Quick Start Guide
00825-0100-3228, Rev AB
March 2024

Rosemount™ 228 Toroidal Conductivity Sensors

ROSEMOUNT™

EMERSON

Safety information

⚠ WARNING

High pressure and temperature hazard

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

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

⚠ WARNING

Physical access

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental in protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

⚠ CAUTION

Equipment damage

The wetted sensor materials may not be compatible with process composition and operating conditions.

Application compatibility is entirely the operator's responsibility.

Contents

1 Description and specifications

1.1 Description

The Rosemount 228 Toroidal Conductivity Sensor uses flow-through technology to measure conductivity in highly conductive liquids up to 2 S/cm (2,000,000 µS/cm). This sensor works in dirty and corrosive applications where metal electrode sensors would otherwise fail. A robust sensor design makes the Rosemount 228 ideal for measuring concentrations of acid, base, and salt solutions.

2 Installation

2.1 Unpack and inspect

Procedure

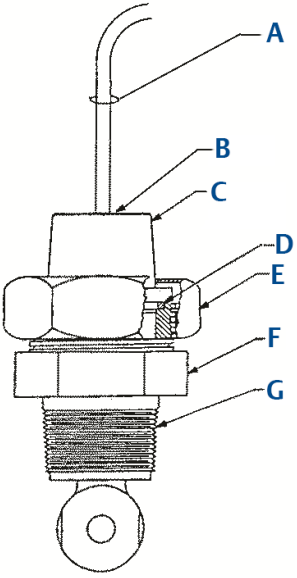
1. Inspect the shipping container(s). If there is damage, then contact the shipper immediately for instructions.
2. If there is no apparent damage, then unpack the container(s).
3. Ensure that all items shown on the packing list are present.

   If items are missing, then contact Emerson.com/global.
4. Save the shipping container and packaging.

   They can be used to return the instrument to the factory in case of damage.

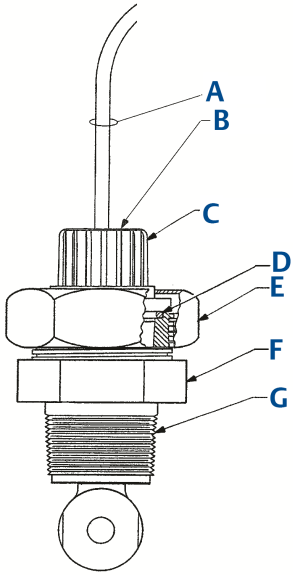
2.2 Install the sensor

Figure 2-1: Insertion Adapter 23242-02 with Rosemount 228 Toroidal Conductivity Sensor (-21 option)



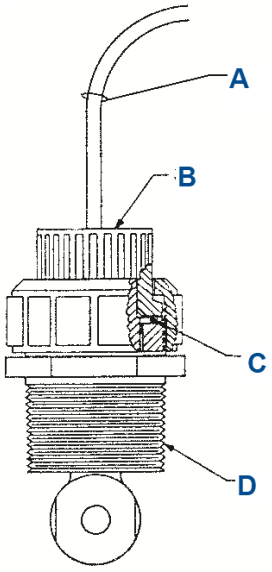
A. Cable
B. 1″ FNPT
C. Adapter ¾″ FNPT thread
D. 2-135 FKM O-ring
E. Nut, hex union 2″
F. Neck, union fitting
G. 1½″ MNPT

Figure 2-2: Insertion Adapter 23242-03 with Rosemount 228 Toroidal Conductivity Sensor (-20 option)



A. Cable
B. ¾" FNPT
C. Adapter ⅝"-11 UNC-2B x ¾" NPT
D. 2-135 FKM O-ring
E. Nut, hex union 2"
F. Neck, union fitting
G. 1½" MNPT

Figure 2-3: Insertion Adapter 2001990 with Rosemount 228 Toroidal Conductivity Sensor (-21 option)



A. Cable
B. ¾″ FNPT
C. 1-132 FKM O-ring
D. 2″ MNPT

Procedure

1. Mount the sensor in the pipe.
2. Keep at least 1 inch (25 mm) between the sensor and pipe wall.
   If the clearance is too small, calibrate the sensor in place.
3. Mount the sensor in a vertical pipe run with flow from bottom to top.
   If the sensor must be mounted in a horizontal pipe run, then orient the sensor perpendicular to the pipe flow.
4. Ensure the sensor is completely submerged in liquid.

2.3 Install the insertion/retraction assembly

2.3.1 Installation considerations

Requirements

Process connection	1½″ Larger openings may keep the sensor from inserting far enough into the process liquid.
Line size	• 2″ line (requires in-place calibration)

- 3″ line or larger

Valve	1½″ NPT full port valve (PN 9340065)
Retraction clearance	2 ft. (0.6 m)
Excess vibration	Provide mechanical support if excess vibration is expected.
Flush water	Provide ⅛″ valves in inlet and outlet flush ports. Position flush ports so the retraction chamber can be drained.

Installation specifications

Table 2-1: Sensor Specifications

Specification	Description
Wetted materials	Body materials either glass-filled PEEK, glass-filled Tefzel, or unfilled Tefzel. Option -20 has EPDM gasket
Process connection	-20: ⅝″ 11 UNC, -21: ¾″ MNPT
Cable length	20 ft. (6.1 m)
Maximum cable length	200 ft. (61.0 m)
Weight/shipping weight	2 lb./3 lb. (1.0 kg/1.5 kg)

Table 2-2: Maximum Operating Temperature and Pressure

Body material option	Maximum temperature	Maximum pressure	Maximum pressure (for CRN registration only)
-02 (Glass-filled PEEK [standard temperature])	248 °F (120 °C)	295 psig (2135 kPa)	220 psig (1618 kPa [abs])
-03 (Glass-filled PEEK [high temperature])	392 °F (200 °C)	295 psig (2135 kPa)	220 psig (1618 kPa [abs])
-04 (Glass-filled Tefzel)	248 °F (120 °C)	200 psig (1480 kPa)	150 psig (1135 kPa [abs])
-05 (Unfilled Tefzel)	248 °F (120 °C)	200 psig (1480 kPa)	150 psig (1135 kPa [abs])

