

# Retractable pH/ORP Sensor



## **ESSENTIAL INSTRUCTIONS**

### **READ THIS PAGE BEFORE PROCEEDING!**

Rosemount Analytical designs, manufactures, and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use, and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using, and maintaining Rosemount Analytical products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- Read all instructions prior to installing, operating, and servicing the product. If this Instruction Manual is not the correct manual, telephone 1-800-654-7768 and the requested manual will be provided. Save this Instruction Manual for future reference.
- If you do not understand any of the instructions, contact your Rosemount representative for clarification.
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation, and maintenance of the product.
- Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Rosemount. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look alike substitutions may result in fire, electrical hazards, or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

### **DANGER**

#### **HAZARDOUS AREA INSTALLATION**

This sensor is not Intrinsically Safe, or Explosion Proof. Installations near flammable liquids or in hazardous area locations must be carefully evaluated by qualified on site safety personnel.

To secure and maintain an intrinsically safe installation, an appropriate transmitter/safety barrier/sensor combination must be used. The installation system must be in accordance with the governing approval agency (FM, CSA or BASEEFA/CENELEC) hazardous area classification requirements. Consult your analyzer/transmitter instruction manual for details.

Proper installation, operation and servicing of this sensor in a Hazardous Area Installation is entirely the responsibility of the user.

### **WARNING**

#### **RETRACTABLE SENSORS**

Retractable sensors must not be inserted nor retracted when process pressures are in excess of 64 psig (442kPa).

### **CAUTION**

#### **SENSOR/PROCESS APPLICATION COMPATIBILITY**

The wetted sensor materials may not be compatible with process composition and operating conditions. Application compatibility is entirely the responsibility of the user.

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## About This Document

This manual contains instructions for installation and operation of the Model 385 Retractable pH Sensor.

The following list provides notes concerning all revisions of this document.

<b><u>Rev. Level</u></b>	<b><u>Date</u></b>	<b><u>Notes</u></b>
A	8/98	This is the initial release of the product manual. The manual has been reformatted to reflect the Emerson documentation style and updated to reflect any changes in the product offering.
B	7/02	Updated drawing on page 5.
C		
D	9/09	Update last page with division name and new DNV logo 2008.

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# MODEL 385 RETRACTABLE pH/ORP SENSOR

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## SECTION 1.0

# DESCRIPTION AND SPECIFICATIONS

- **RETRACTABLE SENSOR** can be easily removed and replaced under pressure without process shutdown.
- **CHEMICALLY RUGGED “TEFZEL”<sup>1</sup> BODY** with Titanium tube provides maximum resistance and is completely sealed to eliminate sensor leakage.
- **LONG-LIFE, TRIPLE 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 385 Retractable 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. The Model 385's body is constructed of standard Titanium tube and Tefzel allowing the sensor to be used in especially harsh applications such as bleach lines in paper mills.

The Model 385 Retractable pH/ORP Sensor is designed for use with a standard 1-1/2 in. ball valve. This makes it ideal for replacing or updating any manufacturer's existing retractable pH/ORP sensor without process shut-down. Initial installations can even be accomplished without process shut-down by hot tapping a 1-1/2 in. ball valve at the desired point of measurement.

Sensor removal is accomplished by 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, and the sensor removed. The entire process is accomplished with almost no loss of process fluid and without depressurizing the line. Once the sensor is removed from the ball valve it can easily be buffer checked or its disposable sensor tube replaced.

The Model 385 pH sensor comes standard with a triple junction gel filled reference cell. The peripheral ceramic liquid junction around the base of the glass electrode assures maximum working life even in solutions containing ammonia, chlorine and other poisoning ions.

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 transmission of the pH/ORP signal to a remote analyzer, such as the Rosemount Analytical Models 54 pH/ORP, 1054A pH/ORP, 3081 pH/ORP and many others. (Refer to their respective Product Data Sheet for further information.)

### 1.2 PERFORMANCE SPECIFICATIONS

**pH Range:** ACCUGLASS™ GPLR 0-13pH, HIpH 0-14pH

**Repeatability:** ± 0.05 pH

**Temperature Compensation:** 0 to 100° C (212° F)

**Maximum Process Pressure and Temperature:**  
100 psig (790 kPa abs) at 100° C

**Maximum Pressure at Retraction and Insertion:**  
64 psig (542 kPa abs)

### 1.3 PHYSICAL SPECIFICATIONS

**Junction Box:** Weatherproof

**Process Connection:** 1-1/2 in. FNPT ball valve  
1 in. MNPT with only male connector

**Wetted Materials:** Tefzel, titanium, Viton<sup>1</sup>, Teflon<sup>1</sup>, a 316 stainless steel compression fitting with EPDM, glass, and ceramic

**Interconnecting Cable:** P/N 9200000

**Electrical Classification:** General Purpose

**Weight/Shipping:** With Ball Valve: 10 lb/15 lb  
(4.5 kg/6.8 kg)

Without Ball Valve: 5 lb/10 lb (2.25 kg/4.5 kg)

<sup>1</sup> Registered trademarks of E.I. du Pont de Nemours & Co.

**1.4 ORDERING INFORMATION**

**The Model 385 Retractable pH/ORP Sensor:** Standard features include Tefzel sensor body with triple junction gel filled reference electrode and automatic temperature compensation housed in a titanium tube. The sensor comes with a weatherproof junction box and an internal preamplifier.

MODEL	
385	RETRACTABLE pH/ORP SENSOR
CODE	TUBE MATERIAL (Required Selection)
02	Titanium
CODE	SENSOR COMPATIBILITY (Required Selection)
04	For 1181 ORP, 1060, 1023 (no T.C.)
06	For 1054/1054A/B ORP (Pt-100)
07	For 1181 pH, 1050, 1003 (3K T.C.)
08	For 1054/1054A/B pH, 2054 pH and 2081 pH (Pt-100)
CODE	COMBINATION ELECTRODE (Required Selection)
10	General Purpose pH
11	High pH
12	ORP
CODE	PREAMPLIFIER (Required Selection)
50	For use with Models 1181 pH/ORP and 1050/1060
51	For use with Models 1003/1023
52	Remote, for use with Models 1181 pH/ORP, 1050/1060, & 1003/1023, with 15 ft (4.5 m) cable
53	Remote, for use with Models 1054, 1054A, 1054B, 2054 & 2081 with 15 ft (4.5 m) cable
54	For use with Models 1054, 1054A, 1054B, 2054, 2081
CODE	BALL VALVE KIT (Optional)
20	Carbon Steel
21	316 Stainless Steel
385pH	02 08 11 54 20
	EXAMPLE

**NOTES:**

Recommended interconnecting cable from sensor to transmitter is Belden 8722 or equivalent, available from Rosemount Analytical as P/N 9200000. Specify length.

