

OPERATING MANUAL

pHD™ Differential pH and ORP Sensors

(PEEK® or Ryton® Body)

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

In addition to information on installation and operation, this instruction manual may contain WARNINGS for user safety, CAUTIONS regarding possible sensor 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 SENSOR MALFUNCTION OR DAMAGE.

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

**30-MONTH
GLI DIFFERENTIAL SENSOR WARRANTY/REPLACEMENT PLAN**

GLI International, Inc. will replace or repair any GLI Differential Sensor that fails due to defects in material or workmanship for a period of up to 12 months from the date of shipment from our facility. In this case, the following condition applies:

0-12 months oldSensor is replaced free

If the sensor fails -- for any reason -- within 30 months from the date of shipment, it will be replaced at the following prorated pricing:

0-18 months old.....Sensor is replaced at approximately 1/3 of current list price.

19-30 months old.....Sensor is replaced at approximately 2/3 of current list price.

Each sensor is identified with a unique serial number that is used by GLI International, Inc. to validate the month and year of shipment. 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.

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PART ONE - INTRODUCTION

SECTION 1

GENERAL INFORMATION

1.1 Description

Sensor Electronics

The electronics of the sensor are encapsulated in a PEEK[®] or Ryton[®] body. The pH sensor has an integral NTC 300 ohm thermistor to automatically compensate pH readings for temperature changes. (ORP sensors do not have a temperature element since the ORP measurement is not temperature dependent.)

Sensor Body Styles

pHD[™] Differential pH and ORP sensors are available in three body styles:

- **Convertible Body Style** which has 1-inch NPT threads at both ends of its body, enabling it to be mounted:
 - Into a standard 1-inch NPT pipe tee,
 - Into a GLI pipe adapter for union mounting with a standard 1-1/2 inch pipe tee,
 - Onto the end of a pipe for immersion into a vessel.

The convertible style sensor can also be retrofitted into existing installations for GLI 1-1/2 inch LCP, Ryton[®], and epoxy sensors.

- **Insertion Body Style** which is similar to the convertible sensor except that its 1-inch NPT threads are only on the cable end for mounting into the pipe adapter of a GLI ball valve hardware assembly. This hardware enables the sensor to be inserted into or retracted from the process without stopping the process flow.

The insertion style sensor can also be retrofitted into existing installations for GLI Model 6010 and 6070-series vinyl ester insertion sensors.

- **Sanitary Body Style** which features a built-in 2-inch flange for mounting into a GLI 2-inch sanitary tee. Included with the sanitary style sensor is a special cap and EDPM compound gasket for use with the GLI sanitary hardware.

1.2 Operating Precautions



1. Before placing the pH or ORP sensor into operation, remove its protective cap to expose the process electrode and salt bridge (shown in Figure 3-1). Save the cap for future use.

Important Operating Tip! For short-term storage (when sensor is out of the process for more than an hour or two) put a few drops of water on the absorbent material in the protective cap and then replace the cap back on the sensor. This keeps the process electrode and salt bridge moist which avoids slow response when the sensor is put back into operation.

For extended storage, repeat the above short-term storage procedure every 2 to 4 weeks, depending on the surrounding environmental conditions.

2. The process electrode at the tip of the pH sensor has a glass bulb, which can be broken. Do not subject it to abrupt impact or other mechanical abuse.

CAUTION:

**IF THE pH PROCESS ELECTRODE BREAKS,
HANDLE THE SENSOR VERY CAREFULLY TO
PREVENT SERIOUS CUTS.**

The gold or platinum process electrode at the tip of the ORP sensor has a glass shank (hidden by salt bridge) which can break. Do not subject this electrode to impact or other mechanical abuse.

SECTION 2

SPECIFICATIONS

	pH Sensors (see Note 1)	ORP Sensors (see Note 2)
Wetted Materials	PEEK® or Ryton® (PVDF) body, salt bridge of matching material with Kynar® junction, glass process electrode, titanium ground electrode, and Viton® O-ring seals (pH sensor with optional HF-resistant glass process electrode has 316 stainless steel ground electrode, and perfluoroelastomer wetted O-rings; for other wetted O-ring materials consult factory)	PEEK® or Ryton® (PVDF) body, salt bridge of matching material with Kynar® junction, glass and platinum (or plastic and gold) process electrode, titanium ground electrode, and Viton® O-ring seals
Operating Temperature Range	23 to 203°F (-5 to +95°C)	23 to 203°F (-5 to +95°C)
Pressure/Temperature Limits (without mounting hardware)	100 psi at 221°F (6.9 bar at 105°C)	100 psi at 221°F (6.9 bar at 105°C)
Maximum Flow Rate.....	10 ft. (3 m) per second	10 ft. (3 m) per second
Built-in Temperature Element	NTC 300 ohm thermistor for automatic temperature compensation and analyzer temperature readout	NTC 300 ohm thermistor for analyzer temperature readout only -- not for automatic temperature compensation
Measuring Range	0-14 pH	-1500 to +1500 mV
Sensitivity	Less than 0.005 pH	Less than 0.5 mV
Stability.....	0.03 pH per 24 hours, non-cumulative	2 mV per 24 hours, non-cumulative
Maximum Transmission Distance.....	3000 ft. (914 m)	3000 ft. (914 m)
Sensor Cable (integral).....	5 conductor (plus two isolated shields) cable with XLPE (cross-linked polyethylene) jacket; rated to 302°F (150°C); 20 ft. (6 m) standard length	5 conductor (plus two isolated shields) cable with XLPE (cross-linked polyethylene) jacket; rated to 302°F (150°C); 20 ft. (6 m) standard length

- NOTES:**
- Most pH applications fall in the 2.5-12.5 pH range. A GLI pHDTM Differential pH sensor with the wide-range glass process electrode performs exceptionally well in this range. Some industrial applications require accurate measurement and control below 2 or above 12 pH. In these special cases, please contact GLI for further details.
 - For best ORP measuring results in solutions containing zinc, cyanide, cadmium or nickel, GLI recommends using the pHDTM ORP sensor equipped with an optional gold electrode.

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 Ryton® is a registered trademark of Phillips 66 Co.
 Kynar® is a registered trademark of Pennwalt Corp.
 Viton® is a registered trademark of E.I. DuPont de Nemours + Co.

PART TWO - INSTALLATION

SECTION 1

LOCATION REQUIREMENTS

Mount the sensor vertically with electrodes pointing downward. If the sensor must be installed on an angle, it should be **at least 15° above horizontal**. Other mounting angles may cause erratic measurement readings.

SECTION 2

PIPE TEE MOUNTING

The convertible style pH^D™ sensor can be mounted into a standard 1-inch NPT pipe tee for a new installation or, when used with an appropriate adapter, retrofitted into an existing installation for GLI 1-1/2 inch sensors.

2.1 New Installation

1. Install a standard 1-inch NPT pipe tee into the process line.
2. Connect the pH^D™ sensor cable wires to the analyzer:
 - A. Direct Connection
 - a. Route the sensor cable into the analyzer through a watertight fitting in the analyzer cable entry hole.
 - b. Connect the sensor wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.
 - B. Indirect Connection with Junction Box
 - a. Mount a junction box that has a terminal strip onto a flat surface. Make sure the junction box cover can be removed after installation.
 - b. Route the sensor cable into the junction box through a watertight fitting.
 - c. Route an interconnect cable into the junction box through a watertight fitting. Connect the sensor and interconnect cable wires, by

matching colors and their inner and outer shields (Section 8.2). Fasten cover onto j-box.



NOTE: *Keep the terminal strip dry to prevent problems caused by wet and/or corroded terminals.*

- d. Route interconnect cable from the junction box to the analyzer through a watertight fitting in the analyzer cable entry hole. If the cable is too long, cut it to the proper length to avoid electrical interference caused by inductive pickup.

Recommendation: Route the interconnect cable in 1/2-inch or larger grounded metal conduit to protect it from moisture and mechanical damage.



NOTE: *Do not route the interconnect cable in any conduit containing AC or DC power wiring. Electrical noise may interfere with the sensor signal.*

- e. Connect interconnect cable wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.

3. After connecting the pH^D[™] sensor, remove its protective cap and save it for when the sensor is temporarily out of service. (It protects the electrode and prevents the salt bridge from drying out to ensure fast response when the sensor is put back into service.)
4. Before installing the pH^D[™] sensor, calibrate the system using the procedure in the analyzer instruction manual.
5. After calibration, apply Teflon tape to the sensor and mounting tee threads to avoid leaks. (Pipe sealant with Teflon, Loctite No. 59321 or equivalent, may not provide adequate sealing at higher solution temperatures.)

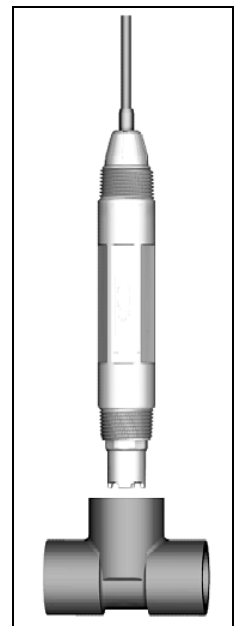


FIGURE 2-1
*Pipe Tee Mounting --
New Installation*

6. Refer to Figure 2-1 and carefully insert the sensor into the tee and hand tighten. Use a strap (not pipe) wrench on the sensor body to carefully snug the threads into the tee to prevent leaking. **DO NOT OVER TIGHTEN!**

This completes a new installation pipe tee mounting.

2.2 Existing Installation Retrofit with Adapter

Figure 2-2 shows an existing GLI sensor in an existing 1-1/2 inch tee, and the required new adapter that enables the pH^D[™] GLI sensor to be mounted into the existing tee.

1. Remove the existing sensor from the installed 1-1/2 inch tee.
2. Disconnect existing sensor wires from the analyzer. In their place, connect the cable wires of the pH^D[™] sensor (see Section 8.2 in this manual).
3. Fasten new GLI adapter into the installed 1-1/2 inch tee.

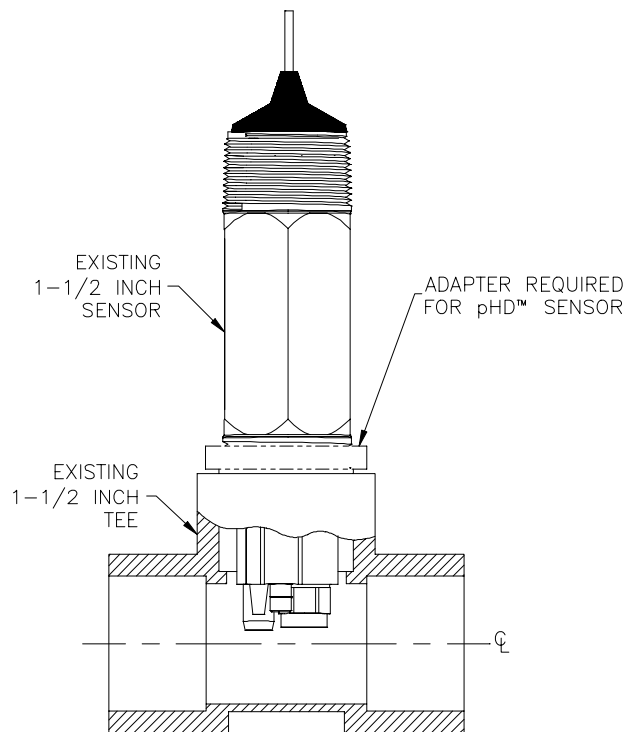


FIGURE 2-2
Pipe Tee Mounting -- Existing Installation Retrofit with Adapter

4. Remove the protective cap from the pH^D[™] sensor and save it for when the sensor is temporarily out of service. (It protects the electrode and prevents the salt bridge from drying out to ensure fast response when the sensor is put back into service.)
5. Before mounting the pH^D[™] sensor, calibrate the system using the procedure in the analyzer instruction manual.
6. After calibration, apply Teflon tape to the sensor and mounting tee threads to avoid leaks. (Pipe sealant with Teflon, Loctite No. 59321 or equivalent, may not provide adequate sealing at higher solution temperatures.)
7. Carefully insert the pH^D[™] sensor into the GLI adapter and hand tighten. Use a strap (not pipe) wrench on the sensor body to carefully snug the threads into the adapter to prevent leaking. **DO NOT OVER TIGHTEN!**

This completes a retrofit installation pipe tee mounting.

