Analog Output Calibration

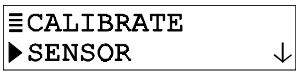
The transmitter analog output is factory-calibrated. However, it can be re-calibrated if desired.

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 

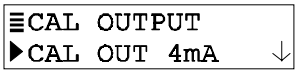
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display 

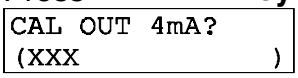
.

3. Press ⇩ **key** <u>once</u> to display 

.

4. Press **ENTER key** to display 

.

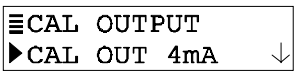
5. Press **ENTER key** again to display a screen like 

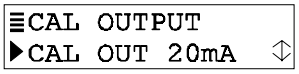
. The displayed value is "counts" -- not mA -- that dynamically change as the output is adjusted.

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

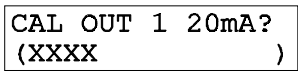
7. Use **arrow keys** to adjust the minimum output value to read <u>exactly</u> "4.00 mA" on the <u>digital</u> <u>multimeter</u> -- not

the transmitter display, and press **ENTER key** to complete calibration of the minimum endpoint value.

8. After the 

screen re-appears, press ⇩ **key** <u>once</u> 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 <u>maximum</u> mA output in the loop with the digital multimeter.

11. Use **arrow keys** to adjust the maximum output value to read <u>exactly</u> “20.00 mA” on the <u>digital</u> <u>multimeter</u> -- 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

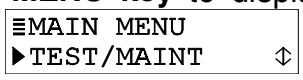
The transmitter has TEST/MAINT menu screens to:

- 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 pH (or mV) or temperature signal to exercise the measurement loop.
- Reset configuration -- not calibration -- values to defaults.
- Reset calibration -- not configuration -- values to defaults.

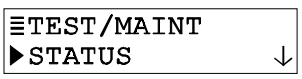
☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to use the TEST/MAINT menu screens.*

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 is inoperative or its signal is out of range (more than + 480 mV or less than -480 mV for pH, or more than +2100 mV or less than -2100 mV for ORP).

5. Press **ENTER key** once to view "STATUS: SLOPE" screen, which indicates a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

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

7. 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 ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** once to display ≣TEST/MAINT ▶HOLD OUTPUT ⇳.

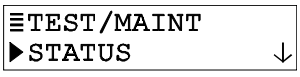
2. Press **ENTER key** to immediately hold the analog output ("HOLD OUTPUT: ENTER TO RELEASE" screen appears, acknowledging hold is applied).

☞ ***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).

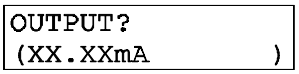
5.3 OUTPUT Test Signal

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 

.

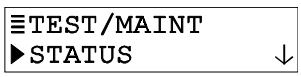
NOTE: *The mA output test signal is now active. Its value is shown on this screen.*

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 

screen displayed, press ⇩ **key** until 

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. **(When using the transmitter to measure ORP, the SELECT SIM function is not provided because the simulated measurement always represents mV.)**