## SECTION 2.0 INSTALLATION

**2.1 UNPACKING AND INSPECTION.** Before opening the shipping carton, inspect the outside of the carton for any damage. If damage is detected, contact the carrier immediately. If there is no apparent damage, open the carton and inspect the instrument and hardware. Make sure all the items in the packing list are present and in good condition. Notify the factory if any part is missing. If the instrument appears to be in satisfactory condition, proceed to Section 2.2, Mechanical Installation.

The Model 385 is shipped in two parts. The measuring electrode and sensor housing with junction box and the preamplifier (or 15 ft coaxial cable for use with a remote preamplifier). The 1-1/2 in. ball valve, 1 x 1-1/2 in. reducing coupling and 1-1/2 in. close nipple are available as an option (P/N 23240-00 in 316 stainless steel or P/N 23240-01 in carbon steel).

### NOTE

Save the original packing cartons and materials as most carriers require proof of damage due to mishandling, etc. Also, if it is necessary to return the instrument to the factory, you must pack the instrument in the same manner as it was received. Refer to Section 6.0 for return instructions.

### WARNING

Glass electrode must be wetted at all times (in storage and in line) to maximize sensor life.

**2.2 MECHANICAL INSTALLATION.** The Model 385 Sensor may be installed through a 1-1/2 in. weldolet or in a pipe tee or "Y", as shown in Figure 2-1, when used with a ball valve. Insert the end of the sensor to a depth sufficient to ensure that the glass bulb is continuously wetted by the process fluid. The Model 385 can also be inserted directly into process without a ball valve using its 1 in. MNPT process fitting (Figure 2-2). **ALLOW SUFFICIENT ROOM FOR THE SAFE MAINTENANCE OF THE SENSOR. PERSONNEL SHOULD HAVE ROOM FOR STABLE FOOTING DURING RETRACTION AND RE-INSERTION OF THE SENSOR.**

The sensor must be mounted within 80 degrees of vertical with the tip pointed downward, thus keeping air bubbles out of the pH sensitive glass bulb. Bubbles settled in the glass bulb disrupt the electrical continuity between the pH sensitive glass and the silver/silver chloride measuring element.

**2.2.1 Installing The Sensor (Refer to Section 4.3 and Figure 4-2).**

1. If the sensor is inserted directly into the process without a ball valve, go to Step 2. Carefully remove the rubber boot which protects the glass electrode and keeps the liquid junction wet. Make sure the lubricated O-ring is in place in the groove inside the male connector body (A). With the male connector on the sensor, screw the male connector body (A) into the process ball valve. Insert the sensor into the ball valve assembly until it gently contacts the closed valve. (The molded electrode guard will protect the glass bulb from breakage.)
2. Thread the male connector body tightly into the ball valve assembly or process connection. DO NOT tighten the hex nut on the male connector body; this would crimp the ferrule on the sensor tube prematurely.
3. Pull back hard on the sensor assembly, as if trying to remove the sensor, to be certain that the sensor cannot come free from the valve assembly and the male connector. The built-in retraction stop collar at the end of the sensor will butt against the shoulder of the 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 ball valve assembly, the valve may be opened and the sensor positioned into the process at the desired depth and orientation.
5. Tighten the hex nut of the male connector to tightly secure the sensor in place during process conditions. When tightened, the Teflon ferrule inside the hex nut clamps the sensor tube. (See Figure 4-3).

### CAUTION

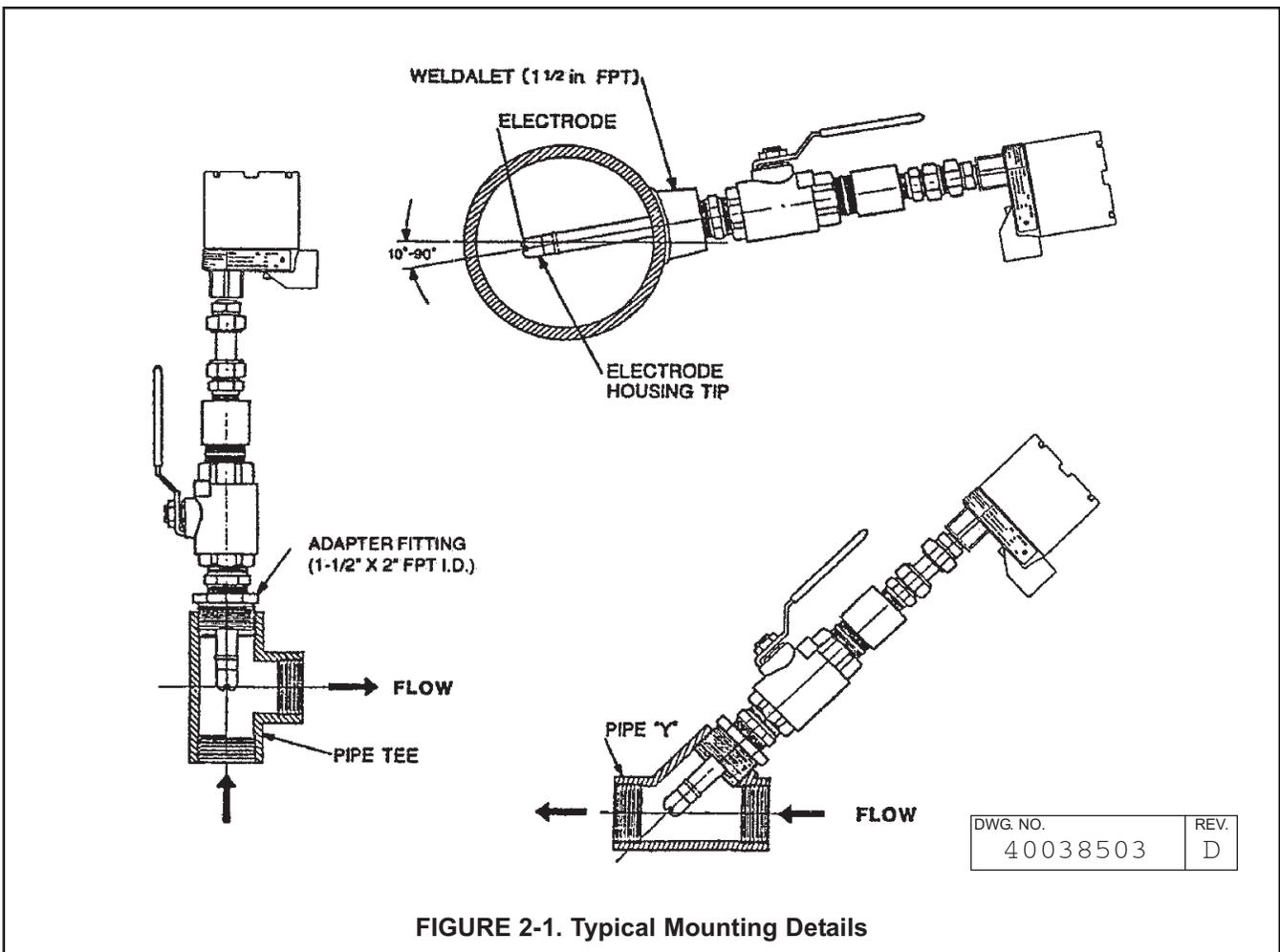
Over tightening the hex nut may damage the ferrule.

