

# Retractable pH Sensor

- RETRACTABLE SENSOR can be easily removed and replaced under pressure without process shutdown.
- PLUG-IN PATENTED\* COMBINATION ELECTRODE CARTRIDGE is simple to replace thus reducing labor costs.
- LONG-LIFE, DOUBLE JUNCTION REFERENCE ELECTRODE provides longer service life in applications where poisoning ions are present.
- INTEGRAL PREAMPLIFIER provides noise free long distance transmission of the high impedance pH signal.
- WEATHERPROOF JUNCTION BOX permits installation in most environments.

## 1.1 FEATURES AND APPLICATIONS

The Rosemount Analytical Model 300 pH/ORP Sensor is designed to meet a wide variety of industrial applications. It has been specially designed for applications where the process cannot be shut down and a separate sample stream is difficult or impossible to provide. Paper pulp stock lines and reaction towers are typical applications.

The Model 300 Retractable pH/ORP Sensor is designed for use with a standard one inch ball valve. This makes it ideal for replacing or updating any manufacturer's existing retractable pH/ORP sensors without process shut-down. Initial installations can even be accomplished without process shut-down by hottapping a one inch ball valve at the desired point of measurement.

Sensor removal is accomplished by loosening the hex nut on its barrel and retracting the sensor until it reaches the built-in retraction stop collar (no cables or chains are required for retraction). The ball valve may then be closed, the hex nut completely detached and the sensor pulled out of the ball valve assembly.

After the Model 300 is removed from the process, the disposable electrode cartridge can easily be replaced

by removing the threaded cartridge retaining holder, discarding the old cartridge and replacing it with a new one. Once the electrode retaining holder is replaced, the sensor assembly is ready to be put back into the process.

The patented\* disposable combination electrode cartridge is available in two configurations, side bulb and end bulb. The side bulb cartridge (Code 10-12) features a double junction gel-filled reference cell, providing long service life. The end bulb cartridge comes standard with a single gel-filled reference. Both cartridges are available in general purpose, high pH and ruggedized glass construction for higher temperatures or abrasive processes. A platinum electrode (Option 13) is available for ORP measurements. A custom seal prevents moisture from reaching the high impedance connection at the back of the electrode.

The plug-in style solid state preamplifier is housed in a weatherproof junction box as an integral part of the sensor. This preamplifier provides noise-free, long distance transmissions of the pH/ORP signal to an analyzer, such as the 1023, the microprocessor-based Models 1181pH/ORP, 2081 Two Wire Transmitter.

\*US Patent No. 4,783,252

**1.2 PERFORMANCE SPECIFICATIONS**

**Measuring Range:** pH: 0 to 14  
ORP: -1500 to +1500 mV

**Temperature Compensation:** 0°C to 80°C (32°F to 176°F)

**Maximum Pressure:** 790 kPa abs (100 psig)

**Maximum Temperature:** 80°C (176°F)

**Plug-in Cartridge:**

Side Bulb

Code 10: General Purpose pH Electrode (0-13 pH)

Code 11: High-pH Electrode (0-14 pH)

Code 12: Ruggedized pH Electrode

Code 13: Platinum ORP Electrode

End Bulb

Code 14: General Purpose pH (0-13 pH)

Code 15: High-pH (0-14 pH)

**Maximum Retraction Pressure:** 64 psig

**1.3 PHYSICAL SPECIFICATIONS**

**Enclosure:** Weatherproof

**Mounting:** Insertion through 1 inch (or larger) ball valve (See Figure 1-1)

**Process Connection:** 1 inch MNPT

**Wetted Materials:**

Side Bulb:

pH: Glass, 316 stainless steel, Viton<sup>1</sup>, CPVC, EPDM, Epoxy

ORP: Glass, 316 stainless steel, Viton, CPVC, Platinum, Epoxy

End Bulb:

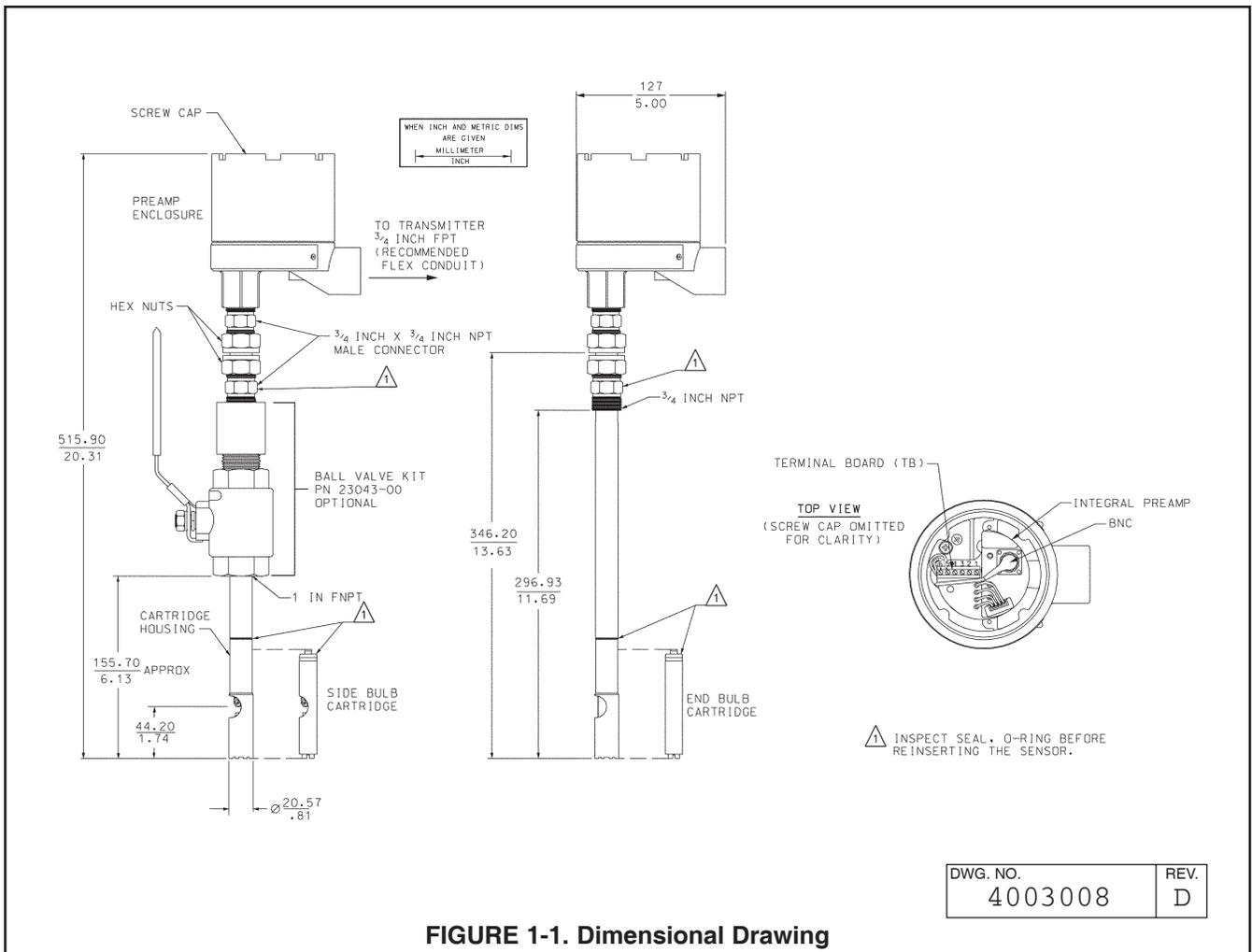
Glass, 316 stainless steel, EPDM, PPE (Polyphenylene Ether), Ceramic, Viton