Table 2-3: Insertion Adapter Specifications

Specification	23242-02	23242-03	2001990	
Sensor compatibility	Option -21	Option -20	Option -21	
Process connection	1½″ MNPT	1½″ MNPT	2″ MNPT	
Wetted materials	316 stainless steel, glass-filled PEEK, and Viton®	316 stainless steel, glass-filled PEEK, and Viton	CPVC and Viton	
Maximum temperature	392 °F (200 °C)	392 °F (200 °C)	100 °F (38 °C)	185 °F (85 °C)
Maximum pressure	295 psig (2135 kPa [abs])	295 psig (2135 kPa [abs])	100 psig (791 kPa [abs])	45 psig (412 kPa [abs])
Maximum pressure (for CRN registration only)	220 psig (1618 kPa [abs])	220 psig (1618 kPa [abs])	N/A	
Weight/ shipping weight	3 lb./4 lb. (1.5 kg/2.0 kg)	3 lb./4 lb. (1.5 kg/2.0 kg)	1 lb./2 lb. (0.5 kg/1.0 kg)	

Table 2-4: Retraction Assembly Specifications

Specification	Description
Sensor compatibility	The retraction assemblies are used with Rosemount 228 - [ ]-20-54-62 only
Wetted materials	315 stainless steel, ethylene polypropylene (EP), unfilled PTFE, carbon-filled PTFE
Process connection	1½″ MNPT
Maximum operating condition	392 °F (200 °C), 295 psig (2135 kPa [abs])

Table 2-5: Maximum Retraction/Insertion Conditions

Condition	23311-00, mechanical retraction assembly	23311-01, manual retraction assembly
Maximum temperature	392 °F (200 °C)	266 °F (130 °C)
Maximum pressure	295 psig (2135 kPa [abs])	35 psig (343 kPa [abs])
Maximum insertion travel	10.5″ (267 mm)	12.0″ (305 mm)

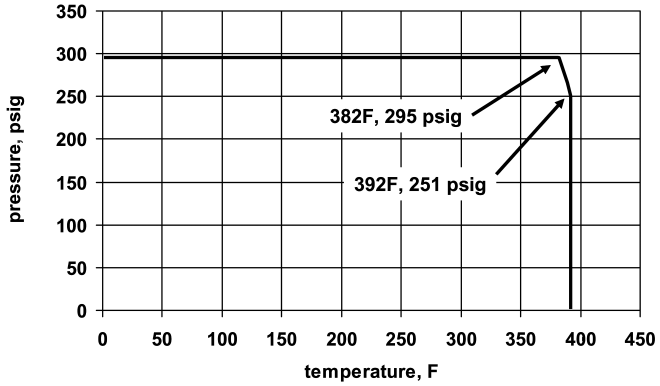
Table 2-5: Maximum Retraction/Insertion Conditions *(continued)*

Condition	23311-00, mechanical retraction assembly	23311-01, manual retraction assembly
Weight/shipping weight	12 lb./15 lb. (5.5 kg/7.0 kg)	9 lb./12 lb. (4.5 kg/5.5 kg)

Table 2-6: Ball Valve Specifications (Sold Separately)

Specification	Description
Part number	9340065
Wetted materials	316 stainless steel, PTFE
Process connection	1½″ FNPT
Weight/shipping weight	4 lb./5 lb. (2.0 kg/2.5 kg)

Figure 2-4: Ball Valve Pressure and Temperature



Options (manual or mechanical retraction assemblies)
Retract manual retraction assembly

Prerequisites

Ensure the system pressure is less than 35 psig (342 kPa [abs]).

Procedure

1. Using the top of the junction box, push the sensor.

⚠ WARNING

High pressure

Failure to reduce pressure may cause a loose collet nut to disengage and cause injury to personnel.

Reduce pressure to 0 psig. Do not loosen collet nut until pressure is 0 psig.

2. Slowly loosen the collet nut.
3. When the collet nut is loose enough, slowly ease the sensor back until it clears the ball valve.
4. Close the valve to the process line.
5. Drain the retraction chamber contents using the ⅛″ flush ports.
6. Loosen the 3″ hex union nut.
7. Remove the sensor and tube assembly.
8. Replace the 3″ hex nut O-ring.
9. Place the sensor and tube assembly back in the retraction assembly.
10. Tighten the 3″ hex union nut.
11. Verify that the ⅛″ flush ports are closed.

Note
With the ball valve closed and the retraction chamber ⅛″ flush ports open, some residual process fluid may leak from the 3″ hex union nut female ACME threads. This leakage is normal and to be expected.

⚠ WARNING

High pressure

Failure to reduce pressure may cause a loose collet nut to disengage and cause injury to personnel.

Retraction chamber contents may be under pressure. Before opening the ball valve, verify the process pressure is less than 35 psig (342 kPa [abs]).

12. Open the ball valve and check for leaks.
13. Insert the sensor into the process.
14. Tighten the collet nut.

Retract mechanical retraction assembly

Prerequisites

Before retracting the sensor, ensure the system pressure is less than 295 psig (2135 kPa [abs]).

Procedure

⚠ WARNING

Retraction chamber contents may be under pressure.

Failure to reduce pressure may cause a loose part to disengage and cause injury to personnel.