**NOTE**

A stainless steel ferrule is available if the Teflon is inadequate. When using the metallic ferrule, be careful and avoid over tightening. This can damage the sensor tube. If the male connector leaks during insertion or retraction, replace the O-ring in the male connector.

**2.3 ELECTRICAL INSTALLATION.** Make electrical connections as shown on Figure 2-3 using the following guidelines:

1. Pay particular attention to the analyzer or transmitter model number when following details on the wiring diagrams to ensure that the connections are made to the proper terminals.
2. Use a high quality four conductor shielded instrument cable such as Belden 8722. This is available from Rosemount Analytical as Part Number 9200000.
3. Maximum sensor to analyzer distance is:  
(Integral preamplifier in sensor)  
1054, 1054A pH/ORP, 1054B pH/ORP and 2054 pH - 1000 ft  
1181 pH/ORP, 1050A/1060A, 1003/1023 - 1 mile with standard cable.
4. Signal cable should be run in a dedicated conduit and should be kept away from AC power lines.



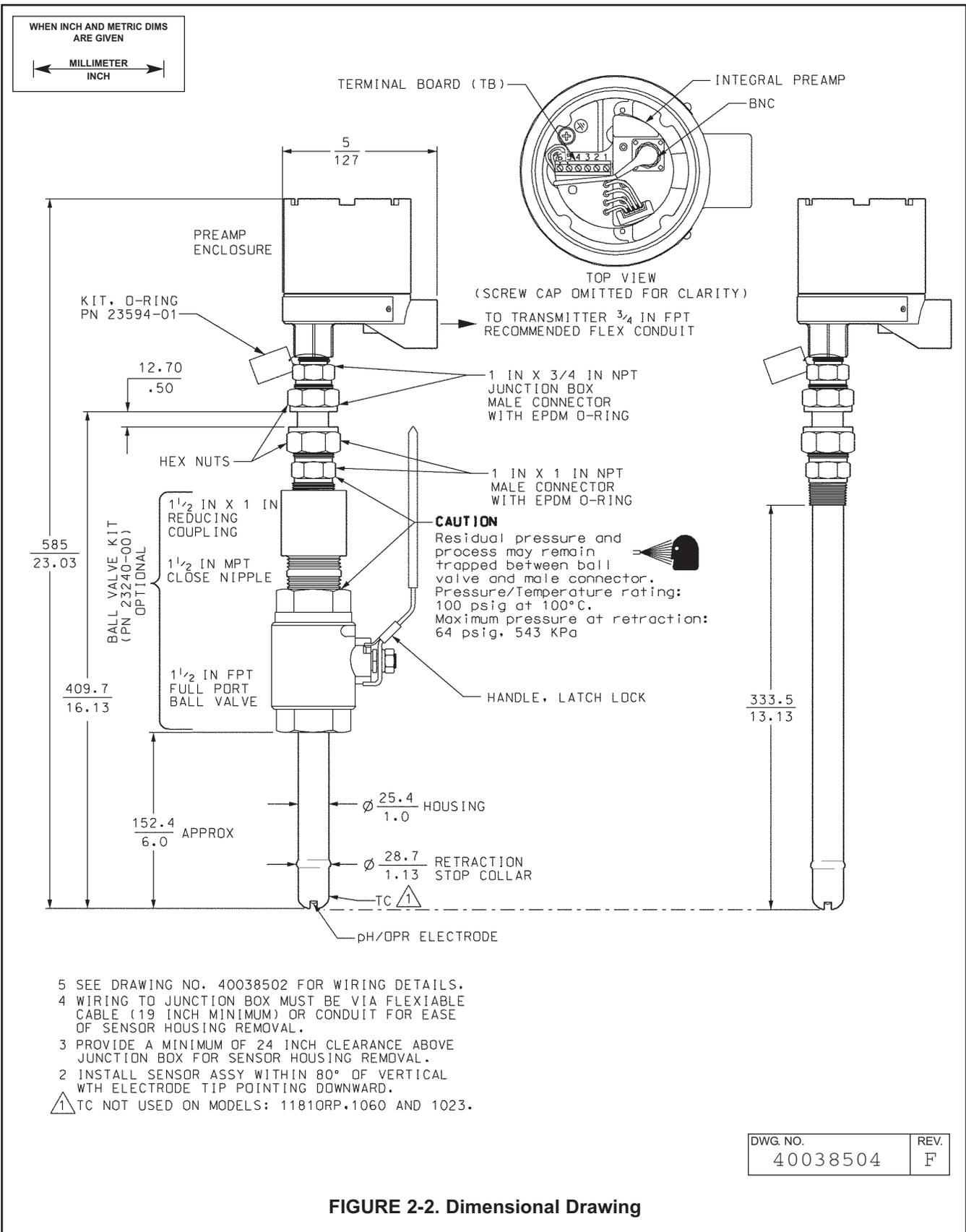
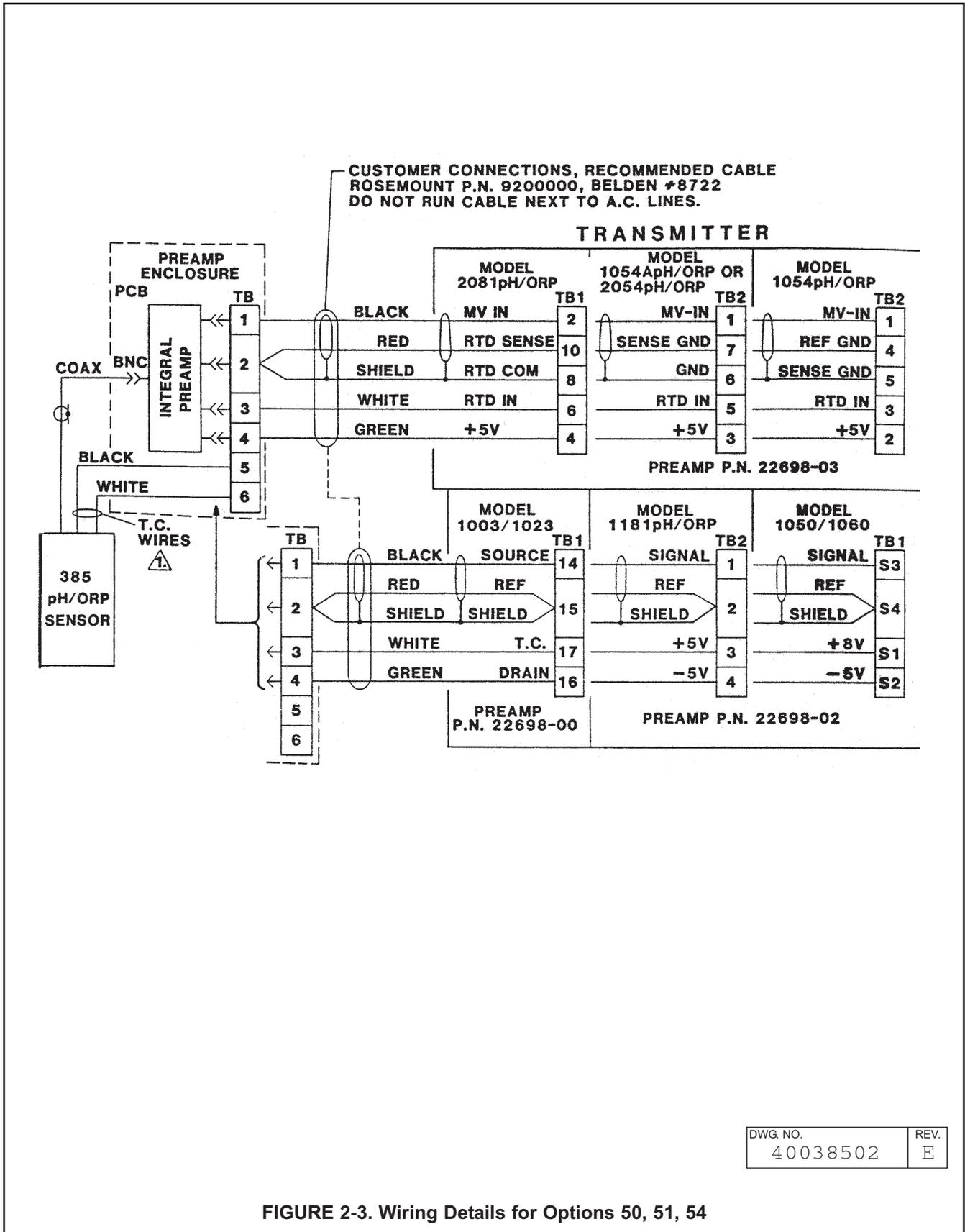


