

Triple Junction 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 while maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

DANGER

HAZARDOUS AREA INSTALLATION

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

To secure and maintain an intrinsically safe installation, the certified safety barrier, transmitter, and sensor combination must be used. The installation system must comply 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.

About This Document

This manual contains instructions for installation and operation of the Model 385+ pH Sensor. The following list provides notes concerning all revisions of this document.

<u>Rev. Level</u>	<u>Date</u>	<u>Notes</u>
A	2/01	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	5/02	Drawings updated throughout
C	5/03	Drawing 40385+02 updated to rev. C; added drawing 41055119 — both on page 9.
D	9/04	Updated wiring diagrams and Table 5-2
E	10/04	Added 1055 single input wiring diagram.
F	3/05	ORP info revision.
G	5/05	Fixed LED font mis-print on page 16.
H	3/06	Added a note on page 6.
I	5/09	Updated for SMART sensors.

MODEL 385+ TRIPLE JUNCTION pH/ORP SENSOR

TABLE OF CONTENTS

Section	Title	Page
1.0	DESCRIPTION AND SPECIFICATIONS.....	1
1.1	Features and Applications.....	1
1.2	Performance Specifications.....	1
1.3	Physical Specifications.....	1
1.4	Ordering Information.....	2
2.0	INSTALLATION.....	3
2.1	Unpacking and Inspection.....	3
2.2	Mechanical Installation.....	3
2.3	Electrical Installation.....	4
3.0	START UP AND CALIBRATION.....	16
3.1	Start up.....	16
3.2	pH Calibration.....	16
3.3	ORP Calibration.....	16
4.0	MAINTENANCE.....	17
4.1	Maintenance.....	17
4.2	Sensor Removal.....	17
4.3	pH Electrode Cleaning.....	17
4.4	Platinum Electrode Cleaning.....	18
4.5	Sensor Tube Replacement.....	18
5.0	DIAGNOSTIC AND TROUBLESHOOTING.....	20
5.1	Model 54, 81, 3081, and 4081 pH Diagnostics.....	20
5.2	Troubleshooting.....	20
5.3	Model 1056, 1057, SMART Diagnostics.....	21
6.0	RETURN OF MATERIAL.....	22
6.1	General.....	22
6.2	Warranty Repair.....	22
6.3	Non-Warranty Repair.....	22

MODEL 385+ PH/ORP SENSOR

LIST OF FIGURES

Figure No.	Title	Page
2-1	Typical Mounting Details	4
2-2	Dimensional Drawing: Retraction Version (Code -02).....	5
2-3	Dimensional Drawing: Submersion/Insertion Version (Code -03 and -04).....	5
2-4	Submersion Accessory (Code -03 and -04)	6
2-5	Submersion Installations, Handrail Mounting Assembly	6
2-6	6081 VP8 wiring to 385+-02.....	6
2-7	6081 VP8 wiring to 385+-03.....	7
2-8	6081 VP8 wiring to 385+-04.....	7
2-9	5081P-HT VP8 wiring to 385+-02	8
2-10	5081P-HT VP8 wiring to 385+-03	8
2-11	5081P-HT VP8 wiring to 385+-04	9
2-12	1056 VP8 wiring to 385+-02.....	9
2-13	1056 VP8 wiring to 385+-03.....	10
2-14	1056 VP8 wiring to 385+-04.....	10
2-15	Wiring to Model 1055-10-22 (single measurement only)	11
2-16	Wiring Model 385+-04-() Sensor to Model 1055-01-10-22-32 Analyzer	11
2-17	Wiring Details	12
2-18	Wiring Model 385+-02 to Model 1055-11-22-32 through a remote j-box.....	12
2-19	Retraction Version Wiring.....	13
2-20	Wiring Model 385+-02, -03, and remote J-box w/preamp to Model Xmt-P	13
2-21	Wiring Model 385+-04 to Model Xmt-P	13
2-22	Remote Junction Box Wiring for Extension Cable	14
2-23	Remote Junction Box with Preamplifier Wiring	15
3-1	SMART Start up Screen	16
4-1	Sensor Tube Replacement.....	19
4-2	Male Connector Diagram	19

LIST OF FIGURES CONT'D

Figure No.	Title	Page
5-1	SMART Start-up Screen.....	21
5-2	Calibration History Menu.....	21
5-3	Calibration History Screen	21
5-4	Factory Data, SMART Screen	21

LIST OF TABLES

Table No.	Title	Page
1-1	Accessories.....	2
3-1	ORP of Saturated Quinhydrone Solutions (in Millivolts).....	16
5-1	Diagnostic Messages	20
5-2	Replacement Parts.....	21

SECTION 1.0 DESCRIPTION AND SPECIFICATIONS

- SMART enabled
- RETRACTABLE VERSION allows removal and replacement under pressure without process shutdown.
- LONG-LIFE, TRIPLE JUNCTION REFERENCE ELECTRODE provides longer service life in applications where poisoning ions are present.
- DISPOSABLE TEFLON AND TITANIUM DESIGN provides maximum chemical resistance and economical advantage where minimum troubleshooting and maintenance downtime are of prime importance.
- PLATINUM ORP Electrode

1.1 FEATURES AND APPLICATIONS

The Triple-junction Model 385+ is now offered with SMART capabilities. SMART option becomes enabled when used with the Model 1056, 1057 Analyzer and on 6081P wireless transmitter. The pH-loop capabilities include auto-recognition of the SMART sensor, automatic upload of calibration data and associated time stamp, historical recording of pH diagnostics (slope, offset, reference impedance, glass impedance). This trending data allows technicians to predict frequency of maintenance and estimate sensor life for a particular process condition. Additional SMART features include factory calibration, resetting SMART sensor calibration data with user menus without power cycling, and manufacturing information.

The Model 385+ Sensor measures the pH or ORP (Oxidation Reduction Potential) of aqueous solutions in pipelines, open tanks, or ponds. It is suitable for applications where a low cost, industrial, disposable sensor is required. The combination electrode features a peripheral ceramic junction. The triple junction reference cell provides longer life in processes containing sugar, ammonia, chlorides, sulfides or other poisoning ions. The Model 385+ body is constructed of molded, chemically resistant Tefzel in two standard body versions.

The retraction version is housed in a titanium tube, with a plug-in style surface mount preamplifier in a weatherproof junction box. It is designed for use with a standard 1-1/2 in. ball valve assembly for process mounting where a separate sample stream is difficult or impossible to provide. The entire installation process is accomplished without line depressurization and minimal process fluid loss. Upon sensor removal, from the ball valve, maintenance and replacement is easy.

The insertion/submersion version has two body configurations: 25 ft (7.6 m) integral cable and preamplifier; 15 ft (4.5) integral cable for use with remote preamplifier.

1.2 PERFORMANCE SPECIFICATIONS

Measuring Range: pH: 0-14 \pm 1500mV
ORP: -1500 to 1500 mV

Percent Linearity Over pH Range		
	Option 10	Option 11
0-2 pH	94%	94%
2-12 pH	99%	97%
12-13 pH	97%	98%
13-14 pH	92%	98%

Temperature Compensation: (pH only) 0 to 100°C
(32 to 212°F)

1.3 PHYSICAL SPECIFICATIONS

Wetted Materials: Tefzel, titanium, EPDM, 316 SS and Teflon¹ (Code 02), Viton², glass, ceramic and (ORP only) platinum.

Maximum Process Pressure and Temperature:
790 KPa abs (100 psig) at 100°C (212°F)

Maximum Pressure at Retraction or Insertion (ball valve version): 542 KPa abs (64 psig)

Process Connections: 1-1/2 in. with ball valve
1 in. without ball valve

Cable: P/N 9200273 (Unprepped) or P/N 23646-01 (Prepped)

Weight/Shipping Weight:

Submersion/insertion: 1.6 lb/2.8 lb 0.7Kg /1.25 Kg
Retraction: 6 lb/11 lb (2.7 Kg/5.0 Kg)
Ball Valve: 5 lb/10 lb (2.25 Kg/4.5 Kg)

¹Teflon is a registered trademark of E.I. du Pont de Nemours and Company.

²Viton is a registered trademark of DuPont Performance Elastomers.

ORDERING INFORMATION

The Model 385+ pH/ORP Sensor: Standard features include a Tefzel sensor body with a triple junction gel filled reference electrode and automatic temperature compensator housed in a titanium tube. The retractable version comes with a weatherproof junction box, a process connector, and preamplifier. The insertion/submersion version has two optional body configurations: integral SMART preamplifier (-03) option. The SMART is standard preamp option. and 25 ft (7.6 m) integral cable, or 15 ft (4.5 m) integral cable for use with remote preamplifier. The 385+ is designed to be used with the Models 54e, 1055, 1056 or 1057 pH/ORP Analyzer, or Models 81, 3081, 4081, 5081, 6081 or Xmt pH/ORP Transmitter.

MODEL 385+ pH/ORP SENSOR	
Code	Body Configuration (Required Selection)
02	Retractable with sensor head junction box, preamplifier, and process connector
03	Insertion/Submersion with Integral SMART Preamplifier (Standard option) and 25 ft (7.6 m) cable
04	Insertion/Submersion for use with Remote Preamplifier and 15 ft (4.5 m) cable
Code	Combination Electrode (Required Selection)
10	GPLR, General Purpose Low Resistivity (0-13 pH)
11	High (0-14 pH)
12	ORP (Platinum)
385+	-03 -10
EXAMPLE	

NOTES:

OPTION-02 recommended interconnecting cable from sensor to transmitter is Rosemount Analytical P/N 23646-01 (prepped) or P/N 9200273 (unprepped). Specify length.

OPTION-03, 04 require a 1 x 1 in. NPT process connector. Recommended PN's 23166-00 or 23166-01.

TABLE 1-1 ACCESSORIES

ACCESSORIES	DESCRIPTION
11275-01	Handrail mounting assembly (Code 03, 04 only)
23550-00	Remote J-Box without preamplifier (Code 02, 03 only)
23555-00	Remote J-Box with preamplifier, (Code 04 only)
23166-00	Process connector, 316SS, insertion/submersion 1 in. MNPT (Code 02, 03, 04)
23166-01	Process connector, titanium, insertion/submersion 1 in. MNPT (Code 02, 03, 04)
9510066	Process connector, Nylon, submersion only, 1 in. MNPT (Code 03, 04)
9210012	Buffer solution, 4.01 pH, 16 oz
9210013	Buffer solution, 6.86 pH, 16 oz
9210014	Buffer solution, 9.18 pH, 16 oz
R508-80Z	ORP solution, 460 mV \pm 10 at 20°C
9550167	EPDM O-ring for Process Connector (PN 23166-00 or 23166-01)
12707-00	Jet Spray Cleaner for submersion service
23566-00	Sensor Tube, pH, Pt 100, Titanium, Low Resistance Glass
23566-01	Sensor Tube, pH, Pt 100, Titanium, High pH
23566-02	Sensor Tube, ORP, Pt 100, Titanium, General Purpose
23240-00	Ball Valve Assembly 316 Stainless Steel
23646-01	Cable, 12 Conductor, Shielded, Prepped
23557-00	Preamplifier, J-box
33046-00	Ferrule, 1 in. 316 SS, Split
9200258	Cable, 12 Conductor, Shielded, Unprepped
9310094	Ferrule, 1 in. 316 SS
9310096	Nut, Swage, 1 in. 316 SS
9310100	Ferrule, 1 in. TEFLON
9550099	O-ring, 2-214, VITON

SECTION 2.0 INSTALLATION

2.1 UNPACKING AND INSPECTION. Inspect the outside of the carton for any damage. If damage is detected, contact the carrier immediately. Inspect the instrument and hardware. Make sure all items in the packing list are present and in good condition. Notify the factory if any part is missing.

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 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+ is available in two versions, the retraction version (Code 02) and the insertion/submersion version (Code 03, & 04). Please refer to the appropriate section below.

2.2.1 Retraction Option. (Code option -02) The Model 385+ Sensor may be installed through a 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 the process without the use of a ball valve for applications not requiring continuous operation during sensor maintenance (Figure 2-2). **ALLOW SUFFICIENT ROOM FOR SAFE RETRACTION AND INSERTION OF THE SENSOR. PERSONNEL SHOULD HAVE ROOM FOR STABLE FOOTING WHILE PERFORMING REMOVAL OR INSERTION OF THE SENSOR.**

The sensor must be mounted within 10-90 degrees of the horizontal 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.

If the retraction version is to be installed without a ball valve follow the installation procedure for insertion service (Section 2.2.2). Perform the following steps for sensor installation through a ball valve:

1. Carefully remove the liquid filled rubber boot which protects the glass electrode and keeps the liquid junction wet during shipping and storage. Discard the liquid and boot. Make sure the lubricated O-ring is in place in the groove inside the male connector on the sensor body (Figure 4-1, item A).

