Instruction Sheet
PN 51A-3900
September 2010/rev.A

General Purpose pH/ORP Sensor

For additional information, please visit our website at *www.emersonprocess.com/raihome/liquid/*.

SPECIFICATIONS

Sensor Type: General purpose 3900

Measured Range: pH: AccuGlass 0-14
ORP: -1500 to +1500 mV

Percent Linearity Over pH Range:

Range	Linearity
0 - 7	97%
1 - 7	98%
4 - 7	98%
7 - 10	99%
7 - 12	97%
7 - 13	96%
7 - 14	95%

Operating Temperature: -10° to 100°C (14° to 212°F)
Automatic temperature compensation -10° to 100°C (14° to 212°F)

Maximum Pressure: 790 kPa [abs] (100 psig) at 100°C (212°F)

Materials of Construction: stainless steel, glass, Teflon, polyphenylene sulfide (PPS), and EPDM

Materials of ORP: Platinum

Process Connections

Front facing: ¾″ and 1″ MNPT

Rear facing: 1″ MNPT

Integral Cable: 32 ft (10m) cable with integral SMART preamp; 15 ft (4.7m) cable without preamp sensor

VP8 Cable: use 24281-XX, 2.5 ft (.8m) to 100 ft (31m)

Weight/Shipping Weight: 0.45 kg/0.9 kg (1 lb/2 lb)

MODEL 3900
Insertion/Submersion Sensor

⚠ 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.

⚠WARNING

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!

⚠ CAUTION

The solution used during calibration 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.

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STORAGE

1. It is recommended that electrodes be stored in their original shipping containers until needed.
2. Do not store at temperatures below -10°C (14°F).
3. Electrodes should be stored with a protective cap containing KCl solution (PN 9210342).
4. For overnight storage, immerse the sensor in tap water or 4 pH buffer solution.
5. A pH glass electrode has a limited shelf life of one year.

ELECTRODE PREPARATION

1. Remove electrode from shipping container.
2. Remove the protective boot covering the electrode bulb.
3. Rinse away salt film with clean water, then shake the electrode so that the internal solution fills the bulb, thus removing any air trapped there.

INSTALLATION

For sensor orientation, see Figure 1.

For sensor dimensions, see Figure 2.

For mounting options, see Figures 3-6.

For wiring, see Figures 7-22.

For additional wiring information, please visit our website at www.emersonprocess.com/raihome/liquid/wiring.

TWO POINT BUFFER CALIBRATION

Select two stable buffer solutions, preferably pH 4.0 and 10.0 (pH buffers other than pH 4.0 and pH 10.0 can be used as long as the pH values are at least two pH units apart).

NOTE

A pH 7 buffer solution reads a mV value of approx. zero, and pH buffers read approximately ± 59.1 mV for each pH unit above or below pH 7. Check the pH buffer manufacturer specifications for millivolt values at various temperatures since it may affect the actual value of the buffer solution mV/pH value.

1. Immerse sensor in the first buffer solution. Allow sensor to equilibrate to the buffer temperature (to avoid errors due to temperature differences between the buffer solution and sensor temperature) and wait for reading to stabilize. Value of buffer can now be acknowledged by analyzer/ transmitter.
2. Once the first buffer has been acknowledged by the analyzer/transmitter, rinse the buffer solution off of the sensor with distilled or deionized water.
3. Repeat steps 1 and 2 using the second buffer solution.
4. The theoretical slope value, according to the Nernst equation for calculating pH, is approximately 59.1 mV/pH. Over time the sensor will age, both in the process and in storage, which will result in reduced slope values. To ensure accurate readings, it is recommended that the electrode be replaced when the slope value falls below 47 to 49 mV/pH.

RECOMMENDED pH SENSOR STANDARDIZATION

For maximum accuracy, the sensor can be standardized on-line or with a process grab sample after a buffer calibration has been performed and the sensor has been conditioned to the process. Standardization accounts for the sensor junction potential and other interferences. Standardization will not change the sensor's slope but will simply adjust the analyzer's reading to match that of the known process pH.

MAINTENANCE FOR pH ELECTRODE

Electrodes should respond rapidly. Sluggishness, offsets, and erratic readings are indicators that the electrodes may need cleaning or replacement.

1. To remove oil deposit, clean the electrode with a mild non-abrasive detergent.
2. To remove scale deposits, soak electrodes for 1 to 5 minutes in a 5% hydrochloric acid solution.
3. Temperature effect on life expectancy: If glass electrode life expectancy is 100% at 25°C (77°F), then it will be approximately 25% at 80°C (176°F), and approximately 10% at 100°C (212°F).

⚠ CAUTION

Hydrochloric acid is toxic and highly corrosive. Avoid skin contact, wear protective gloves. Use only in a well ventilated area. Do not inhale fumes. In case of an accident, consult a doctor immediately.

ORP CALIBRATION

1. After making an electrical connection between the sensor and the instrument, obtain a standard solution of saturated quinhydrone PN R508-8OZ (475mV). This can also be made quite simply by adding a few crystals of quinhydrone to either pH 4 or pH 7 buffer. Quinhydrone is only slightly soluble, therefore only a few crystals will be required.
2. Immerse the sensor in the standard solution. Allow 1-2 minutes for the ORP sensor to stabilize.
3. Standardize the instrument to the solution value shown in the table, right. 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 the table below. Solution temperature must be noted to ensure 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.
4. Remove the sensor from the buffer, rinse, and install in the process.

MAINTENANCE FOR ORP ELECTRODE

Electrodes should respond rapidly. Sluggishness, offsets, and erratic readings are indicators that the electrodes may need cleaning or replacement.

1. To remove oil deposit, clean the electrode with a mild non-abrasive detergent.
2. To remove scale deposits, soak electrodes for 1 to 5 minutes in a 5% hydrochloric acid solution.
3. ORP (metallic) electrodes should be polished with moistened baking soda.

ORP of Saturated Quinhydrone Solution (millivolts)

	pH 4 Solution			pH 7 Solution		
Temp °C	20	25	30	20	25	30
mV Potential	268	264	260	94	87	80