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 pH.
   - **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?
(X.XX pH             )
```
.

☞ ***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 A.

NOTE: *Resetting configuration values also excludes the SELECT SENSOR function (DIFF pH, COMB pH or ORP) 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 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, check the junction box, then 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 (daily, weekly or monthly intervals). Use the recommended cleaning procedure described in the GLI 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.

- pH: Calibrate using one of the methods described in PART THREE, Section 4.2.
- ORP: Calibrate using only the method described in PART THREE, Section 4.3.

Calibrating with old, contaminated or diluted pH buffers may cause measurement errors. **Do not reuse buffers.** Never pour the portion of buffer used for calibration back into the buffer bottle -- always discard it. Note that the pH value of a buffer changes as its temperature changes. (Always refer to the pH value-versus-temperature table on the buffer bottle.) Therefore, always allow the temperatures of the sensor and buffer to equalize while calibrating.

2.3 Avoiding Electrical Interference

Recommendation: Do not run the sensor cable (and interconnect cable, if used) in the same conduit with AC or DC power wiring. Also, connect cable shielding as recommended (PART TWO, Section 3.1).

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

SECTION 3
TROUBLESHOOTING

3.1 Ground Loops

The transmitter may be affected by a "ground loop" problem (two or more electrically grounded points at different potentials).

Symptoms Indicating a Possible Ground Loop

- Transmitter reading is offset from the actual value by a consistent amount, or ....
- Transmitter reading is frozen on one value, or ....
- Transmitter reading is "off scale" (upscale or downscale).

Although the source of a ground loop is difficult to determine, there are several common causes.

Common Causes of a Ground Loop

- Components, such as recorders or computers, are connected to non-isolated analog outputs.
- Not using shielded cabling or failure to properly connect all cable shields.
- Moisture or corrosion in a junction box.

Determining if Ground Loop Exists

The following simple test can help to determine if there is a ground loop:

1. With the pH (or ORP) MEASURE screen displayed, immerse the sensor in a non-conductive container (plastic or glass) filled with a pH buffer (or ORP refer-

ence solution) of known value. Note the transmitter reading for this solution.

2. Connect one end of a wire to a known earth ground such as a metal water pipe. Place the other end of this wire into the buffer next to the sensor.

3. Note the transmitter reading now and compare it with the reading taken in step 1. If the reading changed, a ground loop exists.

Finding Source of Ground Loop

Sometimes the source of a ground loop is easy to find, but it usually takes an organized approach to isolate the problem.

Troubleshooting Tip! Use a systematic troubleshooting method. If possible, start by grounding all shields and electrical grounds at one stable point. One at a time, turn off all pumps, motors, and switches that are in contact with the process. Each time you do this, check if the ground loop still exists. Since the process media being measured is electrically conductive, the source of the ground loop may not be readily apparent.

3.2 Isolating Measuring System Problem

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

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.

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

Verifying Transmitter Operation

1. After disconnecting DC power from the transmitter, disconnect the sensor (and interconnect cable, if used).

2. Depending on the type of sensor, refer to the appropriate category below and follow the steps to simulate a pH (or ORP) input signal and a temperature signal:

For GLI Differential Technique Sensor

A. Connect a jumper between Terminal 3 (shield/ black) and Terminal 5 (green) on TB2.

B. Connect a millivolt generator (or a jumper, if generator is not available) between Terminal 5 (green) and Terminal 7 (red) on TB2, with the (+) lead on Terminal 7.

C. When using the transmitter to measure pH, connect a 1% tolerance, 301 ohm resistor between Terminals 4 (yellow) and 5 (green) on TB2. **When using transmitter to measure ORP, disregard this step.**

D. Make sure transmitter is configured for a 300 ohm NTC temperature element (PART THREE, Section 3.2, subheading “Select TEMP ELEMENT Type”).

For Conventional Combination Electrode

A. Connect a jumper between Terminal 3 and Terminal 5 (reference) on TB2.

B. Connect a millivolt generator (or a jumper, if generator is not available) between Terminal 3 and Terminal 7 (active) on TB2, with the (+) lead on Terminal 7.

C. When using the transmitter to measure pH, connect a 1% tolerance, 1000 ohm resistor between Terminals 3 and 4 on TB2. **When using transmitter to measure ORP, disregard this step.**

D. Make sure the transmitter is configured for a Pt 1000 temperature element (PART THREE, Section 3.2, subheading “Select TEMP ELEMENT Type”).

3. Reconnect DC power to the transmitter.

4. Set millivolt generator to provide each of the following outputs, checking the transmitter MEASURE screen each time for these corresponding pH (or mV) readings:

Generator Output	Corresponding Transmitter Reading	
	For pH	For ORP
Zero mV	7 pH (approximately)	0 mV
(-)175 mV	10 pH (approximately)	(-)175 mV
(+)175 mV	4 pH (approximately)	(+)175 mV
When Using Jumper Only (not generator)		
- - - -	7 pH (approximately)	0 mV

5. When using the transmitter to measure pH, change the transmitter MEASURE screen to show temperature. **When using transmitter to measure ORP, disregard this step.**

   - For a GLI Differential Technique sensor, the temperature value should be approximately “25°C.”
   - For a conventional combination electrode, the temperature value should be approximately “0°C.”

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

Verifying Interconnect Cable Integrity

1. Disconnect DC power, the millivolt generator, and temperature simulation resistor from the transmitter.

2. Reconnect the sensor directly to the transmitter (purposely bypassing the interconnect cable and junction box, if used).

3. Reconnect DC power to the transmitter.

4. Use a <u>two-point</u> <u>method</u> to calibrate the transmitter. (For ORP measurement, use only the “1 POINT SAMPLE” method described in PART THREE, Section 4.3.) If calibration was:

   - **Successful:** The transmitter and sensor are operating properly, but the interconnect cable is probably faulty.
   - **Unsuccessful:** The sensor is probably inoperative.

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(s) 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.