⚠ CAUTION

Buffer solution, in the vinyl boot, may cause skin or eye irritation

2. With the male connector on the sensor’s body, insert the sensor into the ball valve until it gently touches the closed valve. The molded electrode guard will protect the glass bulb from breakage.
3. Thread the male connector body tightly into the ball valve assembly. **DO NOT** tighten the hex nut on the male connector body; doing so would not allow the sensor to be inserted through the ball valve.
4. Pull back hard on the sensor assembly, as if trying to remove the sensor, to be certain that the sensor cannot come free of the ball valve assembly. The built-in retraction stop will butt against the shoulder of the male connector if properly installed.

⚠ CAUTION

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

5. After confirming that the sensor assembly is properly secured by the valve assembly, the valve may be opened and the sensor positioned into the process at the desired depth and orientation.
6. While holding the sensor in position, tighten the hex nut of the male connector to firmly secure the sensor in place. When the hex nut is tightened, the Teflon ferrule inside the compression fitting clamps the sensor tube. (See Figure 4-2.)

⚠ CAUTION

Over tightening the hex nut may damage the ferrule.

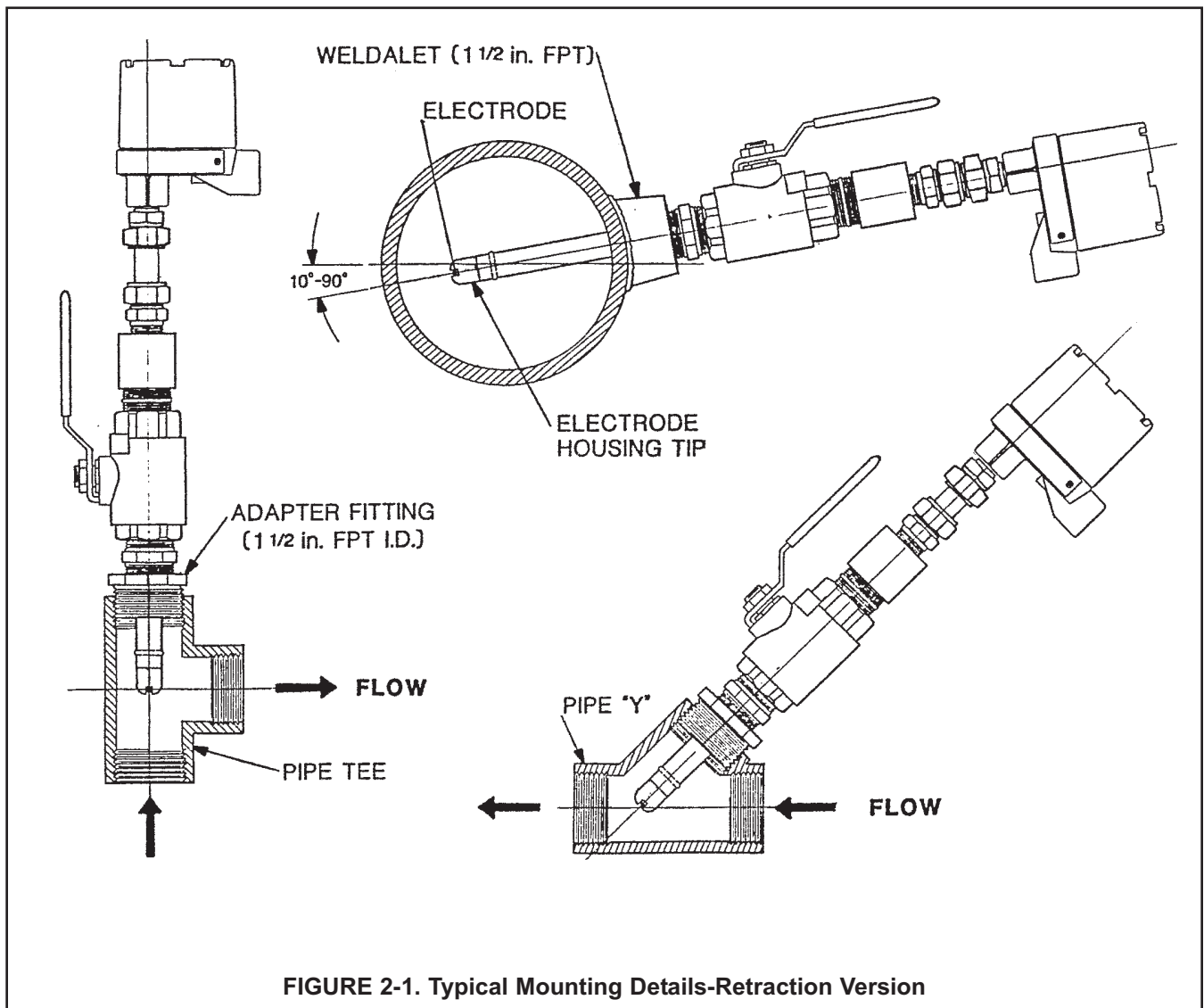
NOTE

A stainless steel ferrule is available if the TEFLON ferrule does not inadequately grip. When using the metallic ferrule, care must be taken to avoid over tightening and damaging the sensor tube. If the male connector leaks during insertion or retraction, replace the O-ring in the male connector.

2.2.2 Submersion/Insertion Option. Code Option -03 & -04). Figure 2-3 and Figure 2-4. The Model 385+ Sensor may be installed through a weldalet or a pipe tee or "Y" when used with a process connector (P/N 23166-00-01). For submersion service, a process connector (P/N 23166-00-01 or 9510066) may be used with a water tight 1 in. schedule 80 CPVC or PVDF standpipe conduit. Refer to Figure 2-5. Tapered threads in plastic tend to loosen after installation. It is therefore recommended that TEFLON tape be used on the threads and that the tightness of the connection be checked frequently to assure that no loosening has occurred. The sensor should be installed within 80° of vertical, with the electrode facing down.

2.3 ELECTRICAL INSTALLATION. Make electrical connections as shown on Figures 2-6 through 2-14 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 Rosemount custom cable PN 9200273.
3. The maximum distance from the sensor to the analyzer is 15 ft without an integral preamplifier.
4. Signal cable should be run in a dedicated conduit and should be kept away from AC power lines.



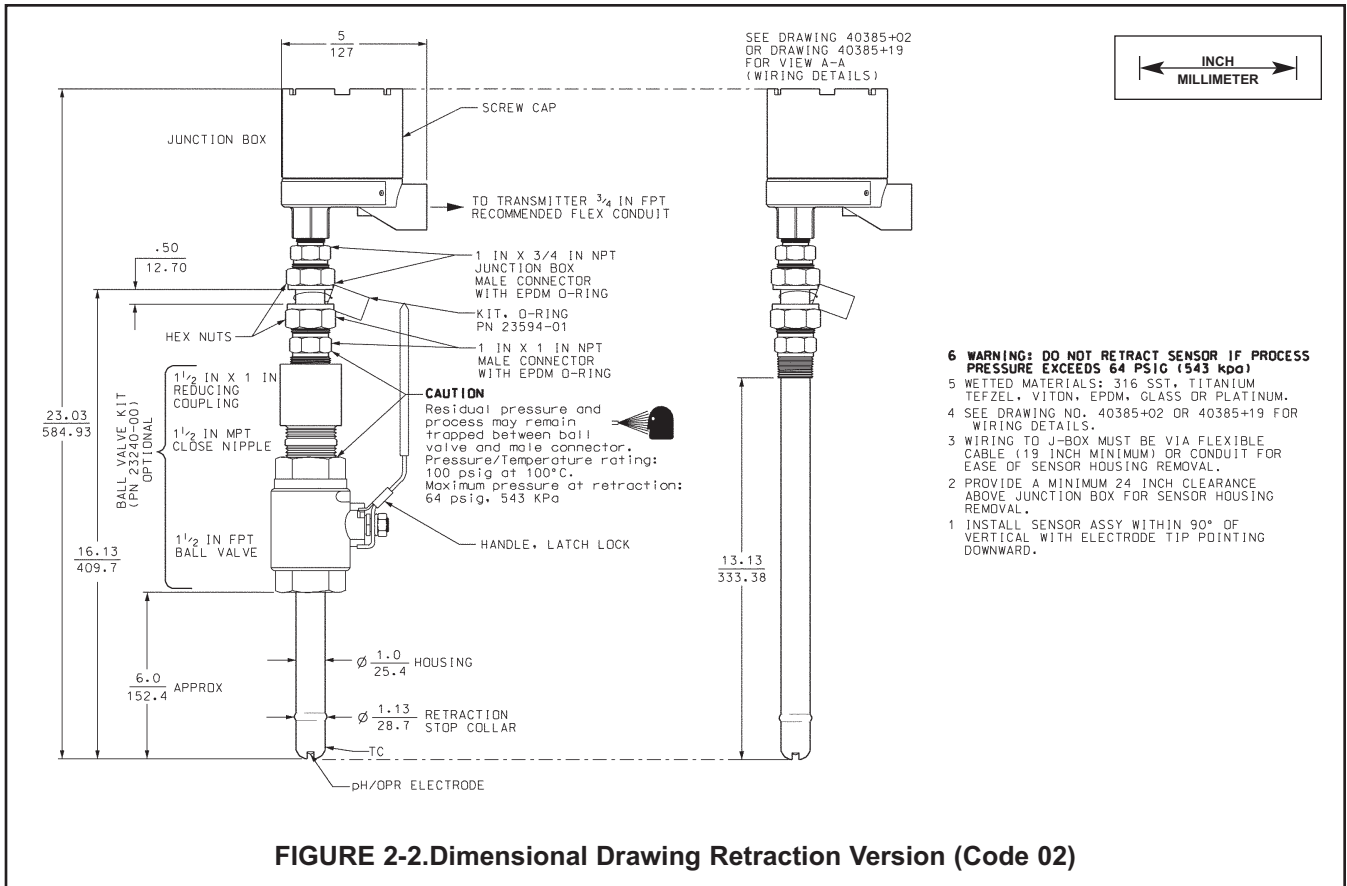


FIGURE 2-2. Dimensional Drawing Retraction Version (Code 02)

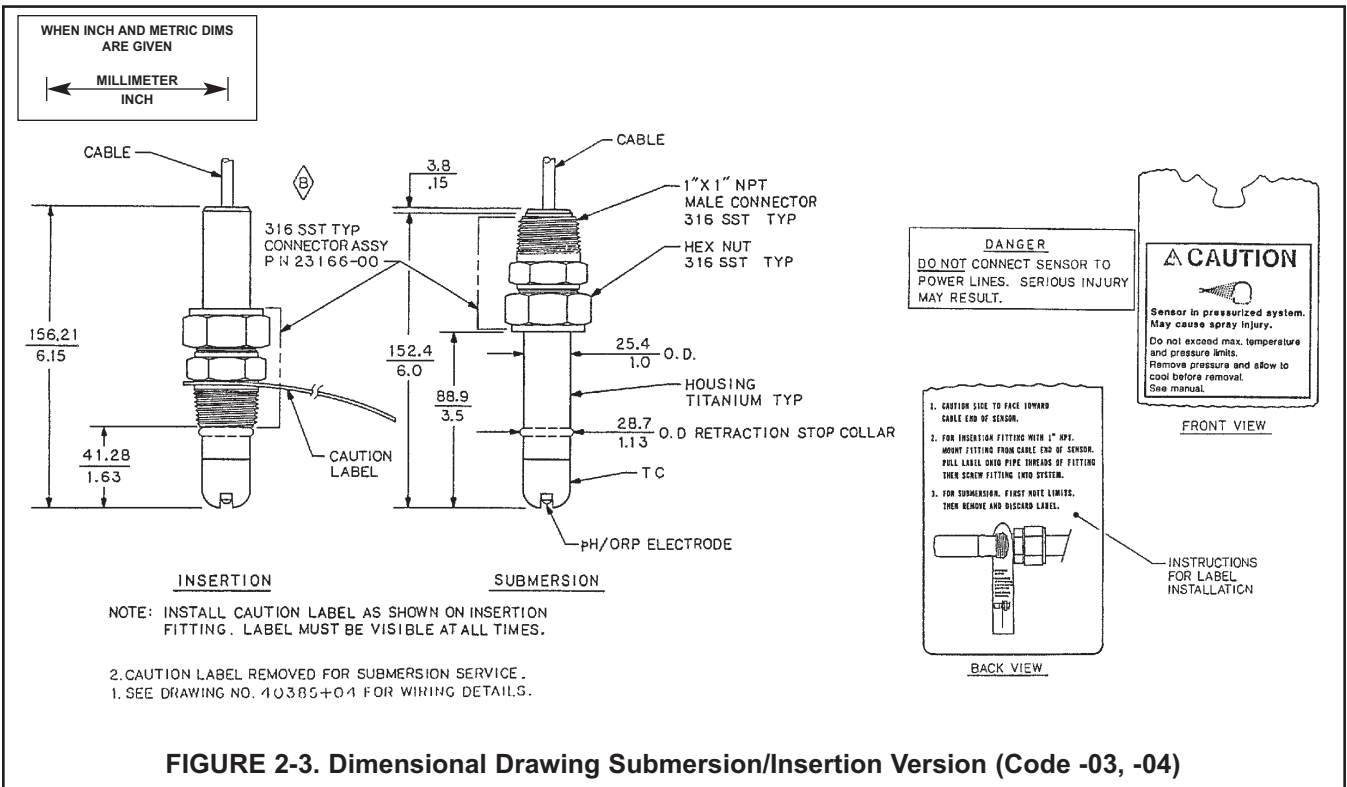


FIGURE 2-3. Dimensional Drawing Submersion/Insertion Version (Code -03, -04)

