Quick Start Guide
LIQ-QSG-225, Rev L
May 2017

Rosemount™ 225

Toroidal Conductivity Sensor

ROSEMOUNT

EMERSON

Safety Information

⚠ WARNING!

HIGH PRESSURE AND TEMPERATURE HAZARD

Before removing the senosr, reduce the process pressure to 0 psig and cool down the process temperature.

Failure to reduce the pressure and temperature may cause serious injury to personnel.

⚠ CAUTION!

EQUIPMENT DAMAGE

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

Contents

1 Description and Specifications

1.1 General

Rosemount 225 toroidal conductivity sensors are intended to be used in many pharmaceutical and food and beverage applications where a sanitary design is required. These corrosion and fouling resistant sensors are ideal for measuring the concentration of CIP solutions, detecting product/water interfaces, checking product quality, and monitoring eleuents in chromatographic separations.

1.2 Unpacking and Inspection

1. Inspect the shipping container. If it is damaged, contact the shipper immediately for instructions.
2. If there is no apparent damage, remove the sensor.
3. Ensure that all items shown on the packing list are present. If items are missing, contact your local Customer Care representative.
4. Save the shipping container and packaging.

   They can be reused to return the sensor to the factory in case of damage.

1.3 Specifications

Table 1-1: Specifications

Cell Constant (Nominal)	2.7/cm
Minimum Conductivity	200 µS/cm (15 µS/cm when used with Rosemount 1056 and 56 transmitters)
Maximum Conductivity	2 S/cm
Process Connection	2-inch Tri-Clamp
Conformance to 3-A Sanitary Standards	Sensors with option -07 meet 3-A sanitary standards for sensors and sensor fittings and connections used on milk and milk products equipment (74-06).
Compliance with FDA Food Contact Requirements	Sensors with option -07 are molded from PEEK that meet 21CFR177.2415.
Compliance with USP Class VI	Sensors with option -08 are molded from PEEK that meet USP Class VI requirements.
Cable Length	20 ft (6.1 m)
Maximum Cable Length	200 ft (61 m)
Weight/Shipping Weight	2 lb/3 lb (1.0 kg/1.5 kg)

Table 1-2: Options

Body Material Option	Wetted Materials	Maximum Temperature	Maximum Pressure
03	Glass-filled PEEK	230 °F (110 °C)	200 psig (1480 kpa [abs])
07	Unfilled PEEK (meets 21CFR177.2415 and 3A standard 74-06)	266 °F (130 °C)	
08	Unfilled PEEK (meets USP VI standards)		
09	Unfilled Tefzel	230 °F (110 °C)	

Table 1-3: Rosemount 225 Sanitary Toroidal Conductivity Sensor Ordering Information

Model	Sensor Type
225	Toroidal Conductivity Sensor
Body Material & Mounting Type	
03	Glass-filled PEEK with tri-clamp
07	Unfilled PEEK with tri-clamp
08	USP Class VI unfilled PEEK with tri-clamp(1)
09	Unfilled Tefzel(2)
Transmitter Compatibility	
54	Standard integral cable
56	Integral cable with additional shielding for improved EMI/RFI protection(3)
Typical model number: 225-03-56	

(1) *Only available with -56 option.*

(2) *Only available with -56 option.*

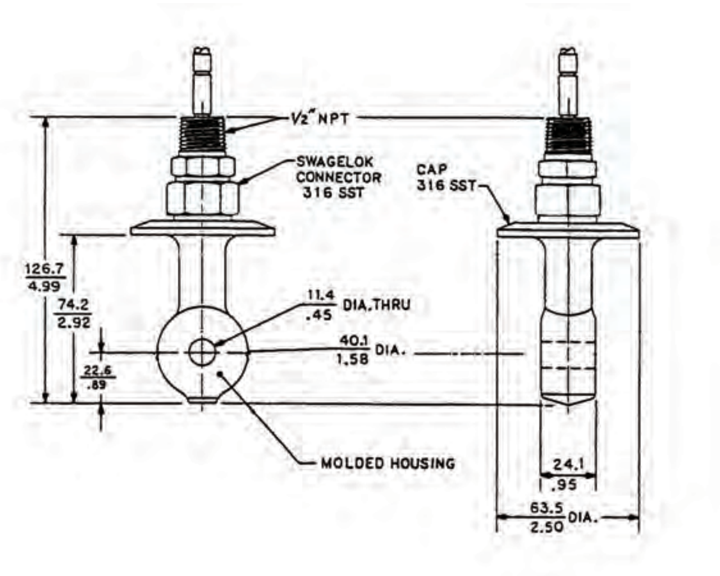
(3) *Recommended for use with Rosemount transmitter models 56, 1056, 5081, and 1066*

2 Install

2.1 Installing the sensor

The sensor may be installed in either a tank or pipe using a customer-supplied Tri-Clamp and tee assembly. Keep at least 1 in. (25 cm) between the sensor and the pipe wall. If clearance is too small, calibrate the sensor in place. Ensure that the sensor is completely submerged in liquid.

Figure 2-1: Rosemount 225 dimensional drawing



Prerequisites

1. 2 inch Tri-Clamp
2. 2 inch type 1 gasket
3. 2 inch tank ferrule or tee

Procedure

1. Mount the sensor in the pipe.
2. Mount the sensor in a vertical pipe run with flow from top to bottom.

   If the sensor must be mounted in a horizontal pipe run, orient the sensor in the or 9 o'clock position.
3. Ensure that the sensor is completely submerged in liquid to the flange.