FIGURE 2-2. Dimensional Drawing



DWG. NO. 40038502	REV. E
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FIGURE 2-3. Wiring Details for Options 50, 51, 54

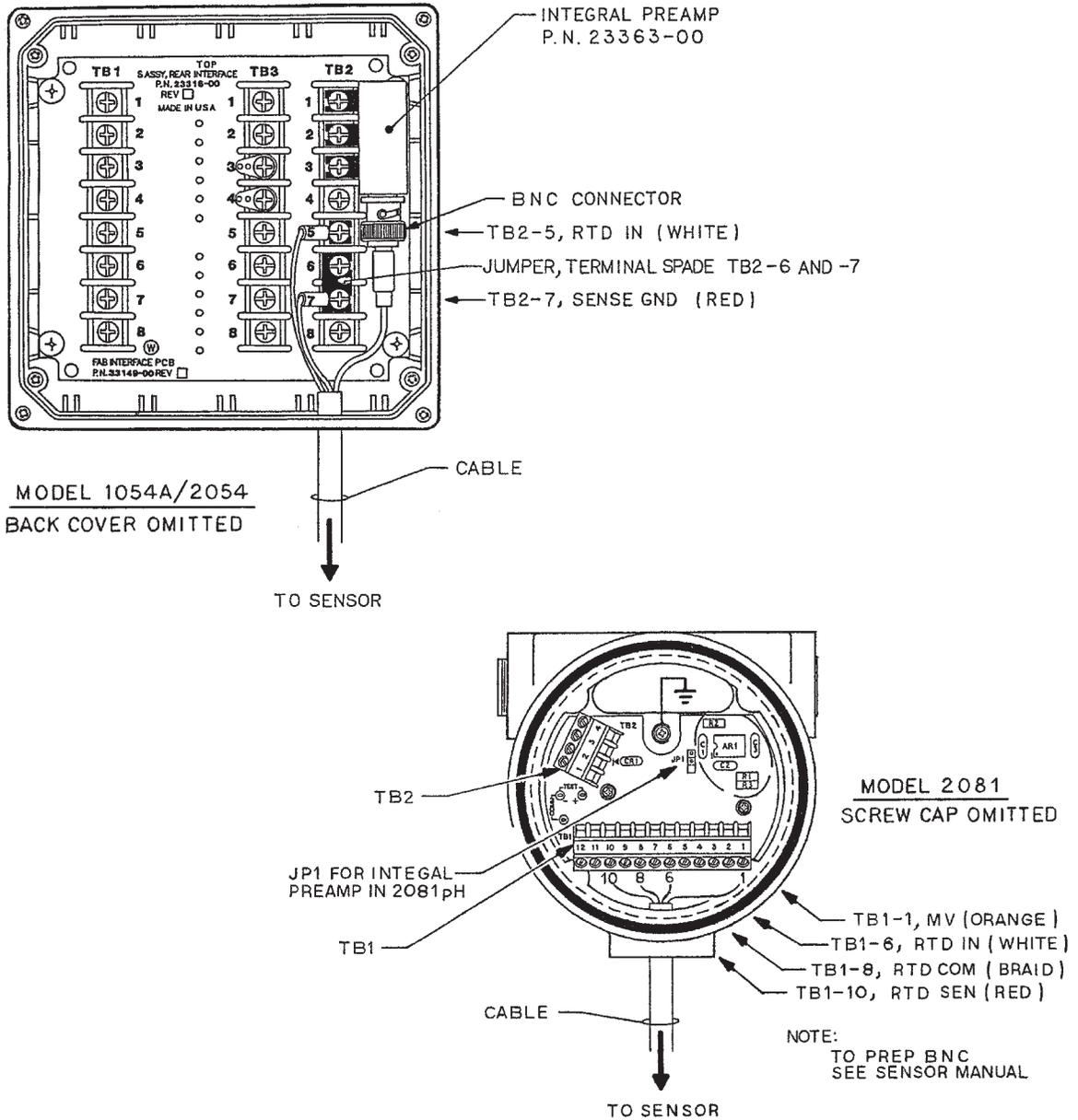


FIGURE 2-4. Wiring Details for Option 53

## SECTION 3.0 START UP AND CALIBRATION

**3.1 START UP.** In most cases, the sensor can simply be installed as shipped and readings with an accuracy of ± 0.6 pH may be obtained. To obtain greater accuracy or to verify proper operation, the sensor must be calibrated as a loop with its compatible analyzer or transmitter. Please refer to the analyzer's or the transmitter's respective instruction manuals for proper calibration procedures.

**3.2 CALIBRATION USING BUFFER SOLUTIONS OR GRAB SAMPLES.** The sensor-analyzer/transmitter loop may be calibrated by submersing the sensor in a buffer solution (standard solutions of known pH values) or in a process grab sample whose pH value may be checked by a calibrated laboratory or portable pH meter.

### 3.3 MODEL 385 ORP

Most industrial applications have a number of ORP reactions occurring in sequence or simultaneously. There can be several components that are oxidized or reduced by the reagents that are used. Theoretically, the ORP potential is absolute because it is the result of the oxidation-reduction equilibrium. However, the actual measured potential is dependent on many factors, including the condition of the surface of the ORP platinum electrode. Therefore, the sensor should be allowed 1-2 hours to become "conditioned" to the stream when first set-up or after being cleaned.

### 3.3.1 ORP Calibration:

1. Make a temporary electrical connection between the sensor and the instrument.
2. Obtain a standard solution of saturated quinhydrone (4 pH or 7 pH). This can be made quite simply by adding a few crystals of quinhydrone to either pH 4 or pH 7 buffer. Quinhydrone is only slightly soluble, so only a few crystals will be required. The resulting solution is yellow in color. (Refer to Section 4.4.1 for an alternate ORP standard solution).
3. Immerse the sensor in the standard solution. Allow 1-2 minutes for the ORP sensor to stabilize.
4. Adjust the standardize control of the transmitter to the solution value shown in Table 3-1. The resulting potentials, measured with a clean platinum electrode and saturated KCl/AgCl reference electrode, should be within ±20 millivolts of the value shown in Table 3-1. Solution temperature must be noted to insure accurate interpretation of results. The ORP value of saturated quinhydrone solution is not stable over long periods of time; therefore, these standards should be made up fresh each time they are used.
5. Remove the sensor from the buffer, rinse and install in the process.

**TABLE 3-1. ORP of Saturated Quinhydrone Solution (In Millivolts)**

	pH 4 Solution			pH 7 Solution		
<b>Temp °C</b>	20	25	30	20	25	30
<b>Millivolt Potential</b>	268	264	260	94	87	80

## SECTION 4.0 MAINTENANCE

**4.1 SENSOR REMOVAL.** Remove the sensor from the ball valve as follows:

### WARNING

System pressure may cause the sensor to blow out with great force unless care is taken during removal. Make sure the following steps are adhered to.



1. Be certain system pressure at the sensor is below 64 psig (542 kPa) before proceeding with the retraction. It is also recommended that the personnel wear a faceshield and have a stable footing.
2. Push in on the sensor using the top of the J-box and slowly loosen the hex nut (B) of the process end male connector (A). (Refer to Figure 4-2).
3. When the hex nut is loose enough, slowly ease the sensor back completely until the retraction stop collar is reached.

### CAUTION

Failure to withdraw the sensor completely may result in damage to the sensor when the valve is closed.

4. Close the ball valve slowly. If there is resistance it may be hitting the sensor. Double check 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.



5. The Male Connector Body (A) may now be completely unthreaded from the reducing coupling and the sensor removed for servicing.

### 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.

### 4.2 SENSOR MAINTENANCE.

**4.2.1 Electrode Cleaning.** If the electrode is coated or dirty, clean as follows:

1. Remove the sensor from process as previously instructed in Section 4.1.
2. Wipe the glass bulb with a soft, clean, lint free cloth or tissue. If this does not remove the dirt or coating, go to Step 3. (Detergents clean oil and grease; and acids remove scale.)
3. Wash the glass bulb in a strong detergent solution and rinse it in clean water. If this does not clean the glass bulb, go to Step 4.

### 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. Do not let the solution come in contact with skin or clothing. If contact with skin is made, immediately rinse with clean water.

4. Wash the glass bulb in a dilute 5% hydrochloric acid solution and rinse with clean water. Soaking the sensor overnight in the acid solution can improve cleaning action.

Replace the sensor if it cannot be cleaned.

**4.2.2 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  $\pm 1\%$  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 4-1 or the following formula:

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

Where  $R_T$  = Resistance  
T = Temperature in °C

Refer to Table 4-2 for  $R_0$  and  $R_1$  values.