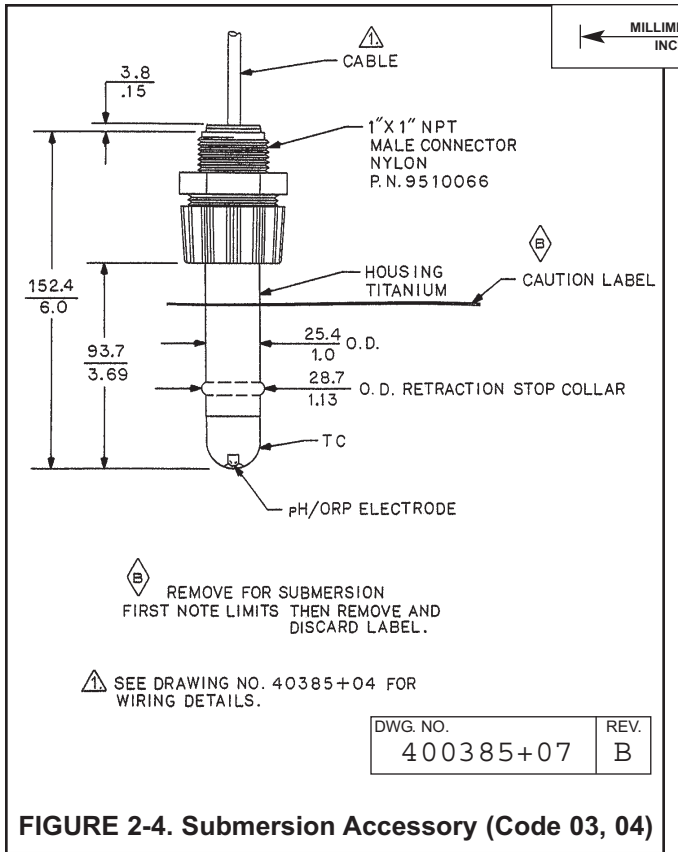


FIGURE 2-4. Submersion Accessory (Code 03, 04)

NOTE

Remove electrical tape or shrink sleeve from gray reference wire before connecting wire to terminal.

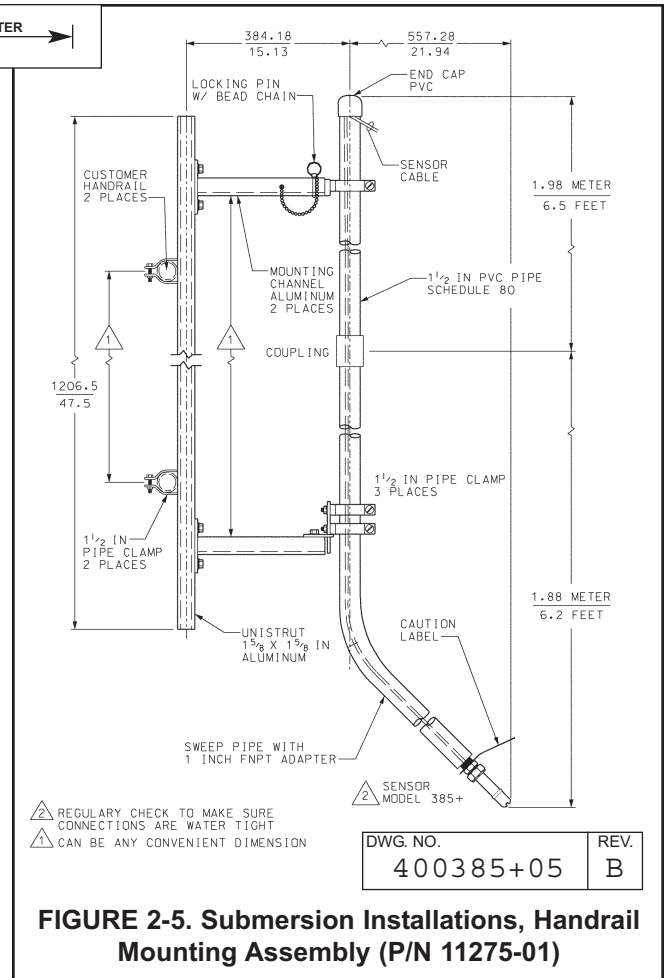


FIGURE 2-5. Submersion Installations, Handrail Mounting Assembly (P/N 11275-01)

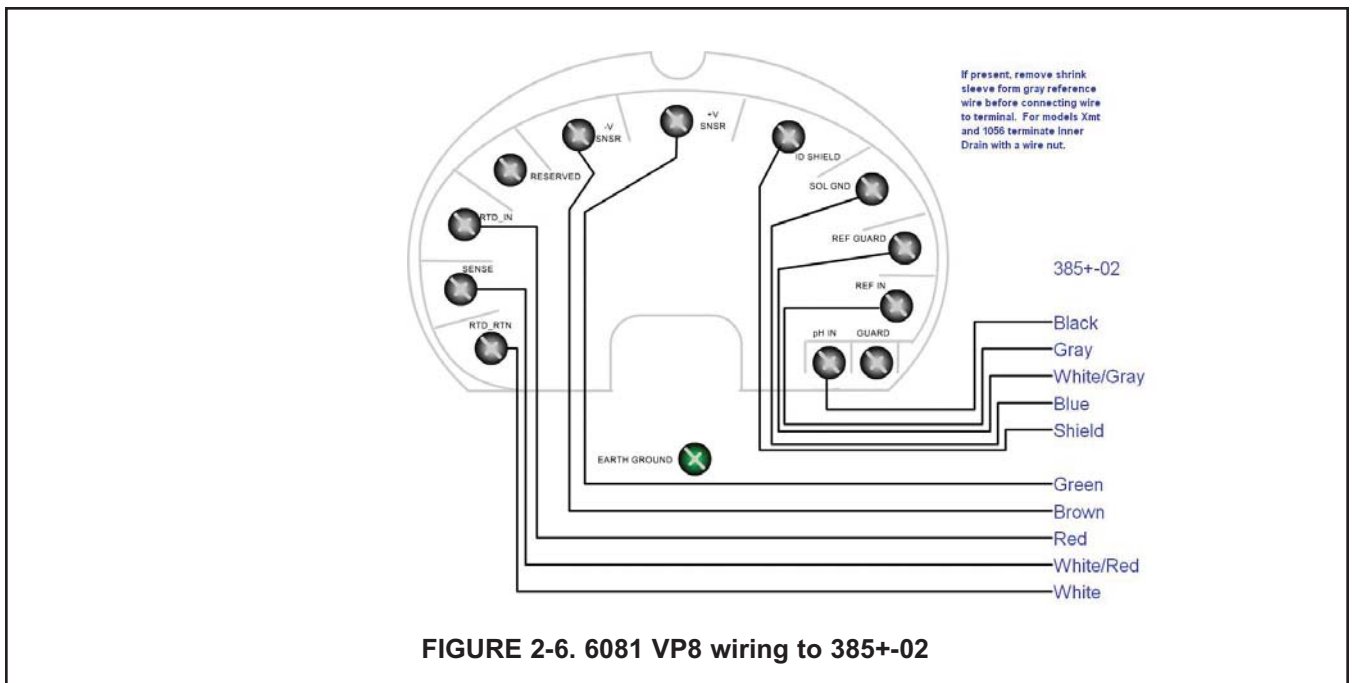
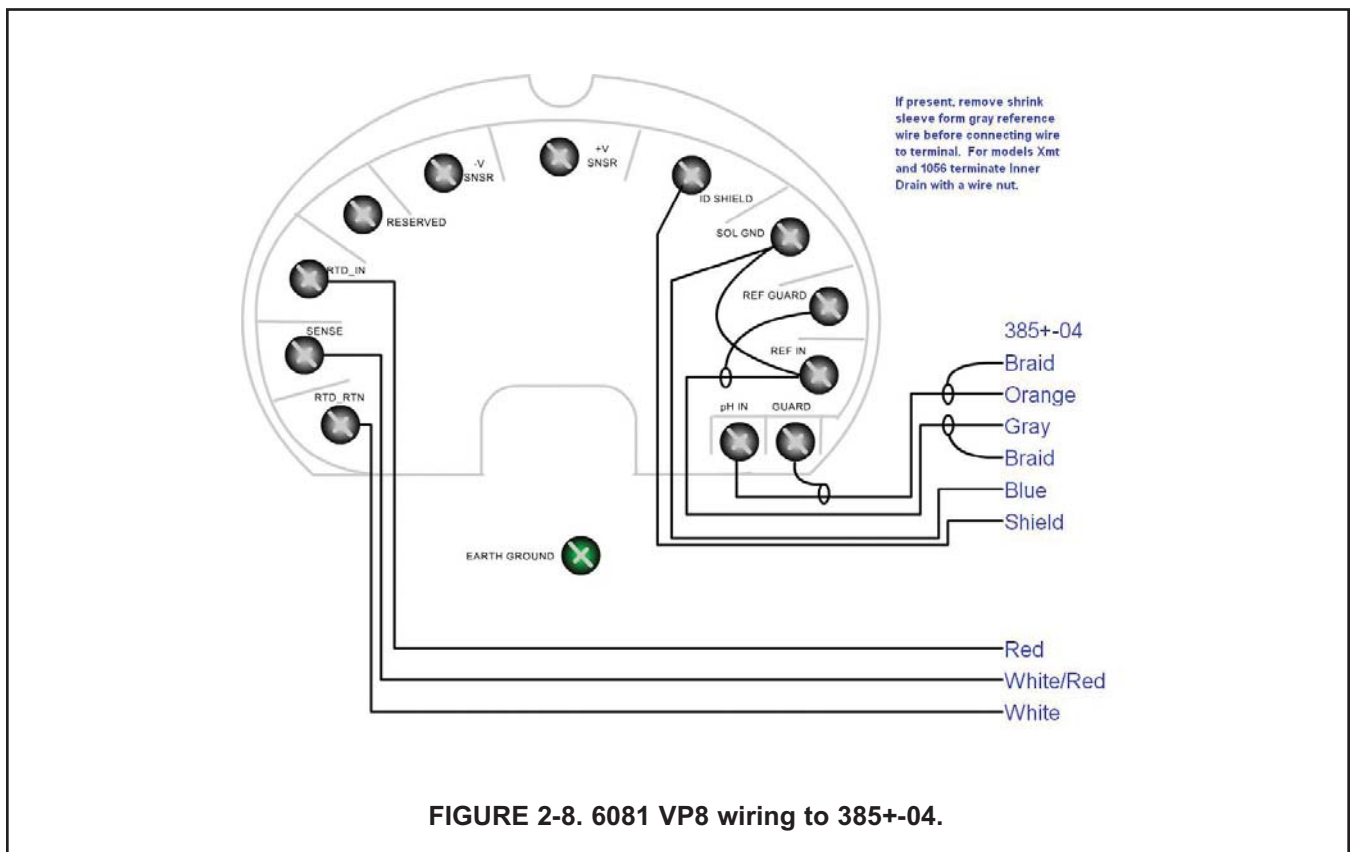
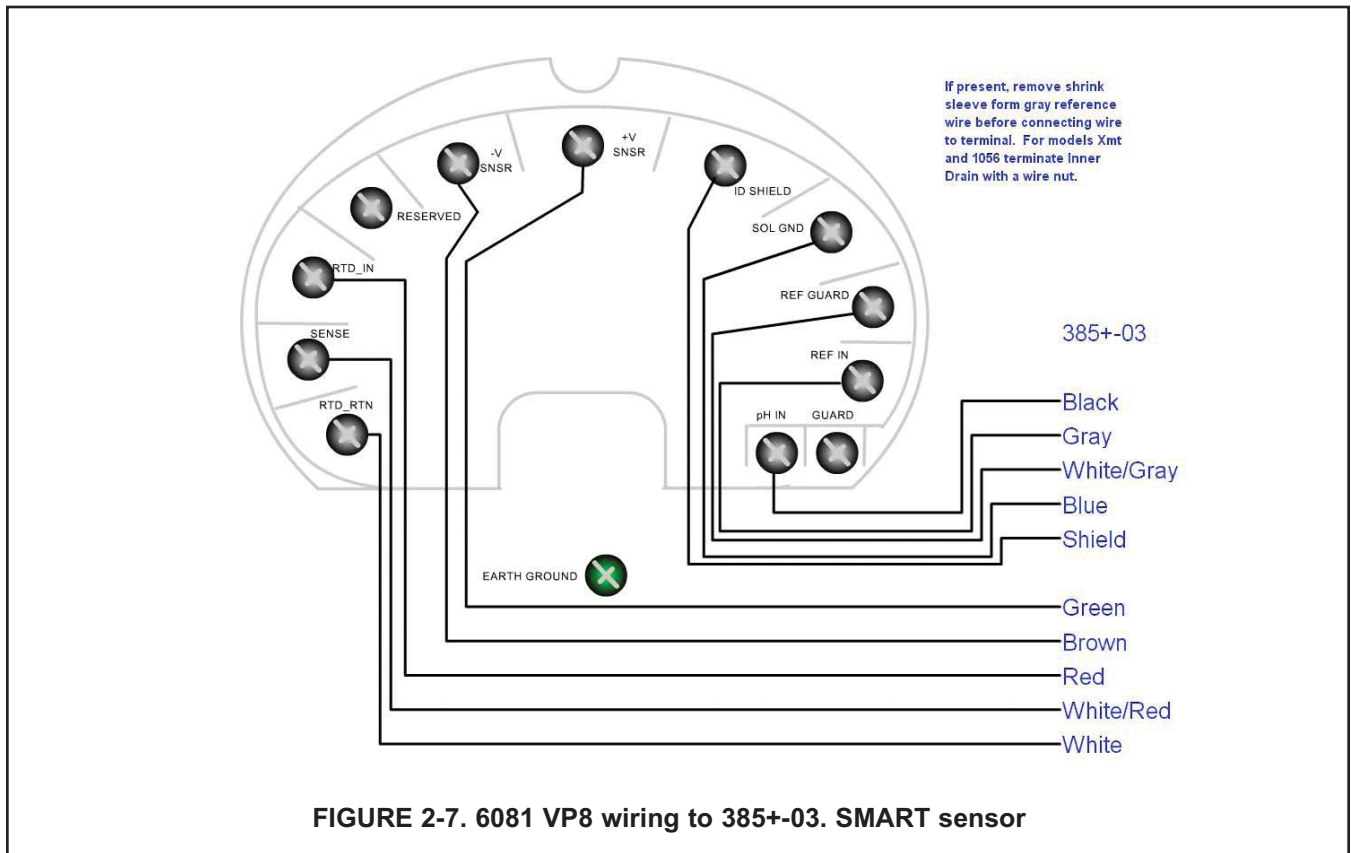