2.2 Wiring the Sensor

Keep sensor wiring away from ac conductors and high current demanding equipment. Do not cut the cable.

NOTICE

For additional wiring information on this product, please refer to the *Liquid Transmitter Wiring Diagrams*.

Figure 2-2: Wire functions

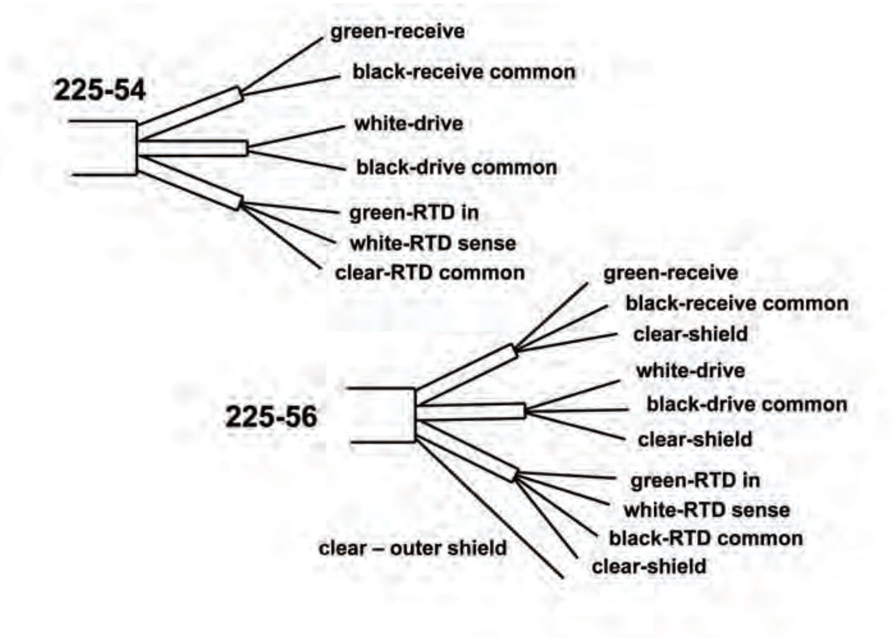
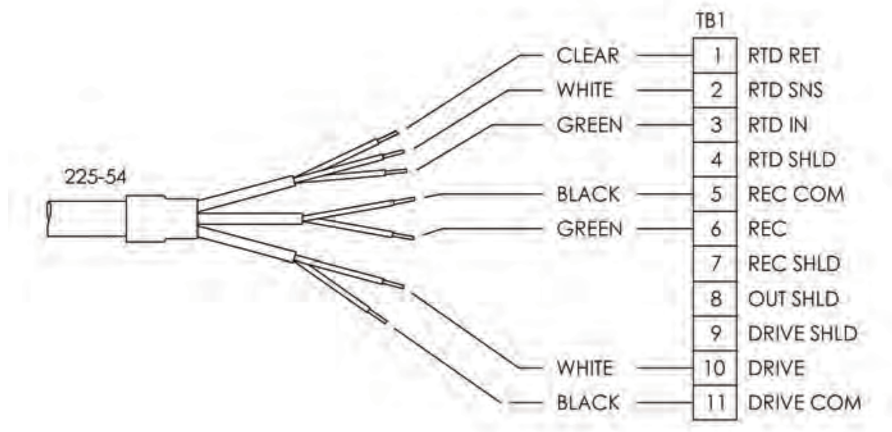