**Interconnecting Cable:** P/N 9200000 (Belden type 8722 or equivalent)

**Dimensions:** See Figure 1-1

**Weight/Shipping Weight:** 1.6 kg/2.0 kg (3.5 lbs./4.6 lbs.)

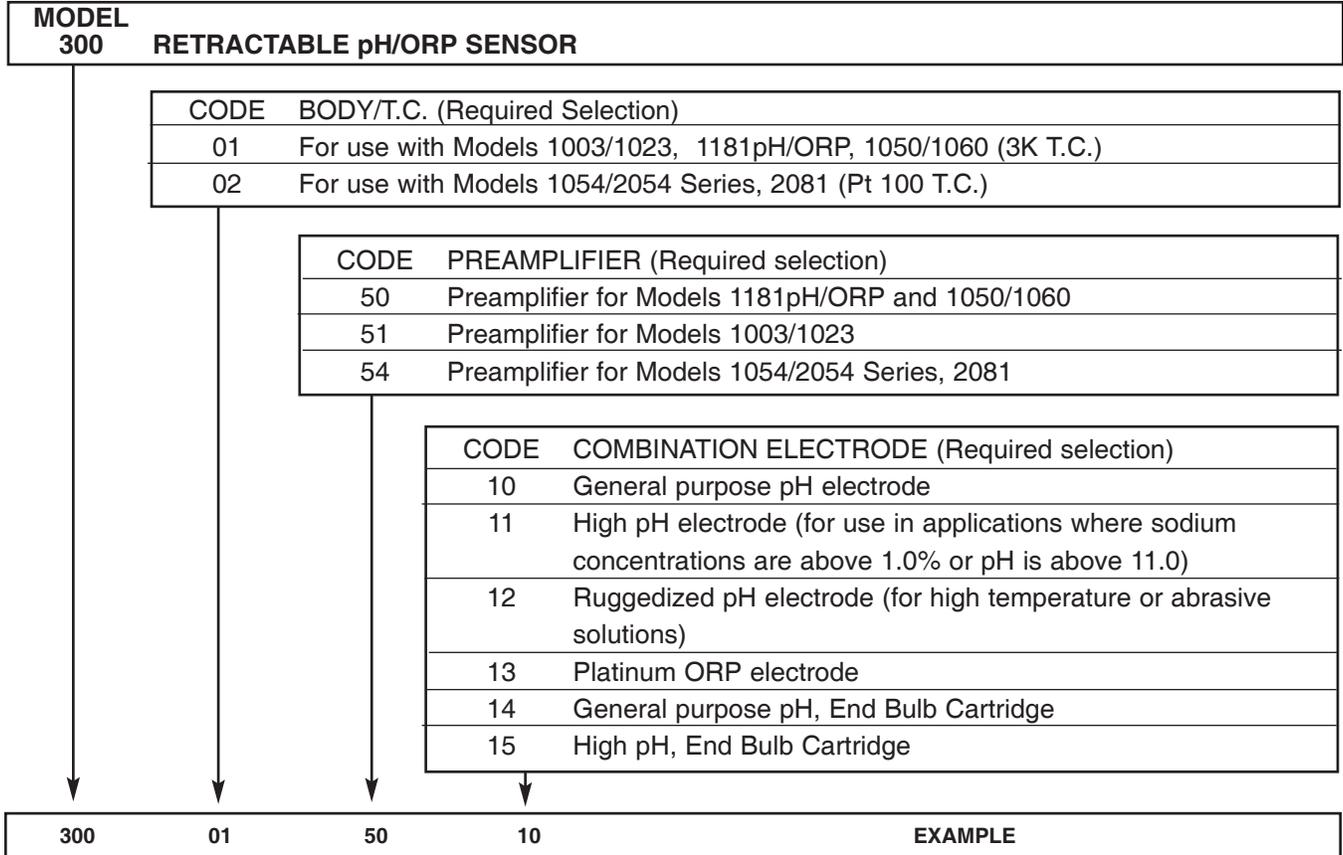
<sup>1</sup> Viton is a registered trademark of E.I. du Pont de Nemours & Company



**FIGURE 1-1. Dimensional Drawing**

**1.4 ORDERING INFORMATION**

**Model 300 Retractable pH/ORP Sensor** includes a choice of disposable CPVC side bulb or PPE end bulb combination pH/ORP electrode cartridge with ceramic liquid junction. The sensor body is constructed of 316 stainless steel and includes a weatherproof junction box with stainless steel tag and plug-in preamplifier. The sensor is designed for use with all Rosemount Analytical pH/ORP Analyzer/Transmitters listed below.



**NOTE:** Recommended interconnecting cable is P/N 9200000 (Belden 8722), or equivalent.

**TABLE 1-2. Accessories and Replacement Parts**

PART #	DESCRIPTION	PART #	DESCRIPTION
23043-00	316 stainless steel ball valve kit	23500-01	High pH End Bulb (Code 15)
23048-00	3K TC tube assembly	23103-00	Cartridge Housing
23048-01	Pt100 TC tube assembly	22698-00	Preamplifier for Models 1002 and 1003
23036-00	General purpose pH side bulbcartridge (Code 10)	22698-02	Preamplifier for Models 1181pH and 1050A
23036-02	High pH side bulb cartridge (Code 11)	22698-03	Preamplifier for Models 1054/2054 Series
23036-01	Ruggedized pH side bulb cartridge (Code 12)	32951-00	Cartridge Seal (Viton)
23036-03	ORP Electrode side bulb cartridge (Code 13)	9200000	Cable
23500-00	GP End Bulb (Code 14)	9550056	O-Ring (Viton), Male Connector Process Seal
		9550079	O-Ring (Viton), Cartridge Housing / Sensor Tube
		9300148	1" Hex nipple/connector

## SECTION 2.0 INSTALLATION

**2.1 MECHANICAL INSTALLATION.** The Rosemount Analytical Model 300 Sensor Assembly may be installed through a one-inch weldolet or in a pipe tee or "Y" as shown in Figure 2-1. Insert to a depth sufficient to ensure that the glass bulb is continuously wetted by the process fluid. When the sensor is to be installed in a weldolet, the angle must be within 10 degrees off horizontal (see Figure 2-1) with the electrode tip pointing downward, to keep air bubbles from settling at the pH sensitive glass bulb. If bubbles are allowed to settle at the glass bulb, electrical continuity between the pH sensitive glass and the reference element will be disrupted.

The Model 300 sensor assembly is shipped in three parts. The measuring electrode (cartridge), sensor housing with junction box, and the preamplifier. If an optional ball valve is selected, it will be shipped as a separate item.

### 2.1.1 Cartridge Preparation.

1. Remove the electrode cartridge from the plastic container. Inspect the cartridge for evidence of damage.
2. Assure that the rubber seal is in place around the connector with the rounded edge showing.

#### NOTE

The seal is coated with grease. Care should be taken to ensure that this grease does not get on the pH glass, the white reference junction, or the connector. The cartridge will not work if these parts become contaminated with grease.