FIGURE 2-6. 6081 VP8 wiring to 385+-02



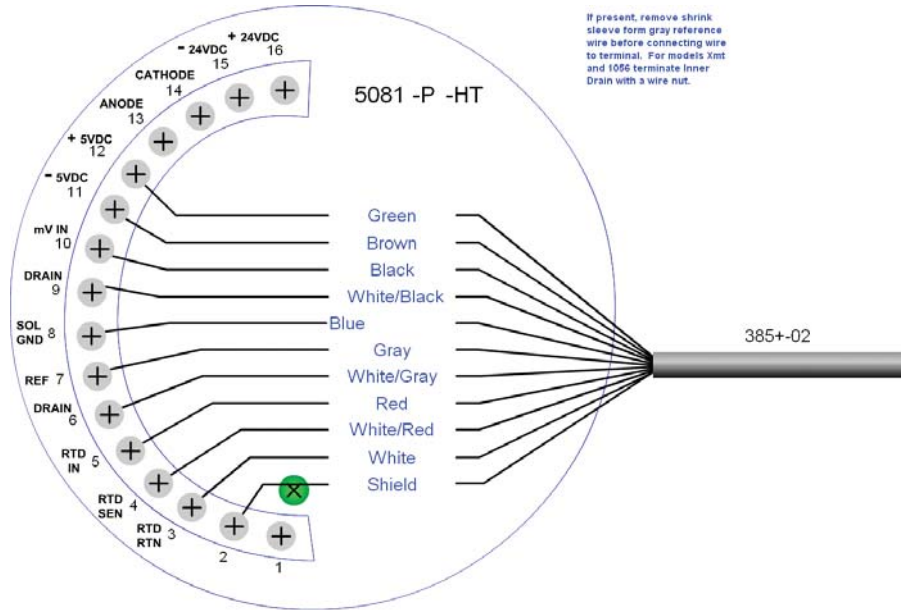


FIGURE 2-9. 5081P-HT VP8 wiring to 385+-02

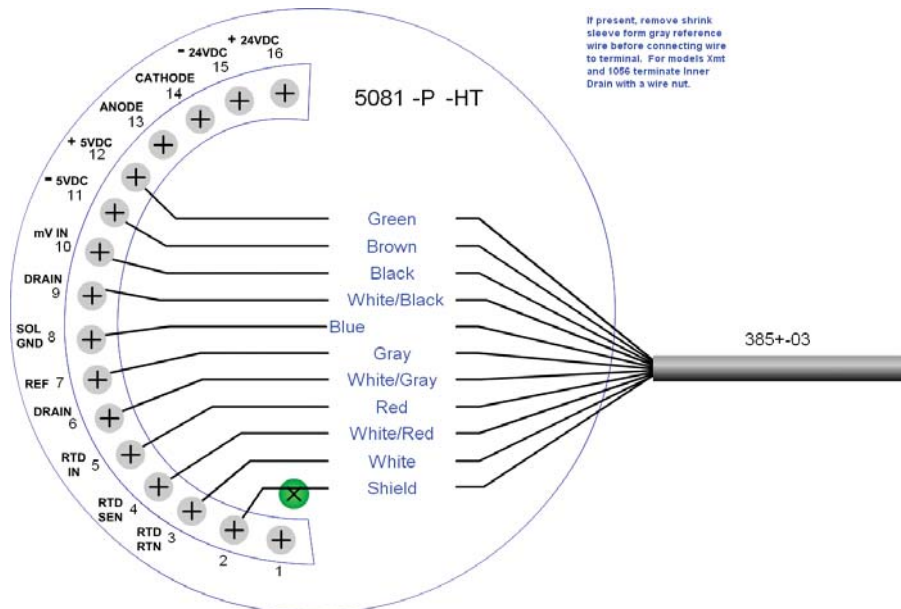
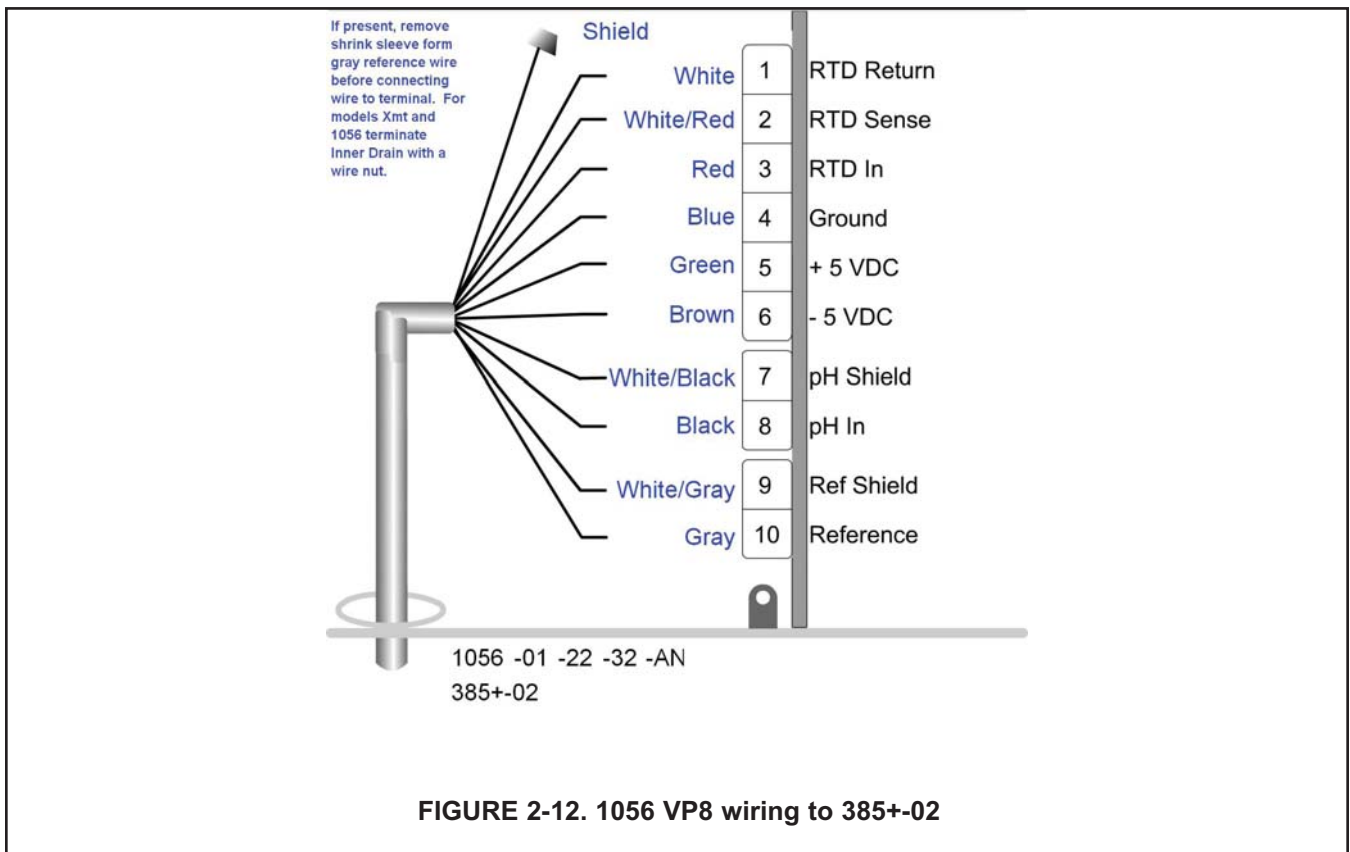
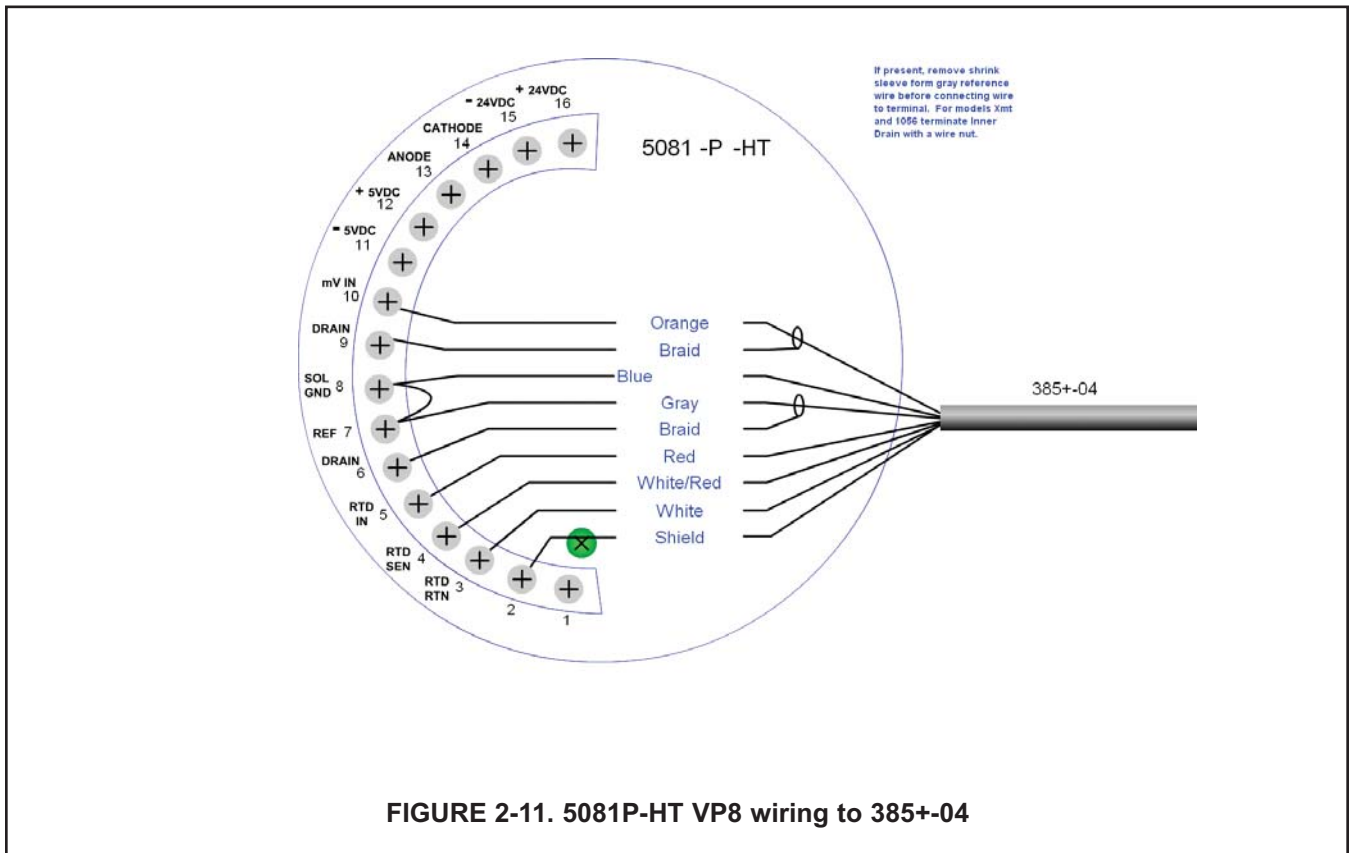


