

Rosemount™ 245

Toroidal Flow-Through Conductivity Sensor



About This Document

This manual contains instructions for installation and operation of the 245 Sanitary Flow-Through Toroidal Conductivity Sensor. The following list provides notes concerning all revisions of this document.

Rev. Level	Date	Notes
A	2/04	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	1/08	Addition of section 1.7 on page 5
C	3/12	Update pages 12 and 16
D	01/14	The manual has been reformatted to reflect the Emerson documentation style and updated to reflect any changes in the product offering. Wiring diagrams were also added under Section 1.

Essential Instructions

Read this page before proceeding

Rosemount 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 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, for example, ANSI B16.5. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, qualified personnel should install, operate, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Rosemount Analytical. Replacement of original components with those constructed from alternative materials will void any CSA, FM, and BASEEFA/CENELEC agency approvals that were applicable to the original device. Furthermore, replacement of original components with those constructed from alternative materials might change the pressure, temperature, and/or performance specifications from those of the original configuration. Ensure replacement parts are compatible with process requirements. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, and 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**

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, BASEEFA/CENELEC, or ATEX) hazardous area classification requirements. Consult your analyzer/transmitter instruction manual for details.

Replacement of original components with those constructed from alternative materials will void any CSA, FM, and BASEEFA/CENELEC agency approvals that were applicable to the original device.

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

CAUTION: SENSOR/PROCESS APPLICATION COMPATIBILITY

The wetted sensor materials may not be compatible with process composition and operating conditions. Replacement of original components with those constructed from alternative materials might change the pressure, temperature, and/or performance specifications from those of the original sensor configuration. Application compatibility is entirely the responsibility of the user.

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Section 1: 245 Sensor

1.1 Features and Applications

The 245 Sanitary Flow-Through Toroidal Conductivity Sensor is intended for use in the pharmaceutical, biopharmaceutical, and food and beverage industries where a conductivity sensor that does not obstruct the process flow is required.

The sensor consists of two toroids surrounding a PEEK liner through which the liquid flows. An alternating voltage applied to the first toroid induces a voltage in the liquid, which causes an ionic current to flow. The ionic current is directly proportional to the conductance of the liquid. The ionic current, in turn, induces a proportional current in the second toroid. The analyzer measures this current and displays the conductivity of the liquid.

For a current to flow in the second toroid, a complete electric circuit must exist around the toroids. The sample passing through the toroid openings forms part of the circuit. The metal mounting flanges at the end of the sensor, which contact the liquid and are connected by the metal housing passing outside the toroids, complete the circuit.

The 245 sensor is available with 0.5, 1.0, 1.5, and 2 inch Tri Clamp connections. The liner meets the requirements of 21CFR177.2415, and the O-rings meet 21CFR177.2600. Both the liner and the O-rings are compliant with USP Class VI requirements.

The 245 sensor is easy to install. It clamps into the process piping between two Tri Clamp flanges. Installation of special grounding rings is not needed because contact rings are already built into the sensor. A junction box to facilitate wiring is included.

Conductivity depends strongly on temperature, and conductivity measurements are typically corrected to a reference value. A Pt 100 or Pt 1000 RTD, provided by the user, can be wired into the sensor junction box, allowing the analyzer to measure temperature and use it for automatic temperature correction.

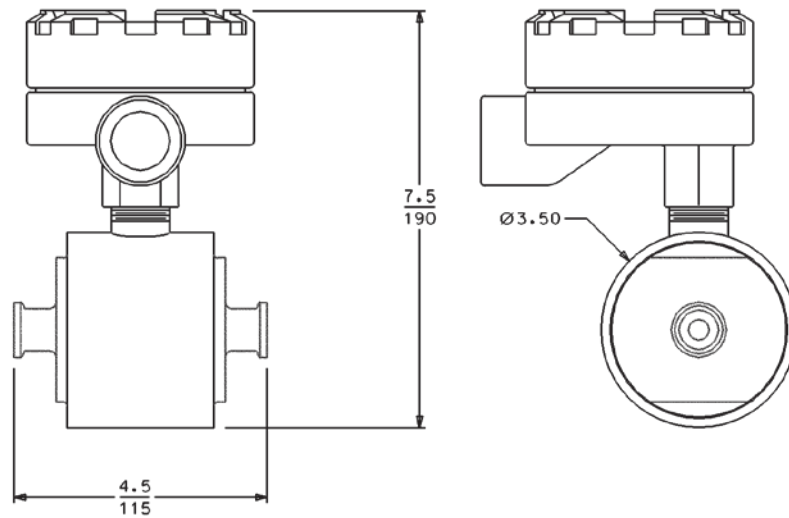
The 245 is not sensitive to flow rate or direction. It does not obstruct the process flow.