3. For side bulb cartridges: Carefully remove the protective wrap from around the cartridge just prior to placing the cartridge into service.

For end bulb cartridges: carefully remove the red protective boot from the tip of the cartridge.

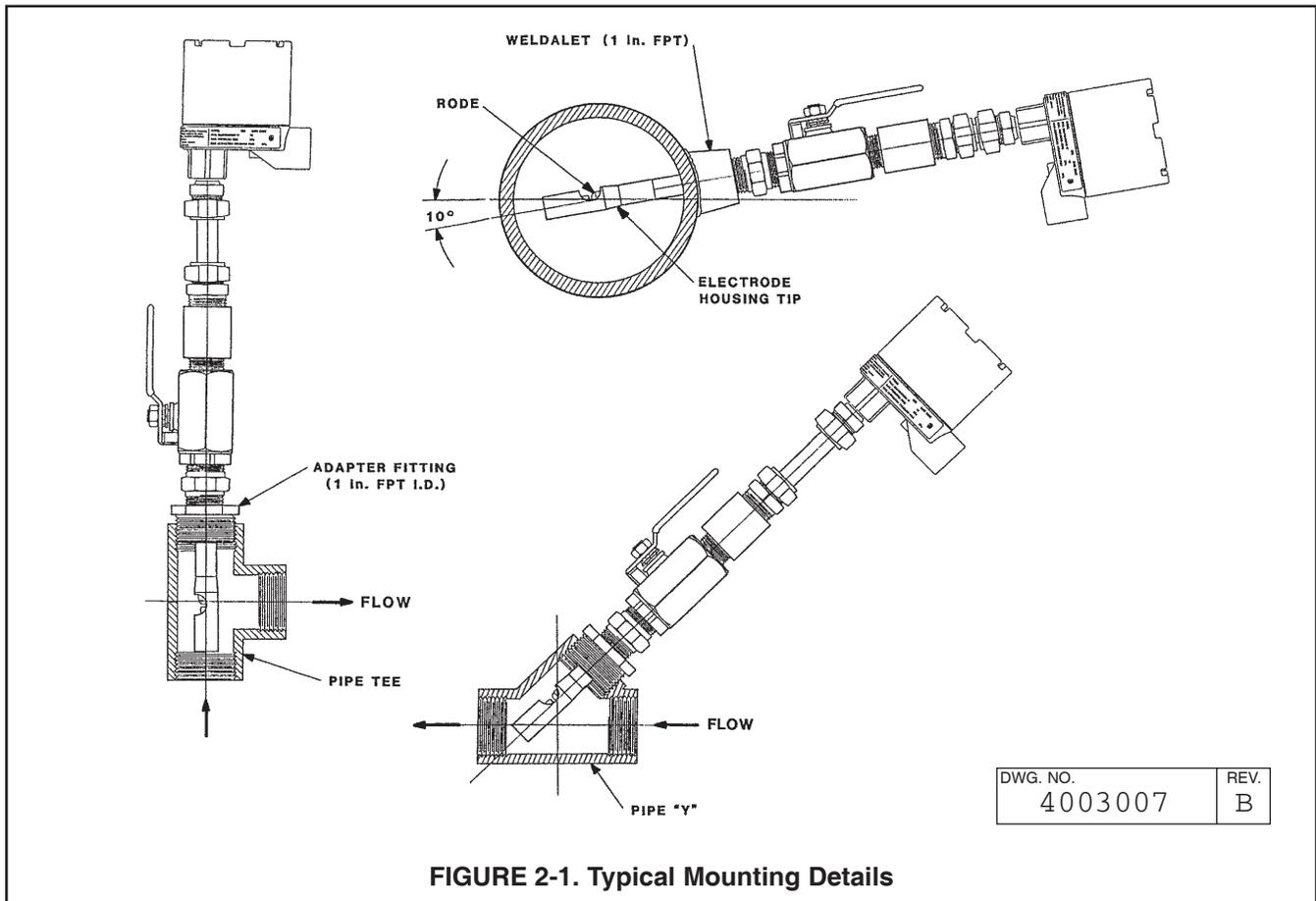


FIGURE 2-1. Typical Mounting Details

**NOTE**

This wrap or boot contains a harmless salty wetting solution that may spill when removed. Do not allow any of this wetting solution to get onto the connector.

4. Dry the cartridge with a clean cloth.

**2.1.2 Sensor Preparation.** The process side male connector must be in place on the sensor tube with the o-ring properly seated in the groove. The sensor must be dry and clean, especially at the cartridge connector.

1. Plug the cartridge onto the cartridge connector at the end of the tube, with the rubber seal between the end of the tube and cartridge.
2. Inspect the cartridge housing to assure that it is clean and dry, and that threads are clear of foreign matter. Apply grease on the threads.
3. Slide the cartridge housing over the cartridge and loosely screw it onto the sensor tube (see Figure 1-1). Make sure the cartridge housing o-ring is in place. For side bulb cartridges before tightening the housing, insert a screwdriver or dime into the slot at the end of the sensor and rotate the cartridge so that the cartridge cutout and the holder cutout are aligned.
4. Hand tighten the holder until it is firmly seated against the sensor tube. Do not use tools.