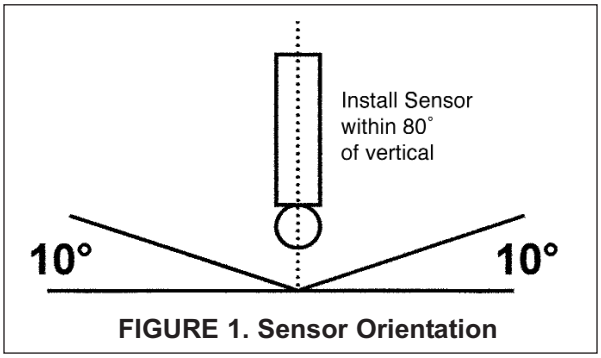


FIGURE 1. Sensor Orientation

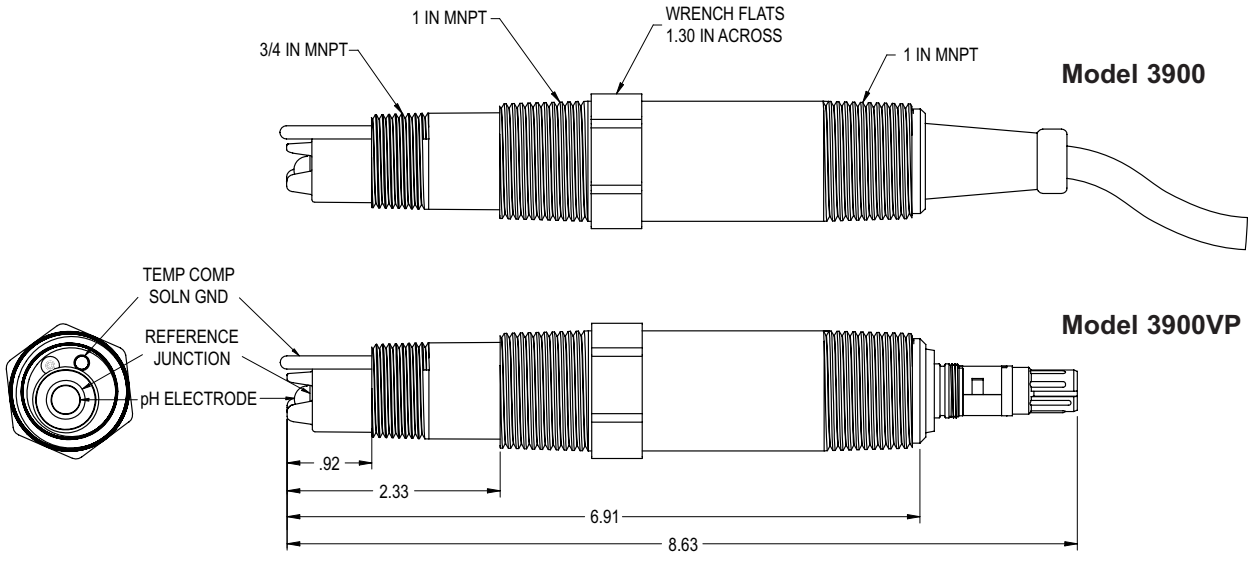
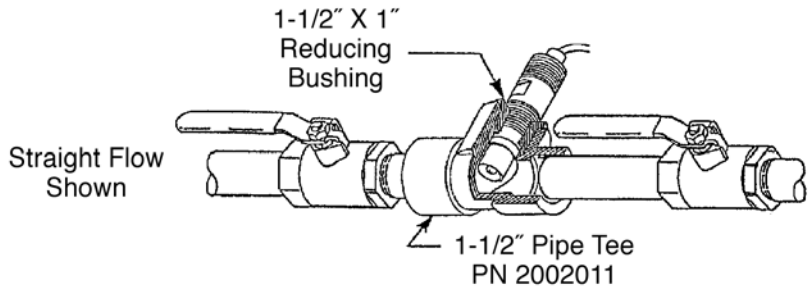


FIGURE 2. Sensor Dimensions



Horizontal Pipe Tee (PN 2002011)
Pressure/Temperature Ratings

psig (kPa [abs])	°F (°C)
150 (1136)	150 (65)
128 (984)	160 (71)
102 (805)	170 (77)
80 (653)	180 (82)
57 (494)	200 (93)
48 (432)	210 (99)

FIGURE 3: Typical Flow Through insertion installation using PN 2002011 Pipe Tee (sensor must be installed at least 10° above the horizon)

Inlet and outlet connections are stainless steel and take 1/4-inch OD tubing. Flow cell is polycarbonate with 1/4-inch FNPT fittings.

WETTED MATERIALS:	
BODY	- ACRYLIC
NUT	- CPVC
FITTINGS	- 316 SST
SEALS	- BUNA N

FLOW CELL RATINGS

TEMPERATURE: 32˚-194˚F (0-90˚C)
MAX. PRESSURE: 90 PSIG (721 kPa [abs])
FLOW RATE: 2-5 GPH (7.6-18.9 LPH)

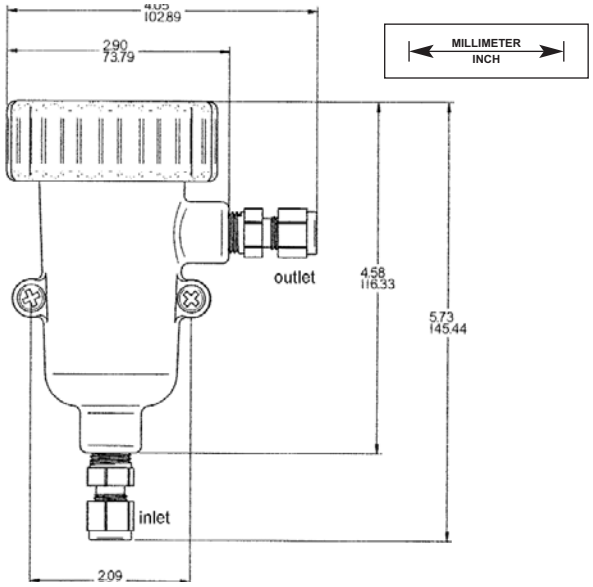
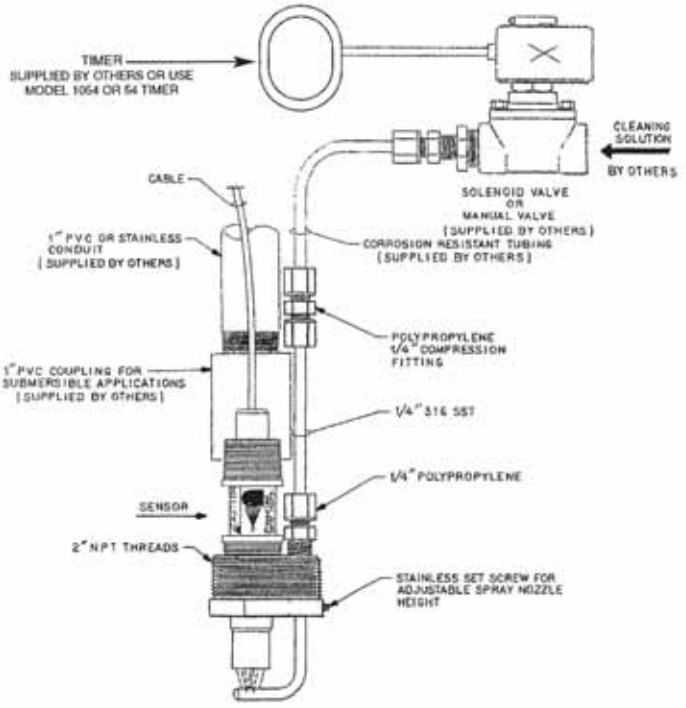


FIGURE 4: Low Flow Cell PN 24091-00



The Jet Spray Cleaner eliminates routine, manual sensor maintenance by cleaning the sensor with water or compressed air. Flow through the cleaner can be controlled by a solenoid valve.

Jet Spray Cleaner shown with Model 3900VP pH sensor

NOTE: The Jet Spray Cleaner can be used with Handrail Mounting Assembly (PN 11275-01, not shown) or can be mounted through conduit as shown above.