The 245 Sanitary Flow-Through Conductivity Sensor is compatible with the 1056, 56, 5081T, and 1066-T.

1.2 Specifications

Installation Type:	Flow through
Conductivity Range:	Consult analyzer product data sheet
Process Connections:	½ inch, 1 inch, 1 ½ inch, and 2 inch
Wetted Materials:	316L stainless steel (mounting flanges); unfilled PEEK (liner); EPDM (O-rings). PEEK liner meets 21CFR177.2415 and USP Class VI. EPDM O-rings meet 21CFR177.2600 and USP Class VI,
Surface Finish:	Mounting flanges have a 16 micro inch (0.41 µm) Ra surface finish. PEEK liner has a 32 micro inch (0.81 µm) Ra surface finish.
Minimum Temperature:	32 °F (0 °C)
Maximum Temperature:	250 °F (121 °C) continuous; 266 °F (130 °C) in steam for 45 minutes
Maximum Pressure	(½ inch sensor only): 300 psig (2170 kPa abs)
Maximum Pressure (all others):	100 psig (791 kPa abs)
Shipping Weight:	9 lb (4.5 kg)

Figure 1-1 Sanitary Flow-Through Toroidal Conductivity Sensor



1.3 Ordering Information

The 245 Sanitary Flow-Through Sensor is configurable to meet the needs of many applications and installations. A NEMA 7D junction box is also included. Compatible instruments include Rosemount 1056, 56, 5081T, and 1066-T.

The extension cable required for wiring from the junction box to the instrument is ordered separately. The customer supplies the mating flanges, clamps, gaskets, and Pt 1000 RTD.

Model 245	Sanitary Flow-Through Toroidal Conductivity Sensor	
CODE	LINE SIZE (Required Selection)	
01	½"	
02	1"	
03	1-½"	
04	2"	
CODE	PROCESS CONNECTION (Required Selection)	
12	Tri Clamp	
CODE	CONTACT RING MATERIAL (Required Selection)	
SS	316L Stainless Steel	
CODE	LINER MATERIAL (Required Selection)	
PK	unfilled PEEK	
CODE	PROCESS O-RING MATERIAL (Required Selection)	
EP	EP O-rings	
245	-01 -12 -SS -PK -EP	EXAMPLE

Accessories

Part #	Description
23909-00	Extension cable, prepped, for connection to instruments 1056, 56, 5081, 1066-T (Specify length)
24086-00	RTD Mounting Accessory Kit, consisting of ¾" NPT tee, nipple, and cable connectors

1.4 Installation

Before starting installation, determine whether the analyzer/transmitter will be calibrated at the bench or on-line. If bench calibration is to be performed, wiring instructions can be found at the end of this section and calibration procedures can be found in Section 1.5.

Installation of the 245 Flow Through Sensor is similar to installation of a section of pipe. Consequently, be prepared to use tools, supplies, equipment, and techniques similar to those used to install process pipes. Use common piping practices to minimize torque and bending loads on process connections. Observe all applicable safety standards. Dimensional information is shown in Figure 1-2 below.

Note

1. The sensor should be installed into a straight section of piping at least 4 pipe diameters in length on either side of the sensor to optimize sensor performance.
2. The sensor should be installed at an orientation that will keep the sensor filled with process solution at all times during which measurements are being made. Avoid downward flowing solutions as such a configuration might leave the sensor partially empty.

Installing the Sensor in the Process Line

1. Install Tri-Clamp flanges onto pipes in accordance with applicable instructions, standards, and local regulations.
2. Position the sensor between the Tri-Clamp flanges with the flange gaskets inserted between each set of flanges. Ensure that the locations of the junction box connection and the RTD are suitable for ease of the remainder of installation, wiring, and use.