**NOTE**

The two cutouts can be intentionally offset to provide increased protection for the pH glass, however, this could cause increased fouling in some applications.

**2.1.3 Sensor Installation.**

1. For side bulb cartridges note the orientation of the cartridge cutout to the sensor J-box for later positioning of the cartridge to the process flow.
2. Insert the sensor assembly into the valve assembly until it bottoms on the closed valve.
3. Screw the male connector tightly into the valve assembly. (Do not tighten the hex nut at this time.) Pull back hard on the sensor assembly to be certain that it cannot come free of the valve assembly and male connector.

**CAUTION**

The sensor must be captured by the valve assembly and male connector so that it cannot be blown free by system pressure if mishandled during insertion or retraction.

4. When the sensor assembly is properly secured by the male connector, the valve may be opened and the sensor inserted into the process.
5. For side bulb cartridges the sensor may now be rotated to position the cartridge cutout according to your application. The insertion depth may be adjusted.

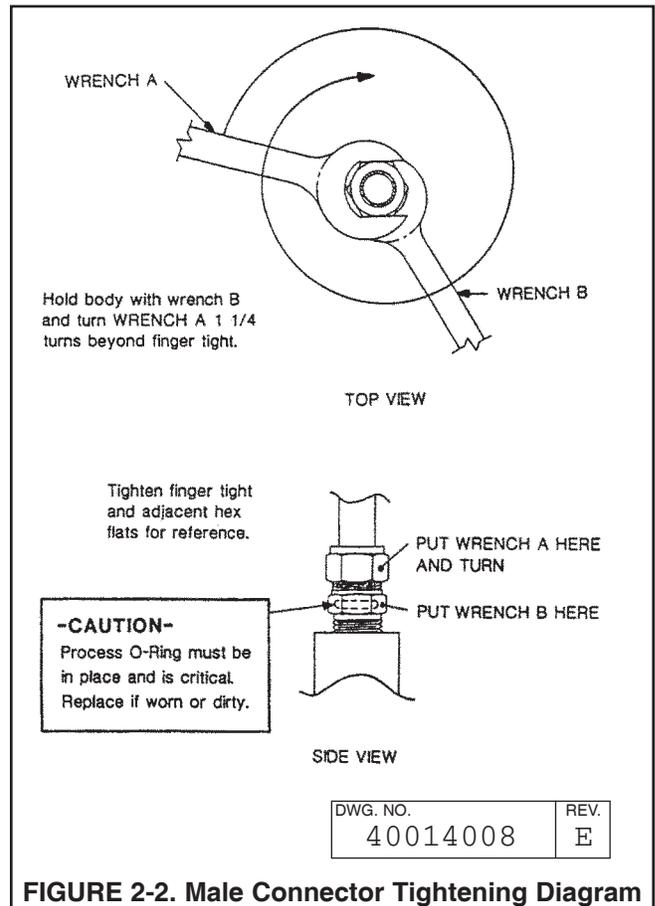
**NOTE**

For maximum protection, for side bulb cartridges, the cutout should be positioned to face downstream. An upstream position will allow for maximum exposure to the flow.

6. With the sensor assembly in the desired position, tighten the hex nut to secure the sensor in place (see Figure 2-2).

**NOTE**

If the male connector leaks during insertion or retraction replace the O-ring in the male connector. If the O-ring needs frequent replacement the sensor tube may be burred and in need of replacement.