FIGURE 2-10. 5081P-HT VP8 wiring to 385+-03. SMART sensor



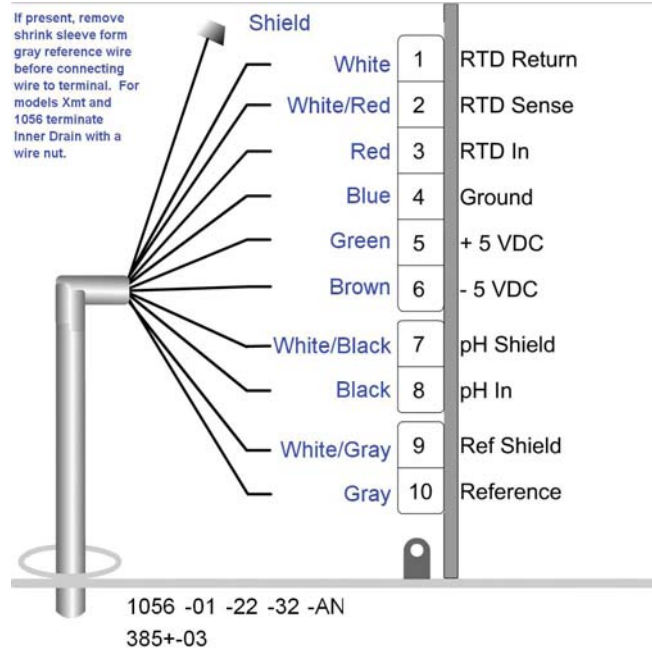


FIGURE 2-13. 1056 VP8 wiring to 385+03. SMART sensor

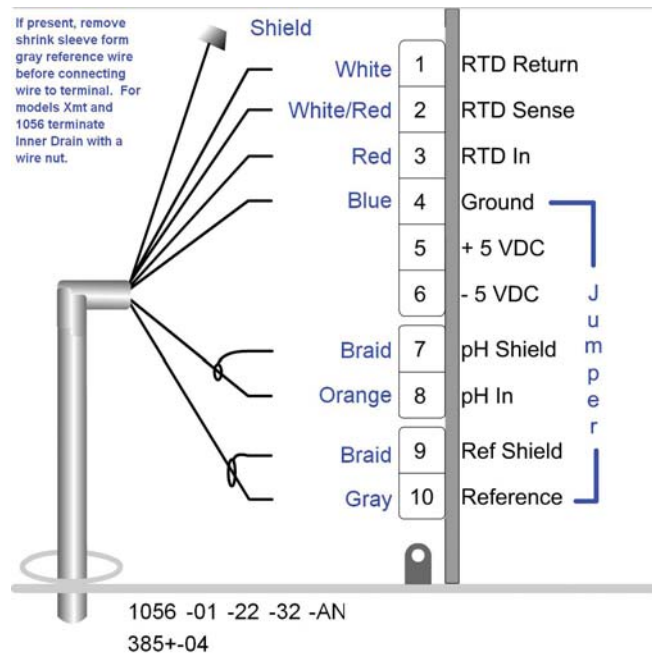


FIGURE 2-14. 1056 VP8 wiring to 385+04

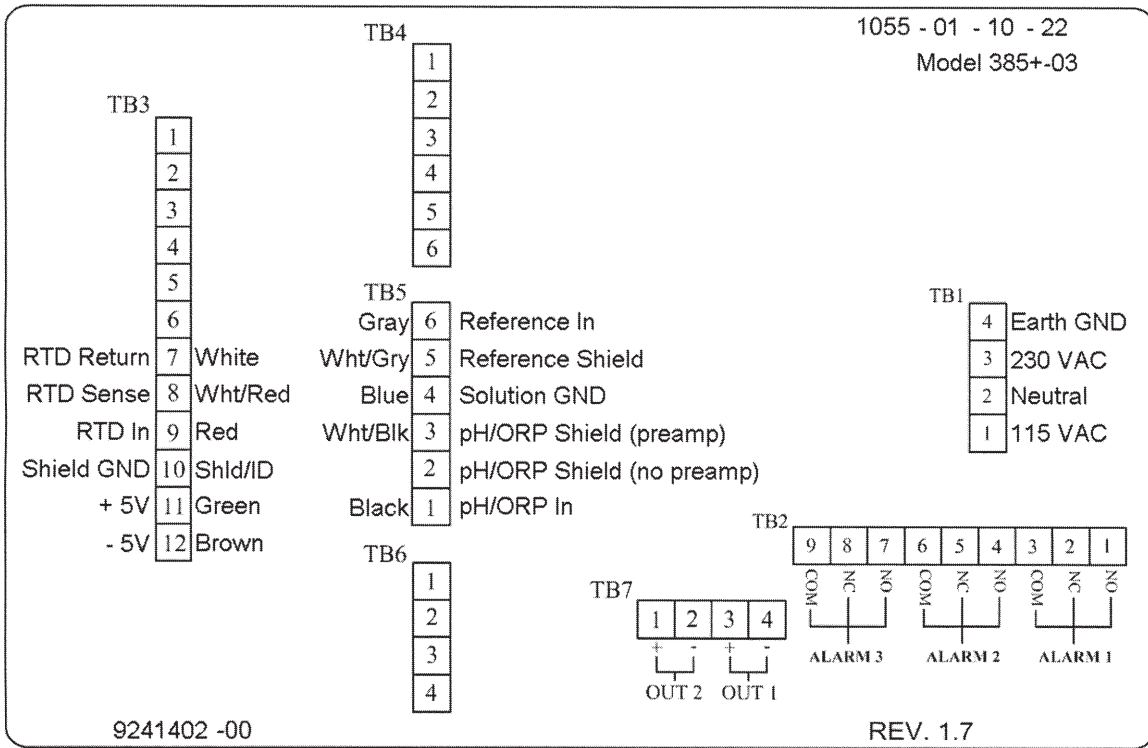


FIGURE 2-15. Wiring to Model 1055-10-22 (single measurement only)

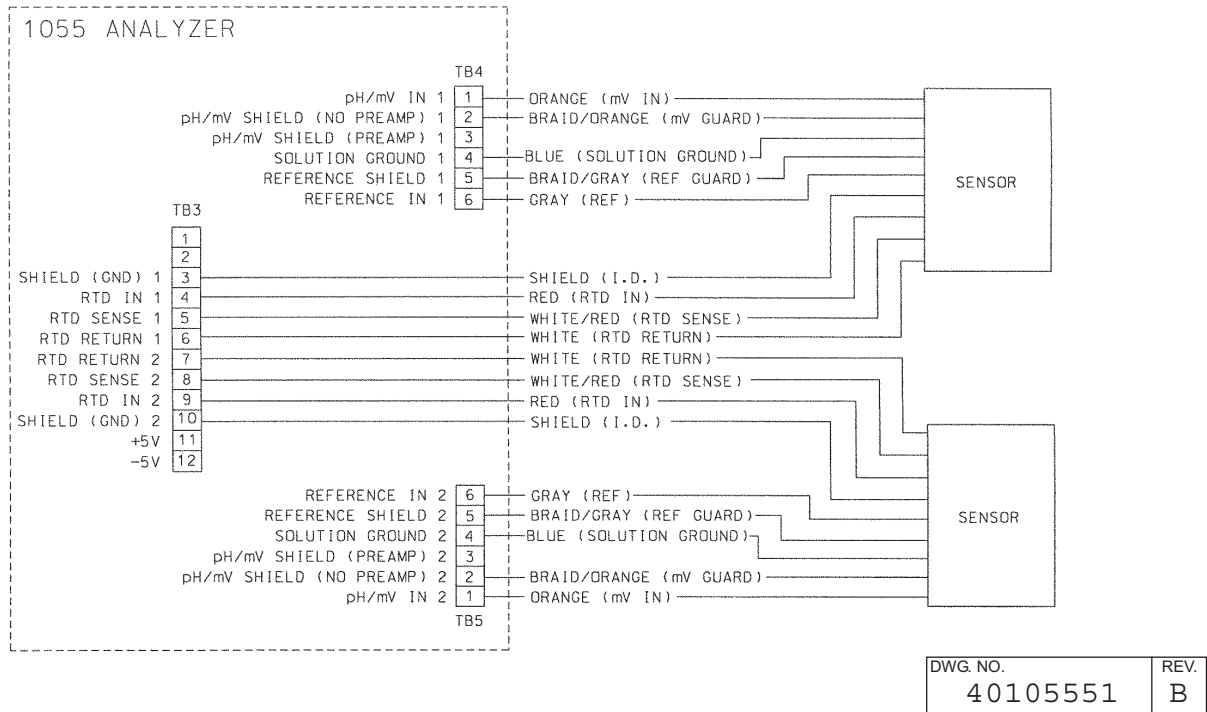


FIGURE 2-16. Wiring Model 385+ - 04 - () Sensor to Model 1055-01-10-22-32 Analyzer