SECTION 3

UNION MOUNTING

The convertible style pHD™ sensor can be mounted into a GLI 1-1/2 inch union pipe tee for new installation or, when used with an appropriate adapter, retrofitted into an existing installation for GLI 1-1/2 inch LCP, Ryton®, or epoxy sensors.

3.1 New Installation

1. Install the GLI 1-1/2 inch union pipe tee into the process line.
2. Route the sensor cable first through the sealing hub and then through the union lock ring, orienting them with respect to the sensor cable as shown in Figure 2-3.
3. Fasten the sealing hub onto the cable end of the sensor.
4. Connect the pHD™ sensor cable wires to the analyzer:

A. Direct Connection

- a. Route sensor cable into the analyzer through a watertight fitting in the analyzer cable entry hole.
- b. Connect the sensor wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.

B. Indirect Connection with Junction Box

- a. Mount a junction box that has a terminal strip onto a flat surface. Make sure the junction box cover can be removed after installation.
- b. Route the sensor cable into the junction box through a watertight fitting.



FIGURE 2-3
Union Mounting --
New Installation

- c. Route an interconnect cable into the junction box through a watertight fitting. Connect the sensor and interconnect cable wires, by matching colors and their inner and outer shields (Section 8.2). Fasten cover onto j-box.



NOTE: *Keep the terminal strip dry to prevent problems caused by wet and/or corroded terminals.*

- d. Route interconnect cable from the junction box to the analyzer through a watertight fitting in the analyzer cable entry hole. If the cable is too long, cut it to the proper length to avoid electrical interference caused by inductive pickup.

Recommendation: Route the interconnect cable in 1/2-inch or larger grounded metal conduit to protect it from moisture and mechanical damage.



NOTE: *Do not route the interconnect cable in any conduit containing AC or DC power wiring. Electrical noise may interfere with the sensor signal.*

- e. Connect interconnect cable wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.

3. After connecting the pH^DTM sensor, remove its protective cap and save it for when the sensor is temporarily out of service. (It protects the electrode and prevents the salt bridge from drying out to ensure fast response when the sensor is put back into service.)
4. Before installing the pH^DTM sensor, calibrate the system using the procedure in the analyzer operating manual.
5. After calibration, make sure that the O-ring is properly seated in its groove on the union tee extension, and carefully insert the sensor into the union tee. Hand tighten the lock ring onto the union tee extension.

This completes the union mounting for a new installation.

3.2 Existing Installation Retrofit with Adapter to Replace GLI LCP or Ryton® Sensor

Figure 2-4 shows an existing GLI sensor in an existing 2-inch union tee. The required new union adapter is similar to the existing adapter, but has a smaller internal diameter that enables the pHDTM sensor to be mounted into the existing union tee.

1. Remove the existing GLI 1-1/2 inch sensor (LCP or Ryton®) from the installed 2-inch union tee.
2. Remove the existing adapter from the existing sensor.
3. Remove the split retaining ring and lock ring from the existing adapter. Keep the lock ring for use with the pHDTM sensor and new union adapter.
4. Disconnect existing sensor wires from the analyzer. Route the pHDTM sensor cable through the lock ring. Connect the pHDTM sensor cable wires (see Section 8.2 in this manual).
5. Remove the protective cap from the pHDTM sensor and save it for when the sensor is temporarily out of service. (It protects the electrode and prevents the salt bridge from drying out to ensure fast response when the sensor is put back into service.)

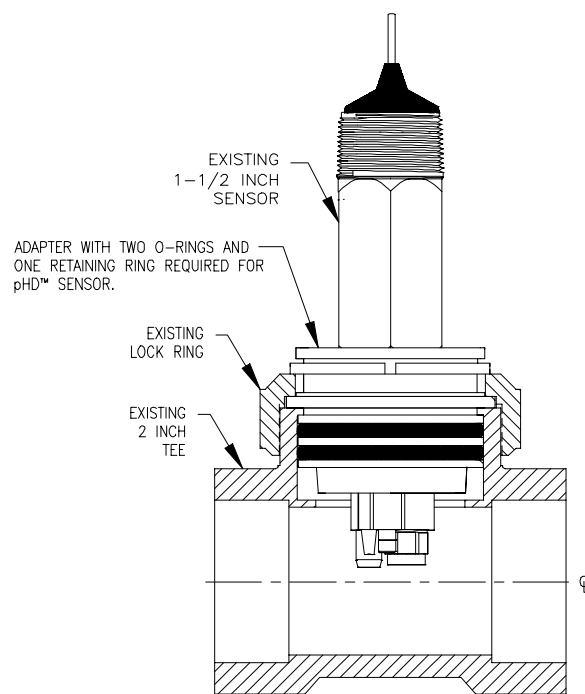


FIGURE 2-4
*Union Mounting -- Existing Installation Retrofit
 with Adapter to Replace GLI LCP or Ryton® Sensor*

6. Before installing the pH^D™ sensor, calibrate the system using the procedure in the analyzer operating manual.
7. Fasten and tighten the pH^D™ sensor into the new union adapter. Secure the lock ring onto the adapter (threads towards O-rings as shown in Figure 2-4) by placing the split retaining ring over the top of the adapter.
8. After calibration, lubricate the two adapter O-rings with water, and carefully insert the sensor/adapter assembly into the existing 2-inch union tee. Hand tighten the lock ring onto the tee to secure the sensor.

This completes the retrofit installation union mounting to replace an existing GLI LCP or Ryton[®] sensor.

3.3 Existing Installation Retrofit with Adapter Kit to Replace GLI Epoxy Sensor

The left side of Figure 2-5 shows an existing GLI sensor in an existing 1-1/2 inch union tee. The right side of Figure 2-5 shows a pH^D™ sensor with the required adapter pipe and lock ring that enable it to be mounted into the existing union tee. A sealing hub and O-ring, supplied with the adapter kit, are also required.

1. Remove the existing GLI 1-1/2 inch epoxy sensor and close nipple from the installed 1-1/2 inch union tee.
2. Apply Teflon tape to the new union adapter pipe and mounting tee threads to avoid leaks. (Pipe sealant with Teflon, Loctite No. 59321 or equivalent, may not provide adequate sealing at higher solution temperatures.)
3. Fasten the new union adapter pipe into the installed 1-1/2 inch union tee.
4. Disconnect existing sensor wires from the analyzer.
5. Route the pH^D™ sensor cable through the new lock ring and sealing hub. Orient the sealing hub flange towards the front end of the pH^D™ sensor, and fasten it onto the cable end of the sensor.
6. Connect the pH^D™ sensor cable wires (see Section 8.2 in this manual).

7. Remove the protective cap from the pH^D[™] sensor and save it for when the sensor is temporarily out of service. (It protects the electrode and prevents the salt bridge from drying out to ensure fast response when the sensor is put back into service.)
8. Before installing the pH^D[™] sensor, calibrate the system using the procedure in the analyzer operating manual.
9. After calibration, make sure that the O-ring is properly seated in its groove on the union adapter pipe, and carefully insert the sensor/sealing hub assembly into the adapter pipe. Hand tighten the lock ring onto the union adapter pipe to secure the sensor.

This completes the retrofit union mounting installation to replace an existing GLI epoxy sensor.

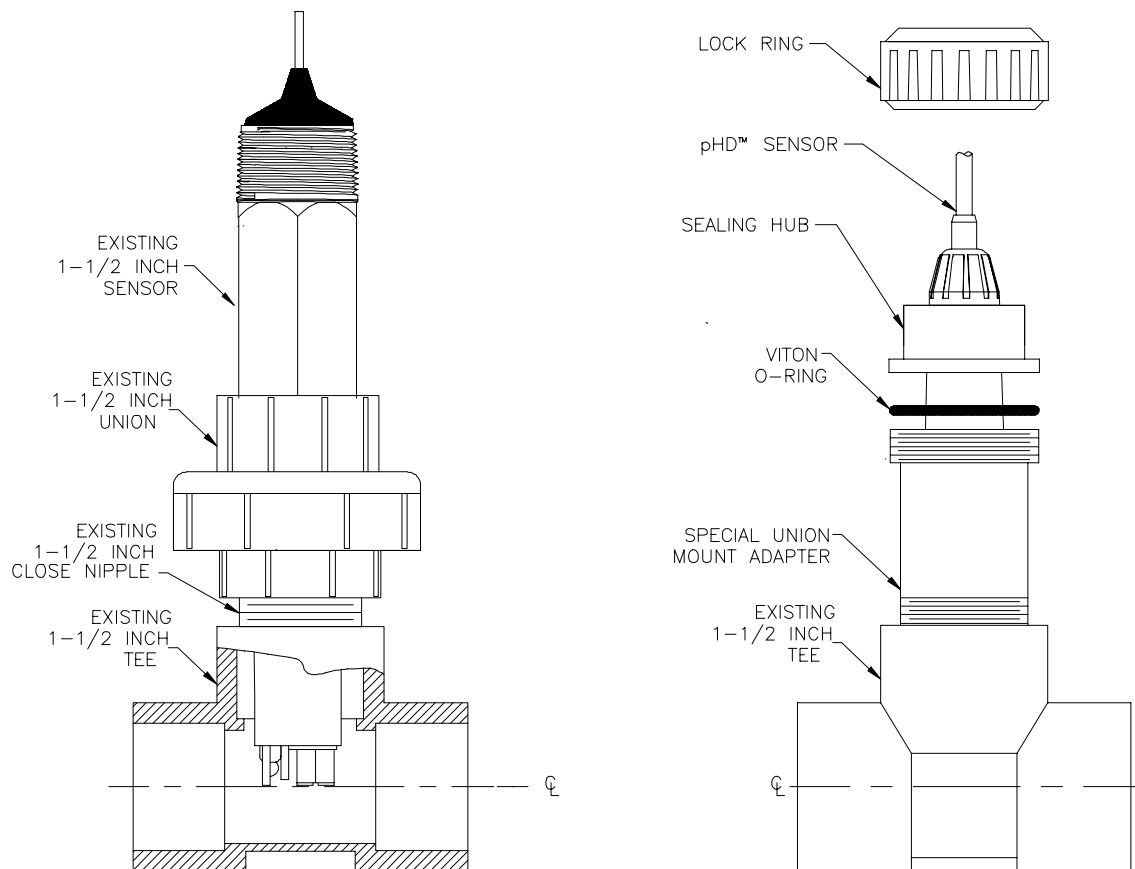


FIGURE 2-5
*Union Mounting -- Existing Installation Retrofit
 with Adapter Kit to Replace GLI Epoxy Sensor*

SECTION 4

IMMERSION MOUNTING (NEW INSTALLATION ONLY)

4.1 Using GLI Immersion Hardware

The cable end of a convertible style pH^D™ sensor can be threaded onto the end of a pipe for immersion into a vessel. GLI has two hardware assemblies for this purpose: immersion or handrail hardware.

1. Refer to Figure 2-6 and apply Teflon tape to the 1-inch x 1-inch coupling and pH^D™ sensor threads at the cable end to avoid leaks. (Pipe sealant with Teflon, Loctite No. 59321 or equivalent, may not provide adequate sealing at higher solution temperatures.)
2. Fasten the 1-inch x 1-inch coupling onto the cable end of the sensor.
3. Route the pH^D™ sensor cable through an appropriate length of 1-inch diameter mounting pipe.
4. Apply Teflon tape to the mounting pipe threads and threads at the other end of the 1-inch x 1-inch coupling to avoid leaks.
5. Fasten the other end of the coupling onto the pipe.
6. Route the pH^D™ sensor cable wires into the junction box through a watertight fitting, and fasten the junction box onto the top of the mounting pipe.
7. Route an interconnect cable into the junction box through a watertight fitting. Connect the pH^D™ sensor and interconnect cable wires, by matching colors and their inner and outer shields (see Section 8.2). Fasten cover onto the junction box.



