

# Rosemount™ 402 and 402VP

## Contacting Conductivity Sensors





# Essential Instructions

## Read this page before proceeding!

Emerson designs, manufactures and tests its products to meet many national and international standards. Because these sensors 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 sensor; and warranty invalidation.

- Read all instructions prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, contact your Emerson 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 Quick Start Guide 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 Emerson. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, and **VOID YOUR WARRANTY**. Third-party substitutions 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.

The information contained in this document is subject to change without notice.

### 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.

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### CAUTION

The 402 and 402VP sensors are retractable. **BEFORE RETRACTING THE SENSOR**, be absolutely certain the process pressure is less than 64 psig (542 kPa abs) and the process temperature is at a safe level!

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# Section 1: Specifications

## 1.1 Specifications

Table 1-1: Rosemount 402/402VP contacting conductivity sensor specifications

<b>Wetted Materials</b>	
Electrodes	Titanium
Insulator	Glass Filled PEEK
Sensor tube	316 Stainless Steel
O-ring	EPDM
Washer	Neoprene
<b>Temperature range</b>	
Standard	32 to 212 °F (0 to 100 °C)
<b>Maximum pressure</b>	
200 psig (1481 kPa abs)	
<b>Maximum retraction pressure</b>	
64 psig (542 kPa abs)	
<b>Vacuum</b>	
At 1.6 in. Hg (5.2 kPa) air leakage is less than 0.005 SCFM (0.00014 m <sup>3</sup> /min)	
<b>Cell constants</b>	
0.01, 0.1, and 1.0/cm	
<b>Process connection</b>	
Sensor is inserted through 1 ¼ in. NPT full port ball valve	
<b>Cable</b>	
10 ft (3.1 m) standard; for longer cable lengths, choose option -60 (integral junction box) and order interconnecting cable separately; 402VP Interconnecting VP6 cables sold separately. (See <a href="#">Accessories</a> ).	

Table 1-2: Weights and shipping weights <sup>(1)</sup>

Sensor model	With 10 ft. (3.1 m) cable		With junction box	
	Weight	Shipping weight	Weight	Shipping weight
Rosemount 402 Contacting Conductivity Sensor	3 lb. (1.5 kg)	4 lb. (2.0 kg)	4 lb. (2.0 kg)	5 lb. (2.5 kg)
Rosemount 402VP Contacting Conductivity Sensor	3 lb. (1.5 kg)	4 lb. (2.0 kg)		

1. Rounded up to the nearest 1 lb or 0.5 kg

Table 1-3: Retraction Assembly Specifications

<b>Assembly includes</b>	
Ball valve, retraction body, and pipe nipple.	
<b>Wetted materials</b>	
Ball valve	32 to 212 °F (0 to 100 °C)
Nipple	316 Stainless Steel
Packing rings	Graphite
Packing bushing	303 Stainless Steel
Retraction body	316 Stainless Steel
<b>Process connection</b>	
Ball valve 1¼ in. FNPT; Nipple 1¼ in. MNPT	
<b>Temperature</b>	
32 to 212 °F (0 to 100 °C)	
<b>Pressure</b>	
200 psig (1481 kPa abs) maximum	
<b>Maximum retraction pressure</b>	
64 psig (542 kPa abs) maximum	
<b>Vacuum</b>	
At 1.6 in. Hg (5.2 kPa) air leakage is less than 0.005 SCFM (0.00014 m <sup>3</sup> /min)	



## Section 2: 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.

### 2.2 Sensor Installation

Figure 2-1 Sensor orientation

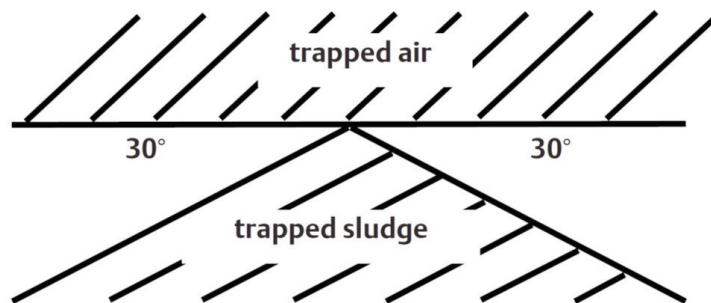
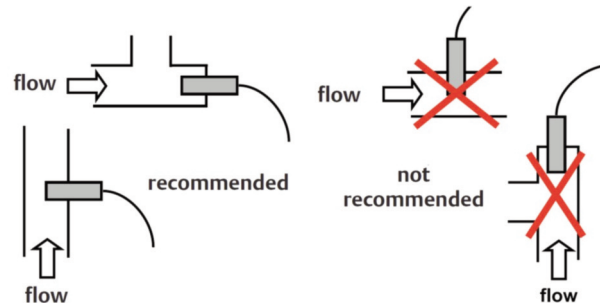


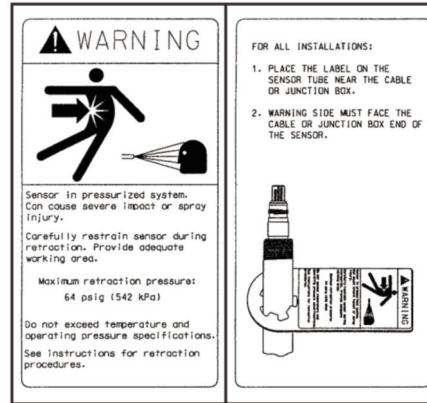
Figure 2-2 Recommended installation



Keep ¼ in. (6 mm) clearance between electrodes and piping. The electrolytes must be completely submerged in the process liquid, i.e., to the upper edge of the guard (item 10 in Figure 2-4).