Figure 2-3: Wiring diagram for Rosemount 1056 and 56 Transmitters



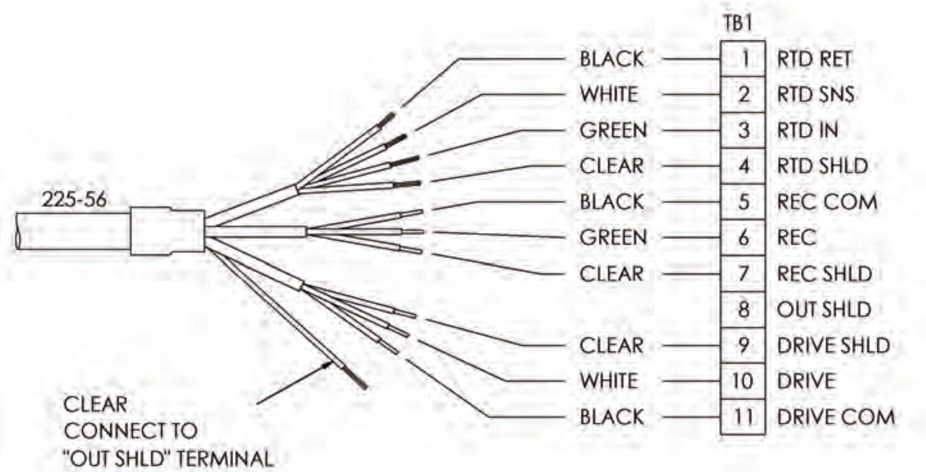
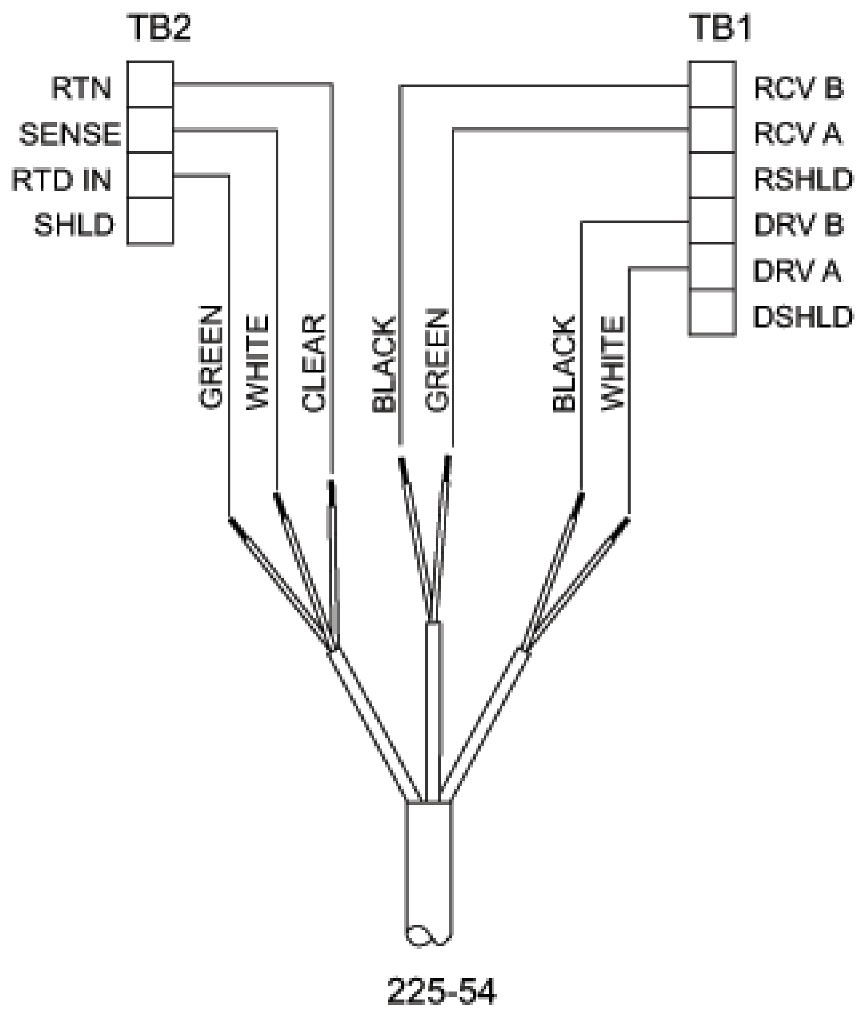