NOTE: *Keep the terminal strip dry to prevent problems caused by wet and/or corroded terminals.*

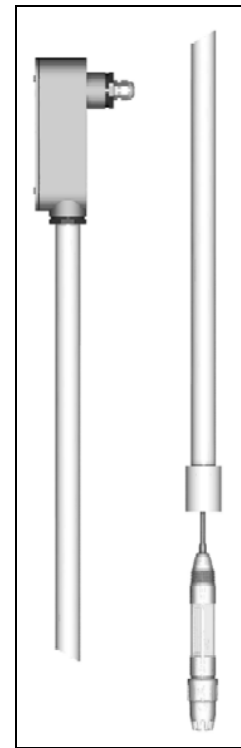


FIGURE 2-6
Immersion Mounting Using
GLI Immersion Hardware

8. Route the interconnect cable from the junction box into the analyzer through a watertight fitting in the analyzer cable entry hole. If the cable is too long, cut it to the proper length to avoid electrical interference caused by inductive pickup.

Recommendation: Route the interconnect cable in 1/2-inch or larger grounded metal conduit to protect it from moisture and mechanical damage.



NOTE: Do not route the interconnect cable in any conduit containing AC or DC power wiring. Electrical noise may interfere with the sensor signal.

9. Connect interconnect cable wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.
10. After connecting the pH^D™ sensor, remove its protective cap and save it for use when the sensor is temporarily out of service. (It protects the electrode and prevents the salt bridge from drying out to ensure fast response when the sensor is put back into service.)
11. Before installing the pH^D™ sensor, calibrate the system using the procedure in the analyzer operating manual.
12. When using GLI self-cleaning equipment, fasten the washer head assembly onto the pH^D™ sensor instead of the optional electrode protector. Otherwise disregard this step. (For installation details on GLI self-cleaning sensor equipment, see PART TWO, Section 7.)
13. After calibration, fasten the optional electrode protector onto the end of the sensor. Then mount the pH^D™ sensor into the process.

This completes GLI immersion hardware mounting.

4.2 Using GLI Handrail Hardware

The GLI handrail hardware contains a unique swivel/pivot/pipe clamp assembly that enables mounting the immersion pipe onto a handrail or horizontal pipe next to the vessel. It is also used to easily move the sensor into and out of the vessel.

1. Mount the swivel/pivot/pipe clamp assembly to a handrail or horizontal pipe in a suitable location where the sensor is to be installed. Refer to Figure 2-7 for clamp assembly details.
2. Refer to Figure 2-8 and mount the hardware **service support assembly** to a handrail in a suitable location that is approximately 5 ft. (1.5 m) from the swivel/pivot/pipe clamp assembly.

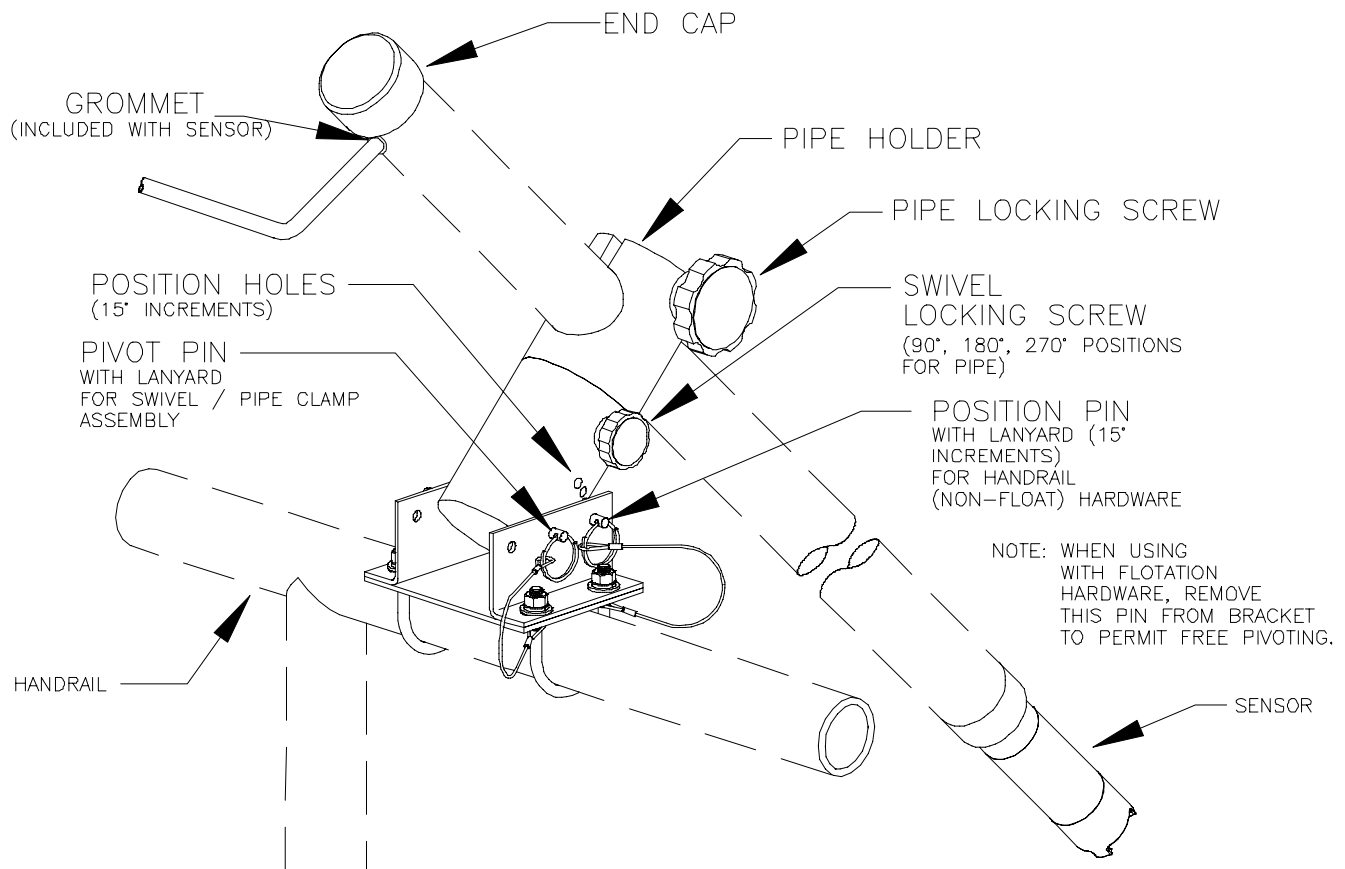


FIGURE 2-7
Immersion Mounting -- Swivel/Pivot/Pipe Clamp Assembly Details (handrail hardware)

3. Unscrew and remove the **end cap** from the long mounting hardware pipe.
4. Loosen the **swivel locking screw** on the swivel/pivot/pipe clamp assembly until the pipe holder swivels freely. Temporarily remove the **position pin** to enable easy pipe insertion (step 5).
5. Insert the end-cap end of the long mounting pipe into the swivel/pivot/pipe clamp assembly, making sure that at least 1 ft. (0.3 m) or more of pipe extends behind the clamp assembly. (This will provide better leverage to make sensor handling easier.) Rest the sensor end of the pipe on the **service support assembly**. Tight the **pipe locking screw** to secure the long pipe.



NOTE: The final position for the long mounting pipe can be re-adjusted in step 11.

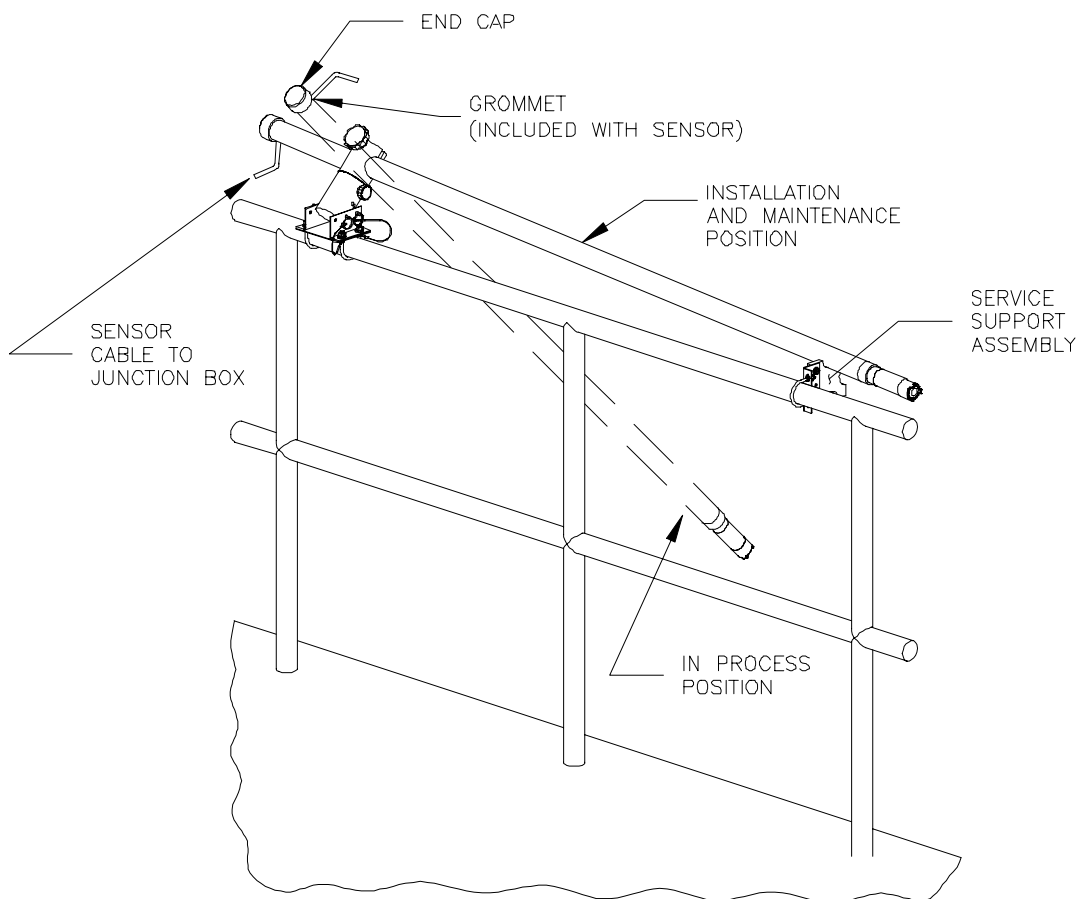


FIGURE 2-8
Immersion Mounting -- Using GLI Handrail Hardware

6. Route the sensor cable through the long mounting pipe.
7. Apply Teflon tape to the mounting pipe and sensor (cable end) threads to avoid leaks. (Pipe sealant with Teflon, Loctite No. 59321 or equivalent, may not provide adequate sealing at higher solution temperatures.)
8. Fasten the pH^D[™] sensor onto the mounting pipe.
9. Position the sensor cable grommet into the slotted cut-out of the long mounting pipe. Replace and tighten the end cap to secure the grommet. **DO NOT OVER TIGHTEN!**
10. Connect the pH^D[™] sensor cable wires to the analyzer:
 - A. Direct Connection
 - a. Route sensor cable into the analyzer through a watertight fitting in the analyzer cable entry hole.
 - b. Connect the sensor wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.
 - B. Indirect Connection with Junction Box
 - a. Mount a junction box that has a terminal strip onto a flat surface. Make sure the junction box cover can be removed after installation.
 - b. Route the sensor cable into the junction box through a watertight fitting.
 - c. Route an interconnect cable into the junction box through a watertight fitting. Connect the sensor and interconnect cable wires, by matching colors and their inner and outer shields (Section 8.2). Fasten cover onto j-box.