1. Retract the sensor using a ½″ (13 mm) socket wrench.
2. When the sensor clears the ball valve, close the valve.
3. Drain the retraction chamber using ⅛ in. flush ports.
4. Loosen the 3″ hex union nut and remove the retraction stop collar and orange clamp top.
5. Remove the sensor and tube assembly.
6. Replace the 3″ hex nut O-ring.
7. Place the sensor and tube assembly back in the retraction assembly.
8. Replace the retraction stop collar about ½″ in front of the clamp.
9. Tighten the:
   - clamp screws
   - retraction stop collar
   - 3″ hex union nut

Note
With the ball valve fully closed and the retraction chamber ⅛″ flush ports open, some residual process fluid may leak from the 3″ hex union female ACME threads. This leakage is normal and to be expected.

10. Verify that the ⅛″ flush ports are closed.

Note
Before opening the ball valve, ensure the process pressure is less than 295 psig (3135 kPa [abs]).

11. Open the valve.
12. Inspect for leaks.

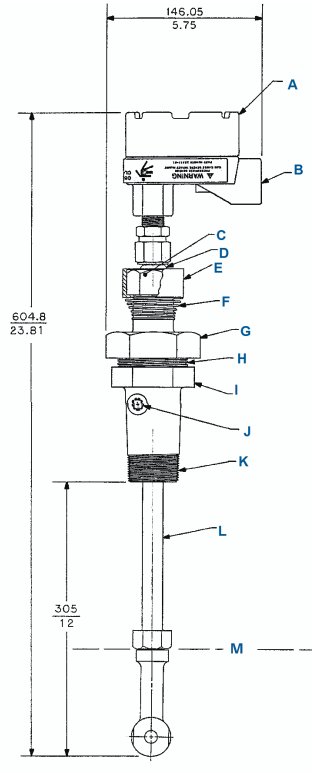
13. Insert the sensor into the process.

2.3.2 Install a manual retraction assembly

Procedure

1. Loosen the collet nut.
2. Retract the sensor tube into the retraction chamber (see Figure 2-5).

Figure 2-5: Manual Retraction Assembly Dimensional Drawing

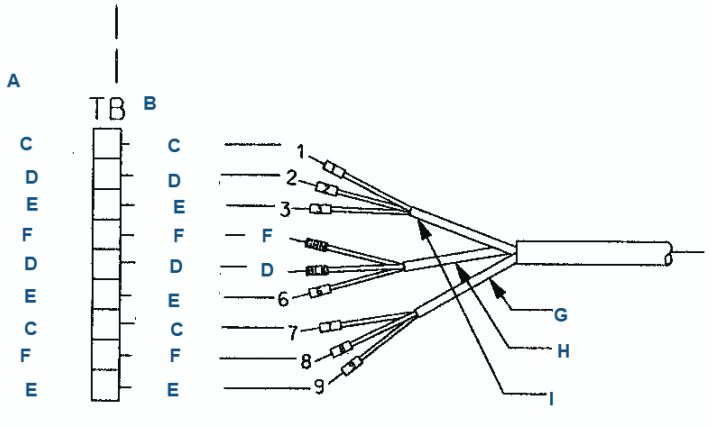


A. Junction box with screw cap
B. ¾″ FNPT
C. Collet nut
D. Collet
E. Nut guard
F. Nut guard spring
G. 3″ hex union nut
H. 2.531″-8 ACME thread
I. 2⅝″ hex retraction chamber
J. ⅛″ MNPT plug
K. 1½″ MNPT
L. 316 stainless steel ¾″ O.D. tube
M. Toroidal sensor model 228-20-62

3. Loosen the union nut.
4. Separate the retraction chamber from the assembly.
5. Install the retraction chamber on the 1½″ NPT full port valve mounted on the process line or vessel.

6. Thread the sensor cable through the tube into the junction box.
7. Screw the sensor into the tube.
8. Hand-tighten the sensor an additional half turn once the gasket is seated.
9. Connect the sensor and interconnecting cable leads to the terminal strip in the junction box (see Figure 2-6).

Figure 2-6: Sensor-Mounted Junction Box Wiring



A. Prewired inside junction box
B. Customer connection
C. White
D. Black
E. Clear
F. Green
G. Temperature element
H. Receive
I. Drive

Note
The wiring diagram shown is for the cable PN 23294-00, which has three RTD (TC) leads. If you are using cable PN 23294-05, which has four RTD (TC) leads, connect the green, white, and clear wires in the RTD bundle as shown in the drawing. Do not disconnect the black wire. When you reconnect the RTD wires in PN 23294-05 to the transmitter, make the connections as described in Step 10 (this section) or Step 5 (Install mechanical retraction assembly).

10. Connect the other end of the cable to the transmitter.

    See the wiring diagrams in:

- Figure 3-2
- Figure 3-4
- Figure 3-5

For cable PN 23294-00, follow the wiring for the Rosemount 228-54 sensor.

For cable PN 23294-05, follow the wiring for the Rosemount 228-56 sensor with the following exception: Refer to the wire function diagram for the Rosemount 228-56 option in Figure 3-1 and identify the RTD wire bundle. Connect the RTD wires to the transmitter as follows:

- Green - RTD in
- Black - No connection
- Clear - RTD common or RTD return
- White - RTD sense

To prevent accidental connections, wrap the bare end of the black wire.

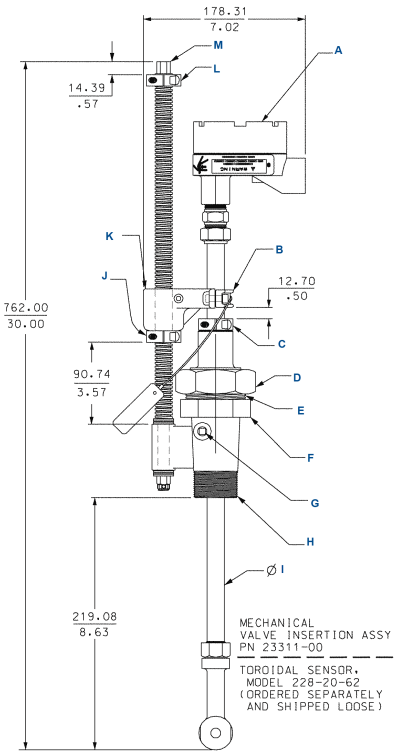
11. Insert the sensor and tube assembly into the retraction chamber.
12. Tighten the union nut.
13. Open the ball valve.
14. Inspect for leaks.
15. Manually insert the sensor into the process.
16. Position the sensor at least ½ in. (13 mm) away from any wall of the vessel or pipe.
17. Tighten the collet nut.