Figure 2-4: Wiring diagram for Rosemount 1066 Transmitters



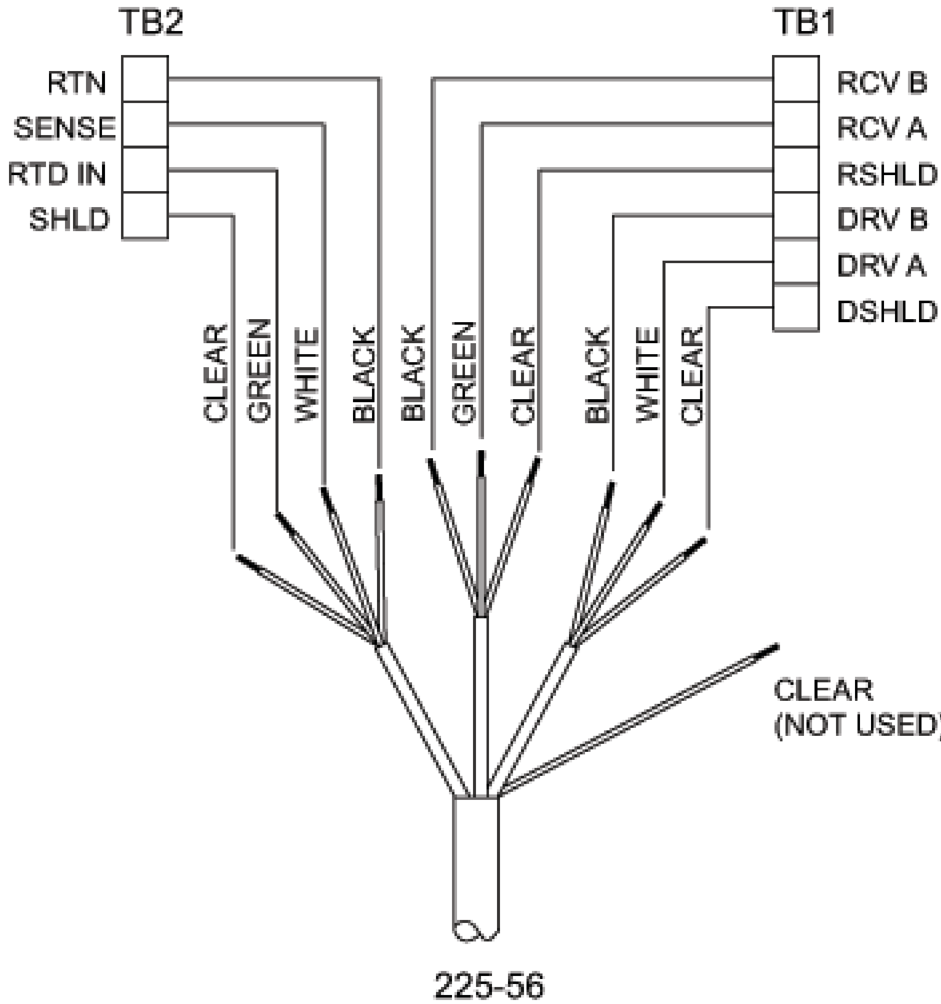

TB2
RTN
SENSE
RTD IN
SHLD
TB1
RCV B
RCV A
RSHLD
DRV B
DRV A
DSHLD
CLEAR
GREEN
WHITE
BLACK
BLACK
GREEN
CLEAR
BLACK
WHITE
CLEAR
CLEAR
(NOT USED)
225-56

Figure 2-5: Wiring diagram for Rosemount 5081 Transmitters

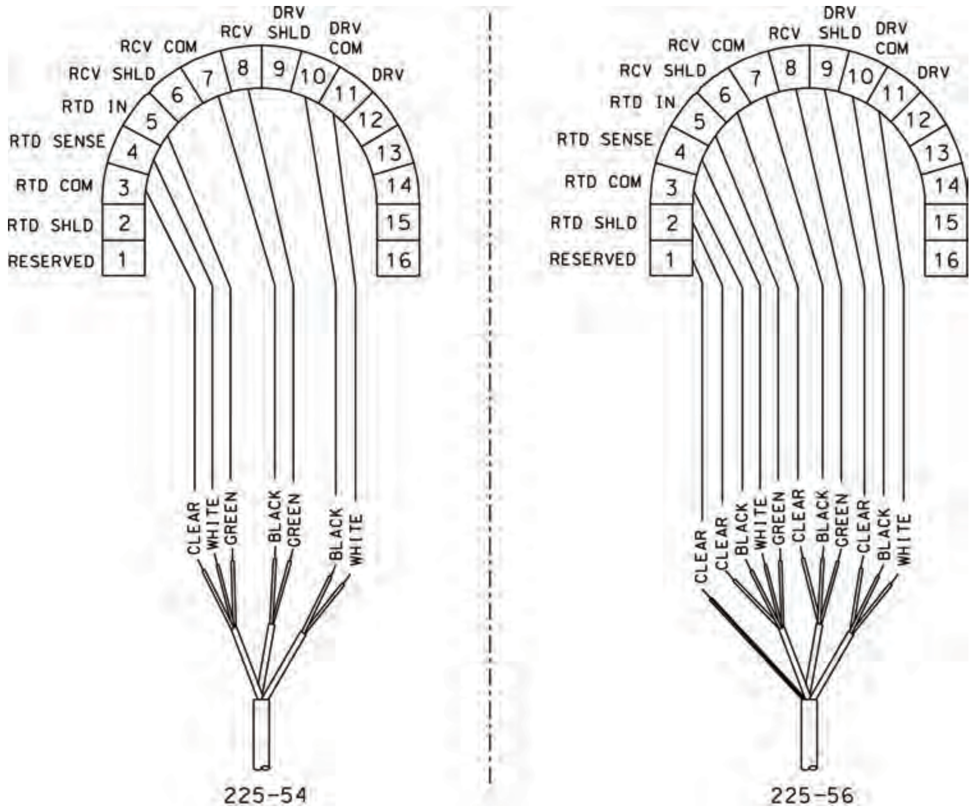
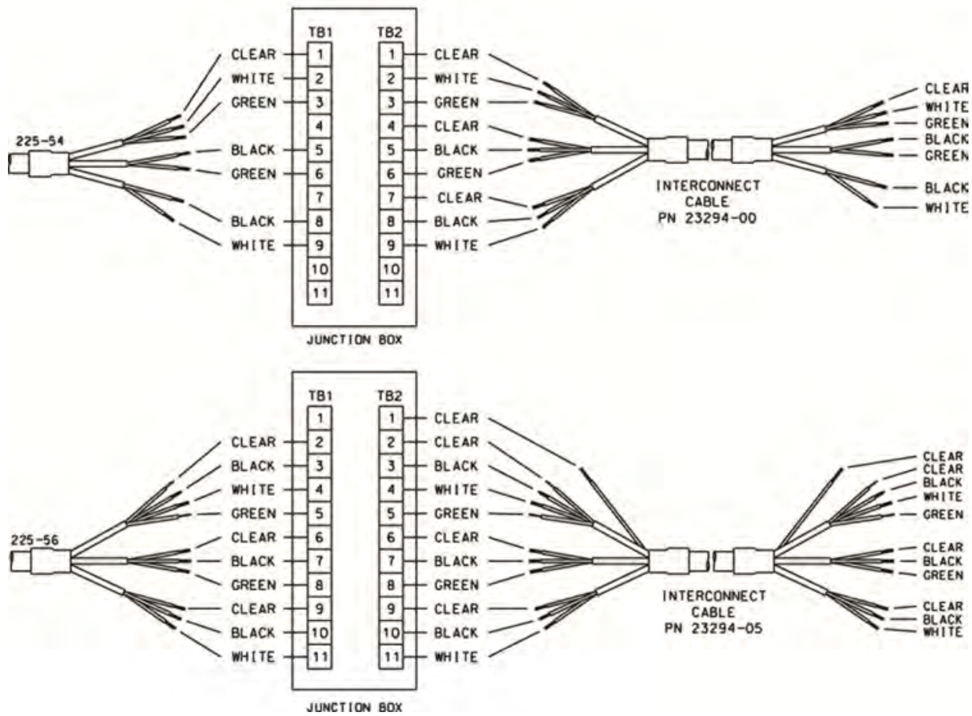
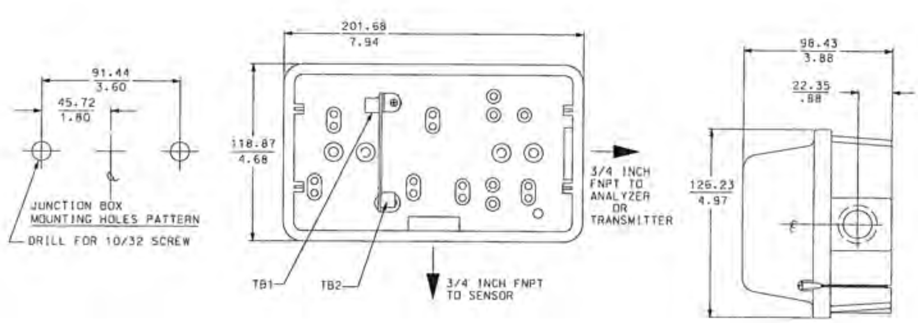