## 2.2 Installation and Retraction of Sensor

Figure 2-3 Label



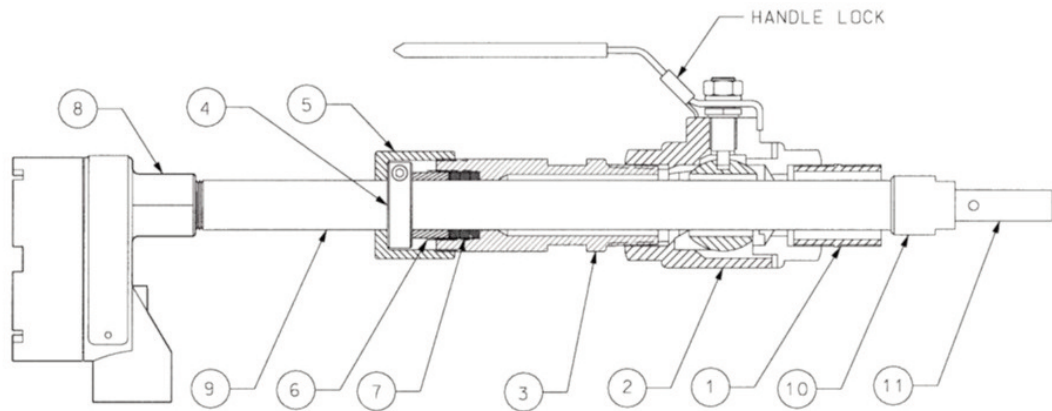
### 2.1.1 Installation

Retraction assembly kit (PN 23765-00) consists of items 1 through 7 shown in Figure 2-4 as well as a hex key and pipe tape. The sensor assembly includes items 8 through 11.

**⚠ IMPORTANT**

Do not remove or alter the guard (10) on the sensor tube (9).

Figure 2-4 Sensor with retraction assembly kit

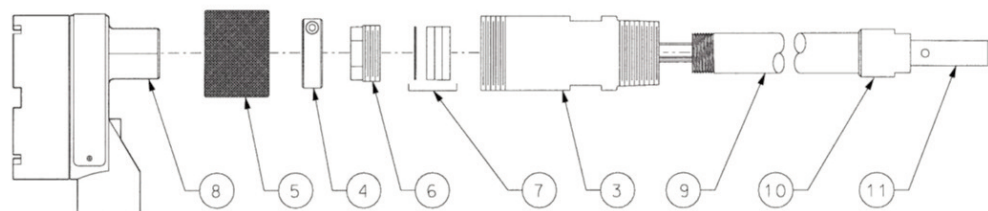


- 1. NIPPLE (PN 4342M)
- 2. BALL VALVE (PN 9340078)
- 3. PACKING ADAPTER (PN 33578-00/01)
- 4. CLAMP (PN 33579-00)
- 5. RETAINER (PN 33577-00)
- 6. PACKING BUSHING (PN 4357M)
- 7. PACKING RINGS (PN 9160410)
- 8. JUNCTION BOX
- 9. SENSOR TUBE
- 10. GUARD
- 11. SENSING ELEMENT

1. Make sure the system is shut down and there is no residual pressure.
2. Attach the ball valve (2) to the process piping using the 1-¼-in. FNPT port on the valve or the 1-¼ in. NPT nipple (1). Use pipe tape on male threads.

3. Slide the handle lock up on the ball valve handle and close the ball valve (2). If the process will be restarted before the sensor is installed, make sure the system pressure is at or below 542 kPa abs (64 psig) before proceeding. If the system will not be restarted until after the sensor installation, leave the valve in the open position.
4. If the sensor includes a junction box (8), it must be removed from the sensor to install the retraction assembly kit. Disconnect the sensor wires inside the junction box prior to disassembly.
5. Follow [Figure 2-5](#) to assemble the sensor and retraction assembly. Keep items 3-7 in the proper sequence. Items 3, 6, and 7 are factory assembled.
6. Position the sensor tube (9) so that the electrodes (11) are completely withdrawn inside the packing adapter (3). If it is difficult to slide the sensor through the packing rings, loosen the packing bushing (6).
7. Position the clamp (4) on the sensor tube (9) so that the electrodes (11) will be completely immersed in the process liquid when the sensor is fully inserted through the ball valve. See [Figure 2-4](#). Use the hex key to secure the clamp to the sensor tube.
8. Slide the retainer (5) onto the sensor tube (9).
9. Screw the junction box (8) — hand tight — onto the sensor tube (9). DO NOT OVER TIGHTEN. Use 2-3 wraps of pipe tape on the tube threads if a NEMA 4 seal is required at the junction box.
10. Apply pipe tape to the packing adapter (3) threads and screw the packing adapter onto the ball valve.
11. Check to ensure that the packing bushing (6) has been tightened. You should be able to push the sensor tube (9) against the resistance provided by the packing rings (7).
12. Open the ball valve (2).
13. There may be some leakage around the packing bushing (6). Tighten the packing bushing to stop the leak. Use the junction box (8) or sensor rear to push the sensor through the valve until the clamp (4) rests against the packing bushing.
14. To secure the sensor tube (9) in place, tighten — hand tighten only — the retainer (5) against the back of the packing adapter (3). If the sensor tube retracts when the system pressure is increased, reduce the pressure to 542 kPa abs (64 psig) or less, remove the retainer (5), and tighten the screw in the clamp (4).