2.3.3 Install mechanical retraction assembly

Procedure

1. Tighten the sensor cable through the tube into the junction box.
2. Screw the sensor into the tube.
3. Once the gasket is seated (see Figure 2-7), hand-tighten the sensor an additional 180°.

Figure 2-7: Mechanical Retraction Assembly



A. Junction box with screw cap
B. Cap
C. Retraction stop collar
D. 3″ hex union nut
E. 2.531"-8 ACME thread type
F. 2⅝″ hex retraction chamber
G. ⅛″ MNPT plug type
H. 1½″ MNPT
I. ¾″ tube 316 stainless steel
J. Travel stop collar "A"
K. Nut housing
L. Travel stop collar "B"
M. Lead screw

Note

Maximum insertion/retraction and operating conditions: 295 psig (2036 kPa) and 392 °F (200 °C).

Requires customer supplied 1½″ FNPT full port ball valve.

Extension cable is ordered separately. Specify length.

4. Terminate the sensor wiring in the junction box (see Figure 2-6 for wiring details).
5. Connect the other end of the cable to the transmitter.

   See the wiring diagrams in:

   - Figure 3-2
   - Figure 3-4
   - Figure 3-5

For cable PN 23294-00, follow the wiring for the 228-54 sensor. For cable PN 23294-05, follow the wiring for the 228-56 sensor with the following exception: Refer to the wire function diagram for the 228-56 option in Figure 3-1 and identify the RTD wire bundle. Connect the RTD wires to the transmitter as follows:

- Green: RTD in
- Black: No connection
- Clear: RTD common or RTD return
- White: RTD sense

To prevent accidental connections, wrap the bare end of the black wire.

6. Using a ½″ (13 mm) socket wrench, retract the sensor into the retraction chamber.
7. Install the assembly on the 1½″ FNPT full port ball valve mounted in the process line or vessel.
8. Tighten the union nut.
9. Open the ball valve and check for leaks.
10. Using a ½″ (13 mm) socket wrench, insert the sensor into the process line or vessel.
11. Position the sensor at least ½ in. (13 mm) away from any wall of the vessel or pipe.

⚠ WARNING

High pressure

Failure to reduce pressure may cause a loose part to disengage and cause injury to personnel.

Do not loosen cap screws or collar when pressurized.

12. Set the travel stop collar *A* net to the nut housing.

2.3.4 Replace seals

Procedure

1. Retract the sensor into the retraction chamber and fully close the ball valve.
2. Drain the retraction chamber contents using the ⅛″ flush ports.

⚠ WARNING

HIGH PRESSURE

Failure to reduce pressure may cause a loose part to disengage and cause injury to personnel.

Retraction chamber contents may be under pressure. Reduce pressure to 0 psig before opening the retraction chamber.

3. For mechanical retraction assemblies,:
    a. Mark the location of the nut housing cap and retraction collar on the sensor tube.
    b. Remove both socket head cup screws from the nut housing.
    c. Loosen the retraction stop collar.
4. Remove the 3″ hex union nut.
5. Withdraw the sensor from the retraction chamber.
6. Open the junction box.
7. Disconnect the sensor wires from the terminal block.
8. Remove the compression fitting directly below the junction box.
9. Remove the junction box from the sensor tube.
10. For manual retraction assemblies,:
    a. Pull down the nut guard.
    b. Remove the collet nut from the bushing housing
11. Slide all hardware, including the bushing housing, off the sensor tube.
12. Remove the retaining ring from the bottom of the bushing housing.
13. Remove the PTFE guard.

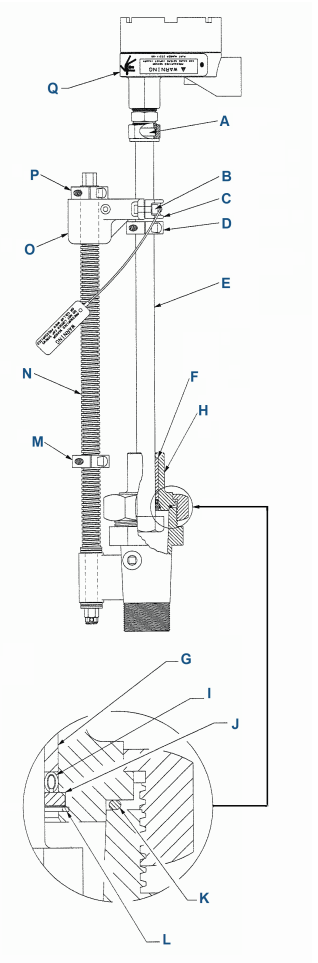
Note
Step 14 also results in pushing out the PTFE cup seal.

14. From the top of the bushing housing, press out the PTFE bushing.

Note
A rough or uneven surface will prevent the PTFE cup from sealing.

15. Replace all damaged parts with replacement parts from Figure 2-8 or Figure 2-9. If the surface is damaged, replace the sensor tube.

