OPERATING MANUAL

LCP and Ryton
Encapsulated pH Sensors

(2-wire and 5-wire Types)

HELPFUL IDENTIFIERS

In addition to information on installation and operation, this instruction manual may contain WARNINGS pertaining to 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.*

T A B L E O F C O N T E N T S

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ILLUSTRATIONS

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 old .....Sensor 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.

PART ONE - INTRODUCTION

SECTION 1
GENERAL INFORMATION

1.1 Description

Sensor Electronics

Depending on its cable, the LCP (liquid crystal polymer) or Ryton-encapsulated pH sensor has an integral preamplifier (5-wire cable) or two-wire transmitter (2-wire cable providing a 4-20 mA output). Both sensor types have a built-in NTC 300 ohm thermistor temperature element.

Sensor Mounting Styles

The LCP or Ryton sensor is available in two mounting styles:

- **Convertible Style** which has threads at both ends. This enables the sensor to be threaded onto the end of a pipe for submersion mounting, or threaded into a standard 1-1/2 inch NPT pipe tee for flow-through mounting.
- **Union-mount Style** which has a union adapter and requires a special 2-inch NPT pipe tee for mounting.

1.2 Operating Precautions

1. **The output of the two-wire transmitter type sensor is non-isolated and not calibrated.** Consequently, the analyzer used with this sensor must be able to provide 24 VDC where “low” is isolated from earth ground to power the sensor. Also, the analyzer must have adjustment capability to calibrate for offset and span. Refer to the analyzer operating manual for calibration details.

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

Important Short-term Storage Tip! When the sensor is out of solution for more than an hour or two, put a few drops of water in each cap and place them 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 this procedure every 2 to 4 weeks, depending on environmental conditions.

3. The process electrode at the tip of the pH sensor has a glass bulb which can easily break. Do not subject it to impact or other mechanical abuse.

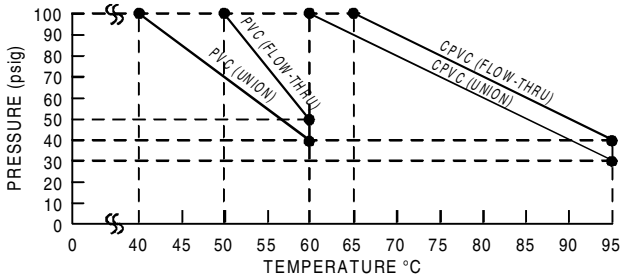
> **CAUTION:**
>
> **IF THE SENSOR PROCESS ELECTRODE BREAKS, CAREFULLY HANDLE THE SENSOR TO PREVENT SERIOUS CUTS.**

4. When measuring pH in hydrofluoric acid, use a pH sensor with a special antimony process electrode. The acid will dissolve a standard glass bulb process electrode.

SECTION 2
SPECIFICATIONS

	Flow-through Mounting	Union Mounting
Minimum Temperature	23°F (-5°C)	23°F (-5°C)
Maximum Temperature:		
PVC Mounting Tee.....	60°C at 50 psi or 50°C at 100 psi	60°C at 40 psi or 40°C at 100 psi
Steel Mounting Tee.....	95°C at 100 psi	95°C at 100 psi
CPVC Mounting Tee	95°C at 40 psi or 65°C at 100 psi	95°C at 30 psi or 60°C at 100 psi
Maximum Pressure:		
PVC Mounting Tee.....	100 psi at 50°C or 50 psi at 60°C	100 psi at 40°C or 40 psi at 60°C
Steel Mounting Tee.....	100 psi at 95°C	100 psi at 95°C
CPVC Mounting Tee	100 psi at 65°C or 40 psi at 95°C	100 psi at 60°C or 30 psi at 95°C

Plastic Mounting Hardware Ratings



Wetted Materials ..... LCP (liquid crystal polymer) body and salt bridge with PVDF (or ceramic) junction (or Ryton body and salt bridge with PVDF or ceramic junction), glass process electrode, titanium ground electrode, and Viton O-rings; union-mount style sensor also has LCP (or Ryton) adapter

NOTE: *When the sensor has an optional antimony process electrode, the ground electrode material is stainless steel.*

The following specifications are common to both LCP and Ryton sensors:

Measuring Range ..... 0 to 14 pH

NOTE: *Most pH applications fall in the 2.5-12.5 pH range. General purpose pH glass electrodes perform well in this range. For pH applications below 4 or above 10 pH, GLI recommends using an LCP-bodied pH sensor. Some industrial applications require accurate measurement and control below 2 or above 12 pH. In these cases, please contact GLI for further details.*

Repeatability and speed of response of a pH sensor with an optional antimony process electrode is not as good as a sensor with a standard glass process electrode. Antimony electrodes are only linear between 3 and 8 pH, and should only be used when the process conditions, such as the presence of hydrofluoric acid, dictate their use.