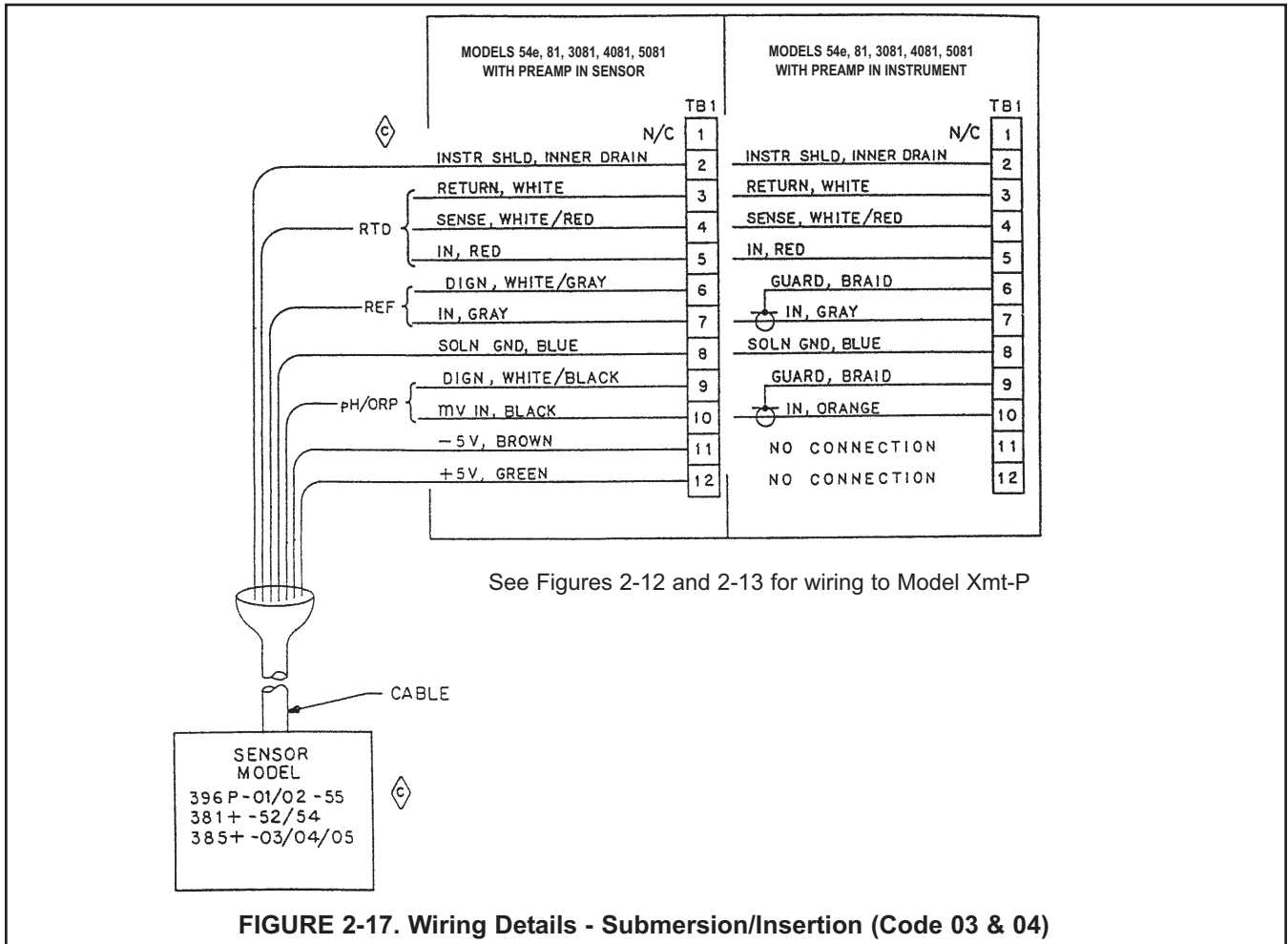
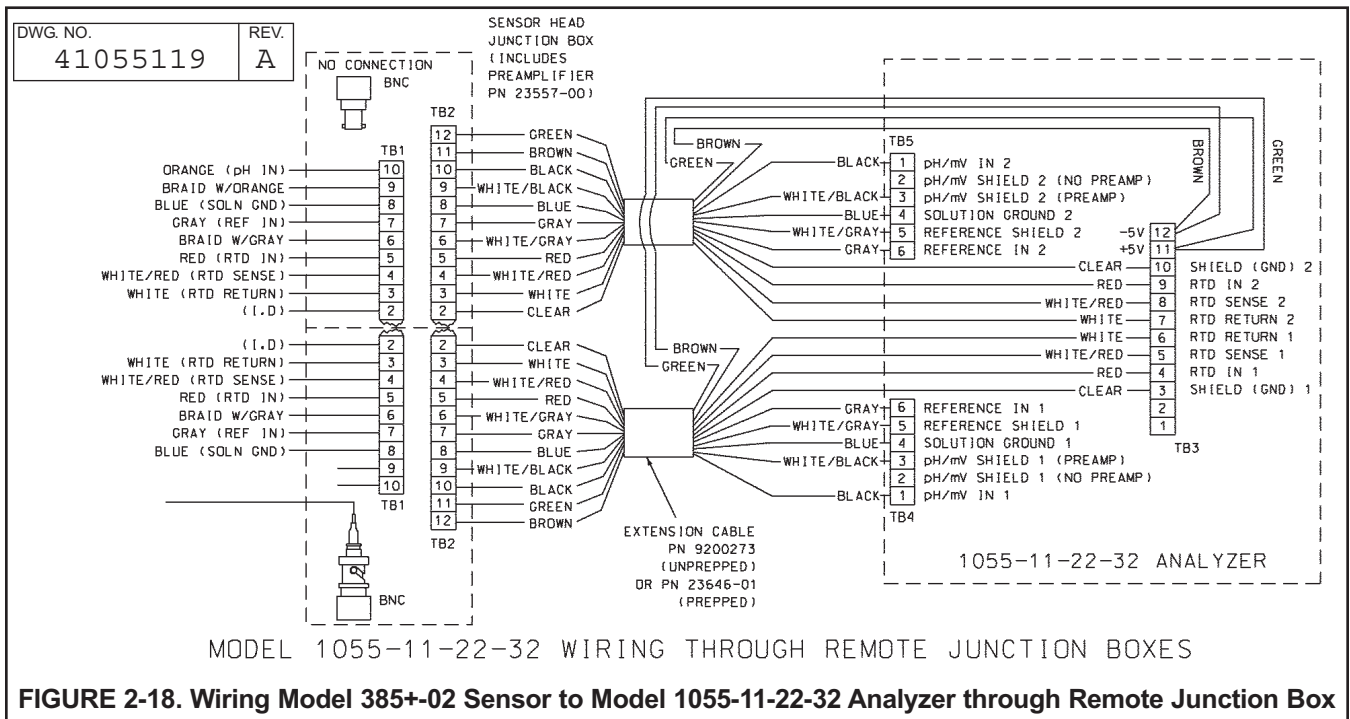
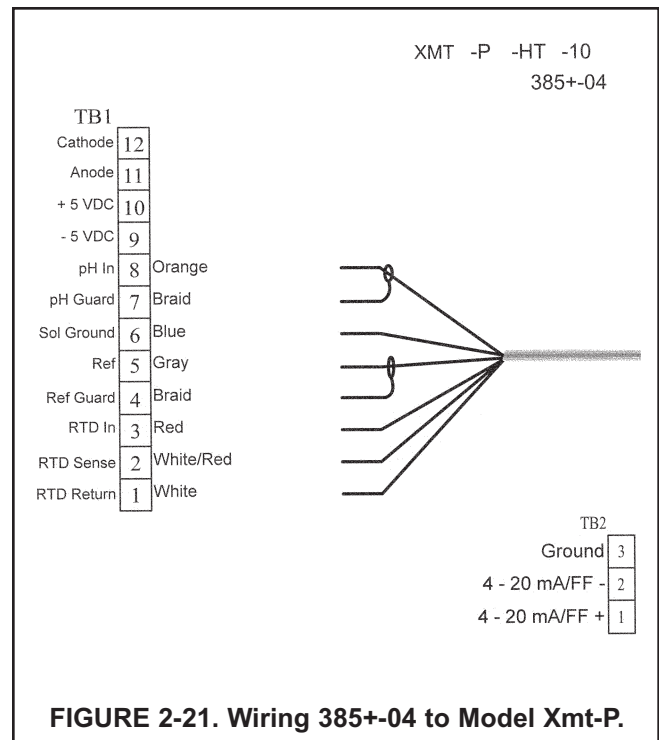
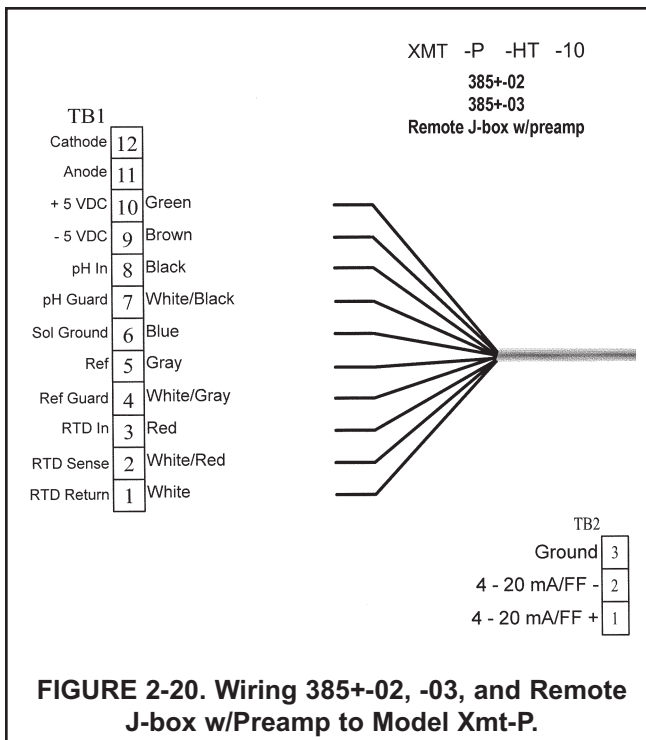
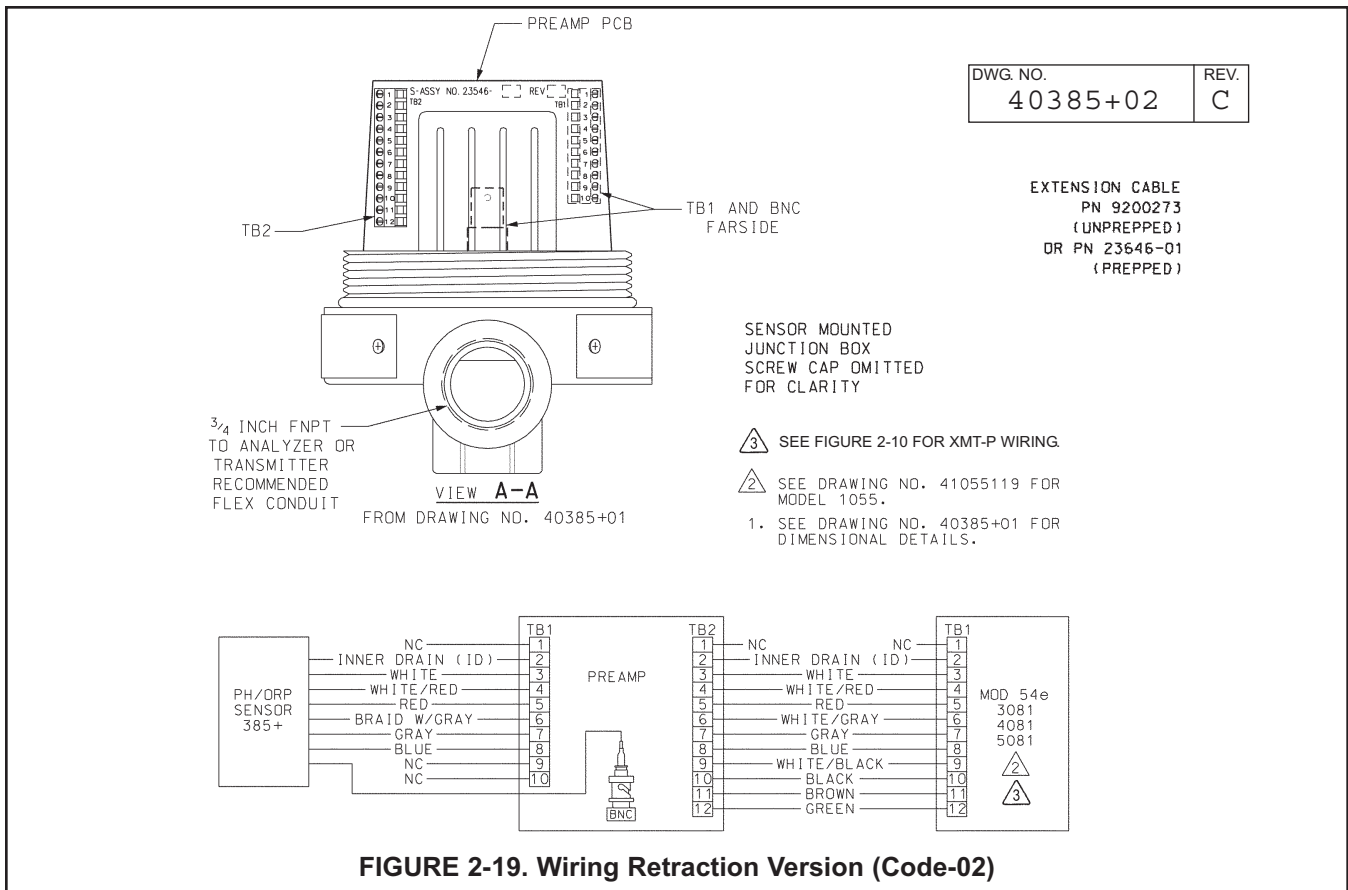


FIGURE 2-17. Wiring Details - Submersion/Insertion (Code 03 & 04)