Figure 2-6: Wiring sensors through a remote junction box



Wire sensors point to point. For wiring at the transmitter end, refer to the appropriate transmitter wiring diagram. For interconnecting cable 23294-00, use the 225-54 wiring diagram. For interconnecting cable 23294-04 and 23294-05, use the 225-54 wiring diagram.

Figure 2-7: Remote Junction Box (PN 23550-00) dimensions



3 Calibration

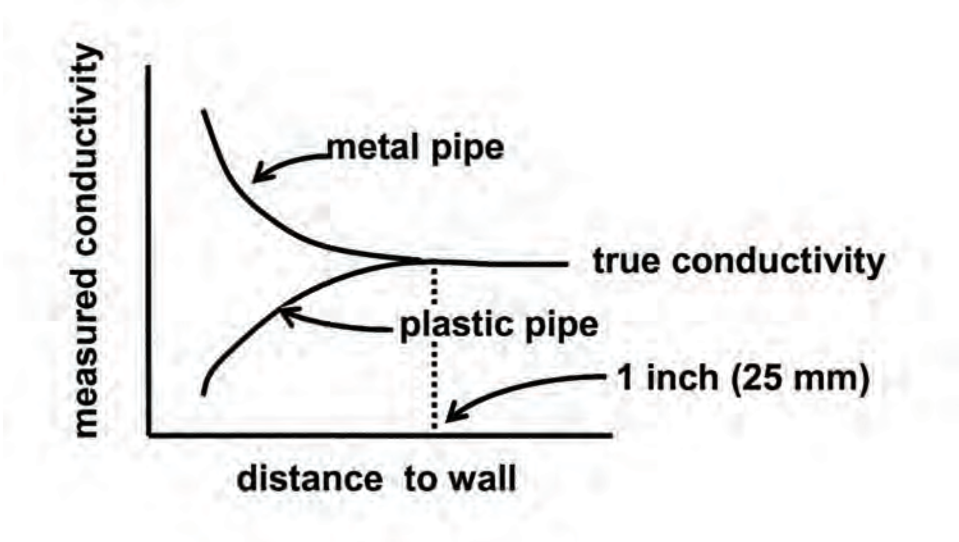
3.1 Sensor calibration

The nominal cell constant of the Rosemount 225 sensor is 2.7/cm. The error in cell constant is about ±10%, so conductivity readings made the using the nominal cell constant will have an error of at least ±10%. Wall effects,as shown in *Figure 3-1*, will likely make the error greater.

There are two basic ways to calibrate a toroidal sensor: against a standard solution or against a referee meter and sensor. A referee meter and sensor is an instrument that has been previously calibrated and is known to be accurate and reliable. The referee instrument can be used to perform either an in-process or a grab sample calibration. Regardless of the calbiration method used, the connected transmitter automatically calculates the cell constant once the known conductivity is entered.

For more detailed information on calibration methods, please reference application data sheet ADS-43-025 available on the *Emerson Liquid Analysis website*.