FIGURE 5: Jet Spray Cleaner PN 12707-00

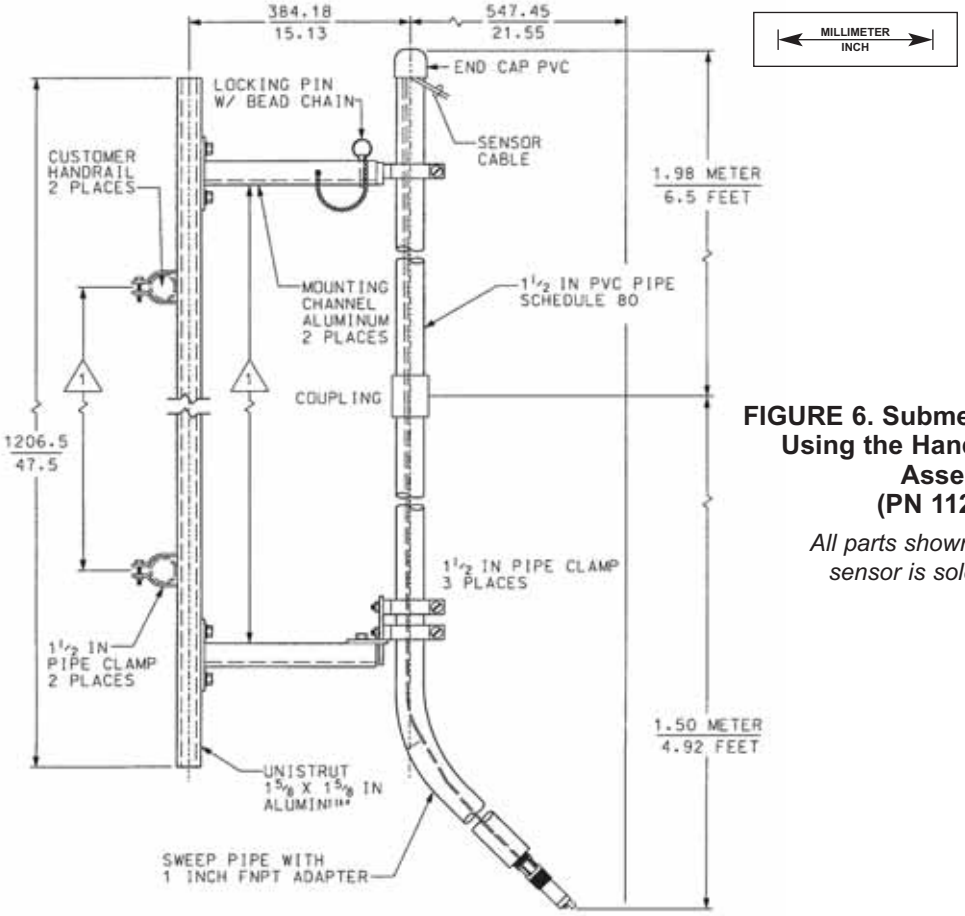


FIGURE 6. Submersion Installation Using the Handrail Mounting Assembly (PN 11275-01)

All parts shown are supplied; sensor is sold separately.