Maximum Flow Rate..... 10 ft. per second

NOTE: *If possible, flow rate should be minimal for low conductivity water or solutions high in suspended solids.*

Performance:

Sensitivity ..... Less than 0.005 pH

Stability ..... 0.03 pH per 24 hours, non-cumulative

Output Span** ..... 0.95 mA per pH unit

Output Offset** ..... 12 mA occurs at 7.0 pH ±0.88 pH

Load at 20 mA** ..... 450 ohms

** These specifications only apply to 2-wire sensors that have a built-in two-wire transmitter.

Maximum Transmission Distance:

5-wire Sensor (with built-in preamp) ..... 3000 ft. (914 m)

2-wire Sensor (with built-in two-wire transmitter). ..... Limited only by wire resistance and power supply voltage

Sensor Cable:

5-wire Sensor (with built-in preamp) ..... 5 conductors (plus shield); 10 ft. (3 m) long

2-wire Sensor (with built-in two-wire transmitter). ..... 2 conductors (twisted pair); 10 ft. (3 m) long

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
MOUNTING

2.1 Submersion

The convertible style sensor may be submersion or tank mounted by threading it onto the end of a pipe of an appropriate length (see Figure 2-1).

1. Apply Teflon tape to the 1-1/2 inch x 1 inch NPT reducer coupling and sensor threads (cable end) to avoid leaks. (Pipe sealant with Teflon, Locktite No. 59321 or equivalent, may not provide adequate sealing at higher solution temperatures.)

2. Fasten the 1-1/2 inch x 1 inch NPT reducer coupling onto the cable end of the sensor.

3. Route the 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 1-1/2 inch x 1 inch NPT reducer coupling to avoid leaks.

5. Fasten other end of reducer coupling onto pipe.

6. Route the sensor cable wires into a Unilet junction box, and fasten the junction box onto the top of the mounting pipe.

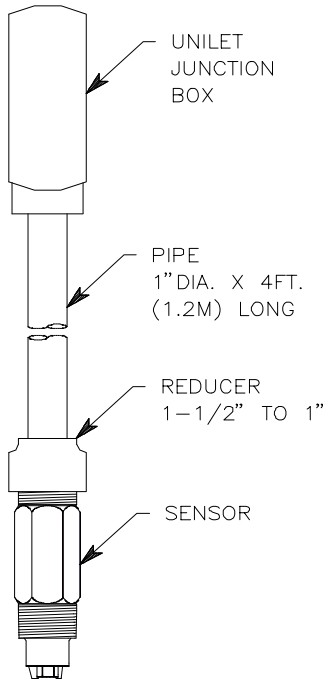


FIGURE 2-1
Submersion Mounting Details

7. Route an interconnect cable into the Unilet junction box. Connect the sensor and interconnect cable wires, by matching colors, to the terminal strip inside the junction box. Fasten the cover onto the junction box.

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

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 flexible, grounded metal conduit to protect it from moisture and mechanical damage. The flexible conduit should be long enough to enable the sensor to be removed from the process for routine maintenance and calibration.

☞ ***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 the interconnect cable wires to the analyzer. Refer to the analyzer operating manual for details.

10. After connecting the sensor, remove its protective plastic caps and save them 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 sensor into the process, calibrate the analyzer using the procedure in the analyzer operating manual.

12. After calibration, fasten the electrode protector onto the end of the sensor. Then mount the sensor into the process.

This completes the submersion mounting.

2.2 Flow-through (pipe tee)

The convertible style sensor may be tee mounted by threading it into a standard 1-1/2 inch NPT pipe tee (see Figure 2-2).

1. Install a standard 1-1/2 inch NPT pipe tee into the process line.

2. Connect the 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 cable wires to the analyzer. Refer to the analyzer operating manual for connection 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

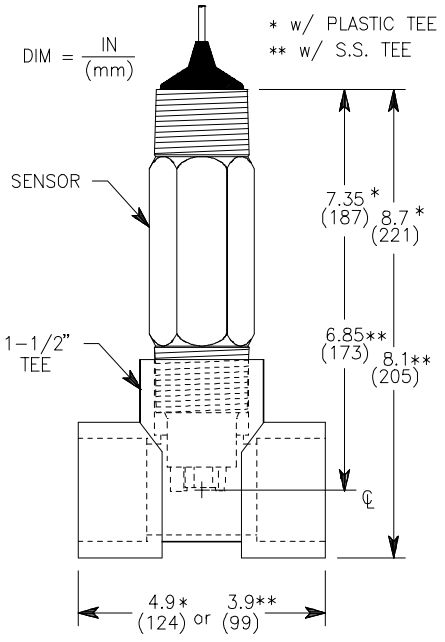


FIGURE 2-2 Tee Mounting Details

sensor and interconnect cable wires, by matching colors, to the terminal strip inside the junction box. Fasten the cover onto the junction box.