Installing the Pt100 RTD

1. Use of the optional Pt100 RTD is recommended. Use of a customer-supplied Pt100 or Pt1000 TC mounted in a separate thermowell is also acceptable.
2. Thread the RTD wires into junction box. Wire the RTD to the j-box terminals as indicated in Figure 1-4. Use of optional kit PN 24086-00 is recommended.

Extension Cable Hook-Up

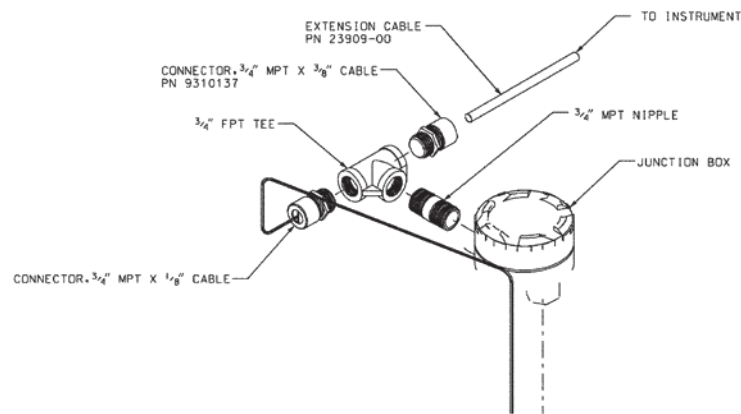
1. Sensor cable should not be run in conduit or open trays with any A.C. power wiring, nor routed near heavy electrical equipment.
2. For best sensor/instrument loop performance, using the preprepared extension cable (PN 23909-00) is recommended. (Using a different cable can introduce noise into the signal and/or reduce loop accuracy.)
3. One end of extension cable (PN 23909-00) has 8 wires, and the other end has 11 wires. Refer to Figure 1-4. The end with only 8 wires goes into the junction box. The end with 11 wires goes to the instrument.

Note

If starting with unprepped cable (PN 9200276), remove only as much insulation as is necessary. The instrument end needs 11 leads: four leads from the green-white-black-drain bundle, three from each of the two coaxial cable bundles (the inner conductor, the insulating braid, and the drain wire), and one from the outermost overall braided-copper shield. For the junction-box end, only 8 leads are used: the white coaxial conductor, its braided shield, the green coaxial conductor, its braided shield, its drain wire, and the green, white, and black conductors from the green-white-black-drain bundle. The remaining shields and drain wires are not used on the J-box end and should be removed -- they should NOT be connected or allowed to short to any other conductor or the junction box.

4. Connect the 8 wires of the extension cable to the terminal block inside the sensor's junction box as indicated in Figure 1-3 and Figure 1-4.
5. Connect the 11 wires of the instrument-end of the extension cable according to the applicable diagram from Figures 1-5 through 1-9, the Wiring Instruction Sheet, or the instrument's instructions.

Figure 1-2 245 Junction Box with RTD Diagram (use of optional kit PN 24086-00 is recommended)



1.5 Calibration

Before starting the calibration, enter the nominal cell constant into the analyzer. See Table 1-1. The accuracy of the nominal cell constant is probably no better than 10%. For greater accuracy, calibrate the sensor.

Table 1-1 Nominal Cell Constants for 245 Sensors

Sensor Size	Nominal Cell Constant
1/2"	8
1"	2
1.5"	1.6
2"	1.3

1.5.1 Calibration against a standard solution

1. Obtain a suitable conductivity standard. If the sensor is being used to measure a broad range of conductivity, choose a standard in the midpoint of the operating range. Otherwise, choose a standard near the expected process conductivity.
2. Attach a blank flange to one end of the sensor. Stand the sensor on the sealed end.
3. Decide whether temperature correction is needed.
 - a. If the conductivity of the standard as a function of temperature is known, configure the analyzer to measure raw conductivity (no temperature correction). Also, obtain a calibrated thermometer. Place the thermometer in a beaker of water next to the sensor. **DO NOT PUT THE THERMOMETER IN THE SENSOR.**
 - b. If the conductivity of the standard is known only at 25 °C, leave the analyzer slope temperature correction on and set the temperature coefficient to the appropriate value. If the temperature coefficient is not given, consult the manufacturer of the standard. Also, obtain a calibrated Pt 100 RTD and connect it to the analyzer. See Wiring Diagrams. Place the RTD in a beaker of water next to the sensor. **DO NOT PUT THE RTD IN THE SENSOR**
4. Fill the sensor with standard. Be sure no air bubbles are sticking to the liner and the sensor is completely filled.
5. Wait for the standard and the water in the beaker containing the thermometer or RTD to come to thermal equilibrium.
6. Refer to the analyzer instruction manual and adjust the analyzer display to match the conductivity of the standard at either the temperature of the standard (step 3a) or at 25 °C (step 3b).