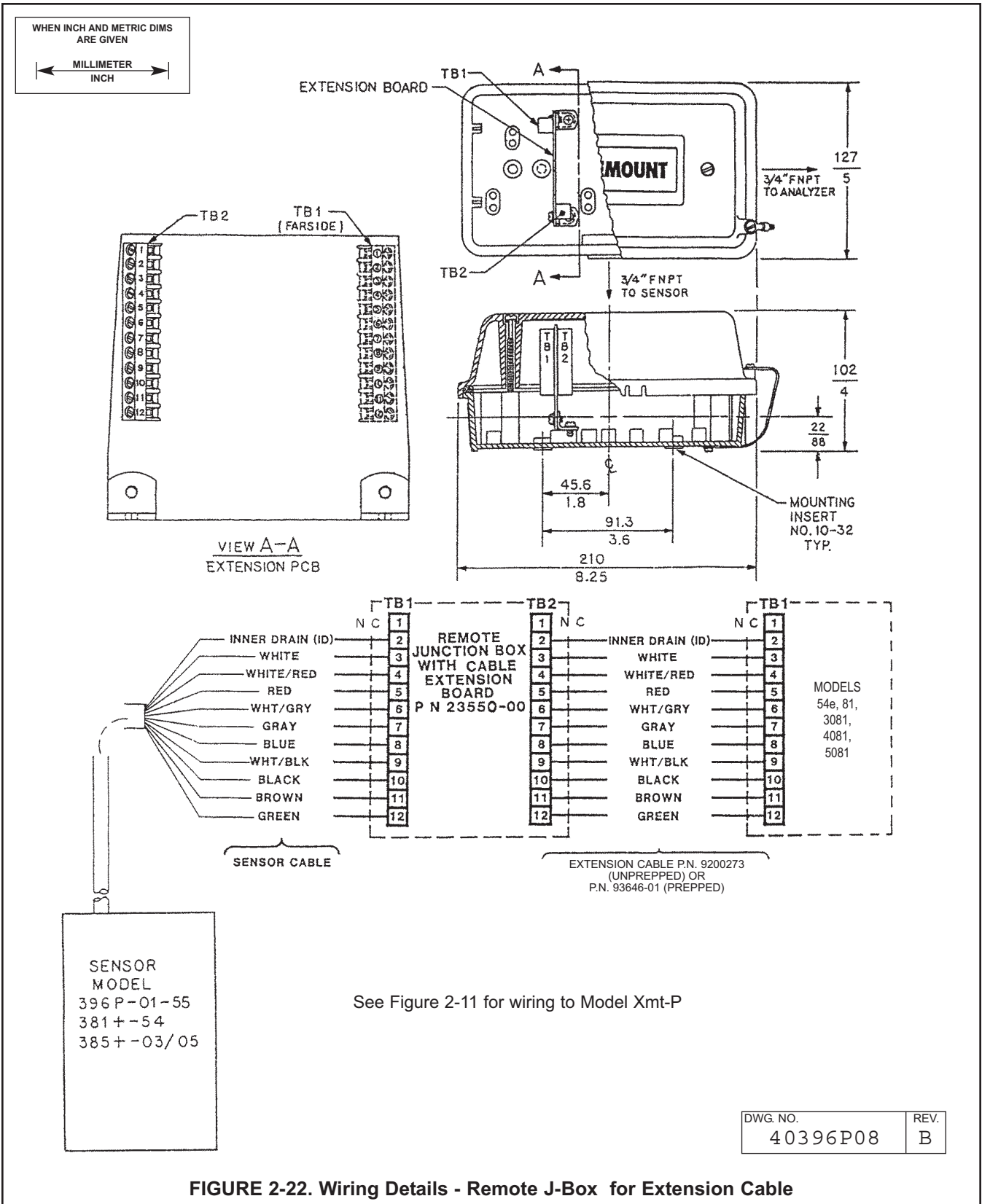


FIGURE 2-22. Wiring Details - Remote J-Box for Extension Cable

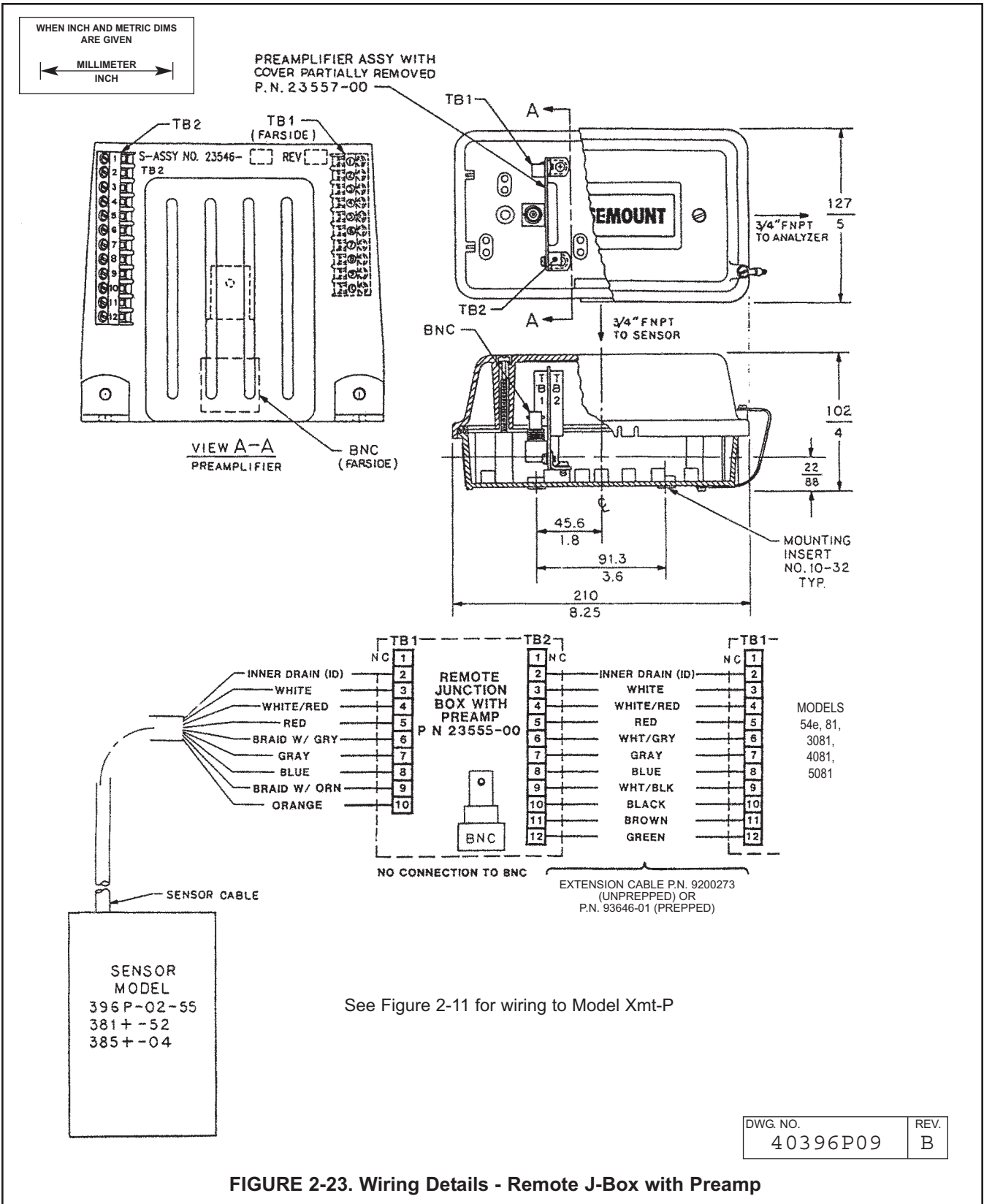
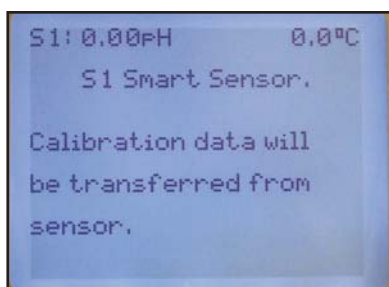


FIGURE 2-23. Wiring Details - Remote J-Box with Preamp

SECTION 3.0

START UP AND CALIBRATION

3.1 START UP. To obtain best accuracy, the sensor must be calibrated as a loop with the analyzer. Please refer to the Model 54 or Model 3081pH instruction manual for proper calibration procedures. SMART 385+ (-03) sensor once connected to SMART 1056, 1057 or 6081 brings up "SMART sensor is detected" screen on instrument. Example of 1056 start-up shown below.



3.2 pH CALIBRATION USING BUFFER SOLUTIONS OR GRAB SAMPLES. The loop may be calibrated with the sensor's measuring tip submerged in standard pH buffer solutions (two point calibration) or with a process grab sample of a known pH value (one point standardization). SMART 1056, 1057 or 6081 offer four calibration options. Please refer to the corresponding models for proper procedures

3.3 ORP CALIBRATION. An ORP loop is best calibrated using an ORP standard solution.

3.3.1 Quinhydrone Solution.

A commonly used ORP standard solution is a saturated quinhydrone solution. This can be made by simply adding a few quinhydrone crystals to either a 4 pH or a 7 pH buffer. Quinhydrone is only slightly soluble so only a few crystals will be required. The solution will have a yellow color. The resulting potentials should be within ± 20 millivolts of the value shown in Table 3-1. The ORP value of saturated quinhydrone solution is not stable over long periods of time and therefore new solutions should be made each time they are used.

TABLE 3-1
ORP of Saturated Quinhydrone Solution

	pH 4			pH 7		
TEMPERATURE °C	20	25	30	20	25	30
Millivolt Potential	268	264	260	94	87	80

3.3.2 Ferric-Ferrous Ammonium Sulfate Solution. Although this solution is not as easy to prepare as the quinhydrone solution in Section 3.3.1, it offers a much more stable solution which will maintain its millivolt value for approximately one year when stored in a glass container.

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

To prepare solution, dissolve 39.2 grams of reagent grade ferrous ammonium sulfate $[\text{Fe}(\text{SO}_4) \cdot (\text{NH})_2\text{SO}_4 \cdot 6\text{H}_2\text{O}]$ 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 1,000 milliliters. This solution (ferric-ferrous ammonium sulfate) will produce a nominal ORP of 476 ± 20 mV at 25°C . 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, consistent repeatable calibrations can be achieved.

NOTE

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 to be measured when first setting up or after being cleaned.

SECTION 4.0 MAINTENANCE

4.1 Maintenance. The Model 385+ Sensor is a disposal type sensor and therefore requires only periodic cleaning and calibration. If the sensor has failed, it should be discarded and replaced.

4.2 Sensor Removal. Please refer to the appropriate paragraph for instructions regarding removal of the sensor for periodic maintenance.

4.2.1 Retractable Version (Code-02).

WARNING
<p>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.</p>

1. Be certain system pressure at the sensor is below 64 psig (442 kPa) before proceeding with the retraction. It is also recommended that the personnel wear a face shield and have a stable footing. Refer to Figure 4-1.
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).

CAUTION
<p>Do not remove nut at this time</p>

3. When the hex nut is loose enough, slowly ease the sensor back completely until the retraction stop collar is reached.

CAUTION
<p>Failure to withdraw the sensor completely may result in damage to the sensor when the valve is closed.</p>

4. Close the ball valve slowly. If there is resistance, the valve may be hitting the sensor. Double check that the sensor has been retracted to the retraction

WARNING
<p>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, however with the ball valve closed, some residual process fluid may leak from the connector's pipe threads.</p>

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

CAUTION
<p>If the male connector leaks during insertion or retraction, replace the O-ring (PN 9550099) in the male connector body (A).</p>

4.2.2 Insertion/Submersion Version (Code -03 & -04).

WARNING
<p>Before removing the sensor, be absolutely certain that the process pressure is reduced to 0 psig and the process temperature is lowered to a safe level!</p>

Remove the sensor from process for cleaning, calibration or replacement.

4.3 pH Electrode Cleaning. If the electrode is coated or dirty, it may be cleaned as follows:

1. Remove the sensor from process as instructed in Section 4.2.
2. Wipe the glass bulb with a soft, clean, lint free cloth or tissue. If this does not remove the dirt or coating, proceed to step 3. If the sensor appears to be clean, go to step 5.
3. Wash the glass bulb in a strong detergent solution and thoroughly rinse with tap water. If the bulb still appears to have a coating, proceed to step 4.

CAUTION
<p>The solution used in the following step 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 the skin is made, immediately rinse with clean water.</p>

4. Following the caution above, wash the glass bulb in dilute 5% hydrochloric acid solution and then rinse it thoroughly in tap water. Replace the sensor if it cannot be cleaned. If the glass bulb appears clean, proceed to step 5.

5. Buffer calibrate the sensor (Refer to Section 3.0). If the sensor appears to respond sluggishly to pH change, soaking it overnight in a weak acid solution (5% hydrochloric acid) may improve its response. Be sure to follow the CAUTION above and to rinse the sensor's tip thoroughly with tap water. If the sensor will not calibrate, it must be replaced.

4.4 Platinum Electrode Cleaning. Remove any film or dirt by wiping the electrodes platinum band with a clean, lint free, cloth. If needed, a strong detergent should be used to remove any remaining dirt or film. Platinum electrodes can become poisoned by cyanide or sulfide compounds. However, processes involving these compounds (such as cyanide destruction) will destroy all the cyanides or sulfides before they can react with the platinum. Should poisoning occur, the electrode can be restored to normal operation by polishing the platinum (metallic) surface with moistened baking soda (after a strong detergent wash to remove any film on the platinum surface).

4.5 Sensor Tube Replacement (Code -02). Replacement of the retraction versions sensor tube assembly 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 4.2 for proper removal of the sensor from process.

1. Remove sensor from process before proceeding. 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 discarded with the sensor tube.

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 1in. 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 to the printed circuit board in the junction box. Butt the ferrule's beveled edge and the sensor tube against 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 4-1). 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 2-4. 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 ferrule does not adequately grip. When using the metallic ferrule, be careful and avoid over tightening. This can damage the sensor tube.

CAUTION

If the male connector leaks during insertion or retraction, replace the O-ring (PN 9550099) 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.