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

d. Route the 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 the interconnect cable wires to the analyzer. Refer to the analyzer operating manual for details.

3. After connecting the sensor, remove its protective plastic caps and save them 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 sensor into the process line, calibrate the analyzer using the procedure in the analyzer operating manual.

5. After calibration, apply Teflon tape to the sensor and mounting tee threads to avoid leaks. (Pipe sealant with Teflon, Locktite No. 59321 or equivalent, may not provide adequate sealing at higher solution temperatures.)

6. Purposely pre-twist the sensor cable (by turning sensor counterclockwise 4 to 5 turns), and 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 OVERTIGHTEN!**

This completes the flow-through (pipe tee) mounting.

2.3 Union

The union-mount style sensor can be mounted by using a special 2-inch NPT pipe tee available from GLI.

1. Install GLI 2-inch NPT pipe tee into the process line.

2. Refer to Figure 2-3 and remove the retaining ring from the top portion of the adapter.

3. Place the lock ring onto the adapter as shown in Figure 2-3 (with lock ring threads towards adapter O-rings). Secure the lock ring onto the adapter by replacing the retaining ring over the top of the lock ring.

4. Connect the sensor cable wires to the analyzer as described in Section 2.2, step 2A (direct connection) or step 2B (indirect connection with junction box).

5. Remove the protective plastic caps from the sensor and save them 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.)

6. Before installing the sensor, calibrate the analyzer using the procedure in the analyzer operating manual.

7. After calibration, lubricate the adapter O-rings with water and then carefully place the sensor into the special tee. Hand tighten the lock ring onto the tee.

This completes the union mounting.

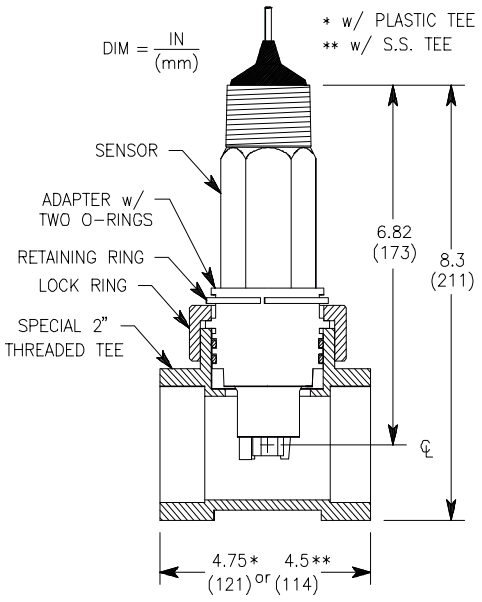


FIGURE 2-3 Union Mounting Details

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, salt bridge, and ground electrode) 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 GLI Customer Service.

   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 analyzer. Refer to the analyzer operating 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 (Section 3).

SPECIAL ANTIMONY ELECTRODE CLEANING

Sensors that have an antimony (instead of glass) process electrode that still cannot be calibrated after cleaning and replacing the standard cell solution and salt bridge may require additional electrode cleaning. Be careful when cleaning the antimony electrode because it is brittle and can easily break. Very carefully file the tip of the antimony electrode and lightly scrape its rounded side surfaces to remove any stubborn coating.

WARNING:

ANTIMONY IS A HIGHLY TOXIC MATERIAL! IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS, PROPERLY DISPOSE ALL RESIDUAL ANTIMONY FILINGS. AFTERWARDS, THOROUGHLY WASH YOUR HANDS.

SECTION 2

REPLACING STANDARD CELL SOLUTION/SALT BRIDGE

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

1. Firmly hold the sensor upright (electrode at top), and remove the hex-shaped salt bridge by turning it counterclockwise with a 9/16-inch socket or nut driver. 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. (The solution may be a special gelled solution for high temperature applications.)

   - Normal 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 25M1A1001-115).