NOTE: *Keep the terminal strip dry to prevent problems caused by wet and/or corroded terminals.*
 - d. Route interconnect cable from the junction box to the analyzer through a watertight fitting in the analyzer cable entry hole. If the cable is too



long, cut it to the proper length to avoid electrical interference caused by inductive pickup.

Recommendation: Route the interconnect cable in 1/2-inch or larger grounded metal conduit to protect it from moisture and mechanical damage.



NOTE: Do not route the interconnect cable in any conduit containing AC or DC power wiring. Electrical noise may interfere with the sensor signal.

- e. Connect interconnect cable wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.
11. After connecting the pH^DTM sensor, remove its protective cap and save it for use when the sensor is temporarily out of service. (It protects the electrode and prevents the salt bridge from drying out to ensure fast response when the sensor is put back into service.)
 12. Before installing the pH^DTM sensor, calibrate the system using the procedure in the analyzer operating manual.
 13. When using GLI self-cleaning equipment, fasten the washer head assembly onto the pH^DTM sensor instead of the optional electrode protector. Otherwise disregard this step. (For installation details on GLI self-cleaning sensor equipment, see PART TWO, Section 7.)
 14. After calibration, fasten the optional electrode protector onto the end of the pH^DTM sensor.
 15. Use the mounting hardware to place the sensor in the process at the desired angle. Tighten the **swivel locking screw**, and replace the **position pin** at the desired angle to secure the sensor position. If necessary, reposition the pipe insertion length to complete the installation.

Recommendation: For best stability, fasten the **swivel locking screw** into one of the 90°-increment lock positions.

This completes GLI handrail hardware immersion mounting.

SECTION 5

INSERTION (BALL VALVE) MOUNTING

5.1 New Installation

Fastening Sensor
to Insert/Extract
Pipe Assembly

The insertion style pH^D™ sensor requires a GLI ball valve insertion hardware assembly to insert the sensor into and extract it from a pressurized process line without stopping flow in the pipe.

1. Unscrew the lock ring (item D, Figure 2-10) to remove the insert/extract pipe assembly from the assembled insertion hardware.
2. Loosen the cord grip cap at the back of the insert/extract shaft assembly. Refer to Figure 2-9, and route the pH^D™ sensor cable through the shaft assembly and out the cord grip.
3. Apply Teflon tape to the pH^D™ sensor threads at the cable end to avoid leaks. (Pipe sealant with Teflon, Locktite No. 59321 or equivalent, may not provide adequate sealing at higher solution temperatures.) Fasten the sensor onto the insert/extract shaft assembly.
4. Pull any excess slack cable through the cord grip, and tighten the cord grip.
5. Connect the pH^D™ sensor cable wires to the analyzer:
 - A. Direct Connection
 - a. Route sensor cable into the analyzer through a watertight fitting in the analyzer cable entry hole.
 - b. Connect the sensor wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.

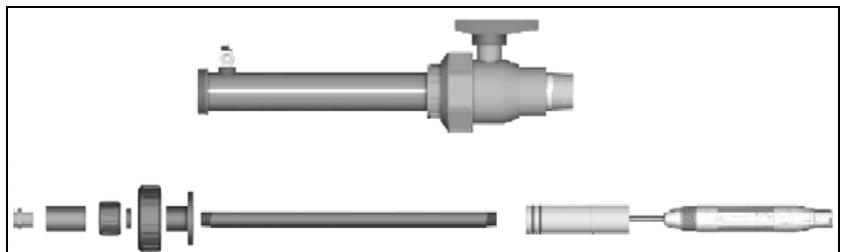


FIGURE 2-9
Insertion (Ball Valve) Mounting -- New Installation

B. Indirect Connection with Junction Box

- a. Mount a junction box that has a terminal strip onto a flat surface. Make sure the junction box cover can be removed after installation.
- b. Route the sensor cable into the junction box through a watertight fitting.
- c. Route an interconnect cable into the junction box through a watertight fitting. Connect the sensor and interconnect cable wires, by matching colors and their inner and outer shields (Section 8.2). Fasten cover onto j-box.



NOTE: *Keep the terminal strip dry to prevent problems caused by wet and/or corroded terminals.*

- d. Route interconnect cable from the junction box to the analyzer through a watertight fitting in the analyzer cable entry hole. If the cable is too long, cut it to the proper length to avoid electrical interference caused by inductive pickup.

Recommendation: Route interconnect cable in 1/2-inch or larger grounded metal conduit to protect it from moisture and mechanical damage.



NOTE: *Do not route the interconnect cable in any conduit containing AC or DC power wiring. Electrical noise may interfere with the sensor signal.*

- e. Connect interconnect cable wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.

Setting Sensor Insertion Depth

The sensor insertion depth is the distance the sensor salt bridge extends beyond the threaded close nipple of the ball valve assembly as shown in Figure 2-10. It is factory set at the maximum distance of 4.5 inches (114 mm). If the factory-set insertion depth is satisfactory for your application, disregard the following procedure, and mount the ball valve assembly into the non-pressurized process pipe/vessel. If you need to reduce the insertion depth, carefully determine

and set it using this procedure before installing the hardware:

1. Unfasten the retaining cap (item A) from the flanged bushing (item B) at the back of the insert/extract pipe assembly to access the metal locking collar (item C).
2. Using a small Allen wrench, loosen the two set screws on the metal locking collar (item C).
3. Slide the locking collar towards the sensor as needed to reduce the insertion depth.



NOTE: Do not reduce the insertion depth to less than 1 inch (25 mm), since optimum sensor performance depends upon the sensor electrode and salt bridge being fully immersed in the process.

4. Tighten both set screws to secure the metal locking collar (item C) to the insert/extract shaft assembly.

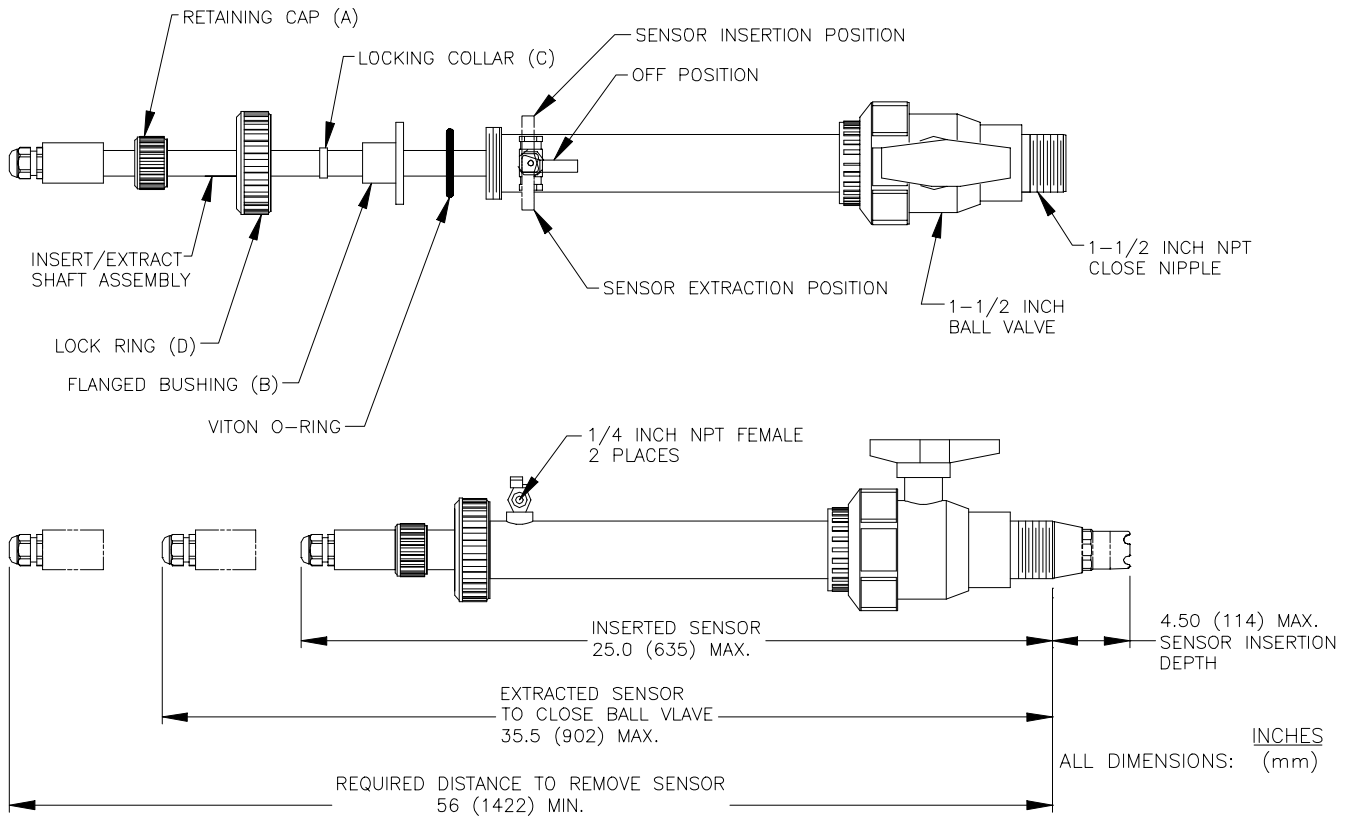


FIGURE 2-10
 Insertion (Ball Valve) Mounting -- Setting Sensor Insertion Depth

Mounting Ball Valve into Non-pressurized Pipe/Vessel

With the insert/extract shaft assembly removed, mount the ball valve hardware into a portion of the process pipe or vessel where air cannot be trapped and subsequently contact the sensor electrode.

1. Apply Teflon tape to the 1-1/2 inch NPT close nipple threads to avoid leaks. (Pipe sealant with Teflon, Lock-tite No. 59321 or equivalent, it may not provide adequate sealing at higher solution temperatures.)
2. Fasten the 1-1/2 inch ball valve hardware into the non-pressurized pipe or vessel at the desired location.
3. Turn the ball valve to its full **OPEN** position.
4. Connect a 1/4-inch air or water-assist line to the 1/4-inch NPT fitting of the brass control valve on the ball valve hardware. Turn this control valve to its center **OFF** position.

CAUTION:

THE AIR OR WATER LINE PRESSURE MUST BE GREATER THAN THE PROCESS PRESSURE, BUT CANNOT EXCEED 120 PSI.

5. Connect a drain line to the fitting on the other side of the control valve.

Installing Sensor into Non-pressurized Ball Valve Hardware

After electrically connecting the pH^D[™] sensor to the analyzer, setting insertion depth (if needed), and mounting the ball valve hardware, install the sensor into the non-pressurized process pipe or vessel.

1. Remove the protective cap from the pH^D[™] sensor and save it for when the sensor is temporarily out of service. (It protects the electrode and prevents the salt bridge from drying out to ensure fast response when the sensor is put back into service.)
2. Before installing the pH^D[™] sensor, calibrate the system using the procedure in the analyzer operating manual.
3. After calibration, apply a small amount of silicone grease (supplied with hardware) to the two small, brown O-rings on the shaft assembly located behind the sensor.

4. With the ball valve open, fully insert the sensor into the ball valve hardware by pushing in the insert/extract shaft assembly to its limit.
5. With the Viton O-ring properly seated in its groove, tighten the lock ring (item D, Figure 2-10) to secure the shaft assembly to the ball valve hardware.
6. Tighten the retaining cap (item A) onto the flanged bushing (item B).
7. Pull the insert/extract shaft assembly outward to its limit to fully extract the sensor from the ball valve hardware.
8. Turn the ball valve to its full **CLOSE** position. The process pipe or vessel can now be pressurized.

Inserting Sensor into Pressurized Pipe/Vessel

After installing the pH^DTM sensor into the ball valve hardware, the sensor can be inserted into a pressurized process pipe or vessel.