Figure 2-8: Mechanical Retraction Assembly Replacement Parts



A. Nylon ferrule

B. Socket head cap screw PN 9722512

C. Cap PN 33168-00

D. Retraction stop collar PN 9090111

E. 316 stainless steel tube PN 33121-01

F. PTFE bushing

G. PTFE bushing PN 33181-00

H. Bushing housing

I. PTFE cup seal PN 955504

J. PTFE guard

K. Union nut O-ring EP PN 9550179

L. Retaining ring PN 9560279

M. Travel stop collar PN 9090111 "A"

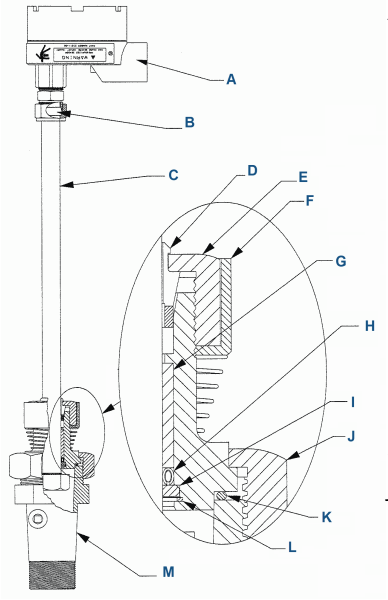
N. Lead screw

O. Nut housing

P. Travel stop collar PN 9090111 "B"

Q. Junction box

Figure 2-9: Manual Retraction Assembly Replacement Parts



A. Junction box

B. Nylon ferrule

C. 316 stainless steel tube PN 33121-01

D. COA 360 brass collet PN 33131-00

E. Collet nut

F. Nut guard

G. PTFE bushing PN 33180-00

H. PTFE cup seal PN 9555004

I. PTFE guard PN 33182-00

J. 3″ hex union nut

K. Union nut O-ring, EP PN 9550179

L. Retaining ring PN 9560279

M. Retraction chamber PN 33127-00

16. Rebuild the bushing housing. The open end of the cup seal (spring visible) faces the process.
17. Carefully slide the bushing housing onto the sensor tube.

⚠ CAUTION

Do not damage the PTFE bushing or the PTFE cup seal.

18. For manual retraction assemblies, slide the 3″ hex union nut, collet nut with nut guard, junction box compression nut, and plastic ferrules onto the sensor tube.
19. For mechanical retraction assemblies, slide the 3″ hex union nut, retraction stop collar, junction box compression nut, and plastic ferrules onto the sensor tube.
20. Connect the junction box to the sensor tube.
21. Wire the sensor leads to the appropriate terminals.

22. For mechanical retraction assemblies, lock the retraction stop collar into position. (see Figure 2-8 or previously marked position for proper location).
23. Place the union nut O-ring at the bottom of the bushing housing.
24. Insert the sensor assembly into the retraction chamber.
25. Tighten the 3″ hex union nut.
26. For mechanical retraction assemblies, install the nut housing cap (see Figure 2-8 or previously marked position for proper location).

3 Wire

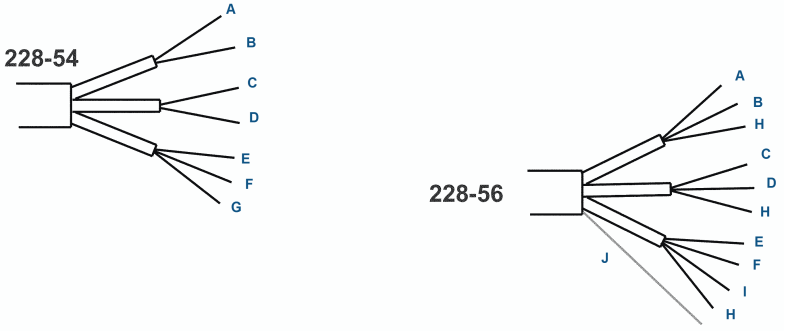
3.1 Wire the sensor

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

NOTICE

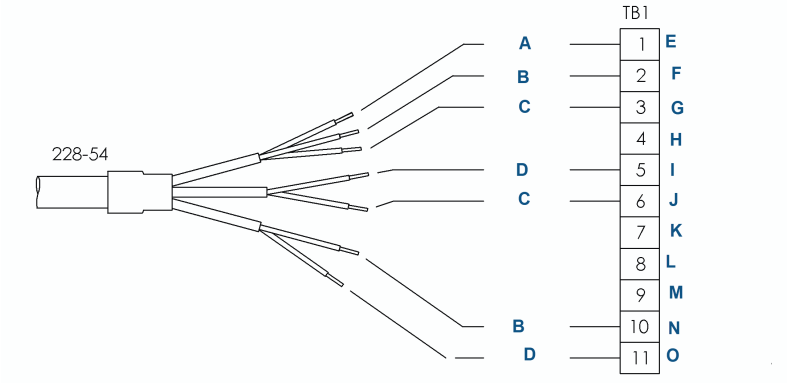
For additional wiring information on this product, refer to Emerson.com/Rosemount-Liquid-Analysis-Wiring.

Figure 3-1: Wire Functions



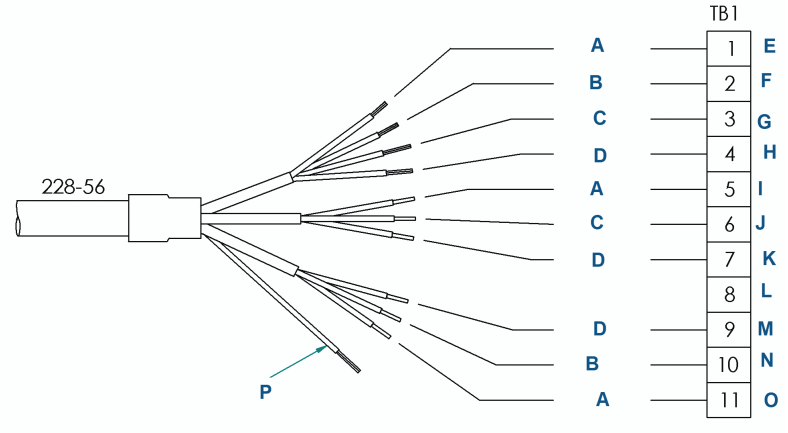
A. Green: Receive
B. Black: Receive common
C. White: Drive
D. Black: Drive common
E. Green: Resistance Temperature Device (RTD) in
F. White: RTD sense
G. Clear: RTD common
H. Clear: Shield
I. Black: RTD common
J. Clear shield (high temperature Rosemount 228-56 sensors only)