   - Special Standard Cell Gelled Solution:

     A. Remove the aged gelled solution 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 25M1A1001-115) 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 part numbers), 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. Then tighten with pliers approximately 1/4 turn more. **DO NOT OVERTIGHTEN!**

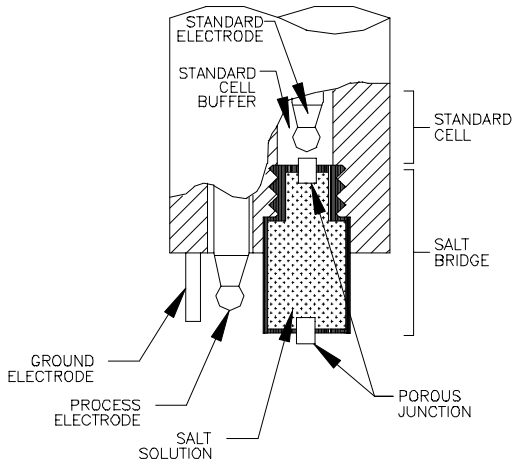


FIGURE 3-1 Replacing Standard Cell Solution and Salt Bridge

SECTION 3
TROUBLESHOOTING

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 sensor operation (Section 3.1 or Section 3.2). These simple tests require a multimeter and two pH buffers (pH 7 and pH 4 or pH 10).

3.1 5-wire Sensor Operating Test (with integral preamplifier)

1. Disconnect the sensor's red, green, yellow, and black 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 4 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:

"Offset" Reading (in pH 7 buffer)	"Span" Reading (in pH 4 buffer)
-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:

"Offset" Reading (in pH 7 buffer)	"Span" Reading (in pH 10 buffer)
-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 4 for sensor replacement details.

This completes the 5-wire sensor operating test.

3.2 2-wire Sensor Operating Test (with integral two-wire transmitter)

1. Connect a DC milliameter in series with the sensor and analyzer (or +24 VDC voltage source). To do this:

   A. Disconnect the sensor's red (+) wire from the analyzer and connect it to the milliameter's (+) lead.

   B. Connect the milliameter's (-) lead to the analyzer's (+) input terminal.

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). Then write down this sensor "offset" reading which should be between 11 and 13 mA. If it is, the sensor "offset" is within factory-specified limits, and the sensor "span" should now be checked (step 3). If not, discontinue this test and refer to the GLI warranty/replacement plan on page 4 for details on sensor replacement.

3. With the milliameter 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 between 2.37 and 3.10 mA less than the noted "offset" reading taken in step 2.

      Example: Suppose the "offset" reading was 11.50 mA with the sensor in pH 7 buffer (from step 2). Then the "span" reading must be between 8.40 and 9.13 mA to be within the factory-specified limits.

   B. Span Reading in pH 10 Buffer

      With the sensor in pH 10 buffer, the sensor "span" reading should be between 2.37 and 3.10 mA more than the noted "offset" reading taken in step 2.

      Example: Suppose the "offset" reading was 11.50 mA with the sensor in pH 7 buffer (from step 2). Then the "span" reading must be between 13.87 and 14.60 mA to be within the factory-specified limits.

   If the calculated "span" reading is within this range, the sensor is operating properly. If not, refer to the GLI warranty/replacement plan on page 4 for details on sensor replacement.

This completes the 2-wire sensor operating test.

3.3 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.
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.

Call GLI Customer Service 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 for a sensor being returned. **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 back. Include preferred shipping method (UPS, Federal Express, etc.) if applicable.
4. A purchase order if sensor 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 FOUR - SPARE PARTS AND ACCESSORIES

	Description	Part Number
Sensor Accessories	LCP Protector (for submersion applications)	60A2F1278
	Ryton Protector (for submersion applications)	60A2F1278-300
	LCP Union Adapter Assembly (includes two Viton O-rings and a retaining ring)	60G9753-101
	Ryton Union Adapter Assembly (includes two Viton O-rings and a retaining ring)	60G9753-301
	Replacement Viton O-rings for Union Adapter Assembly (two)	5H1233
Standard Cell Supplies	Standard Cell Solution (1 pint)	25M1A1001-115
	Optional Gel Powder (2 grams, for gelling standard cell solution)	25M8A1002-101
	Spare Salt Bridge* (includes O-rings):	
	For LCP Sensors	60-9765-000*
	For Ryton Sensors	60-9764-000*
	*Some applications require a special salt bridge (identified with a different dash number). When ordering, specify the complete salt bridge number including the dash number.	
	Spare Viton O-rings** for Salt Bridge:	
	Large O-ring	5H1016
	Small O-ring	5H1261
	**These Viton O-rings are used for sealing the salt bridge on a standard LCP or Ryton sensor. When the LCP or Ryton sensor is specially-equipped with Kalrez or Chemraz O-rings, consult the factory for the appropriate O-ring set to seal the salt bridge.	
pH Buffers for Calibration and Operation Checks	1 pint of pH 7 Buffer	3A0421
	1 pint of pH 4 Buffer	3A0422
	1 pint of pH 10 Buffer	3A0942