1.5.2 In-line calibration against a laboratory measurement

1. Install the sensor in the process piping.
2. Obtain and calibrate a laboratory conductivity meter and sensor capable of measuring the conductivity of the process liquid.
3. Collect a sample of the process liquid and measure the conductivity using the laboratory instrument. The temperature of the sample is likely to change during handling. For this reason, use temperature compensation in both the process and laboratory analyzer. Be sure the temperature correction algorithms are identical.
4. Refer to the analyzer instruction manual and adjust the analyzer display to match the conductivity measured in the laboratory.

1.6 Calibration Verification

Calibration verification is a way of monitoring changes that might occur in the external toroids during service. It does not detect changes in the contact rings. It is not a calibration.

1. Empty and dry the sensor.
2. Attach a resistance decade box to the two yellow wires. See Figure 2-1.
3. Configure the analyzer to measure raw conductivity (no temperature compensation).
4. Adjust the resistance until the analyzer display reads the same number it did during calibration. Record the resistance value, the displayed value, and the temperature.

Calibration verification can be used to check the toroids while the sensor is in the process line.

1. Drain the process line.
2. Connect a resistance decade box to the yellow wires.
3. Configure the analyzer to measure raw conductivity.
4. Set the decade box to the value noted in step 4 above. The analyzer reading should match the original reading to within $\pm 20\%$.

1.7 Wiring

NOTE

For additional wiring information on this product, including sensor combinations not shown here, please refer to the [Liquid Transmitter Wiring Diagrams](#).