Figure 3-1: Measured Conductivity as a Function of Clearance between Sensor and Walls



3.2 Calibrating against a Standard Solution

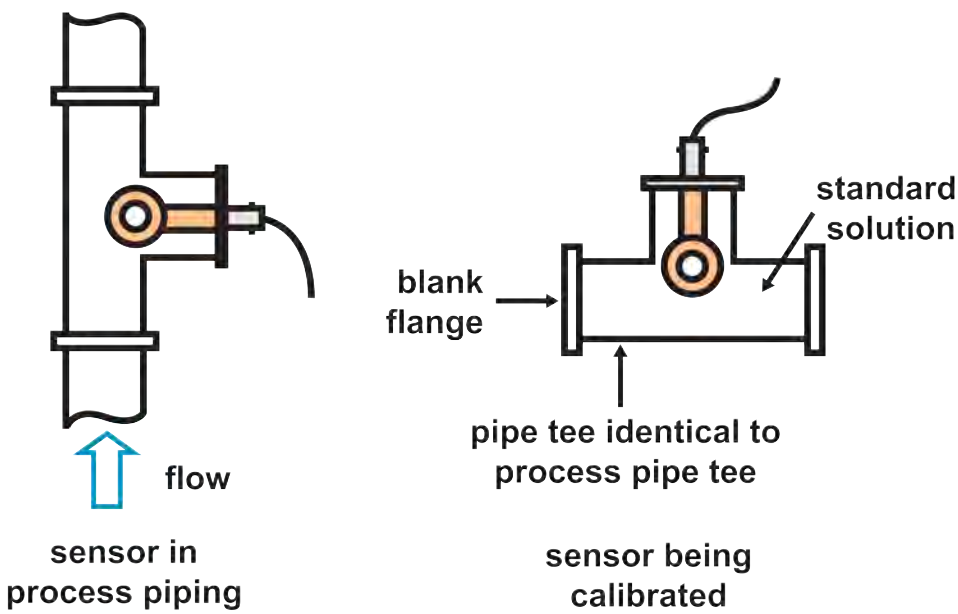
Calibration against a standard solution requires removing the sensor from process piping. This calibration method is practical only if wall effects are absent or if the sensor can be calibrated in a container identical to the process piping. Ideally, the conductivity of the standard used should be close to the middle of the range that the sensor will be used in. Generally, toroidal conductivity sensors have good linearity, and so standards greater than 5000 μS/cm at 77 °F (25 °C) may also be used.

1. Remove the sensor from the pipe.
2. Fill a container with the standard solution.

   If wall effects are absent in the process installation, use a sufficiently large container for calibration to ensure that wall effects are absent. To check for wall effects, fill the container with solution and place the sensor in the center, submerged at least 3/4 of the way up the stem. Note the reading. Then move the sensor small distances from the center and note the reading in each position. The readings should not change.

   If wall effects are present, be sure the vessel used for calibration has exactly the same dimensions as the process piping. Also ensure that the orientation of the sensor with respect to the piping is exactly the same in the process and calibration vessels. See *Figure 3-2*.

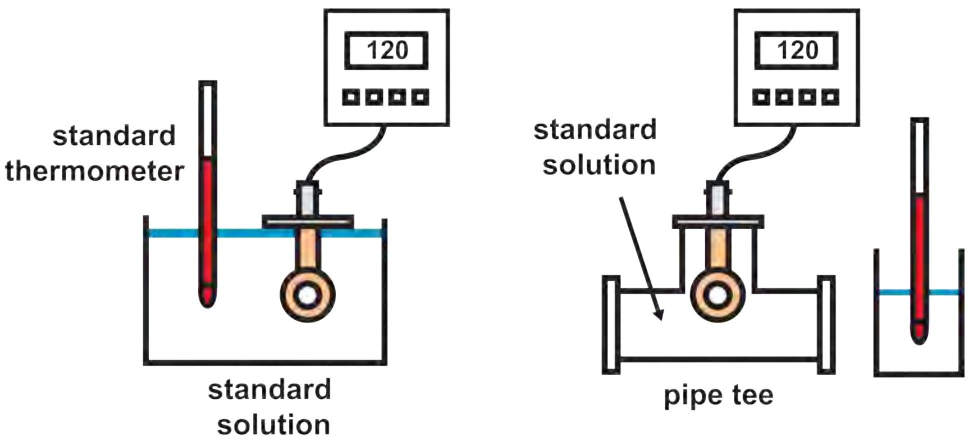
Figure 3-2: Calibration installation orientation



3. Rinse the sensor with water.
4. Immerse the rinsed sensor in the standard solution.

   Use a good quality calibrated thermometer to measure the temperature of the standard solution. The thermometer error should be less than ±1 °C. Allow adequate time for the solution and sensor to reach thermal equilibrium. If the sensor is being calibrated in an open beaker, keep the thermometer far enough away from the sensor so it does not introduce wall effects. If the sensor is being calibrated in a pipe tee or similar vessel, it is impractical to place the thermometer in the standard solution. Instead, put the thermometer in a beaker of water placed next to the calibration vessel. Let both come to thermal equilibrium with the ambient air before continuing calibration. See *Figure 3-3*.

Figure 3-3: Measuring standard temperature



Be sure air bubbles are not adhering to the sensor. An air bubble trapped in the toroid opening has a particularly severe effect on the reading.

5. Turn off automatic temperature compensation in the transmitter.

   This eliminates error in the cell constant.

6. Adjust the transmitter reading to match the conductivity of the standard.

3.3 Calibrating against a Referee - in-Process

Prerequisites

If possible, adjust the conductivity of the process liquid so that it is near the midpoint of the operating range. If this is not possible, adjust the conductivity so that it is at least 5000 µS/cm.

Turn off automatic temperature compensation in the transmitter. This eliminates error in the cell constant.