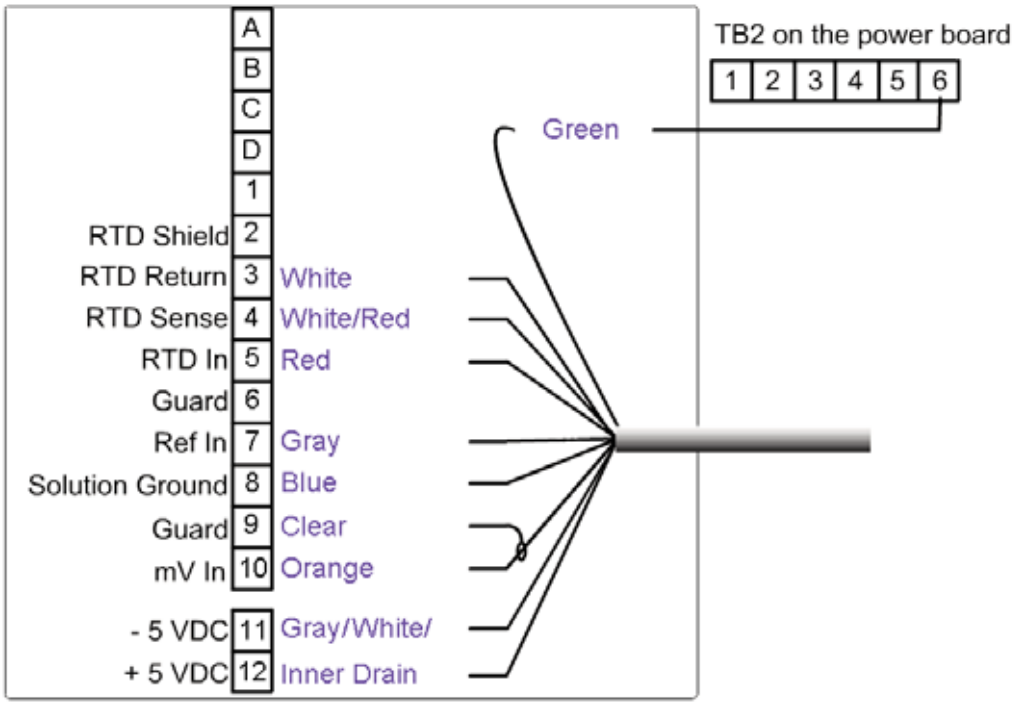


FIGURE 7. 3900-01 and 3900VP-01 to Model 54epH/ORP

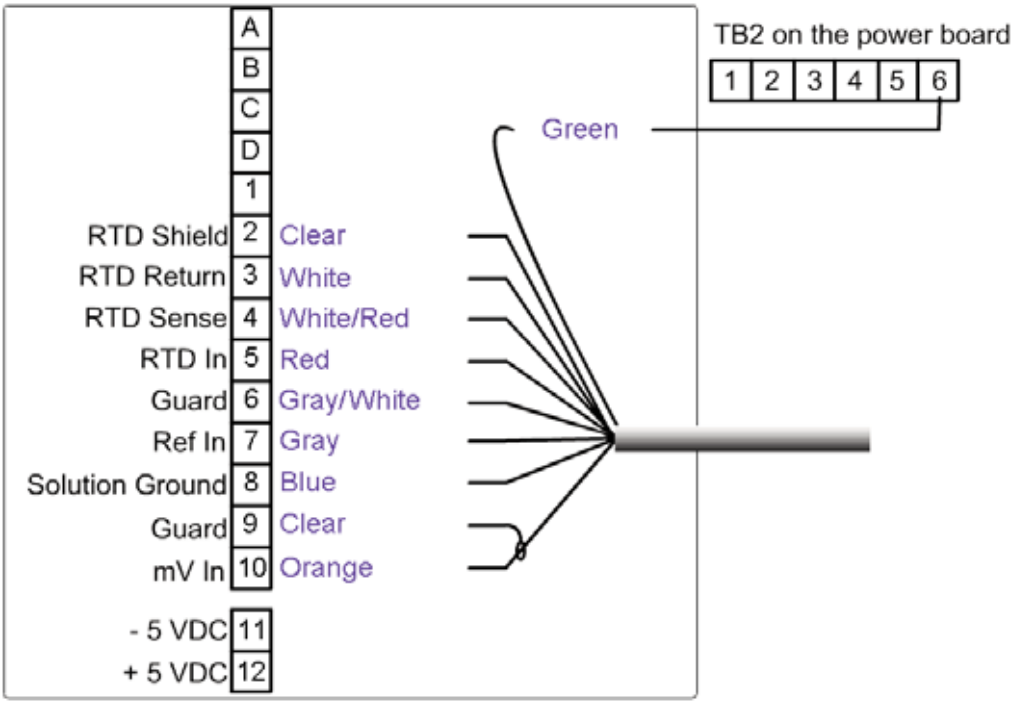


FIGURE 8. 3900-02 and 3900VP-02 to Model 54epH/ORP

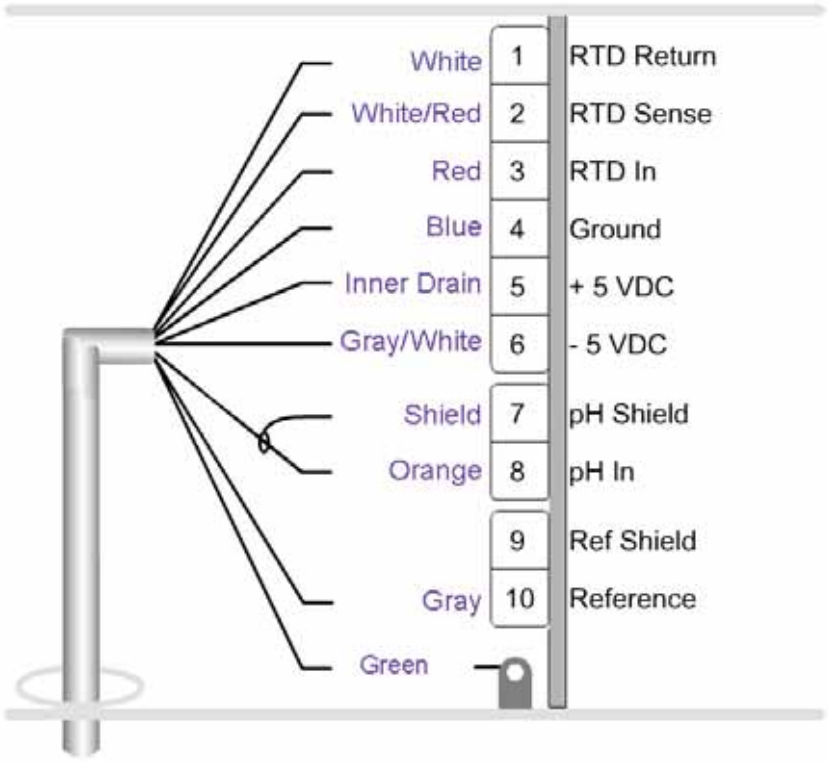


FIGURE 9. 3900-01 and 3900VP-01 to Model 1056 pH

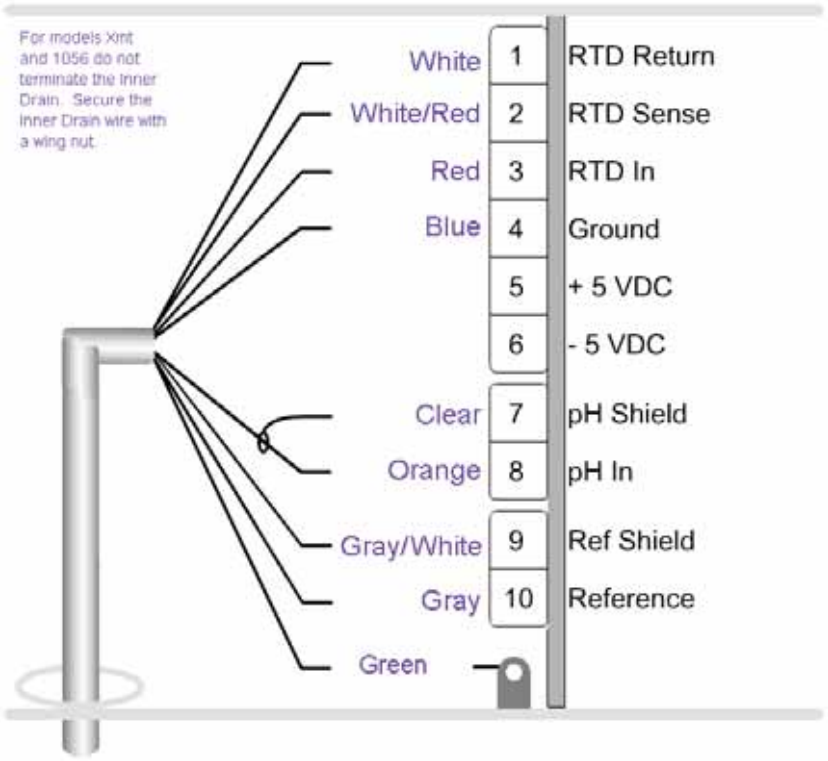


FIGURE 10. 3900-02 and 3900VP-02 to Model 1056 pH

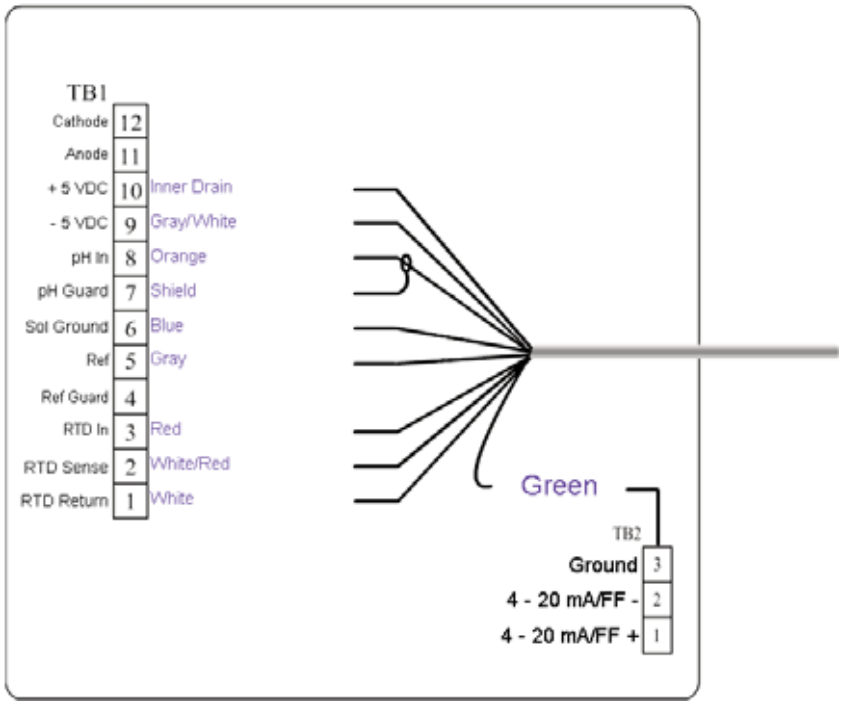


FIGURE 11. 3900-01 and 3900VP-01 to Model Xmt

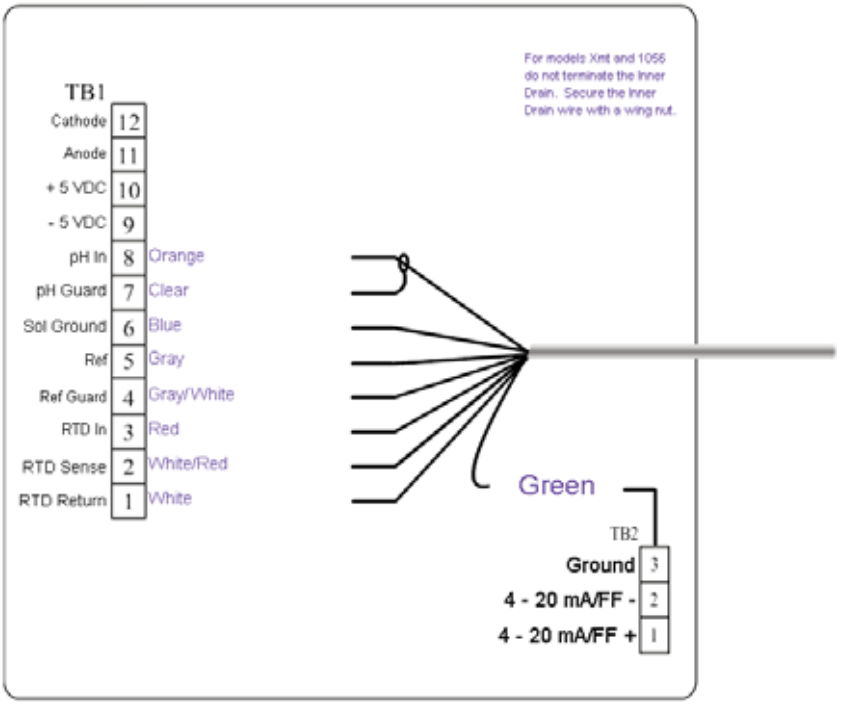


FIGURE 12. 3900-02 and 3900VP-02 to Model Xmt

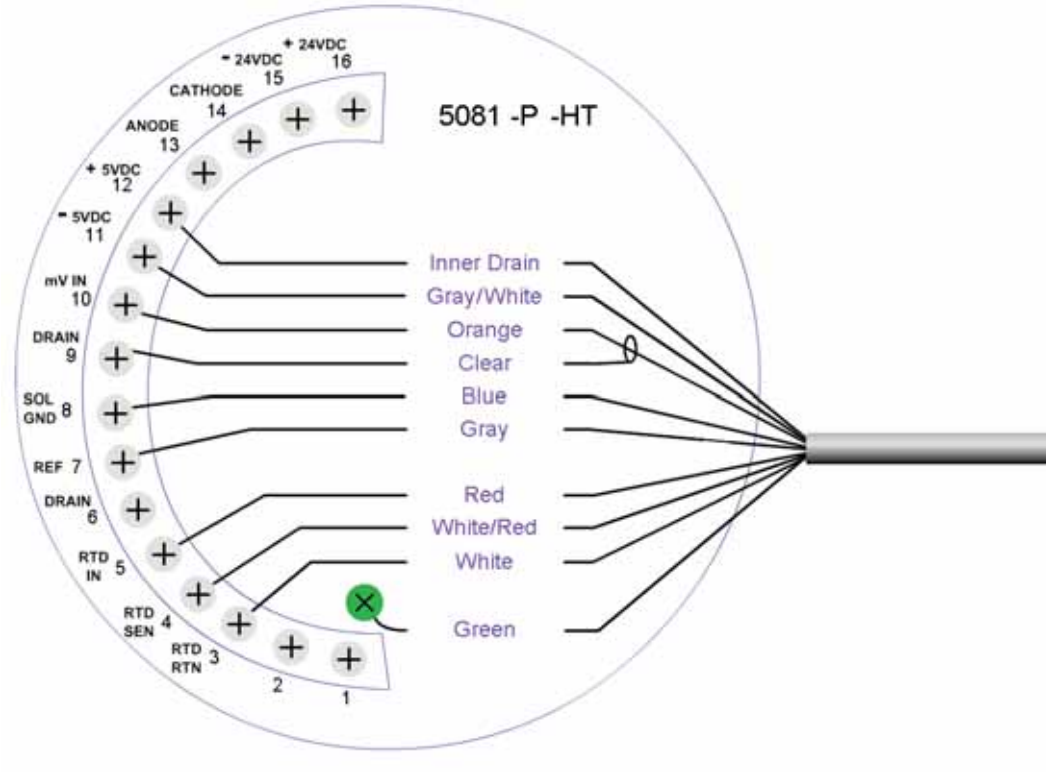


FIGURE 13. 3900-01 and 3900VP-01 to Models 5081, 4081 or 3081

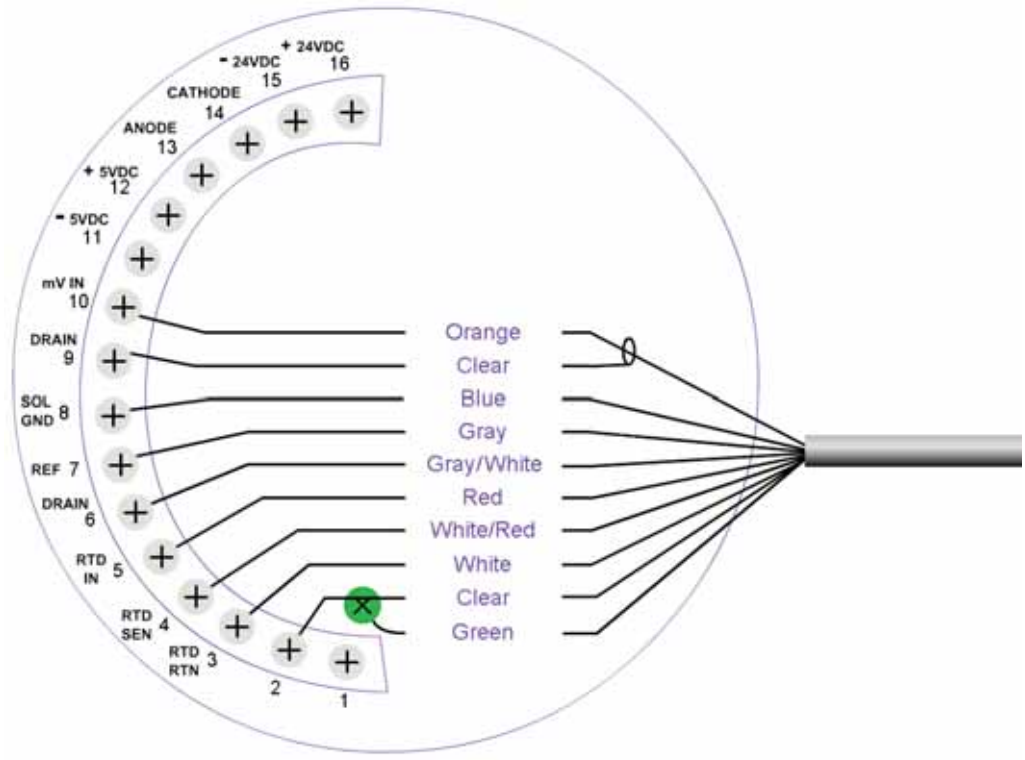


FIGURE 14. 3900-02 and 3900VP-02 to Models 5081, 4081 or 3081