Figure 1-3 Sensor to Junction Box Wiring

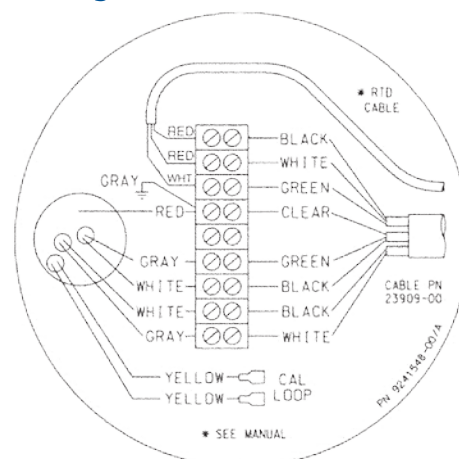


Figure 1-4 Extension Cable

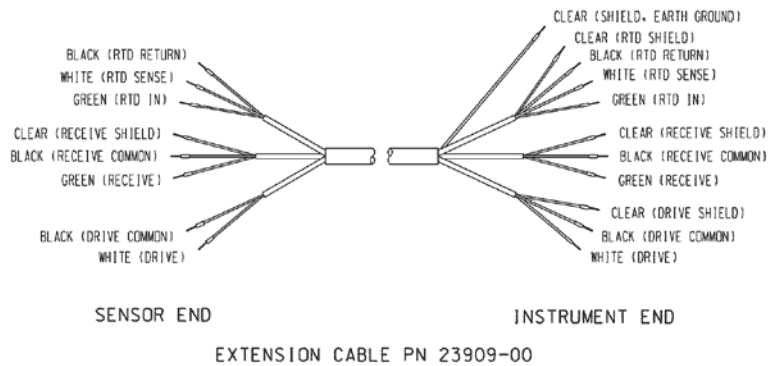


Figure 1-5 Wiring extension cable to 54ec

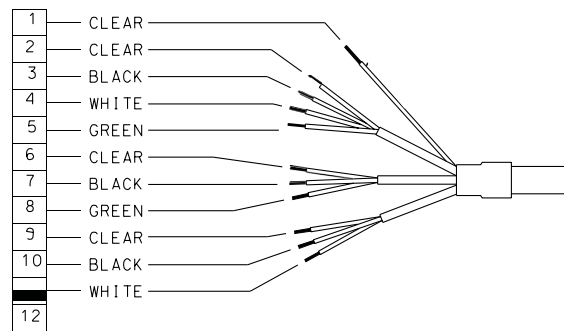


Figure 1-6 Wiring extension cable for 1056 and 56

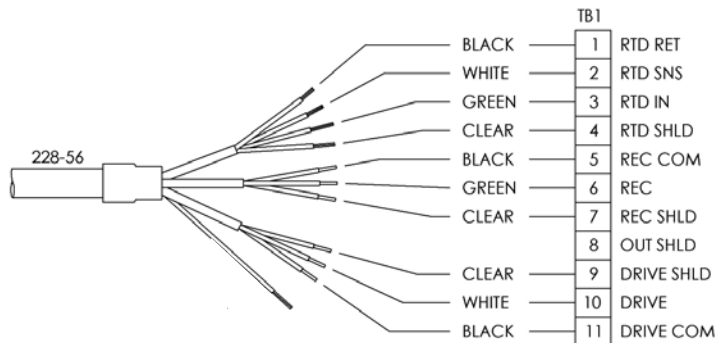


Figure 1-7 Wiring extension cable to Xmt-T (Panel Mount)

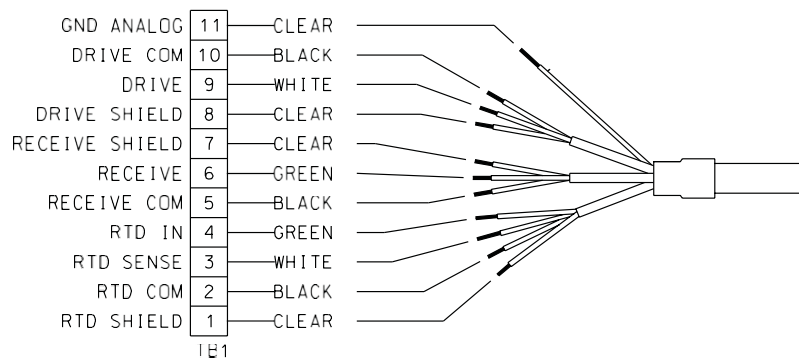


Figure1-8 Wiring extension cable to Xmt-T (Pipe/Wall Mount)