**TABLE 4-1.**  
**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

**TABLE 4-2**  
**R<sub>0</sub> and R<sub>1</sub> Values for Temperature**  
**Compensation Elements**

Temperature Compensation Element	R <sub>0</sub>	R <sub>1</sub>
3K	2934	.0045
PT-100	107.7	.00385

**4.2.3 Preampifier Check (For Models 1003/1023, 1050/1060 Analyzers).** To determine if the preampifier is operable, proceed as follows:

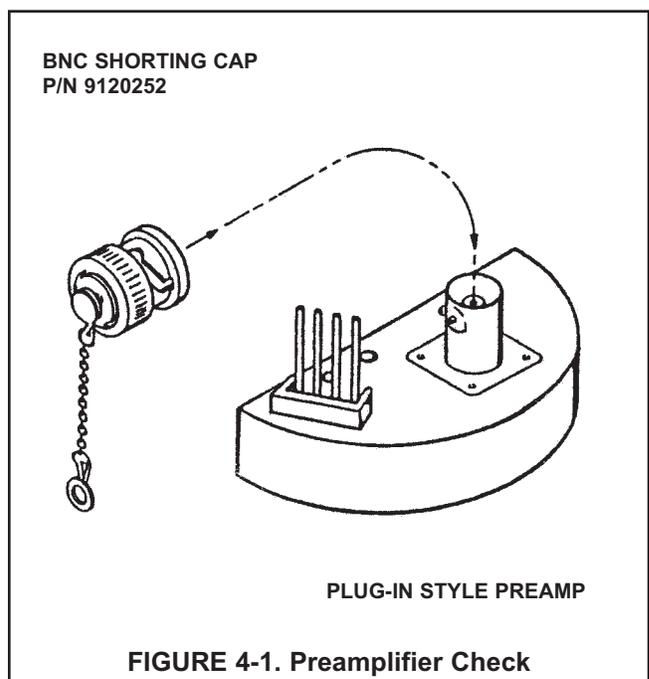
1. Using a BNC Shorting Cap (Refer to Figure 4-1) or a paper clip, short the preampifier connection. See Table 3-2 for input voltages.
2. With the STANDARDIZATION knob on the analyzer in a nearly vertical position, the meter should be able to be made to read 7.0 pH and zero (0) millivolts for ORP.
3. If the meter/display can not be made to read 7.0 pH or zero (0) millivolts, replace the old preampifier with a new one and perform the check again.

**NOTE**

For other model analyzers or transmitters, refer to their respective instruction manuals for input checks, etc.

**4.2.4 Preampifier Replacement.** If the preampifier 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 preampifier.
3. Pull the preampifier straight out.
4. Plug in a new preampifier, reconnect the BNC and four pin connector, and replace the junction box cover.



**4.3 SENSOR TUBE REPLACEMENT (Refer to Figure 4-2).** Replacement of a Model 385 Sensor involves the removal and installation of two sets of male connectors, one at the process end of the sensor, and the other at the junction box end. **Refer to Section 4.1 for removal of the sensor.**

1. The junction box with attached male connector must be recovered from the old sensor for reuse. Unscrew the junction box cover and set aside. Disconnect electrical connections from printed circuit board inside junction box. Disconnect BNC connector to preamp. Unscrew hex nut (D) from male connector body (C). Separate junction box from used sensor. Set aside.
2. Pry off split ferrule from sensor and set aside for reuse. Remove hex nut (D) and set aside for reuse. Check that the internal O-ring is in place in the male connector body (C) attached to the junction box.
3. Remove hex nut (B) from male connector body (A) at process end of sensor and set aside. Slide the Teflon ferrule and the male connector off sensor in the direction of junction box and set aside. Discard sensor tube.

**NOTE**

If stainless steel ferrule was used, male connector body (A) will have to be discard-

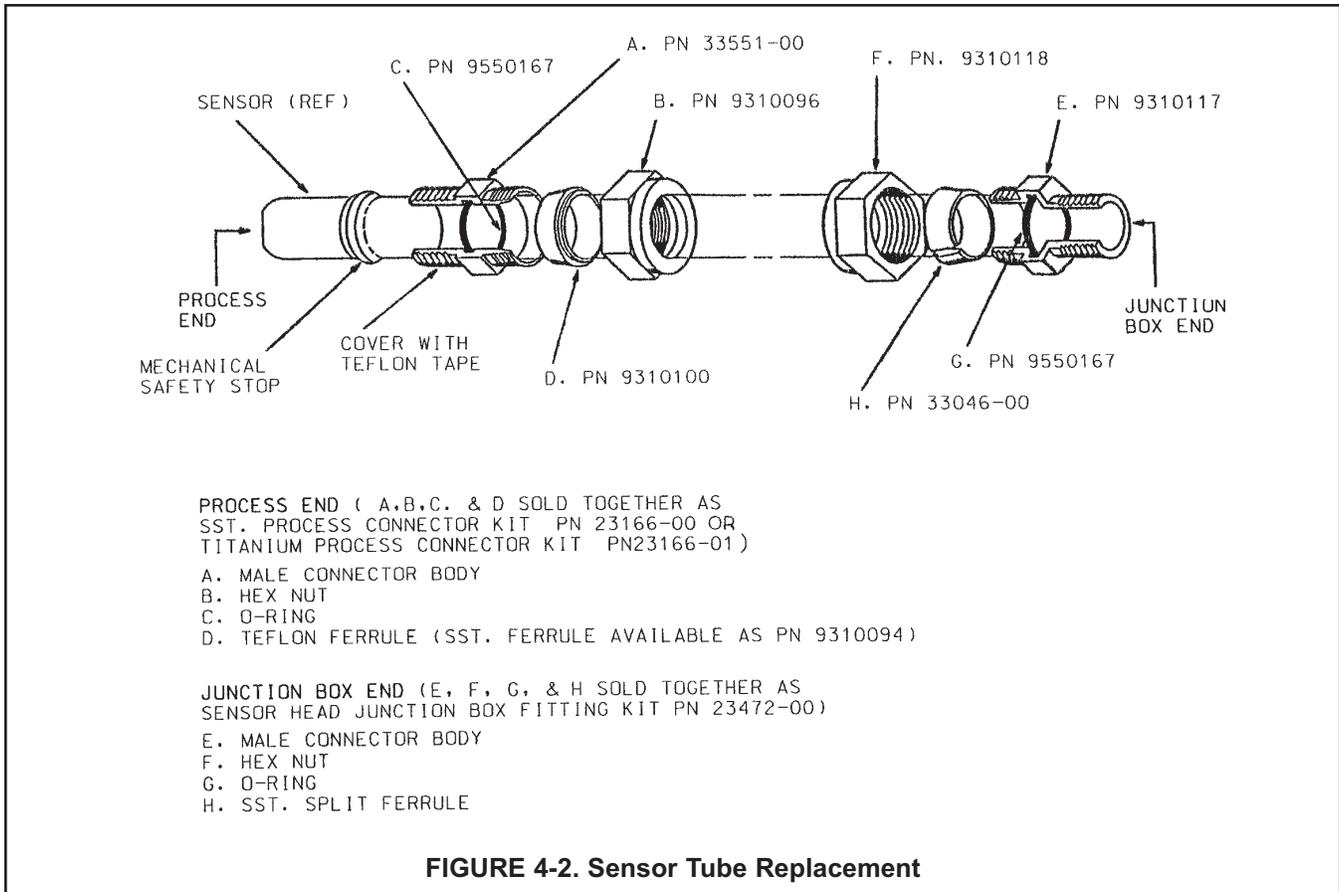
ed with the sensor tube. Save male connector if Teflon ferrule was used. Set aside for future use.