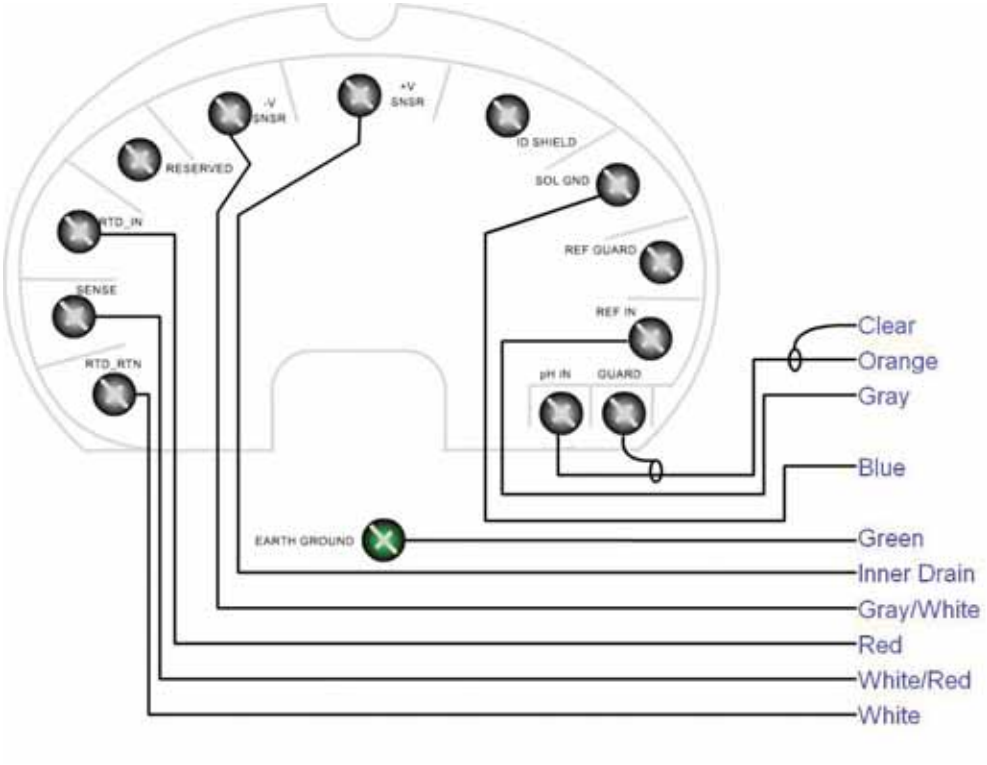


FIGURE 15. 3900-01 and 3900VP-01 to Model 6081-P

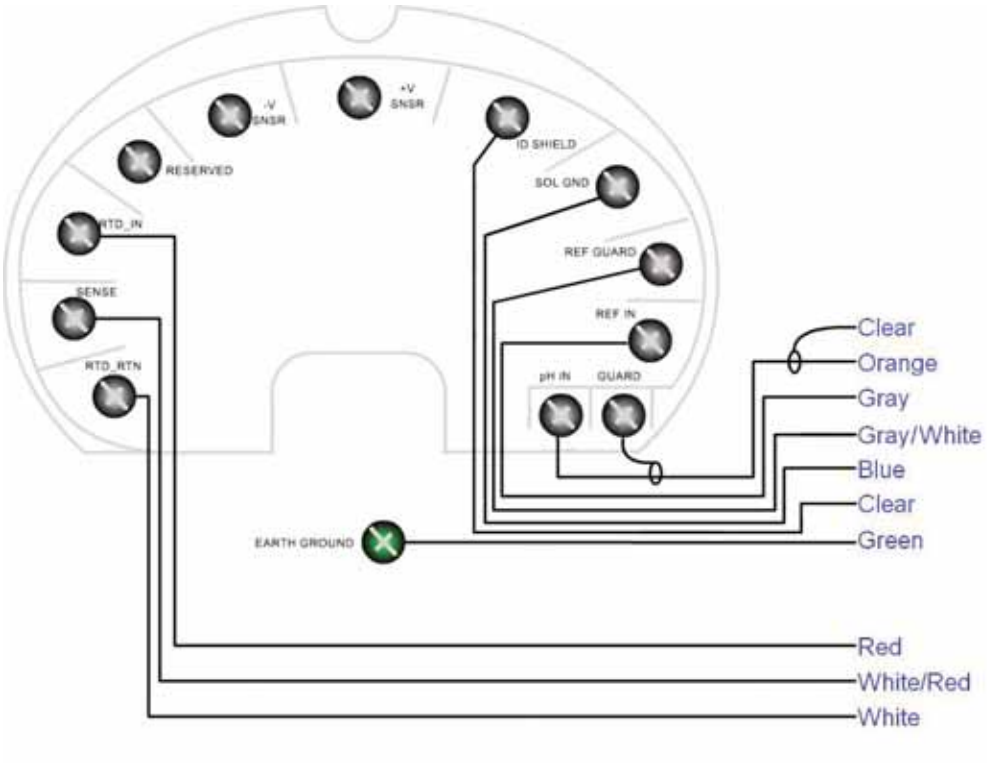


FIGURE 16. 3900-02 and 3900VP-02 to Model 6081-P

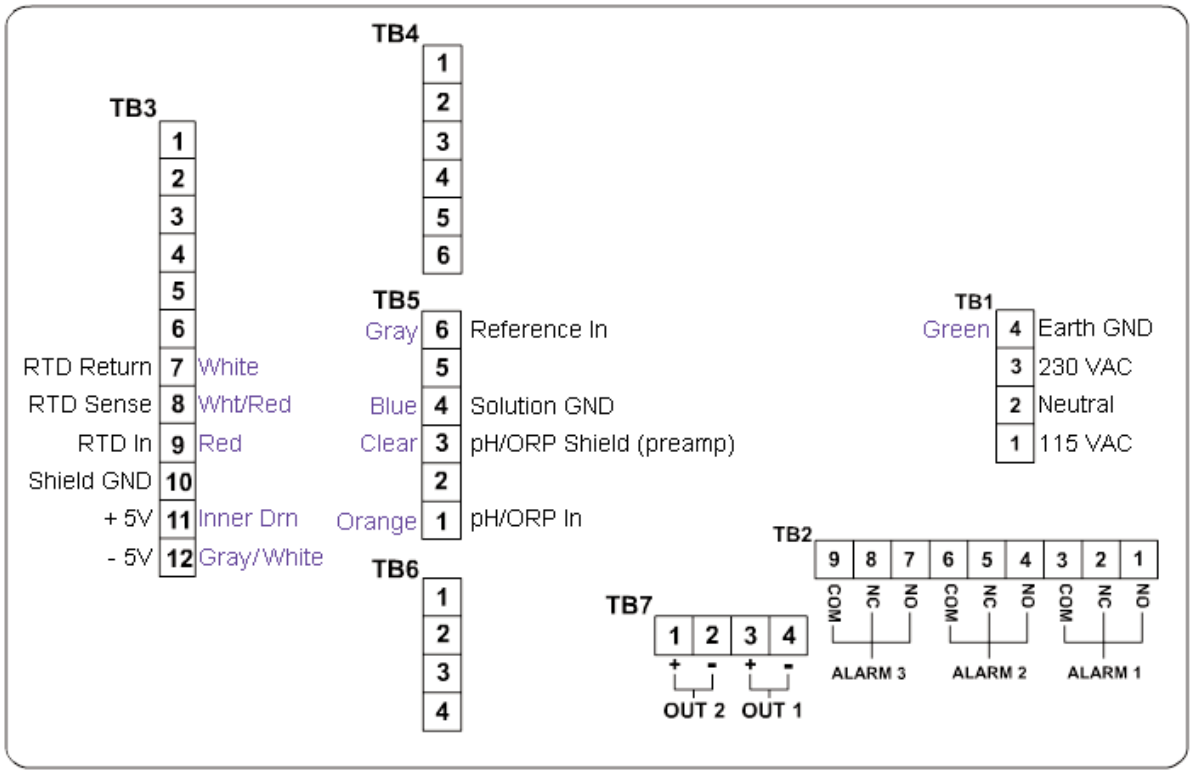


FIGURE 17. 3900-01 and 3900VP-01 to Model 1055

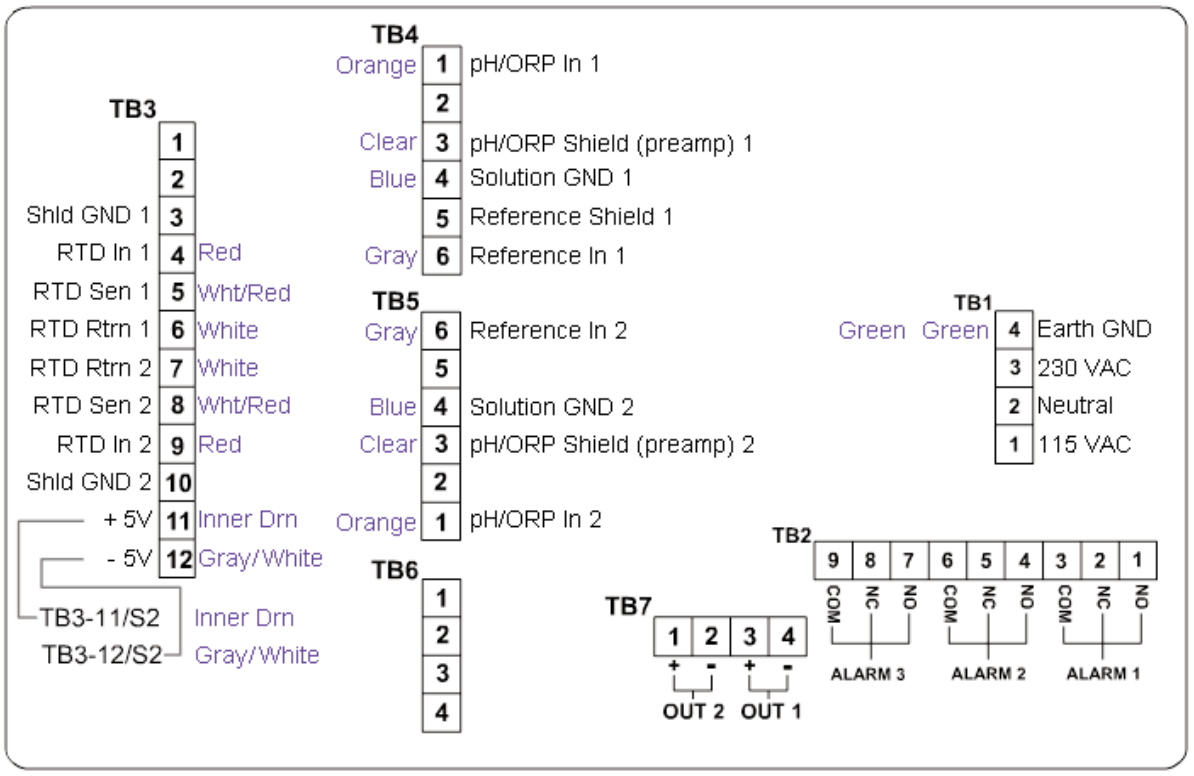


FIGURE 18. Two-Input 3900-01 and 3900VP-01 to Model 1055

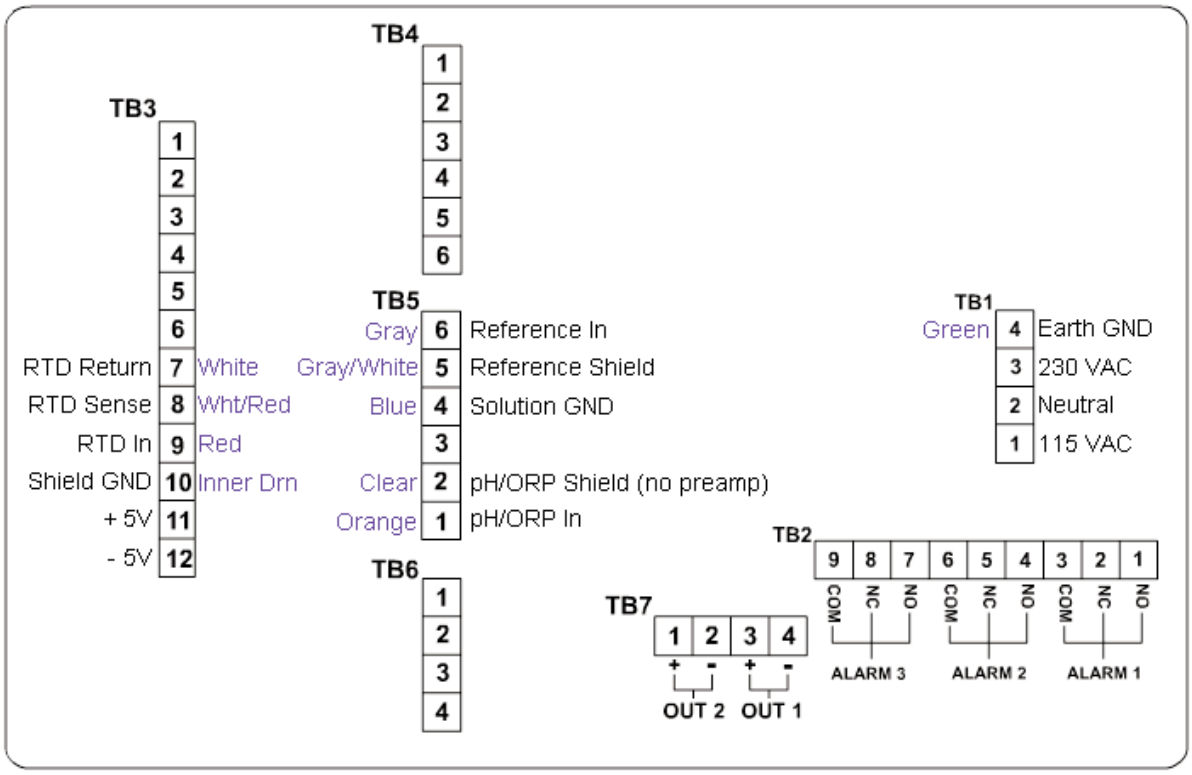


FIGURE 19. 3900-02 and 3900VP-02 to Model 1055

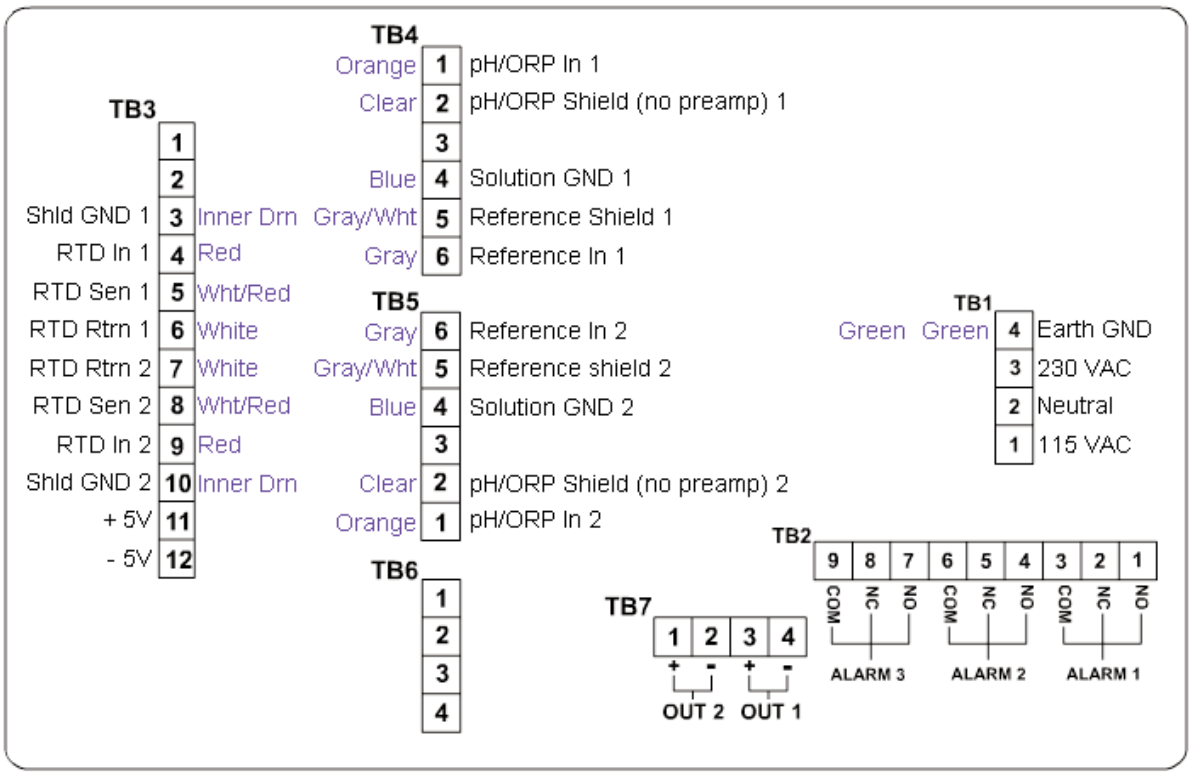


FIGURE 20. Two-Input 3900-02 and 3900VP-02 to Model 1055

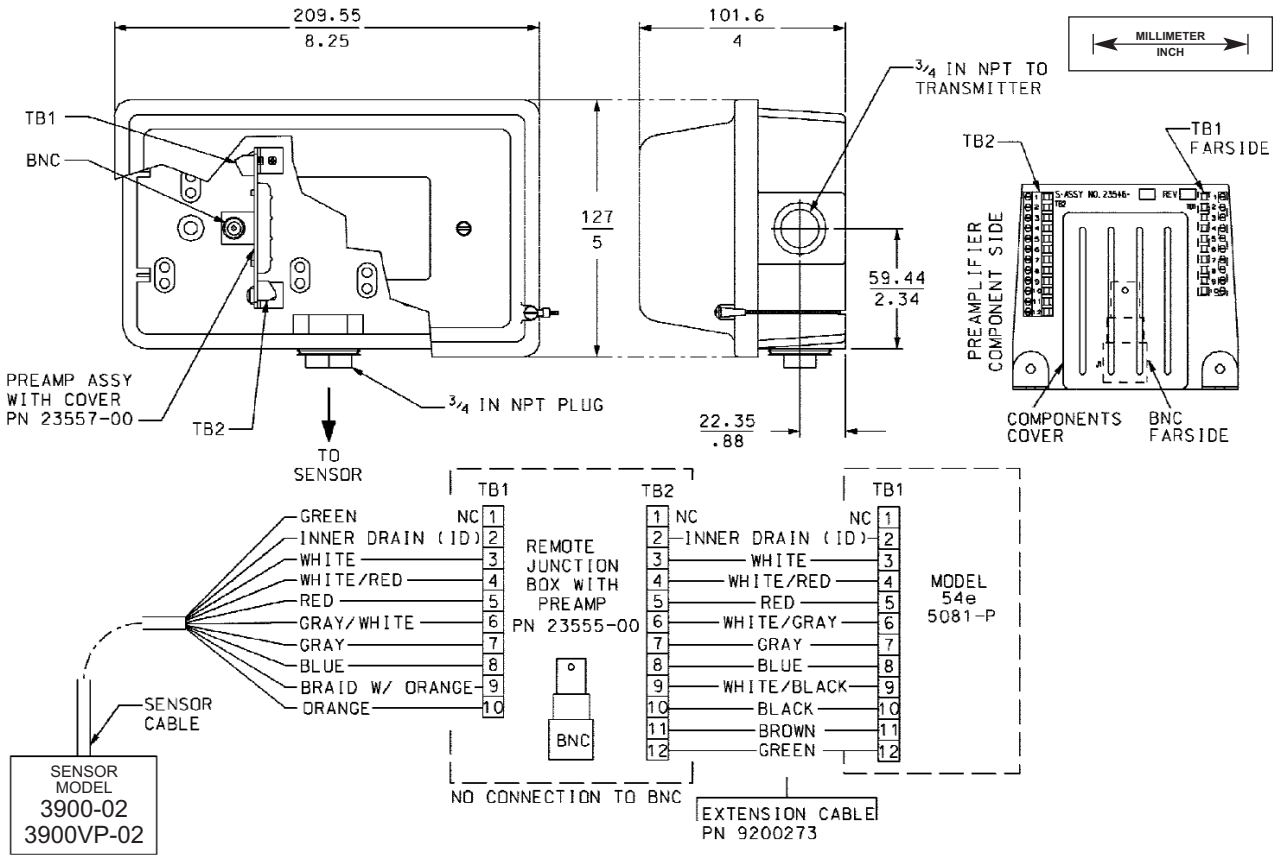


FIGURE 21. Wiring with Remote Junction Box and Preamp (PN 23555-00) to 3900-02 and 3900VP-02