Figure 3-2: Wiring Diagram Connecting Rosemount 228-54 Sensor to Rosemount 1056 and 56 Transmitters



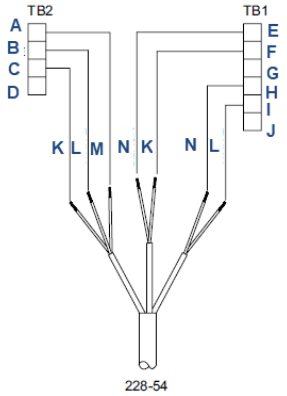
A. Clear
B. White
C. Green
D. Black
E. RTD return
F. RTD sense
G. RTD in
H. RTD shield
I. Receive common
J. Receive
K. Receive shield
L. Outer shield
M. Drive shield
N. Drive
O. Drive common

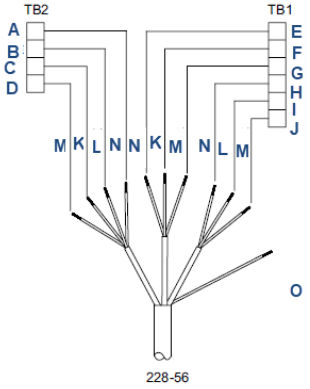
Figure 3-3: Wiring diagram connecting 228-56 to 1056 and 56 Transmitters



A. Black
B. White
C. Green
D. Clear
E. RTD return
F. RTD sense
G. RTD in
H. RTD shield
I. Receive common
J. Receive
K. Receive shield
L. Outer shield
M. Drive shield
N. Drive
O. Drive common
P. Clear present in high temperature sensor (option -03) only. Connect to "Outer shield" terminal

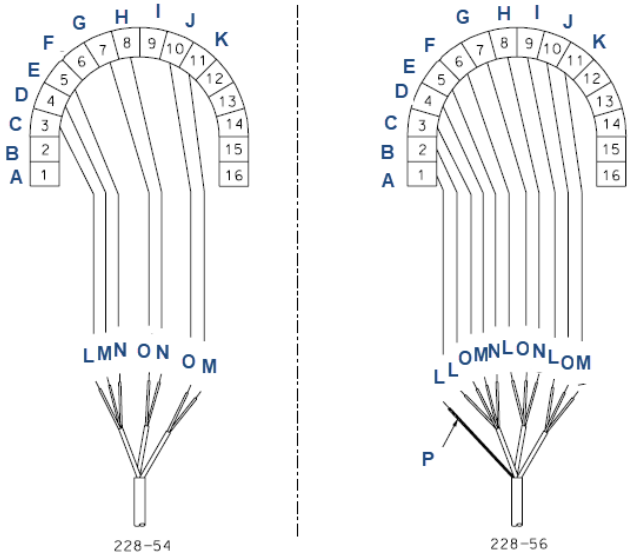
Figure 3-4: Wiring Rosemount 228 to Rosemount 1066 Transmitter





A. Return
B. Sense
C. RTD in
D. Shield
E. Receive B
F. Receive A
G. Receive shield
H. Drive B
I. Drive A
J. Drive shield
K. Green
L. White
M. Clear
N. Black
O. Clear. Clear shield is not connected. It is present in high temperature (option -03) only

Figure 3-5: Wiring Diagram for Rosemount 5081 Transmitters



A. Reserved
B. RTD shield
C. RTD common
D. RTD sense
E. RTD in
F. Receive shield
G. Receive common
H. Receive
I. Drive shield
J. Drive common
K. Drive
L. Clear
M. White
N. Green
O. Black
P. Present in high temperature sensor (option -03) only

Figure 3-6: Wiring Sensors through a Remote Junction Box

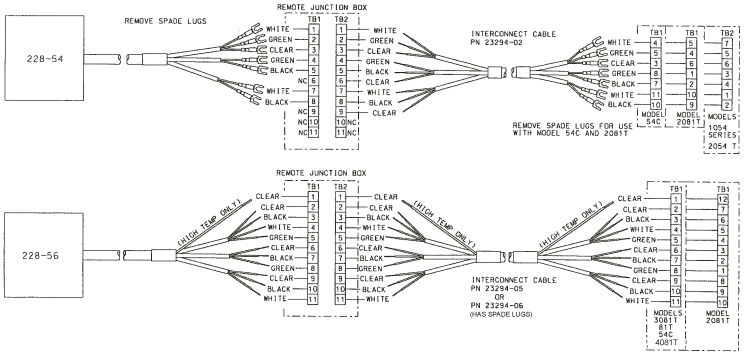


Table 3-1: Wiring Sensors through a Remote Junction Box for Rosemount 228-54

Number	Remote junction box		Rosemount		
	TB1	TB2	54C	2081T	1054 and 2054
1	White	White	N/A	Green	White
2	Green	Green	N/A	N/A	Black
3	Clear	Clear	Clear	N/A	Green
4	Green	Green	White	Green	Black
5	Black	Black	Green	White	Green
6	NC	Clear	N/A	Clear	Clear
7	White	White	Black	N/A	White
8	Black	Black	Green	N/A	N/A
9	NC	Clear	N/A	Black	N/A
10	NC	NC	Black	White	N/A
11	NC	NC	White	N/A	N/A

Table 3-2: Wiring Sensors through a Remote Junction Box Rosemount 228 56

Number	Remote junction box		Rosemount	
	TB1	TB2	3081T, 81T, 54C, and 4081T	2081T
1	Clear	Clear	Clear	Green
2	Clear	Clear	Clear	Black
3	Black	Black	Black	Clear
4	White	White	White	Green
5	Green	Green	Green	White
6	Clear	Clear	Clear	Black
7	Black	Black	Black	Clear
8	Green	Green	Green	Clear
9	Clear	Clear	Clear	Black
10	Black	Black	Black	White
11	White	White	White	N/A
12	N/A	N/A	N/A	Clear