Procedure

1. Connect the process and referee sensors in a series.

   Keep tubing runs between the sensors short and adjust the sample flow to as high a rate as possible. Short tubing runs and high flow ensure that the temperature of the liquid does not change as it flows from one sensor to another.

2. Allow the process liquid to flow through both sensors.

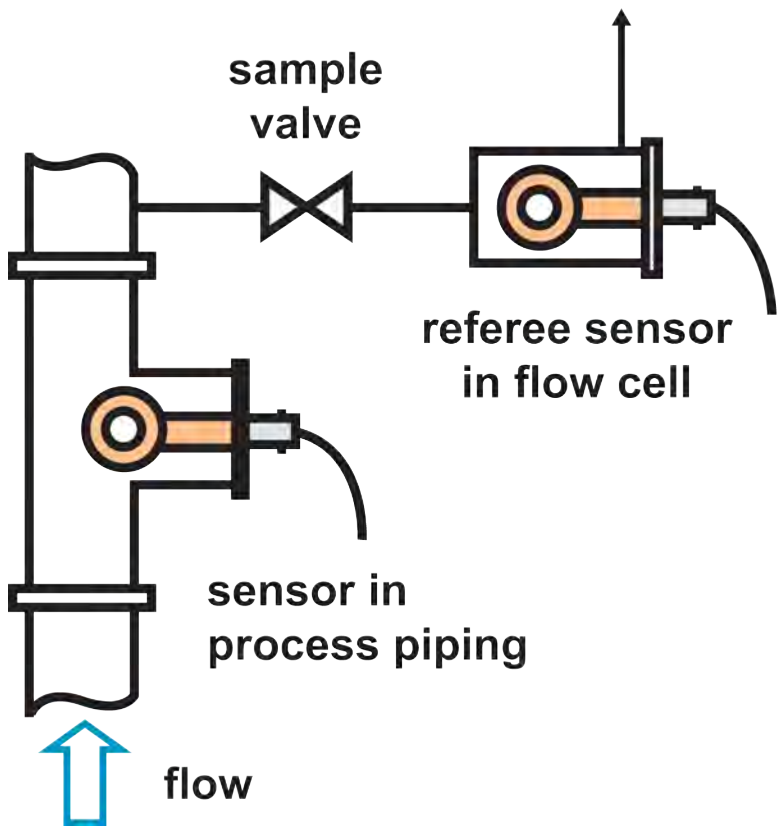
Orient the referee sensor so that the air bubbles always have an easy escape path and cannot get trapped. Tap and hold the flow cell in different positions to allow bubbles to escape.

Wait for readings to stabilize before starting the calibration.

3. Adjust the process sensor to match the conductivity measured by the referee instrument.

Figure 3-4 shows the arrangement.

Figure 3-4: Calibration with a referee instrument example



3.4 Calibrating against a Referee - Grab Sample

This method is useful when calibration against a standard is impractical or when in-process calibration is not feasible, because the sample is hot, corrosive, or dirty, making handling the waste stream from the referee sensor difficult.

1. Take a sample of the process liquid.

Take the sample from a point as close to the process sensor as possible. Be sure the sample is representative of what the sensor is measuring. If possible, adjust the conductivity of the process liquid so that it is near the midpoint of the operating range. If that is not possible, adjust the conductivity so that it is at least 5000 μS/cm.

2. Connect the process and referee sensors.

   Keep temperature compensation with the transmitter turned on. Confirm that the temperature measurements in both process and referee instruments are accurate, ideally to within ±0.5 °C.

3. Place the sensors in the grab sample.

   Wait until the readings are stable before starting the calibration.

4. Adjust the reading from the process analyzer to match the conductivity measured by the referee sensor.

4 Troubleshooting

4.1 Maintaining the sensor

⚠ WARNING!

TOXIC LIQUIDS
Be sure the sensor has been cleaned of process liquid before handling.

Generally, the only maintenance required is to keep the opening of the sensor clear of deposits. Cleaning frequency is best determined by experience.

4.2 Troubleshooting

Table 4-1: Troubleshooting

Problem	Probable cause	Solution
Off-scale reading	Wiring is wrong.	Verify and correct wiring.
	RTD is open or shorted.	Check the RTD for open or short circuits. See *Figure 4-1*.
	Sensor is not in process stream.	Confirm that the sensor is fully submerged in the process stream. See *Section 2.1*.
	Sensor is damaged.	Perform isolation checks. See *Figure 4-1*.
Noisy reading	Sensor is improperly installed in the process stream.	Confirm that the sensor is fully submerged in the process stream. See *Section 2.1*.
	Sensor cable is run near high voltage process stream.	Move cable away from high voltage conductors.
	Sensor cable is moving.	Keep sensor cable stationary.
Reading seems wrong (lower or higher than expected)	Bubbles are trapped in the sensor, particularly in the toroid opening.	Install the sensor in a vertical pipe run with the flow against the toroidal opening. Incresase flow if possible.
	Sensor is not completely submerged in the process stream.	Confirm that the sensor is fully submerged in the process stream. See *Section 2.1*.
	Cell constant is wrong. Wall effects are present.	Calibrate the sensor in place in the process piping. See *Chapter 3*.