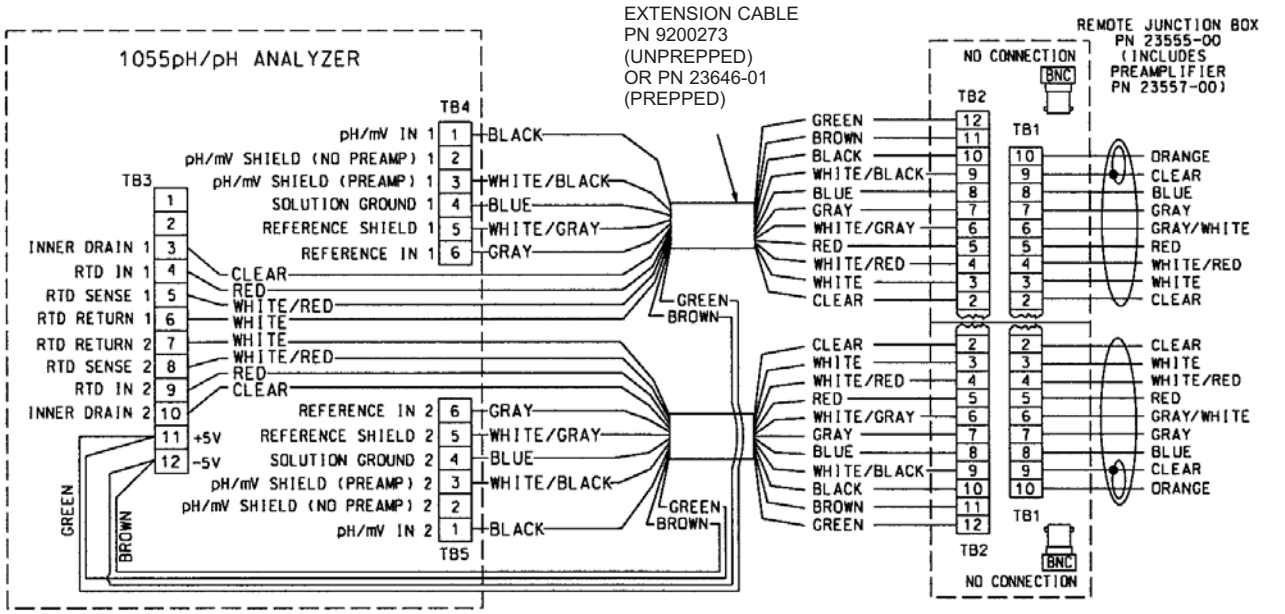


FIGURE 22. Model 1055pH/pH Wiring through Remote Junction Boxes to 3900-02 and 3900VP-02

MODEL 3900/3900VP PH/ORP SENSOR – ORDERING INFORMATION

The Model 3900/3900VP pH/ORP Sensor is housed in a PSS plastic body with built-in solution ground for advanced diagnostics. A Pt-100 RTD is offered for temperature compensator. The sensor is available with an integral cable or VP8 connector. Junction box kits with preamplifiers can be ordered separately if an analyzer/ transmitter with an integral preamplifier is not located within 15 ft. of the sensor. SMART preamplifier (-01) is the standard preamplifier option, and is compatible with Models XMT, 3081, 5081, 6081, 54e, 1055 and 1056 analyzers/transmitters.