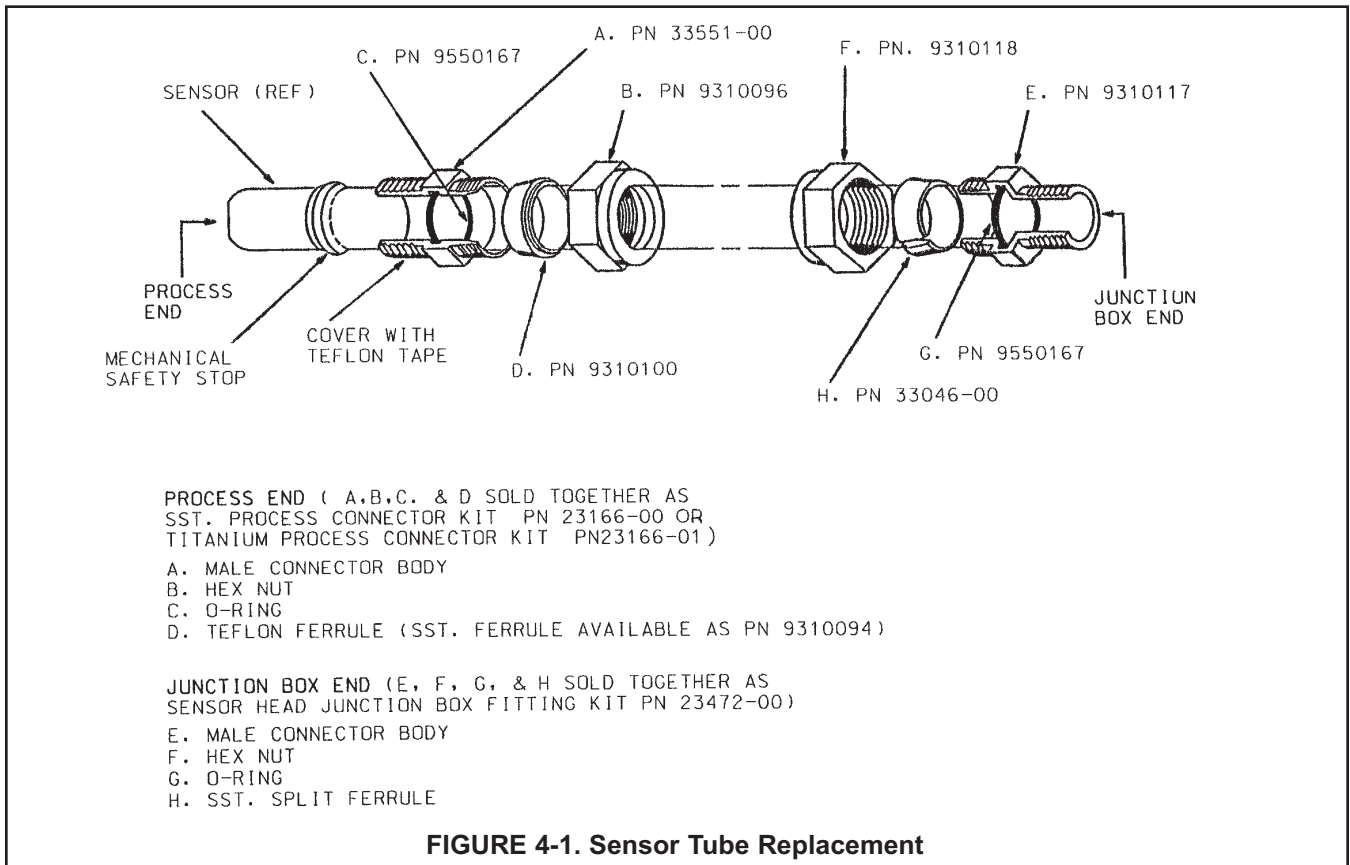


FIGURE 4-1. Sensor Tube Replacement

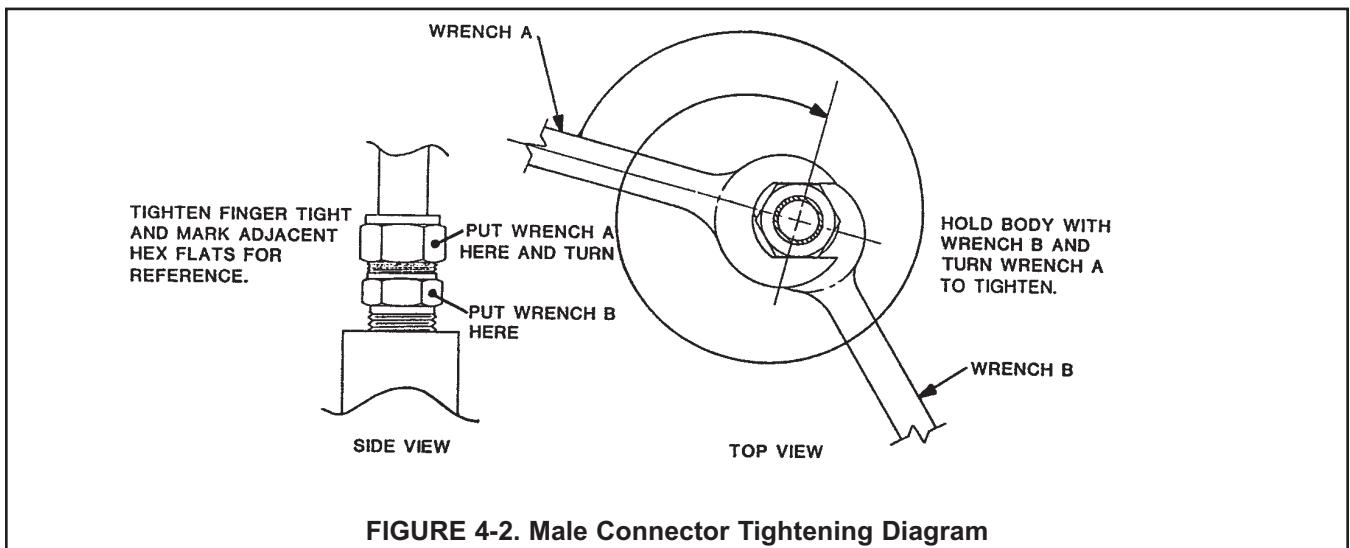


FIGURE 4-2. Male Connector Tightening Diagram

SECTION 5.0

DIAGNOSTICS AND TROUBLESHOOTING

5.1 MODEL 54/3081 pH DIAGNOSTICS. The Models 54 and 54e Analyzers and Models 3081, 4081, and 5081 pH Transmitters automatically search for fault conditions that would cause an error in the measured pH value. Refer to the respective manual for a complete description of the analyzer's fault conditions.

5.2 TROUBLESHOOTING. Table 5-1, below, lists the diagnostic messages that indicate a possible sensor problem. A more complete description of the problem and a suggested remedy corresponding to each message is also listed.

Table 5-1. Troubleshooting

DIAGNOSTIC MESSAGE 54/54E 3081/4081/5081	DESCRIPTION OF PROBLEM	REMEDY
"Calibration Warning" CALibrAtE	1. Aged glass. 2. Sensor not immersed.	1. Perform buffer calibration. 2. Be sure electrode measuring tip is in process.
"Cracked glass failure" 6LASS FAIL	Broken or cracked glass.	Replace Sensor.
"High reference impeded" rEF FAIL or rEF WJArn	1. Liquid junction coated. 2. Reference Cell gel depleted. 3. Sensor not immersed.	1. Clean sensor; replace if necessary. 2. Replace sensor. 3. Be sure electrode measuring tip is in process.
"Input voltage high" "Input voltage low"	pH input shorted or sensor miswired.	Check wiring. Replace sensor if necessary.
"Old glass warning" 6LaSS WJArn	1. Glass electrode worn out. 2. Sensor not immersed.	1. Replace sensor. 2. Be sure electrode measuring tip is in process.
"Reference offset err" (offline only) Std Err	Reference electrode poisoned.	Replace sensor.
"Ref voltage high" "Ref voltage low"	1. Reference shorted or sensor miswired. 2. Sensor not immersed.	Check wiring. Replace sensor if necessary.
"Sensor line open" LInE FAIL	1. Open wire between sensor and analyzer. 2. Interconnecting cable greater than 1000 ft.	1. Check sensor wiring. 2. Relocate analyzer.
"Sensor miswired"	1. Open wire between sensor and analyzer. 2. Bad preamplifier.	1. Check wiring. 2. Replace preamplifier.
"Temp error high" "Temp error low" tEMP HI tEMP LO	1. Open or shorted RTD. 2. Temperature out of range.	1. Replace sensor. 2. Check process temperature.

5.3 MODEL 1056/1057 SMART pH DIAGNOSTICS.

The SMART models 1056, 1057 and 6081 instruments automatically search for SMART sensor. Once the SMART sensor is detected, 385+ (-03), and communication is established the start-up, screen will appear, figure 5-1. Start-up and calibration of pH/ORP are described on page 16. Up to five (5) calibration data sets can be found under DIAG/sensorX/calibration history, see figure 5-2.

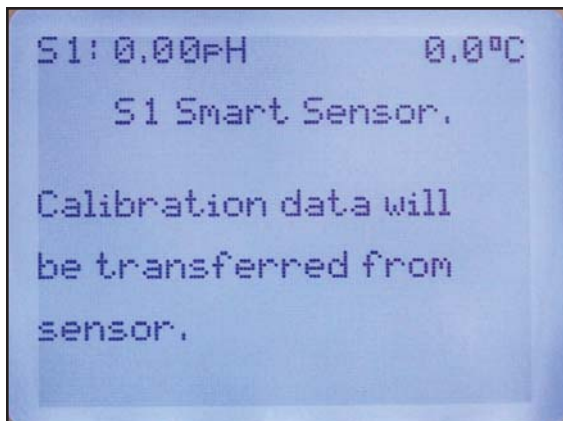


Figure 5-1. SMART start-up screen

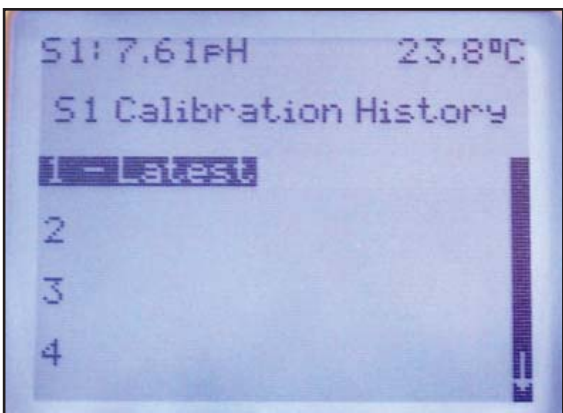


Figure 5-2. Calibration History menu on 1056

The calibration data contain slope, offset, temperature, method of calibration (page 16), glass impedance, reference impedance and time stamp between the calibration, figure 5-3. Advanced diagnostic data can be used for preventive maintenance, replacement and timely troubleshoot.

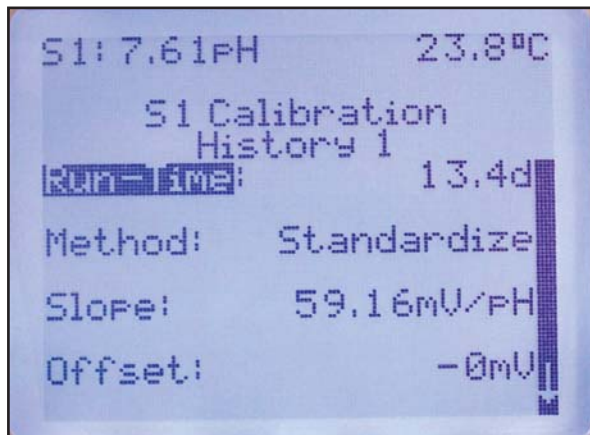


Figure 5-3. Calibration History screen

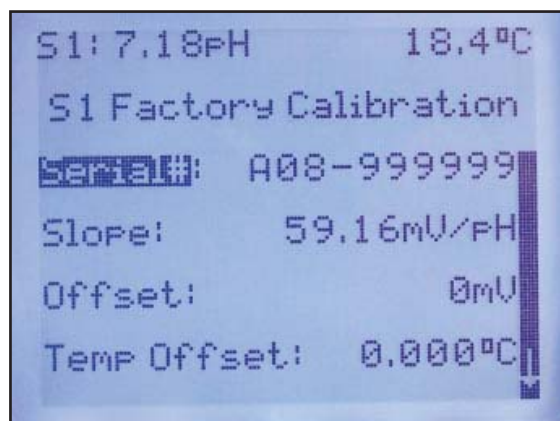


Figure 5-4. Factory Calibration

Please refer to the corresponding installment manual for detailed description.

The factory calibration data can be found on the bottom of Calibration History menu figure 5-2. Use key-pad to scroll down to the bottom, find Factory Cal. line and press enter. The factory calibration screen will appear, figure 5-4. It contains the serial number of the sensor, slope, offset, temperature offset, glass impedance and reference inductance value. It's possible to restore the calibration settings to factory default. Please, refer to corresponding instrument manual for correct procedure.

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.
Liquid 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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