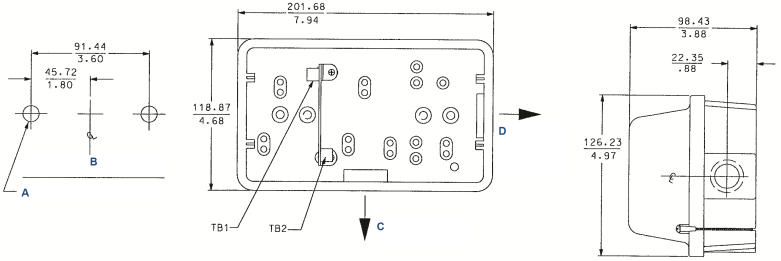
Wire sensors point to point.

For wiring at the transmitter end, refer to the appropriate transmitter wiring diagram.

For interconnecting cable 23294-00, use the Rosemount 228-54 wiring diagram.

For interconnecting cable 23294-04 and 23294-05, use the Rosemount 228-56 wiring diagram.

Figure 3-7: Remote Junction Box (PN 23550-00) Dimensions



A. Drill for 10/32 screw
B. Junction box mounting holes pattern
C. ¾" FNPT to sensor
D. ¾" FNPT to transmitter

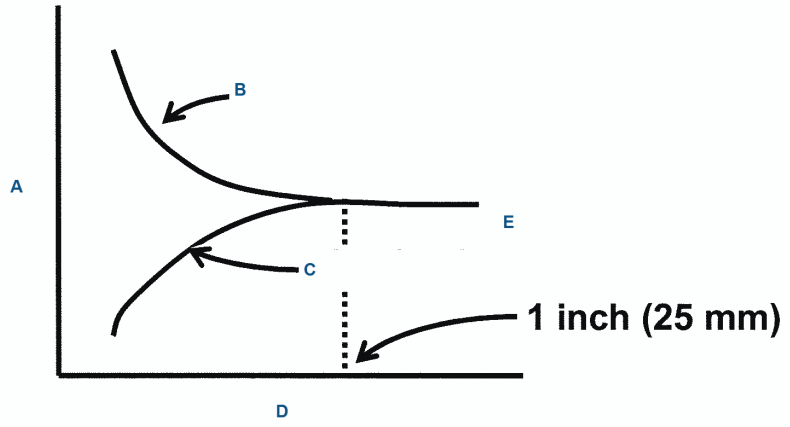
4 Calibration

4.1 Sensor calibration

The nominal cell constant of the Rosemount 228 sensor is 3.0/cm. The error in cell constant is about ±10%, so conductivity readings made using the nominal cell constant will have an error of at least ±10%. Wall effects (Figure 4-1), will likely make the error greater.

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

Figure 4-1: Measured Conductivity as a Function of Clearance between Sensor and Walls



A. Measured conductivity
B. Metal pipe
C. Plastic pipe
D. Distance to wall
E. True conductivity

4.2 Calibrate 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 in which the sensor will be used. Generally, toroidal conductivity sensors have

good linearity, and so standards greater than 5000 µS/cm at 77 °F (25 °C) may also be used.

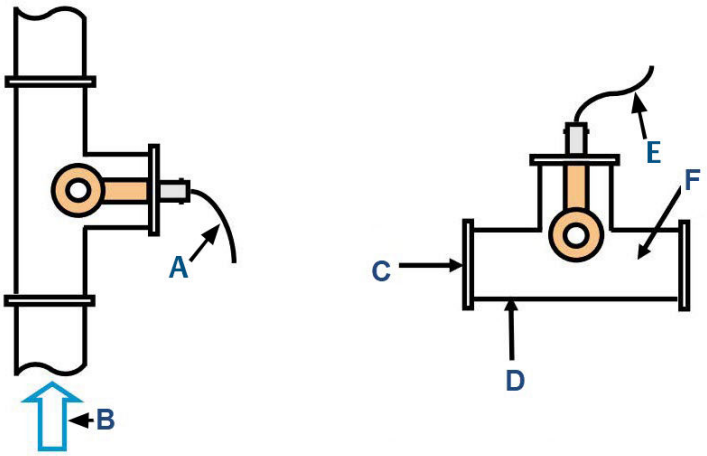
Procedure

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 ¾ 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 4-2).

Figure 4-2: Calibration Installation Orientation



A. Sensor in process piping
B. Flow
C. Blank flange
D. Pipe tee identical to process pipe tee
E. Sensor being calibrated
F. Standard solution

3. Rinse the sensor with water.

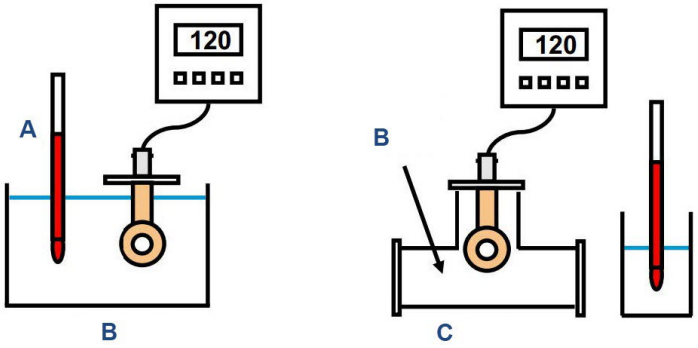
4. Immerse the rinsed sensor in the standard solution.

   Allow adequate time for the solution and sensor to reach thermal equilibrium. Using a good quality calibrated thermometer with an error of less than ±1 °C, measure the standard solution temperature.

   If the sensor is being calibrated in an open beaker, keep the thermometer far enough away from the sensor to prevent 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 callibration vessel. Let both come to thermal equilibrium with the ambient air before continuing calibration (see Figure 4-3).