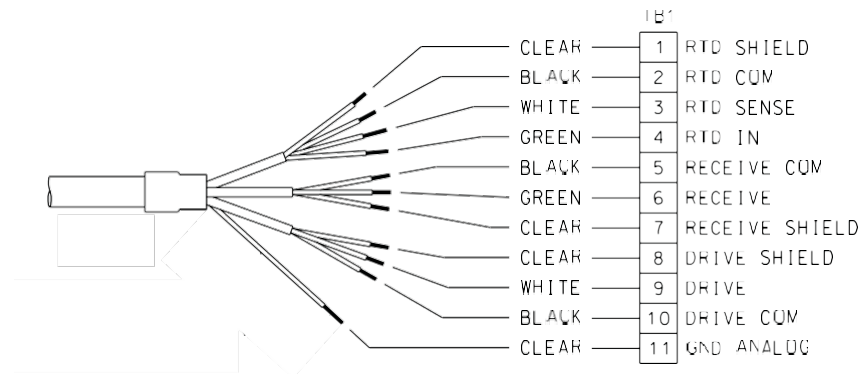


Figure1-9 Wiring extension cable to 1066-T

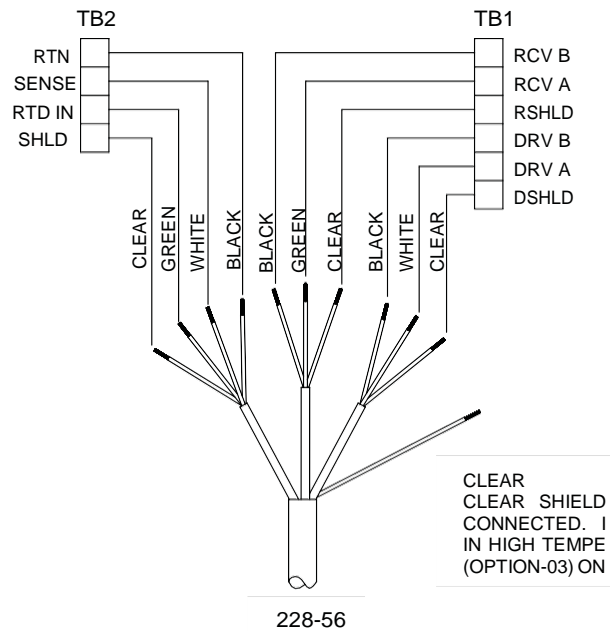
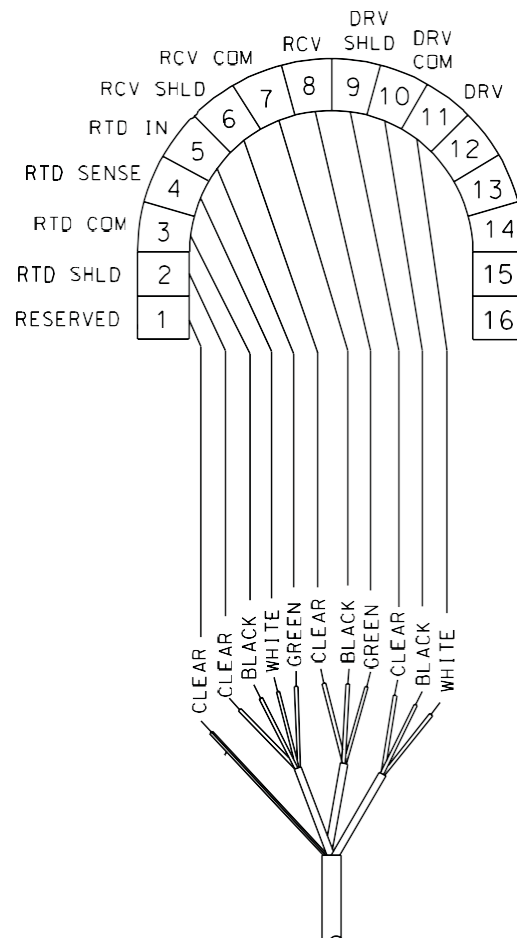


Figure 1-10 Wiring extension Cable to 5081T



1.8 Maintenance

The only routine maintenance required during the operational life of the sensor is to ensure that there are no deposits plugging the sensor or coating the inside of the contact rings. Some customers find it advantageous to periodically replace process (Tri-Clamp) gaskets to ensure adequate process seals. Rebuilding the sensor must be done at the factory.

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Section 2: Troubleshooting

2.1 Troubleshooting

To check the toroids, recall the data obtained during the Calibration Verification Process (see Section 1.6). With the sensor empty of process fluids (preferably also clean and dry), reapply the resistance to the yellow Cal Loop wires in the junction box. The reading should be within + 20% of its original value.