WARNING:

INSERTING A SENSOR INTO A PRESSURIZED PROCESS PIPE OR VESSEL MAY BE DANGEROUS. DO NOT STAND DIRECTLY BEHIND THE ASSEMBLY WHEN OPENING THE BALL VALVE. DEPENDING ON THE PROCESS PRESSURE, THE INSERT/EXTRACT PIPE ASSEMBLY MAY RAPIDLY TRAVEL OUTWARD UNTIL IT IS STOPPED BY THE LOCK RING.

1. Slowly turn the ball valve to its full **OPEN** position.
2. With the air or water-assist line at a pressure higher than the process but not exceeding 120 psi, slowly turn the brass control valve to its full **INSERTION** position. The sensor will begin moving into the process pipe or vessel.
3. When the sensor is fully inserted, it is at the preset insertion depth. The brass control valve can remain in the **INSERTION** position or may be placed to **OFF**.

Extracting Sensor from Pressurized Pipe/Vessel

WARNING:

EXTRACTING A SENSOR FROM A PRESSURIZED PROCESS PIPE OR VESSEL MAY BE DANGEROUS. DO NOT STAND DIRECTLY BEHIND THE INSERTION ASSEMBLY WHEN REMOVING THE RETAINING CAP (ITEM A, FIGURE 2-10) TO EXTRACT THE SENSOR. IT IS RECOMMENDED TO REDUCE THE PROCESS PRESSURE TO BELOW 10 PSI BEFORE EXTRACTING THE SENSOR. IF THIS IS NOT POSSIBLE, USE EXTREME CAUTION. AT HIGHER PRESSURES, THE INSERT/EXTRACT SHAFT ASSEMBLY MAY TRAVEL RAPIDLY TO ITS MAXIMUM OUTWARD POSITION, POTENTIALLY INJURING ANYONE IN ITS PATH.

With air or water pressure supplied to the insertion hardware assembly, use the brass control valve to extract the sensor from the process.

1. Slowly turn the brass control valve to its full **EXTRACTION** position. Permit the insert/extract shaft assembly to move to its maximum outward travel. This ensures that the sensor electrode has cleared the ball valve opening.
2. With the insert/extract shaft assembly fully extended, place the brass control valve to its **OFF** position, and immediately turn the ball valve to its full **CLOSE** position.
3. Loosen and remove the retaining cap (item A).
4. To remove the sensor for routine maintenance and calibration:
 - A. Loosen and remove the lock ring from the ball valve hardware.
 - B. Firmly extract the insert/extract shaft assembly from the ball valve hardware.

5.2 Existing Installation Retrofit with Adapter

Figure 2-11 shows an existing sensor (Model 6010 or 6070-series) in an existing ball valve assembly, and the required new adapter that enables the pHDT™ sensor to be installed into that assembly.

1. Extract and remove the existing sensor from the installed ball valve assembly.
2. Unfasten the existing sensor from the insert/extract shaft assembly, and disconnect its wires from the analyzer.
3. Apply Teflon tape to the new adapter threads to avoid leaks. (Pipe sealant with Teflon, Locktite No. 59321 or equivalent, it may not provide adequate sealing at higher solution temperatures.)
4. Tighten the new adapter (with O-rings and Teflon wiper) onto the insert/extract shaft assembly.

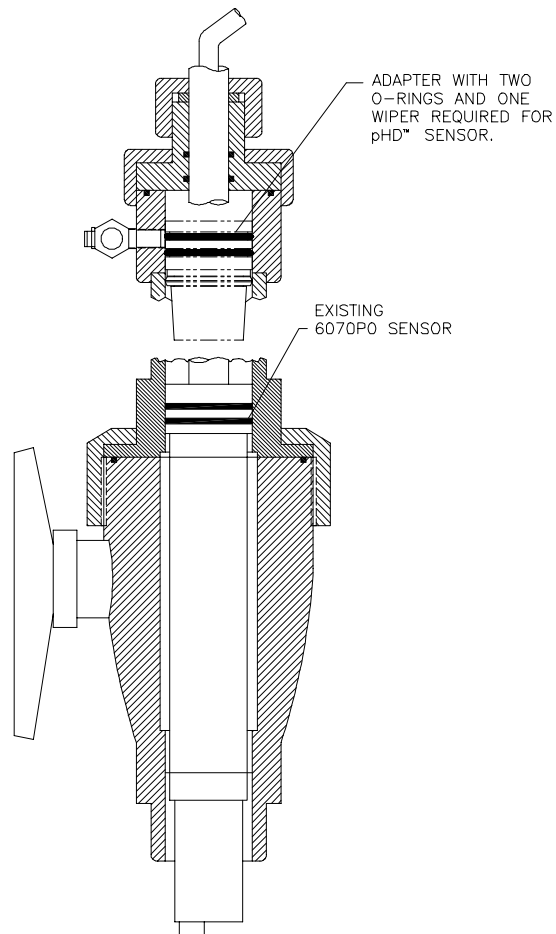


FIGURE 2-11
*Insertion (Ball Valve) Mounting --
 Existing Installation Retrofit with Adapter*

5. Route the pH^DTM sensor cable through the insert/extract shaft assembly.
6. Apply Teflon tape to the pH^DTM sensor threads to avoid leaks. (Pipe sealant with Teflon, Loctite No. 59321 or equivalent, it may not provide adequate sealing at higher solution temperatures.)
7. Fasten the pH^DTM sensor into the new adapter.
8. Connect the pH^DTM sensor cable wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.
9. After connecting the pH^DTM sensor, remove its protective cap and save it for use when the sensor is temporarily out of service. (It protects the electrode and prevents the salt bridge from drying out to ensure fast response when the sensor is put back into service.)
10. Before installing the pH^DTM sensor into the ball valve assembly, calibrate the system using the procedure in the analyzer operating manual.
11. After calibration, apply a small amount of silicone grease (supplied with new adapter) to the two small, brown O-rings on the adapter.
12. Install the pH^DTM sensor into the ball valve assembly, and insert it into the process.
13. Tighten the lock ring to secure the insert/extract shaft assembly into the insertion hardware.

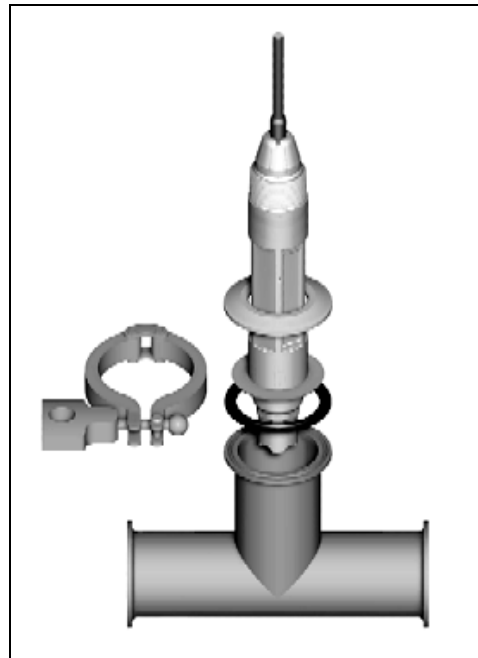
This completes the retrofit installation insertion mounting.

SECTION 6

SANITARY MOUNTING (NEW INSTALLATION ONLY)

The sanitary style pH^D™ sensor has a 2-inch integral flange for mounting into a GLI 2-inch sanitary tee. The sensor includes a special stainless steel cap and EDPM gasket for use with the mounting hardware.

1. Refer to Figure 2-12. Install the GLI 2-inch sanitary tee into the process line.
2. Route the sensor cable through the hole in the special stainless steel cap, orienting the cap as shown in Figure 2-12 with its flat surface towards the sensor flange.
3. Connect the pH^D™ sensor cable wires to the analyzer.
 - A. Direct Connection
 - a. Route sensor cable into the analyzer through a watertight fitting in the analyzer cable entry hole.
 - b. Connect the sensor wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.



*FIGURE 2-12
Sanitary Mounting*

B. Indirect Connection with Junction Box

- a. Mount a junction box that has a terminal strip onto a flat surface. Make sure the junction box cover can be removed after installation.
- b. Route the sensor cable into the junction box through a watertight fitting.
- c. Route an interconnect cable into the junction box through a watertight fitting. Connect the sensor and interconnect cable wires, by matching colors and their inner and outer shields (Section 8.2). Fasten cover onto j-box.



NOTE: *Keep the terminal strip dry to prevent problems caused by wet and/or corroded terminals.*

- d. Route interconnect cable from the junction box to the analyzer through a watertight fitting in the analyzer cable entry hole. If the cable is too long, cut it to the proper length to avoid electrical interference caused by inductive pickup.

Recommendation: Route the interconnect cable in 1/2-inch or larger grounded metal conduit to protect it from moisture and mechanical damage.



NOTE: *Do not route the interconnect cable in any conduit containing AC or DC power wiring. Electrical noise may interfere with the sensor signal.*

- e. Connect interconnect cable wires to the analyzer (see Section 8.2 in this manual). Also, refer to the analyzer operating manual for more details.
4. After connecting the pH^D™ sensor, remove its protective cap and save it for when the sensor is temporarily out of service. (It protects the electrode and prevents the salt bridge from drying out to ensure fast response when the sensor is put back into service.)
 5. Before installing the pH^D™ sensor, calibrate the system using the procedure in the analyzer operating manual.

6. After calibration, mount the pH^D[™] sensor into the sanitary tee:
 - A. Properly seat the sanitary gasket into its groove on the 2-inch sanitary tee.
 - B. Carefully insert the pH^D[™] sensor into the tee, making sure that the gasket is properly seated between the sensor flange and tee.
 - C. Place the special stainless steel cap onto the top of the sensor flange. Make sure its flat (not beveled) surface is mating to the top of the flange.
 - D. Secure the sensor flange to the sanitary tee using the heavy duty clamp.

This completes the sanitary mounting installation.

SECTION 7

OPTIONAL GLI SELF-CLEANING EQUIPMENT MOUNTING

7.1 Washer Head Assembly

You may have an optional GLI washer head assembly (Figure 2-13) or a self-contained air blast cleaning system that also includes an air compressor (Figure 2-14). To install the washer head assembly, refer to subsection 7.1. See subsection 7.2 for air compressor installation details, including instructions for wiring it to a GLI Model P63, P53, or P33 analyzer.

1. Remove the protective cap from the end of the sensor.
2. Temporarily remove the tubing from the washer head assembly. (Unsnap the quick-disconnect tube fitting from its mating connector on the washer head.)
3. Fasten the washer head assembly onto the sensor.
4. Re-attach the air or water delivery tubing to the washer head assembly using the quick-disconnect tube fitting.
5. Using the supplied tie wraps, secure the air or water delivery tubing at approximately 1 ft. (0.3 m) increments along the length of the sensor mounting hardware pipe.

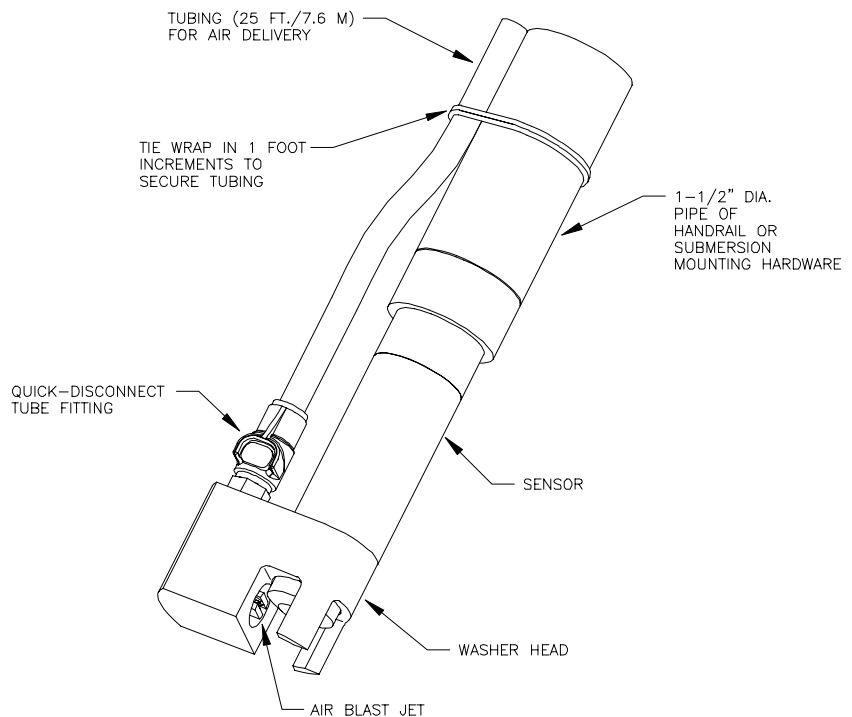


FIGURE 2-13
Optional Washer Head Assembly Installation Details

7.2 Air Compressor (only included with air blast cleaning system)

CAUTION:

REGULATE THE COMPRESSOR TO PROVIDE NO MORE THAN 20 PSI (1.5 BAR). HIGHER AIR PRESSURE MAY DAMAGE THE WASHER HEAD ASSEMBLY.