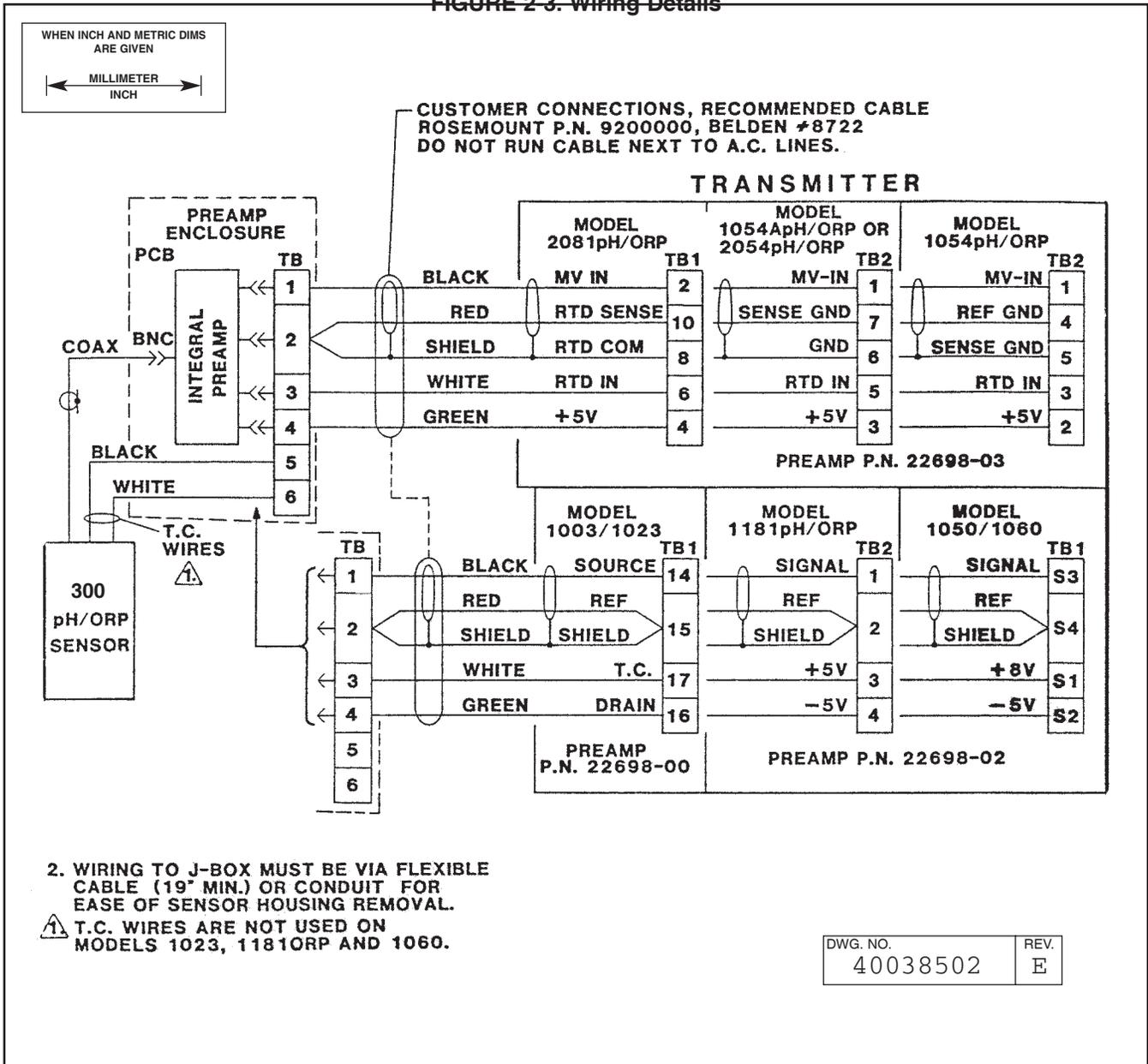
**FIGURE 2-2. Male Connector Tightening Diagram**

**2.2 ELECTRICAL INSTALLATION.**

Make electrical connections as shown in Figure 2-3. Observe the following instructions:

1. Pay particular attention to the transmitter model number when following details on Figure 2-3 to ensure that the connections are made to the proper terminals.
2. Use a quality four conductor shielded instrument cable such as Rosemount Analytical PN 9200000 (Belden 8722 or equivalent).
3. Signal cable should be run in a dedicated conduit, and should be kept away from A.C. power lines.

**FIGURE 2-3. Wiring Details**



## SECTION 3.0 MAINTENANCE

**3.1 GENERAL.** This section describes the Model 300 removal, parts replacement, and re-installation procedures.

### 3.2 SENSOR REMOVAL PROCEDURE.

Remove the sensor from the ball valve as follows:

#### WARNING

The system pressure may cause the sensor to blow out with great force unless care is taken during removal. The system pressure must be below 790 Kpa (100 psig). Make sure the following steps are adhered to.



#### WARNING

Retractable sensors must NOT be inserted or retracted when process pressures are in excess of 64 psig.



1. Push in on the sensor at the junction box and slowly loosen the hex nut at the ball valve.
2. When the hex nut is sufficiently loosened, slowly ease the sensor out until the retraction stop collar is reached.

#### CAUTION

Failure to withdraw the sensor until it reaches the retraction stop collar may allow damage to the sensor when the valve is closed.

3. Close the ball valve slowly. If it starts to move but then resists closing, it may be hitting the sensor. Confirm that the sensor has been retracted to the retraction stop collar.

#### WARNING

Before removing the sensor from the ball valve, be absolutely certain that the ball valve is fully closed. Leakage from the male connector threads may indicate that the male connector is still under pressure. Leakage through a partially open valve could be hazardous.



4. After closing the ball valve fully, the male connector may now be completely unscrewed and the sensor removed for servicing.

#### CAUTION

Residual pressure and process may be trapped between valve and male connector.



#### NOTE

With the ball valve fully closed, some residual process fluid may leak from the connectors MNPT pipe threads. This leakage is normal and to be expected.