4. Discard used O-ring from male connector body (A). Coat new O-ring with a thin film of the O-ring lubricant provided. Position it in the machined O-ring groove in place of the discarded O-ring.

**CAUTION**

Make sure lubricant does not contact any part of the sensor tip particularly the glass bulb.

5. Cover the 1" MNPT pipe threads of the male connector body (A) with Teflon tape (not provided) to protect them from galling during reinstallation.
6. Pass the wires from the new sensor through the process end male connector (A). Make sure that the beveled edge of the ferrule faces the process end of the sensor. Snug the hex nut (B) to keep it in place. Do not tighten down fully on the hex nut at this time.
7. Pass the wires from the new sensor through the hex nut (D), the split ferrule (from the old sensor), male connector body (C), O-ring, and through the junction box from the "neck" opening and out through the space between the printed circuit board and the side of the junction box. Butt the ferrules beveled edge and the sensor tube against



### 4.3 Sensor Tube Replacement (continued)

the junction male connector (C). Screw the hex nut (D) by hand until the tube is “locked” into the male connector body. Make sure that the male connector body (C) is sufficiently tightened. The sensor will “click” into place by pulling the sensor tube away from the junction box, but will not move from side to side or pull clear of the male connector. If the sensor tube is correctly attached to the junction box, wrench tighten hex nut (D) on male connector body (C). (See Figure 4-3.) Do not put the sensor tube in a vise or use a pipe wrench to tighten the hardware as these will damage the sensor. If sensor tube is not correctly attached to the junction box, loosen hex nut (D) and repeat.

8. Connect the sensor wires to the terminals on the printed circuit board in the junction box in the manner recommended on the junction box cover, or see Figure 2-3. Reattach the BNC connector to the preamp. Screw on the cover of the junction box.
9. Insert the sensor in the process fitting. Stop it against the closed ball valve. Slide the process-end male connector down the sensor tube to mate with the process fitting. Tighten the male connector into the process fitting.
10. Pull back hard on the sensor assembly, as if trying to remove the sensor, to be certain that the sensor cannot come free from the valve assembly and male connector. The built-in retraction stop collar at the end of the sensor will butt against the shoulder of the male connector.
11. Open ball valve and position the sensor at the desired insertion depth and orientation. Using a crescent or open end wrench, tighten the hex nut (B) to secure the sensor in place.

#### NOTE

A stainless steel ferrule is available if the Teflon is inadequate. When using the metallic ferrule, be careful and avoid over tightening. This can damage the sensor tube.

If the male connector leaks during insertion or retraction, replace the O-Ring in the male connector body (A).

If the sensor is to be stored, the rubber boot should be filled with 7 pH buffer solution and replaced on sensor tip until ready to use.

### 4.4 MODEL 385 ORP

**4.4.1 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.

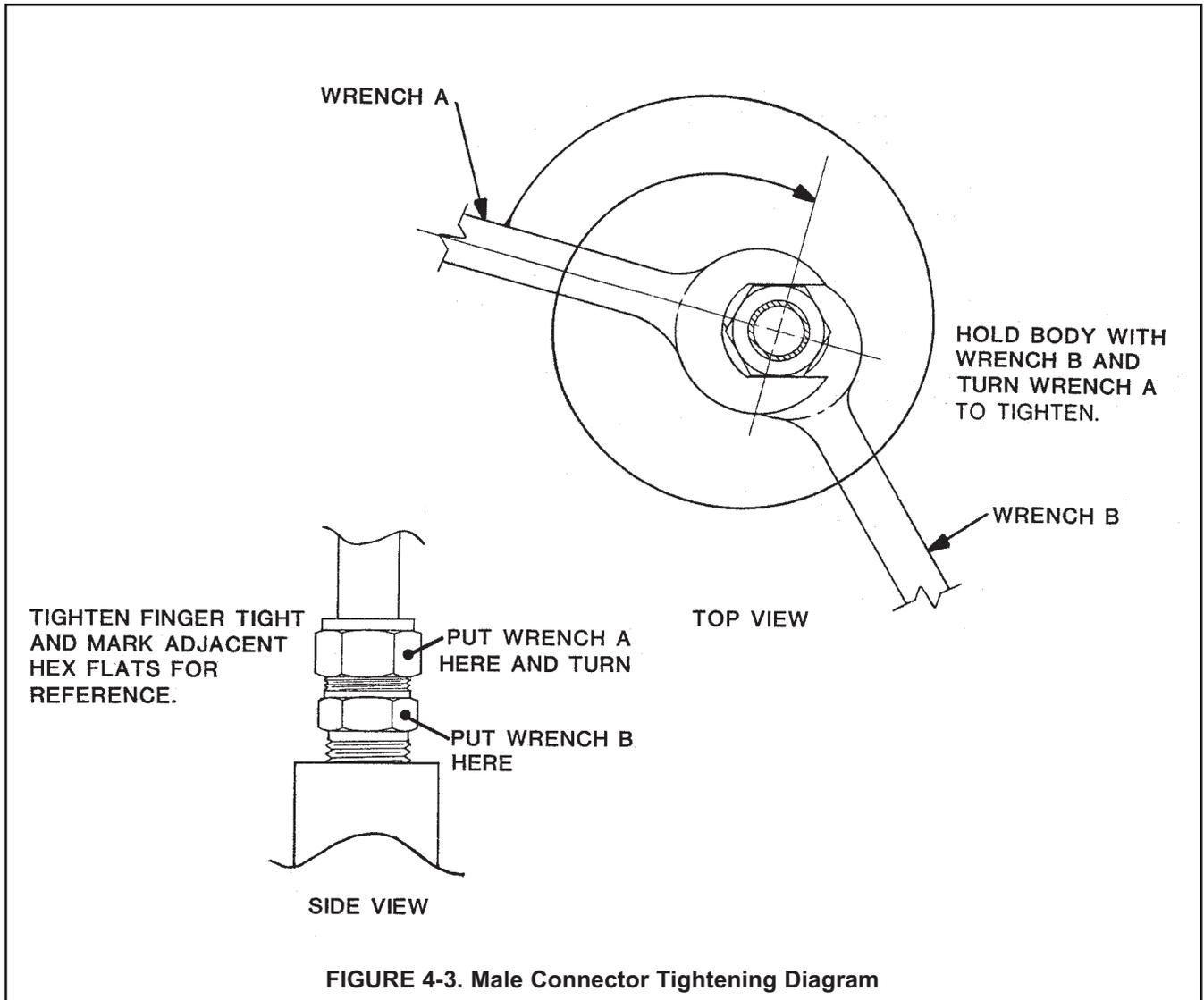
**Type 1:** One type of commonly used ORP standard solution is the saturated quinhydrone solution. Refer to Section 3.3.