1. Locate the air compressor near the installed sensor (Figure 2-14). Do not extend the GLI washer head tubing beyond its standard 25 ft. (7.6 m) length. This prevents exceeding the capacity of the air compressor and/or degrading the response time for air delivery.
2. Mount the compressor in a location where ambient temperature will not exceed the compressor temperature limits (0 to 122°F; -17 to +50°C for GLI air compressor).

CAUTION:

EXPOSING THE COMPRESSOR TO DIRECT SUNLIGHT MAY INCREASE THE OPERATING TEMPERATURE ABOVE ITS SPECIFIED LIMIT.

The drawing supplied with the GLI air compressor shows various ways to mount it. Determine the mounting method and attach the hardware accordingly. Use supplied mounting feet and hardware to surface mount, or mounting channels, clamps, and hardware to pipe mount.

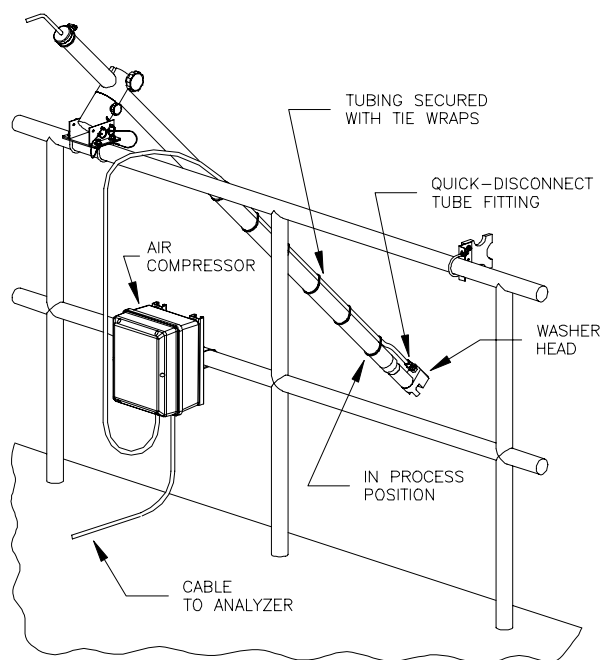


FIGURE 2-14
Air Compressor Location Arrangement

3. Attach the air delivery tubing to the fitting on the bottom of the GLI air compressor enclosure.
4. Wire the compressor to the GLI analyzer to provide power and switch the compressor on/off on a timed basis. Always use the standard three-wire connection arrangement for line power. **Use wiring practices that conform to local codes** (example: National Electrical Code Handbook in the U.S.A.).

WARNING:

REMOVE LINE POWER BEFORE WIRING THE COMPRESSOR TO THE ANALYZER.

Refer to the appropriate analyzer wiring subsection (P63, P53, or P33) for connection details.

Model P63 Analyzer-to-Compressor Wiring

The GLI Model P63 analyzer uses Relay C, operated by a user-defined wash cycle, to switch power on/off to the compressor. (Use the P63 analyzer menu to establish a wash cycle and a schedule of wash events.) Refer to Figure 2-15 for connection details.

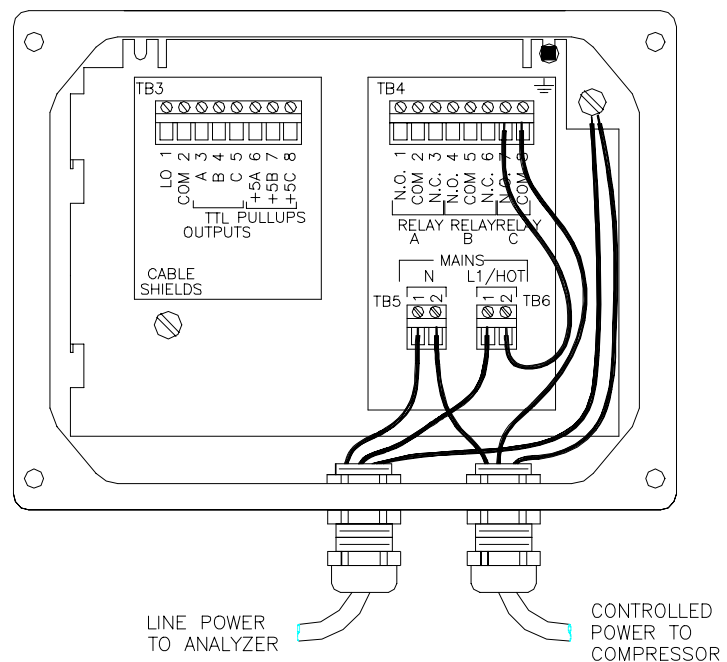


FIGURE 2-15
P63 Analyzer-to-Air Compressor Line Power Wiring

At the P63 Analyzer:

- A. Connect the ground wire (typically green) of the compressor's line power cable to the green ground screw located at right of TB4.
- B. Connect the neutral wire (typically white) of the compressor's line power cable to the unused "N" terminal on TB5.
- C. Connect the hot wire (typically black) of the compressor's line power cable to Terminal 8 on TB4.
- D. Connect a jumper between Terminal 7 on TB4 and the unused "L1/HOT" terminal on TB6.

At the Air Compressor:

- E. Connect the ground wire (typically green) at the other end of the compressor's line power cable to the compressor ground connection (ground symbol terminal on GLI air compressor).
- F. Connect the neutral wire (typically white) at the other end of the compressor's line power cable to the compressor neutral connection ("NEUT" terminal on GLI air compressor).
- G. Connect the hot wire (typically black) at the other end of the compressor's line power cable to the compressor hot wire connection ("L1/HOT" terminal on GLI air compressor).

Model P53 Analyzer-to-Compressor Wiring

The GLI Model P53 analyzer uses any relay that has been set as a TIMER function relay, operated by a user-defined wash cycle, to switch power on/off to the compressor. (Use the P53 analyzer menu to establish INTERVAL and DURATION times to operate the TIMER relay.) Refer to Figure 2-16 for connection details.



NOTE: For illustrative purposes, Figure 2-16 shows RELAY D as the TIMER relay. When using a different relay, wire its terminals the same way.

At the P53 Analyzer:

- A. Connect the ground wire (typically green) of the compressor’s line power cable to the grounding strip located at bottom of analyzer case.
- B. Connect the neutral wire (typically white) of the compressor’s line power cable to “N” Terminal 2 on TB3.
- C. Connect the hot wire (typically black) of the compressor’s line power cable to Terminal 11 on TB2.
- D. Connect a jumper between Terminal 12 on TB2 and Terminal 3 (or Terminal 4 for 230 VAC) on TB3.

At the Air Compressor:

- E. Connect the ground wire (typically green) at the other end of the compressor’s line power cable to the compressor ground connection (ground symbol terminal on GLI air compressor).

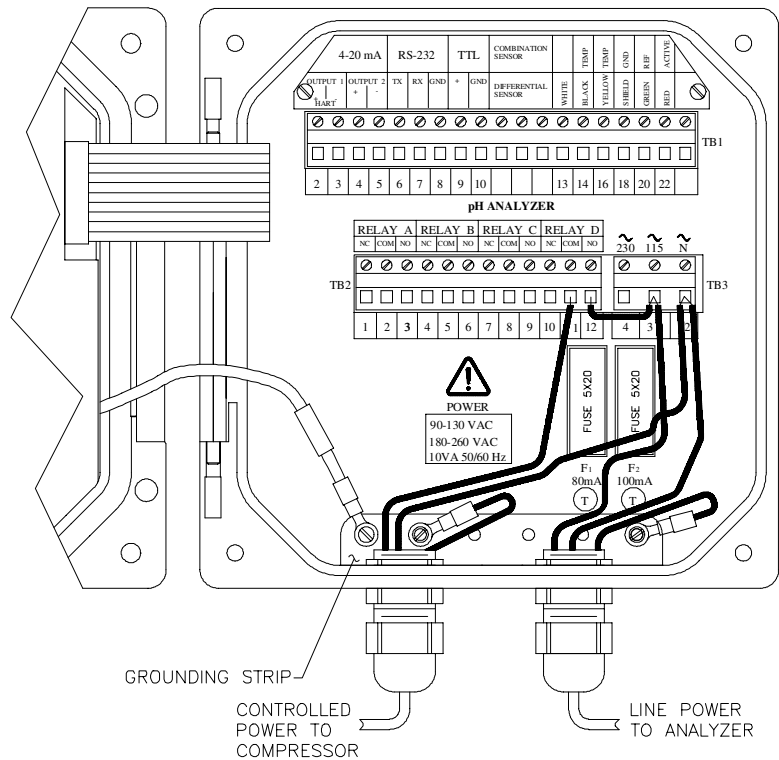


FIGURE 2-16
P53 Analyzer-to-Air Compressor Line Power Wiring

- F. Connect the neutral wire (typically white) at the other end of the compressor’s line power cable to the compressor neutral connection (“NEUT” terminal on GLI air compressor).
- G. Connect the hot wire (typically black) at the other end of the compressor’s line power cable to the compressor hot wire connection (“L1/HOT” terminal on GLI air compressor).

Model P33 Analyzer-to-Compressor Wiring

The GLI Model P33 analyzer uses any relay that has been set as a TIMER function relay, operated by a user-defined wash cycle, to switch power on/off to the compressor. (Use the P33 analyzer menu to establish INTERVAL and DURATION times to operate the TIMER relay.) Refer to Figure 2-17 for connection details.



NOTE: For illustrative purposes, Figure 2-17 shows RELAY B as the TIMER relay. When using a different relay, wire its terminals the same way.

At the P33 Analyzer:

- A. Connect the ground wire (typically green) of the compressor’s line power cable to the ground symbol Terminal 3 on TB1.

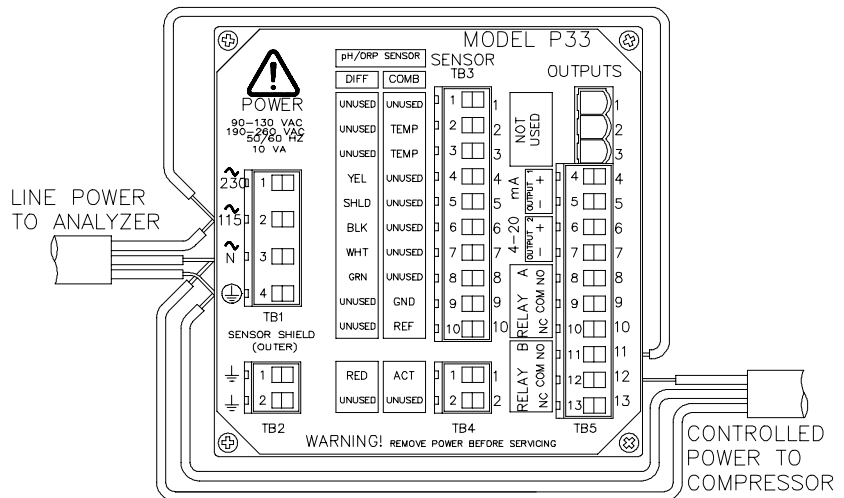


FIGURE 2-17
P33 Analyzer-to-Air Compressor Line Power Wiring

- B. Connect the neutral wire (typically white) of the compressor's line power cable to "N" Terminal 3 on TB1.
- C. Connect the hot wire (typically black) of the compressor's line power cable to Terminal 12 on TB4.
- D. Connect a jumper between Terminal 11 on TB4 and Terminal 2 (or Terminal 1 for 230 VAC) on TB1.