Figure 4-3: Measuring Standard Temperature



A. Standard thermometer
B. Standard solution
C. Pipe tee

Note
Ensure air bubbles are not adhering to the sensor. An air bubble trapped in the toroid opening severely effects the reading.

5. To eliminate error in the cell constant, turn off automatic temperature compensation in the transmitter.
6. Adjust the transmitter reading to match the conductivity of the standard.

4.3 Calibrate against a referee sensor

4.3.1 Calibrate 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.

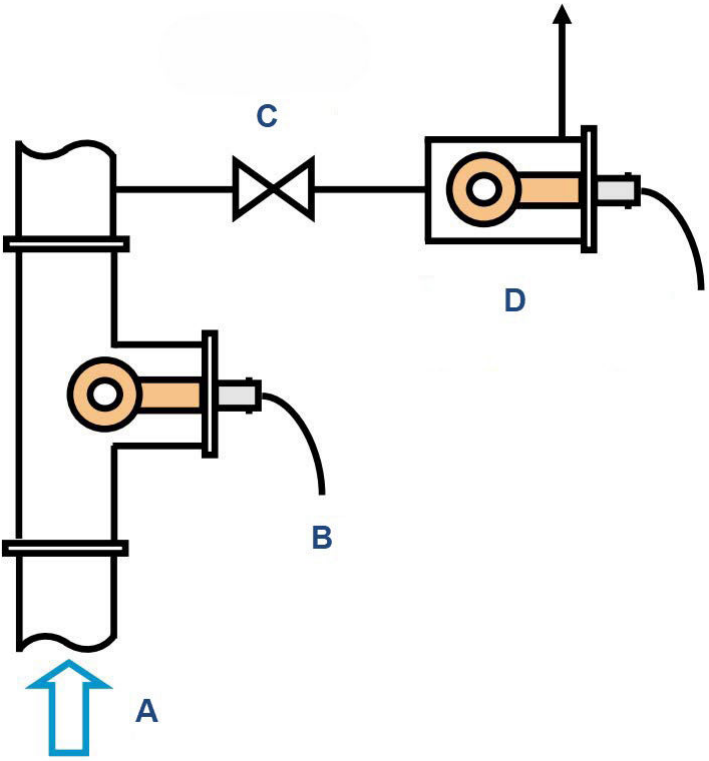
2. Allow the process liquid to flow through both sensors.

   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 (see Figure 4-4).

Figure 4-4: Calibration with a Referee Instrument Example



A. Flow
B. Sensor in process piping
C. Sample valve
D. Referee sensor in flow cell

4.3.2 Calibrate a 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.

Procedure

1. Take a sample of the process liquid.
    a) Take the sample from a point as close to the process sensor as possible.
    b) 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.
    c) If that is not possible, adjust the conductivity so that it is at least 5000 µS/cm.
2. Connect the process and referee sensors.
    a) Keep temperature compensation with the transmitter turned on.
    b) 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.

5 Maintenance and troubleshooting

5.1 Maintaining the sensor

⚠ WARNING

HIGH PRESSURE

Failure to reduce pressure may cause a loose part to disengage and cause injury to personnel.

Retraction chamber contents may be under pressure. Reduce the pressure to 0 psig before opening the retraction chamber.

⚠ 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.

6 Accessories

Table 6-1: Accessory list

Part number	Description
23550-00	Remote junction box without preamplifier
33081-00	Adapter insert, PEEK, 1 x ¾-in. for 23242-02
23294-00	Unshielded interconnecting cable for Rosemount 1054A, 1054B, and 2054C. Can also be used with Rosemount 1056, 56, 5081, and 1066-T, but not recommended. Prepped, specify length, per ft.
23294-05	Shielded interconnecting cable with additional shield wire for -03 option. For use with Rosemount 1056, 1066-T, 56, and 5081T. Prepped, specify length, per ft.
23311-00	Mechanical valve insertion assembly (Code 20)
23311-01	Manual valve insertion assembly (Code 20)
2001990	Sub assembly, adapter 2-in. bushing
9550179	O-ring, 2-135, EPR
23242-02	Mounting adapter, 1½-in. insertion, 1-in. x ¾-in.
23242-03	Mounting adapter, 1½-in. insertion (code 20), 1-in. conduit connection
23277-01	Mounting adapter, Foxboro, PEEK Code 20, ⅝-11 UNC
33075-00	Viton® gasket for option 20
33075-03	Kalrez® gasket for option 20
9200276	Extension cable, unprepped (specify length) per foot
9340065	Ball valve, full port 1½-in. Female National Pipe Thread (FNPT) (to 392 °F [120 °C])

Table 6-2: Spare Parts

Part number	Description
33080-01	Adapter insert, PEEK (Code 20) for 23242-03
33121-01	Sensor tube, 316 stainless steel, valve insertion
33131-00	Collette, brass (for PN 2311-00 only)
33168-00	Cap (for PN 23311-00 only)
33180-00	Bushing, PTFE® (for PN 23311-01 only)
33181-00	Bushing, PTFE (for PN 23311-00 only)

Table 6-2: Spare Parts *(continued)*

Part number	Description
33182-00	Guard, PTFE
9555004	Cup seal, PTFE
9560279	Retaining ring for Rosemount 228 insertion assembly

7 Return of materials

For repair and warranty inquiries, contact Rosemount Customer Care to obtain a Return Material Authorization (RMA) number.

Note
Drain the sensor and thoroughly rinse it before shipping back to Emerson.

Quick Start Guide
00825-0100-3228, Rev. AB
March 2024

For more information: **Emerson.com/global**

©2024 Emerson. All rights reserved.

Emerson Terms and Conditions of Sale are available upon request. The Emerson logo is a trademark and service mark of Emerson Electric Co. Rosemount is a mark of one of the Emerson family of companies. All other marks are the property of their respective owners.

ROSEMOUNT™

EMERSON™