**3.3 CARTRIDGE CLEANING.** If the cartridge is coated, clean it as follows:

1. Remove the sensor from process as instructed in Section 2.2.
2. Unscrew the cartridge holder and remove the electrode cartridge.
3. Wipe the glass bulb with a soft, clean, lint-free cloth or tissue. If this does not remove the coating, go to Step 4.
4. Wash the glass bulb in a strong detergent solution and rinse it in clean water. If this does not clean the tip, go to Step 5.

#### CAUTION

The solution used during the following step is an acid and should be handled with care. Follow the directions of the acid manufacturer. Wear the proper protective equipment. If contact with skin is made, immediately rinse with clean water.

5. Wash the glass bulb in a dilute 5 % solution of hydrochloric acid and then rinse it in clean water.

Replace the sensor cartridge if cleaning does not restore sensor operation.

**3.4 CARTRIDGE REPLACEMENT.** If the cartridge has exceeded its service life replace as follows:

1. Remove the sensor housing as described in Section 2.2.
2. Unscrew the cartridge housing, slide out the spent cartridge and discard.
3. Prepare and assemble the new cartridge as described in Section 2.1.1 and Section 2.1.2.
4. Replace the cartridge seal, the cartridge housing o-ring, and the male connector process seal o-ring.

**3.5 PREAMPLIFIER REPLACEMENT** If the preamplifier is defective, replace as follows:

1. Unscrew and remove the junction box cover.
2. Disconnect the BNC connector and the four pin connector from the preamplifier.
3. Pull the preamplifier straight out.
4. Plug in a new preamplifier, reconnect the BNC and four pin connector, and replace the junction box cover.

**3.6 AUTOMATIC TEMPERATURE COMPENSATOR.**

The temperature compensator element is temperature sensitive and can be checked with an ohmmeter. Resistance increases with temperature.

The 3K element will read 3000 ohms ±1% at 25°C (77°F) and a Pt-100 will read 110 ohms. Resistance varies with temperature for a 3K and Pt-100 element and can be determined according to Table 3-2 or the following formula:

$$R_T = R_0 [1 + R_1 (T - 20)]$$

Where  $R_T$  = Resistance

T = Temperature in °C

Refer to Table 3-1 for  $R_0$  and  $R_1$  values

**TABLE 3-1**

**$R_0$  and  $R_1$  VALUES FOR TEMPERATURE COMPENSATION ELEMENTS**

Temperature Compensation Element	$R_0$	$R_1$
3K	2934	.0045
PT-100	107.7	.00385

**TABLE 3-2**

**Temperature vs Resistance of Auto T.C. Elements**

Temperature °C	Resistance (Ohms) ±1%	
	3K	PT-100
0	2670	100.0
10	2802	103.8
20	2934	107.7
25	3000	109.6
30	3066	111.5
40	3198	115.4
50	3330	119.2
60	3462	123.1
70	3594	126.9
80	3726	130.8
90	3858	134.6
100	3990	138.5

**3.7 MODEL 300 ORP**

**3.7.1 Platinum Electrode Check.** The platinum electrode may be checked as follows: There are two types of standard solutions which may be used to check the ORP electrode/transmitter system.

**Type 1:** One type of commonly used ORP standard solution is the saturated quinhydrone solution (P/N R508-160Z).

**CAUTION**

The solution used during the following check is an acid and should be handled with care. Follow the directions of the acid manufacturer. Wear the proper protective equipment. If contact with skin or clothing is made, immediately rinse with plenty of clean water.

**Type 2:** A second ORP standard solution can be prepared from the following recipe: Dissolve 39.2 grams or reagent grade ferrous ammonium sulfate,  $Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$  and 48.2 grams of reagent grade ferric ammonium sulfate,  $FeNH_4(SO_4)_2 \cdot 12H_2O$ , in approximately 700 milliliters of water (distilled water is preferred, but tap water is acceptable). Slowly and carefully add 56.2 milliliters of concentrated sulfuric acid. Add sufficient water to bring the total solution volume up to 1000 ml. This standard ORP solution, although not as simple to prepare as the quinhydrone recipe, is much more stable, and will maintain its millivolt value for approximately one year when stored in glass containers. This solution (ferric/ferrous ammonium sulfate) will produce a nominal ORP of  $476 \pm 20$  mV at 25°C when used with a saturated KCl/AgCl reference electrode and platinum measuring electrode. Some tolerance in mV values is to be expected due to the rather large liquid reference junction potentials which can arise when measuring this strongly acidic and concentrated solution. However, if the measuring electrodes are kept clean and in good operating condition, consistently repeatable calibrations can be carried out using this standard solution.

**3.7.2 Cleaning Poisoned Platinum Electrode.**

Platinum electrodes can become poisoned to a degree by cyanide and sulfide compounds. However, most processes involving these compounds are controlled to ensure complete destruction of cyanides and sulfides. Ideally, the electrode is never exposed to these undesirable compounds. In the event poisoning is suspected, the electrode can be restored to normal operation by simply cleaning the platinum electrode with baking soda. Polish the electrode by rubbing it with a damp paper towel and baking soda until a bright, shiny appearance is attained.