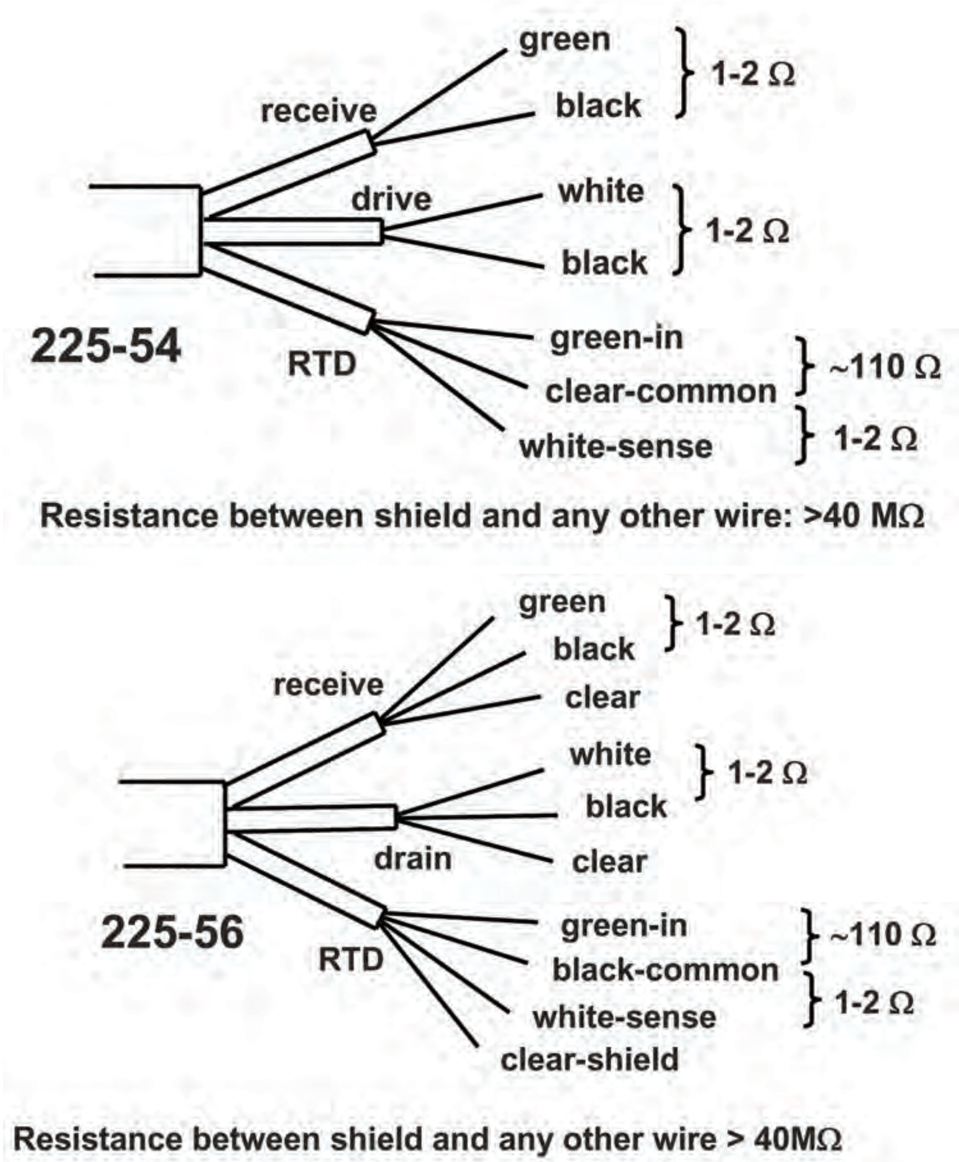
Table 4-1: Troubleshooting *(continued)*

Problem	Probable cause	Solution
	Wrong temperature correction algorithm is being used.	Check that the temperature correction is appropriate for the sample. See transmitter manual for more information.
	Temperature reading is inaccurate.	Disconnect the RTD leads (*Figure 4-1*) and measure the resistance between the in and common leads. Resistance should be close to the value in *Table 4-2*.
	Slow temperature response to sudden changes in temperature.	Use an RTD in a metal thermowell for temperature compensation.
Sluggish response	Sensor is in a dead area in the piping.	Move sensor to a location more representative of the process liquid.
	Slow temperature response to sudden changes in temperature.	Use an RTD in a metal thermowell for temperature compensation.

Table 4-2: Resistance vs. Temperature for Temperature Compensation (PT-100 RTD)

Temperature	Resistance
10 °C (50 °F)	103.9 Ω
20 °C (68 °F)	107.8 Ω
25 °C (77 °F)	109.7 Ω
30 °C (86 °F)	111.7 Ω
40 °C (104 °F)	115.5 Ω
50 °C (122 °F)	119.4 Ω

Figure 4-1: Resistance check. Disconnect leads from transmitter before measuring resistances.



5 Accessories

Part number	Description
23550-00	Remote junction box without preamplifier
23294-00	Interconnecting extension cable, unshielded, prepped (for use with remote junction box)
23294-05	Interconnecting extension cable, shielded, prepped (for use with remote junction box)
9200276	Interconnecting extension cable, shielded, unprepped (for use with remote junction box)

6 Return of Materials

For repair and warranty inquiries, please contact Rosemount Customer Care to obtain a Return Material Authorization (RMA) number. Drain the sensor of fluids before shipping it back to Rosemount.

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2017

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