#### 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 is the Ferric-Ferrous Ammonium Sulfate Solution (PN R508-16OZ), and it can be ordered as a spare part; otherwise, it can be prepared from the following recipe: Dissolve 39.2 grams or reagent grade ferrous ammonium sulfate,  $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$  and 48.2 grams of reagent grade ferric ammonium sulfate,  $\text{FeNH}_4(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ , 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 +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.

**4.4.2 Cleaning Platinum Electrode.** If the electrode is never exposed to undesirable compounds, the electrode can be restored to normal operation by simply cleaning the platinum electrode with baking soda. Polish it by rubbing it with a damp paper towel and baking soda until a bright, shiny appearance is attained.



## SECTION 5.0 TROUBLESHOOTING

**TROUBLESHOOTING.** In the event of malfunction, refer to Table 5-1 below. 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 5-2 is the replacement parts list.

**TABLE 5-1. Troubleshooting**

<b>Trouble</b>	<b>Probable Cause</b>	<b>Remedy</b>
Meter reads off scale. (Display reads overrange).	Defective preamplifier.	Check preamplifier as instructed in Section 4.2.3 and replace preamplifier if defective.
	T.C. element shorted.	Check T.C. element as instructed in Section 4.2.2 and replace sensor tube if defective.
	Electrode not in solution or sample or stream is not full.	Make sure sensor is in solution that sample stream is full (see Section 2.0 for installation details).
	Open glass electrode.	Replace sensor tube.
	Reference element open - no contact.	Replace sensor tube.
Display reads between 3 and 6 pH regardless of actual pH of solution or sample.	Electrode cracked.	Replace sensor tube.
Meter or display indication swings jumps widely in AUTO T.C. Mode.	T.C. element shorted.	Check T.C. element as instructed in Section 4.2.2 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 4.2.2 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 4.2.1 or 4.4.2.
	Electrode defective.	Replace sensor tube.
Transmitter cannot be standardized.	Electrode coated or cracked.	Clean Sensor as instructed in Sections 4.2.1 or 4.4.2 and, if cracked, replace sensor tube.
	Defective preamplifier.	Check preamplifier as instructed in Section 4.2.3 and replace preamplifier if defective.
Transmitter short spans between two different buffer values.	Old glass electrode (greater than 1 year old).	Replace sensor tube.
	Coated glass.	Clean Sensor as instructed in Sections 4.2.1 or 4.4.2.

TABLE 5-2. Model 385 Replacement Parts

PART NUMBER	DESCRIPTION
22698-00	Preamp for 1003/1023 (Code 51)
22698-02	Preamp for 1181pH/ORP, 1050/1060 (Code 50)
22698-03	Preamp for 1054pH/ORP (Code 54)
23166-00	Connector Kit, 1x1" 316 SS, with O-Ring Groove
23166-01	Connector Kit, 1x1" Titanium, with O-Ring Groove
23240-00	Ball valve Kit, 1-1/4" 316 SS (Code 21)
23240-01	Ball valve Kit, 1-1/4" Carbon Steel (Code 20)
23239-04	Kit, pH Sensor Tube w/3K TC, Titanium, General Purpose (Code 07-10, P/N 23288-08) <sup>3</sup>
23239-05	Kit, pH Sensor Tube w/PT 100 TC, Titanium, General Purpose (Code 08-10, P/N 23288-09) <sup>3</sup>
23239-06	Kit, ORP Sensor Tube w/No TC, Titanium (Code 04-12, P/N 23288-12) <sup>3</sup>
23239-07	Kit, ORP Sensor Tube w/PT 100 TC, Titanium (Code 06-12, P/N 23288-13) <sup>3</sup>
23239-08	Kit, pH Sensor Tube w/3K TC, Titanium, High pH (Code 07-11, P/N 23288-16) <sup>3</sup>
23239-09	Kit, pH Sensor Tube w/PT 100 TC, Titanium, High pH (Code 08-11, P/N 23288-17) <sup>3</sup>
33046-00	Ferrule, 1" 316SS, Split (for J-Box)
33054-00	Male Connector, 1" X 1" 316SS, with O-Ring Groove, Process End
9200000	Cable, 20#Ga, 4 Cond, 1 Shielded Pair (Belden 8722)
9210012	pH Buffer, 4.01 pH, 16 oz.
9210013	pH Buffer, 6.86 pH, 16 oz.
9210014	pH Buffer, 9.18 pH, 16 oz.
9310094	Ferrule, 1" 316 SS
9310096	Hex Nut, 1" 316 SS
9310100	Ferrule, 1" Teflon (Standard)
9550167	O-Ring, 2-214 EPDM (Standard)

<sup>3</sup> Kit includes P/N 9310100 and P/N 9550099

## SECTION 6.0 RETURN OF MATERIAL

### 6.1 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.

### 6.2 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. \_\_\_\_\_

### 6.3 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 6.2.

#### 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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the right answers,  
right now.*

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