At the Air Compressor:

- E. Connect the ground wire (typically green) at the other end of the compressor's line power cable to the compressor ground connection (ground symbol terminal on GLI air compressor).
- F. Connect the neutral wire (typically white) at the other end of the compressor's line power cable to the compressor neutral connection ("NEUT" terminal on GLI air compressor).
- G. Connect the hot wire (typically black) at the other end of the compressor's line power cable to the compressor hot wire connection ("L1/HOT" terminal on GLI air compressor).

SECTION 8

SENSOR/INTERCONNECT CABLE WIRING

8.1 Cable Terminations

Depending on the installation, the pH^D™ sensor cable may need to be shortened and then re-terminated. In other cases, a GLI 1W1100 interconnect cable, which is provided with unfinished ends, is required to extend the sensor-to-analyzer distance. Since the pH^D™ sensor cable and 1W1100 interconnect cable are identical, follow the instructions in this section to properly terminate either cable. **The blue wire in each cable is not needed.** Therefore, when stripping either cable during termination, purposely cut off the blue wire from the stripped-back cable (both ends of interconnect cable). This ensures that the 1W1100 cable will have the same wire color coding as the pH^D™ sensor cable.



NOTE: *GLI strongly recommends using only the 1W1100 interconnect cable. If a different cable is used, it must have equivalent construction: five conductors, and two separate isolated shields -- one shielding the signal, and one shielding the overall cable. These specific cable characteristics protect the measurement signal from electromagnetic interference. Using a cable with different construction may allow “noise” to affect the sensor signal, causing erratic measurement readings.*

To properly terminate the pH^D™ sensor cable or 1W1100 interconnect cable, refer to Figure 2-18 and follow this procedure:

1. Carefully strip back 5-1/2 inches of the outer cable jacket, outer shield foil, and cellophane binder. This exposes the outer cable shield wire, inner shield wire, and three foil-wrapped wire pairs.
2. Peel back and cut off the exposed inner shield foil from the red/black, yellow/green, and blue/white wire pairs.
3. Cut off the exposed 5-1/2 inches of only the blue wire.
4. Carefully strip back an additional 1/4-inch of the outer cable jacket and outer shield foil.



NOTE: *Be careful not to damage the exposed 1/4-inch section of the cellophane binder.*

5. Carefully fasten a 5-1/4 inch long piece of shrink tubing/ tape onto the bare inner shield wire 1/4-inch from its end. This exposes 1/4-inch of bare shield wire beyond the tubing/tape for connection purposes.
6. Carefully fasten a 5-inch long piece of shrink tubing/ tape onto the outer shield wire 3/4-inch from its end.
7. Fasten a 1/2-inch long piece of black shrink tubing/ tape onto the end of the outer shield wire to differentiate it from the inner shield wire. This exposes 1/4-inch of bare shield wire for connection purposes.
8. Carefully fasten a 1-1/4 inch long piece of shrink tubing/ tape onto the cable jacket to secure all wires.



NOTE: Do not fold back the cellophane binder exposed in step 4.

9. Using an ohmmeter or test light, verify that the outer shield wire is not shorted to the inner shield wire. If they are shorted, cut the cable to get a new unfinished end and repeat the previous steps.
10. Strip 1/4-inch of insulation from the ends of the red, black, white, yellow, and green wires. Tin these leads and the inner and outer shield wires.

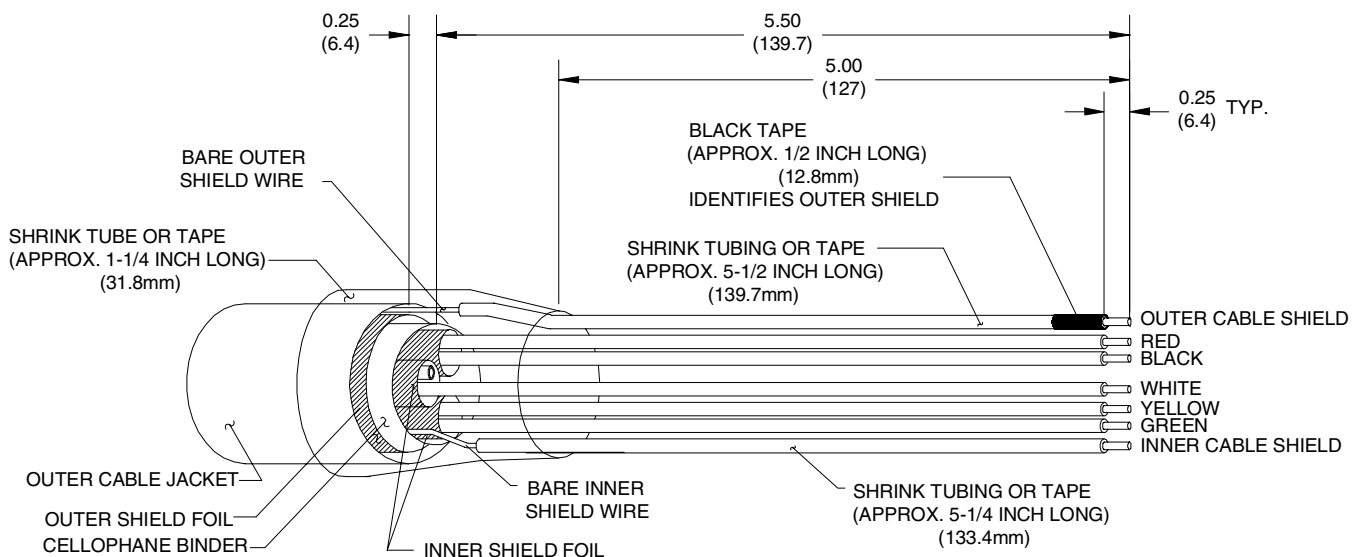


FIGURE 2-18 Sensor/Interconnect Cable Termination Details

8.2 Sensor Cable Connections



To connect the pH^D™ sensor directly to the analyzer, refer to Figure 2-19. When using an interconnect cable and junction box, refer to Figure 2-20.

NOTE: For indirect wiring installations not using GLI 1W1100 interconnect cable, connect the pH^D™ sensor cable outer shield wire to earth ground (junction box wall, if known to be earth grounded). Connect the pH^D™ sensor cable inner shield wire to the shield terminal of the interconnect cable in the junction box. If electromagnetic interference is not a concern, both pH^D™ sensor shield wires can be connected to the interconnect cable shield.

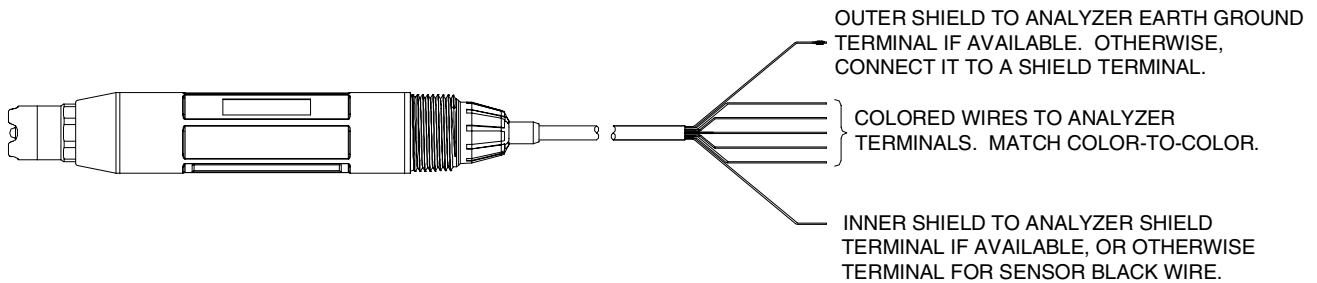


FIGURE 2-19 Sensor Cable Wiring -- Direct Connection

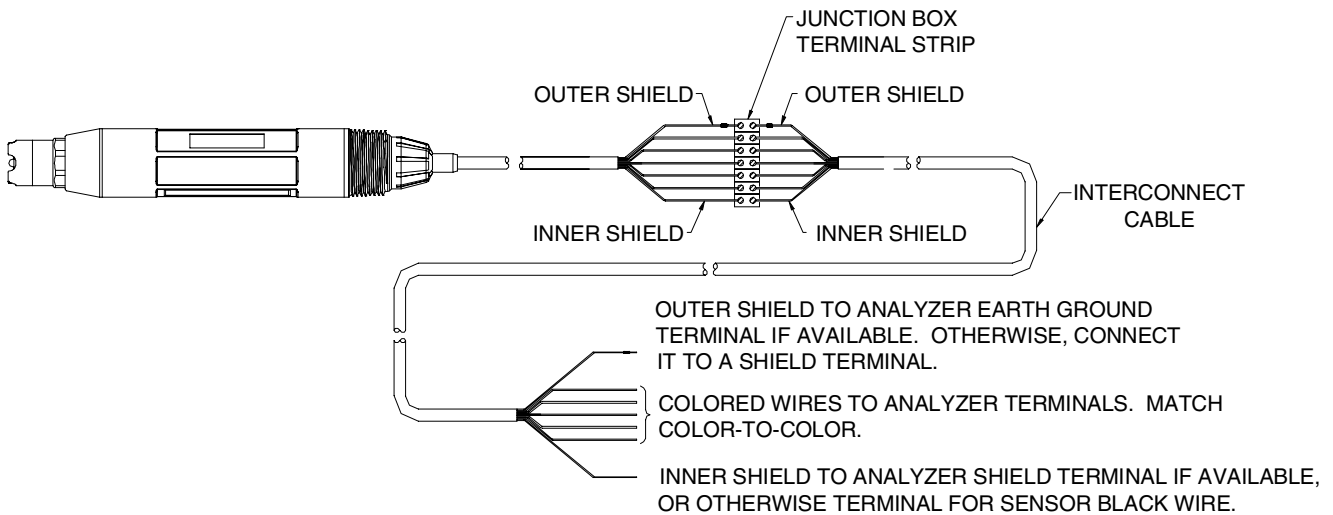


FIGURE 2-20 Sensor Cable Wiring -- Indirect Connection with Junction Box

PART THREE - SERVICE AND MAINTENANCE

SECTION 1

RECOMMENDED CLEANING PROCEDURE

Keep the sensor reasonably clean to maintain measurement accuracy. The time between cleanings (days, weeks, etc.) is affected by the characteristics of the process solution and can only be determined by operating experience.

1. Remove loose contaminate buildup by carefully wiping the entire measuring end of the sensor (process electrode, concentric metal ground electrode, and salt bridge) with a soft clean cloth. Then rinse the sensor with clean, warm water.
2. Prepare a mild soap solution. Use warm water and dishwashing detergent or other non-abrasive soaps that do not contain lanolin which will coat the glass process electrode and may affect sensor performance.
3. Soak the sensor for 2 to 3 minutes in the soap solution.
4. Use a small bristle brush to scrub the entire measuring end of the sensor, thoroughly cleaning electrode and salt bridge surfaces. If surface deposits cannot be removed by detergent solution cleaning, use muriatic (or another dilute) acid to dissolve them. The acid should be as dilute as possible, but yet strong enough to clean. Experience will help determine which acid to use and how dilute it can be. Some stubborn coatings may require a different cleaning agent. For assistance, contact the GLI Customer Service Department.

Before cleaning with acid, determine if this would create a hazardous chemical reaction. (Example: Do not put a sensor that is used in a cyanide bath directly into a strong acid for cleaning because this chemical combination may produce poisonous cyanide gas.)