## SECTION 4.0 TROUBLESHOOTING

**4.1 TROUBLESHOOTING.** In the event of malfunction, refer to Table 4-1. This is intended as a guide and lists the troubles in order of probable frequency of occurrence. Do not be misled by the trouble, always look for the cause before trying the remedy.

**TABLE 4-1. Troubleshooting**

<b>Trouble</b>	<b>Probable Cause</b>	<b>Remedy</b>
Meter reads off scale. (Display reads overrange).	Defective preamplifier.	Replace preamplifier. See Section 3.5
	T.C. element shorted.	Check T.C. element as instructed in Section 3.7 and replace sensor tube if defective.
	Electrode not in solution or sample stream is not full.	Make sure sensor is in solution or that sample stream is full (refer to Section 3.0 for installation details).
	Open glass electrode.	Replace Cartridge.
	Reference element open - no contact.	Replace Cartridge.
Display reads between 3 and 6 pH regardless of actual pH of solution or sample.	Electrode cracked.	Replace Cartridge.
Meter or display indication swings or jumps widely in AUTO T.C. Mode.	T.C. element shorted.	Check T.C. element as instructed in Section 3.6. and replace sensor tube if defective.
Span between buffers extremely short in AUTO T.C. Mode.	T.C. element open.	Check T.C. element as instructed in Section 3.6. and replace sensor tube if defective.
Sluggish or slow meter indication for real changes in pH level.	Electrode coated.	Clean sensor as instructed in Sections 3.3. or 3.7.2.
	Electrode defective.	Replace sensor tube.
Transmitter cannot be standardized.	Electrode coated or cracked.	Clean Sensor as instructed in Sections 3.3 or 3.7.2 and, if cracked, replace sensor tube.
	Defective preamplifier. See Section 3.5	Replace preamplifier
Transmitter short spans between two different buffer values.	Old glass electrode (greater than 1 year old).	Replace sensor tube.
	Coated glass. Sections 3.3 or 3.7.2.	Clean sensor as instructed in

## SECTION 5.0 RETURN OF MATERIAL

### 5.1 GENERAL.

To expedite the repair and return of instruments, proper communication between the customer and the factory is important. Before returning a product for repair, call 1-949-757-8500 for a Return Materials Authorization (RMA) number.

### 5.2 WARRANTY REPAIR.

The following is the procedure for returning instruments still under warranty:

1. Call Rosemount Analytical for authorization.
2. To verify warranty, supply the factory sales order number or the original purchase order number. In the case of individual parts or sub-assemblies, the serial number on the unit must be supplied.
3. Carefully package the materials and enclose your "Letter of Transmittal" (see Warranty). If possible, pack the materials in the same manner as they were received.
4. Send the package prepaid to:

Rosemount Analytical Inc., Uniloc Division  
Uniloc Division  
2400 Barranca Parkway  
Irvine, CA 92606

Attn: Factory Repair

RMA No. \_\_\_\_\_

Mark the package: Returned for Repair

Model No. \_\_\_\_\_

### 5.3 NON-WARRANTY REPAIR.

The following is the procedure for returning for repair instruments that are no longer under warranty:

1. Call Rosemount Analytical for authorization.
2. Supply the purchase order number, and make sure to provide the name and telephone number of the individual to be contacted should additional information be needed.
3. Do Steps 3 and 4 of Section 5.2.

#### NOTE

Consult the factory for additional information regarding service or repair.

## WARRANTY

Seller warrants that the firmware will execute the programming instructions provided by Seller, and that the Goods manufactured or Services provided by Seller will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller, whichever period expires first. **Consumables, such as glass electrodes, membranes, liquid junctions, electrolyte, o-rings, catalytic beads, etc., and Services are warranted for a period of 90 days from the date of shipment or provision.**

Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products.

If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, promptly correct any errors that are found by Seller in the firmware or Services, or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services.

All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources, unsuitable environmental conditions, accident, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by an authorized Seller representative. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller.

Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller. Except as otherwise expressly provided in the Agreement, THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

## RETURN OF MATERIAL

Material returned for repair, whether in or out of warranty, should be shipped prepaid to:

**Emerson Process Management  
Liquid Division  
2400 Barranca Parkway  
Irvine, CA 92606**

The shipping container should be marked:

Return for Repair

Model \_\_\_\_\_

The returned material should be accompanied by a letter of transmittal which should include the following information (make a copy of the "Return of Materials Request" found on the last page of the Manual and provide the following thereon):

1. Location type of service, and length of time of service of the device.
2. Description of the faulty operation of the device and the circumstances of the failure.
3. Name and telephone number of the person to contact if there are questions about the returned material.
4. Statement as to whether warranty or non-warranty service is requested.
5. Complete shipping instructions for return of the material.

Adherence to these procedures will expedite handling of the returned material and will prevent unnecessary additional charges for inspection and testing to determine the problem with the device.

If the material is returned for out-of-warranty repairs, a purchase order for repairs should be enclosed.



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