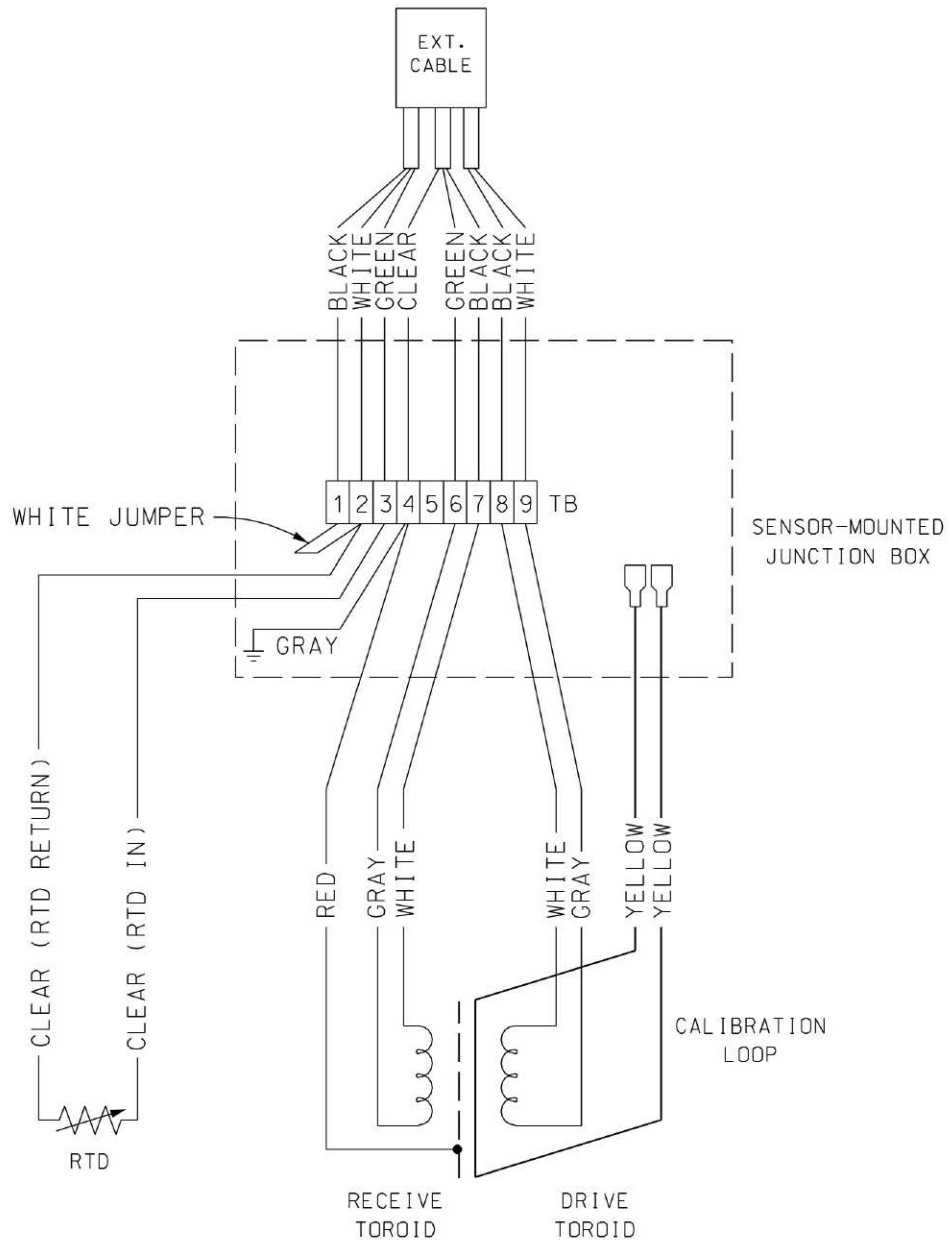
To check the RTD, disconnect RTD leads of the interconnecting cable (PN 23909-00) and measure the resistance across the white and one of the red RTD wire terminals in the junction box. See Figure 1-4. The resistance value should be close to the applicable value shown in Table 2-1.

Finally, check the sensor for open connections and short circuits. Be sure to disconnect the cable (PN 23909-00) before checking. See Table 2-2 and Figure 2-1.

Temperature (°C/°F)	Resistance (Ohms)	
	Pt 100	Pt 1000
18 / 64.4	106.9	1069
19 / 66.2	107.3	1073
20 / 68.0	107.7	1077
21 / 69.8	108.1	1081
22 / 71.6	108.4	1084
23 / 73.4	108.9	1089
24 / 75.2	109.2	1092
25 / 77.0	109.6	1096
26 / 78.8	110.0	1100
27 / 80.6	110.4	1104

Connection (wire or component connections)	Resistance
Each twisted pair, WHITE to GRAY	0.4 to 0.9 Ω
YELLOW to YELLOW	0.1 to 0.5 Ω
WHITE to WHITE	> 20 MΩ
RED to YELLOW	> 20 MΩ
RED to each WHITE	> 20 MΩ
YELLOW to each WHITE	> 20 MΩ
ALL except RED to housing EARTH screw	> 20 MΩ
RED to housing EARTH screw	0.1 to 0.5 Ω

Figure 2-1 Sensor Circuit for Troubleshooting



www.Emerson.com/RosemountLiquidAnalysis



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Emerson Automation Solutions

8200 Market Blvd.
Chanhassen, MN55317,
USA
Tel +1 800 999 9307
Fax +1 952 949 7001

Liquid.CSC@Emerson.com

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