WARNING:

ACIDS ARE HAZARDOUS. ALWAYS WEAR APPROPRIATE EYE PROTECTION AND CLOTHING IN ACCORDANCE WITH MATERIAL SAFETY DATA SHEET RECOMMENDATIONS.

Soak the entire measuring end of the sensor in dilute acid for **no more than 5 minutes**. Rinse the sensor with clean, warm water and then place the sensor back into the mild soap solution for 2 to 3 minutes to neutralize any remaining acid.

5. Remove the sensor from the soap solution, and rinse the sensor again in clean, warm water.
6. After cleaning, always calibrate the measurement system. Refer to the analyzer instruction manual for details.

If calibration cannot be attained, rejuvenate the sensor by replacing its standard cell solution and salt bridge (Section 2). If calibration is still not possible, troubleshoot the sensor by checking its operation using the procedure in Section 3.1 (for pH) or 3.2 (for ORP).

SECTION 2

REPLACING STANDARD CELL SOLUTION/SALT BRIDGE

If calibration cannot be attained after cleaning the pH^D™ sensor, refer to Figure 3-1, and replace the solution in the standard cell, and the sensor's salt bridge.

1. Firmly hold the sensor upright (electrode at top), and remove the salt bridge by turning it counterclockwise with pliers. Take care not to damage the protruding process electrode. Properly discard the old salt bridge.
2. Replace the standard cell solution in the sensor reservoir. (For high temperature applications, the sensor may contain a special gel instead of the solution.)
 - Standard Cell Solution:
 - A. Pour out the aged solution, and thoroughly flush the reservoir with distilled water.
 - B. Fill the reservoir with fresh standard cell solution (GLI part number 25M1A1025-115).
 - Special Gel:
 - A. Remove the aged gel using a jet of water from a "water pik" type device, and thoroughly flush the reservoir with distilled water.

- B. Place one level bottle cap (1/8 level teaspoon) of gel powder (GLI part number 25M8A1002-101) into the reservoir. Then add a small amount of fresh standard cell solution (GLI part number 25M1A1025-115) to the powder. Mix together until attaining a gel consistency. Continue to add small amounts of standard cell solution and thoroughly mix until the gel level would contact a newly installed salt bridge. Check for proper gel level by installing and removing the new salt bridge. A formed salt bridge impression should appear in the gel surface.
3. Before installing the new salt bridge (see PART FOUR for salt bridge part number), inspect the salt bridge O-ring for imperfections and replace it if necessary. Screw in the new salt bridge clockwise (right) until it is finger tight and the bottom surface of the salt bridge is in full contact with the top surface of the sensor body. **DO NOT OVER TIGHTEN!**

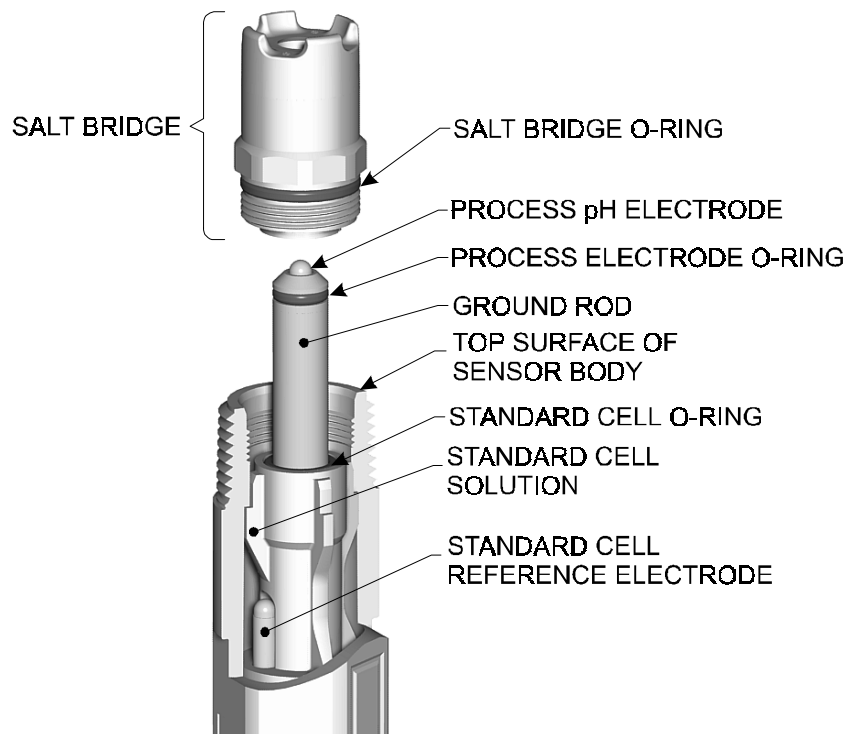


FIGURE 3-1
Replacing Standard Cell Solution and Salt Bridge

SECTION 3

TROUBLESHOOTING

3.1 Checking pH Sensor Operation

First, always clean the sensor using the procedure described in PART THREE, Section 1. If the measuring system cannot be calibrated after cleaning, replace the standard cell solution and salt bridge (see PART THREE, Section 2) and try calibrating again. If the measuring system still cannot be calibrated, check pH^D™ sensor operation (Section 3.1 for pH or Section 3.2 for ORP).

A simple test can determine if the pH sensor is operating properly. It requires a multimeter and two pH buffers (pH 7 and pH 4 or pH 10).

1. Disconnect the red, green, yellow, and black sensor wires from the analyzer (or junction box, if using interconnect cable).
2. Place the sensor in a pH 7 buffer. Before continuing, allow the temperatures of the sensor and buffer to equalize to approximately 25°C (room temperature).
3. Verify that the sensor temperature element (300 ohm thermistor) is okay by measuring the resistance between the yellow and black wires. The reading should be between 250 and 350 ohms at approximately 25°C.
4. Reconnect the yellow and black wires.
5. Connect the multimeter (+) lead to the red wire and (-) lead to the green wire. With the sensor in the pH 7 buffer, measure the DC millivolts. This sensor “offset” reading should be within factory-specified limits between -50 and +50 mV. If it is, write down this millivolt value reading and perform step 6. If the reading is outside these limits, discontinue this test and refer to the GLI warranty/replacement plan on page 2 for sensor replacement details.
6. With the multimeter still connected the same way, rinse the sensor with water and place it in either pH 4 or pH 10 buffer. Before continuing, allow the temperatures of the sensor and buffer to equalize to approximately 25°C (room temperature). Now measure the sensor “span” reading:

A. Span Reading in pH 4 Buffer

With the sensor in pH 4 buffer, the sensor “span” reading should be at least +160 mV more than the noted “offset” reading taken in step 5. Examples of typical readings are:

<u>“Offset” Reading (in pH 7 buffer)</u>	<u>“Span” Reading (in pH 4 buffer)</u>
-50 mV	+110 mV
-25 mV	+135 mV
0 mV	+160 mV
+25 mV	+185 mV
+50 mV	+210 mV

B. Span Reading in pH 10 Buffer

With the sensor in pH 10 buffer, the sensor “span” reading should be at least -160 mV less than the noted “offset” reading taken in step 5. Examples of typical readings are:

<u>“Offset” Reading (in pH 7 buffer)</u>	<u>“Span” Reading (in pH 10 buffer)</u>
-50 mV	-210 mV
-25 mV	-185 mV
0 mV	-160 mV
+25 mV	-135 mV
+50 mV	-110 mV

If the “span” reading is at least +160 mV more than or -160 mV less than the “offset” reading with the sensor respectively in pH 4 or pH 10 buffer, the sensor is within factory-specified limits. If not, refer to the GLI warranty/replacement plan on page 2 for sensor replacement details.

This completes checking the pH sensor.

3.2 Checking ORP Sensor Operation

A simple test can determine if the ORP sensor is operating properly. It requires a multimeter and a 200 mV reference solution.

1. Disconnect the red, green, yellow, and black sensor wires from the analyzer (or junction box, if using interconnect cable).
2. Place the sensor in a 200 mV reference solution. Before continuing, allow the temperatures of the sensor and reference solution to equalize to approximately 25°C (room temperature).
3. Verify that the sensor temperature element (300 ohm thermistor) is okay by measuring the resistance between the yellow and black wires. The reading should be between 250 and 350 ohms at approximately 25°C.
4. Reconnect the yellow and black wires.
5. Connect the multimeter (+) lead to the red wire and (-) lead to the green wire. With the sensor in the 200 mV reference solution, measure the DC millivolts. The reading should be between 160 and 240 mV. If it is, the sensor is within factory-specified limits. If the reading is outside these limits, discontinue this test and refer to the GLI warranty/replacement plan on page 2 for sensor replacement details.

This completes checking the ORP sensor.

3.3 Customer Assistance

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

GLI International, Inc. Phone: [800] 543-8907
 9020 West Dean Road Fax: [414] 355-8346
 Milwaukee, WI 53224 E-mail: info@gliint.com

— GLI CUSTOMER SERVICE DEPARTMENT 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.

Call the GLI Customer Service Dept. before returning a sensor for repair. Many problems can be diagnosed and resolved over the telephone. GLI will issue a Return Material Authorization (RMA) number if it is necessary that the sensor be returned for repair or replacement. **All returned sensors 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 sensor(s) back. Include preferred shipping method (UPS, Federal Express, etc.) if applicable.
4. A purchase order if sensor(s) is out of warranty to cover costs of repair.



NOTE: *If the sensor 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 sensors returned for repair or replacement unless they are thoroughly cleaned and all process material is removed.

PART FIVE - SPARE PARTS AND ACCESSORIES

	<u>Description</u>	<u>Part Number</u>
Standard Cell Supplies	Standard Cell Solution (500 ml)	25M1A1025-115
	Gel Powder (2 grams, to gel standard cell solution for high temperature applications)	25M8A1002-101
	PEEK [®] Salt Bridge (includes O-ring)	SB-P1SV-XXX*
	Ryton [®] Salt Bridge (includes O-ring)	SB-R1SV-XXX*
	* Salt bridges are shipped in specified quantities in a salt solution. Order desired quantity by substituting "001," "005" or "010" for the "XXX" suffix in the salt bridge part number.	
	Replacement Salt Bridge Viton O-ring	5H1304
pH Buffers for Calibration and Sensor Operation Checking	pH 7 Buffer (500 ml)	3A0421
	pH 4 Buffer (500 ml)	3A0422
	pH 10 Buffer (500 ml)	3A0942
ORP Reference Solutions for Calibration and Sensor Operation Checking	200 mV Reference Solution (500 ml)	25M2A1001-115
	600 mV Reference Solution (500 ml)	25M2A1002-115
Sensor Hardware Replacement Parts	Sensor Protective Cap:	
	Convertible Style Sensor.....	1000F3374-001
	Insertion and Sanitary Style Sensors**	1000A3378-001
	**Includes sponge to keep pH glass bulb wet during storage.	
	Immersion Mounting (new installation only):	
	Optional PEEK [®] Protector	1000F3374-002
	Optional Ryton [®] Protector	1000F3374-003
	Union Mounting (new installation only):	
	Viton O-ring.....	5H1233
	CPVC Sealing Hub.....	60F2021-001
316 SS Sealing hub.....	60F2021-002	
Insertion Mounting (new installation only):		
Retaining Cap (item A, Fig. 2-10):	CPVC..... 60F1021-101	
	316 SS	60F1021-102
Flanged Bushing (item B, Fig. 2-10):	CPVC..... 60F1022-103	
	316 SS	60B3F1022-102
Locking Collar (item C, Fig. 2-10):	CPVC..... 60F2001-101	
	316 SS	60A2F2001-102
Lock Ring (item D, Fig. 2-10):	CPVC..... 60F1020-101	
	316 SS	60B3F1020-102
Viton O-ring (shown in Fig. 2-10).....	5H1233	
Sensor Adapter Viton O-ring (two required)	5H1303	
Sanitary Mounting (new installation only):		
EDPM Compound Gasket	9H1327	
Special Cap.....	70F1037-004	