Model 3900	pH/ORP Sensor - New Generation general purpose sensor
CODE	**PREAMPLIFIER OPTION**
01	Preamplifier
02	No preamplifier

CODE	MEASURING ELECTRODE
10	General Purpose Low resistivity GPLR pH Glass (0 - 14pH)
12	platinum ORP

EXAMPLE 3900 - 01 - 12

Model 3900VP	pH/ORP Sensor - New Generation general purpose sensor with VP
CODE	**PREAMPLIFIER OPTION**
01	Preamplifier
02	No preamplifier

CODE	MEASURING ELECTRODE
10	General Purpose Low resistivity GPLR pH Glass (0 - 14pH)
12	Platinum ORP

EXAMPLE 3900VP - 02 - 10

ACCESSORIES

Other Accessories	
PART NUMBER	**DESCRIPTION**
24281-00	15 ft. cable with mating VP8 connector
24281-01	25 ft. cable with mating VP8 connector
24281-02	2.5 ft. cable with mating VP8 connector
24281-03	50 ft. cable with mating VP8 connector
24281-04	100 ft. cable with mating VP8 connector
24281-05	4 ft. cable with mating VP8 connector
24281-06	10 ft. cable with mating VP8 connector
24281-07	20 ft. cable with mating VP8 connector
24281-08	30 ft. cable with mating VP8 connector
12707-00	Jet cleaner
23242-02	Insertion adapter
24091-00	Low flow cell
23555-00	Junction Box with Preamplifier for Models 54e, 3081, 4081, 5081, XMT, 1055, 1056
2002011	CPVC flow through Tee, 1-1/2 in. NPT process connection
11275-01	Sensor handrail assembly
9210012	Buffer solution, 4.01 pH, 16oz
9210013	Buffer solution, 6.86 pH, 16oz
9210014	Buffer solution, 9.18 pH, 16oz
9200273	Extension cable, gray
9200348	Extension cable, blue

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