Figure 2-5 Sensor installation



3. PACKING ADAPTER (PN 33578-00/01)
4. CLAMP (PN 33579-00)
5. RETAINER (PN 33577-00)
6. PACKING BUSHING (PN 4357M)
7. PACKING RINGS (PN 9160410)
8. JUNCTION BOX
9. SENSOR TUBE
10. GUARD
11. SENSING ELEMENT

## 2.1.2 Retraction

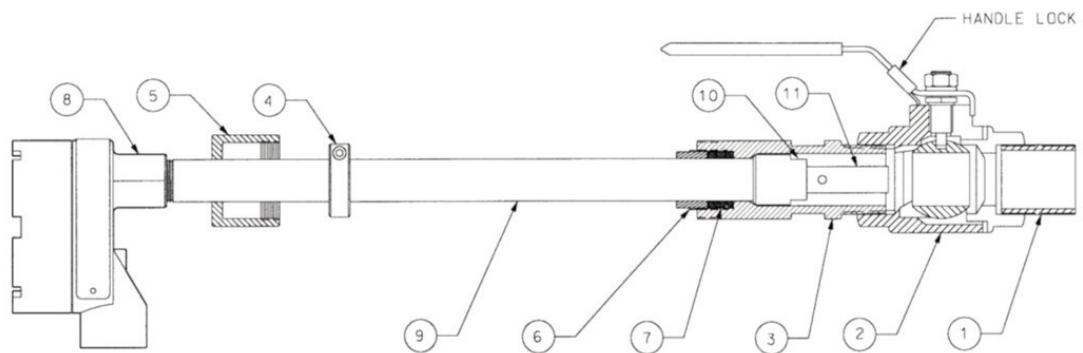
1. Make sure the system pressure is at or below 542 kPa abs (64 psig) at the valve before proceeding. Provide adequate working area for retraction.
2. Unscrew the retainer (5) from the packing adapter (3). If it is difficult to unscrew the retainer, system pressure may be forcing the clamp (4) into the retainer. The packing bushing (6) may not be tight enough to hold the sensor tube (9) in place. To prevent a sudden retraction of the sensor tube as the retainer is removed, hold onto the junction box (8) or sensor rear to restrain the sensor.
3. If the sensor tube (9) does not slide back as the retainer is unscrewed, pull back on the junction box (8) or sensor tube to retract the sensor.
4. If the sensor tube (9) cannot be retracted, loosen the clamp (4) using the hex key. Pull the clamp back and slowly loosen the packing bushing (6) in 1/8-turn increments. System pressure may cause the tube to retract. If not, pull back on the junction box (8) or sensor tube (9) to withdraw the sensor.
5. Withdraw the sensor tube until the guard (10) contacts the stop inside the packing adapter (3). The electrodes (11) are now inside the packing adapter (3). See Figure 2-6. Slide the handle lock up on the valve handle and close the ball valve (2).

### IMPORTANT

Failure to withdraw the sensor completely may result in damage to the electrodes when the valve is closed.

6. Unscrew the packing adapter (3) from the ball valve (2) to remove the sensor and retraction assembly.

Figure 2-6 Rosemount 402 Contacting Conductivity Sensor in Retracted Position



1. NIPPLE (PN 4342M)
2. BALL VALVE (PN 9340078)
3. PACKING ADAPTER (PN 33578-00/01)
4. CLAMP (PN 33579-00)
5. RETAINER (PN 33577-00)
6. PACKING BUSHING (PN 4357M)
7. PACKING RINGS (PN 9160410)
8. JUNCTION BOX
9. SENSOR TUBE
10. GUARD
11. SENSING ELEMENT

## Section 3: Wiring

### 3.1 Wiring for Rosemount 402/402VP

For other wiring diagrams not shown below, please refer to the [Liquid Transmitter Wiring Diagrams](#).

Figure 3-1: Wire color and connections in sensor

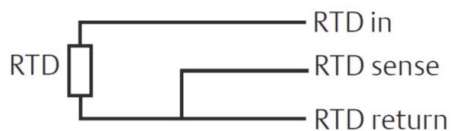
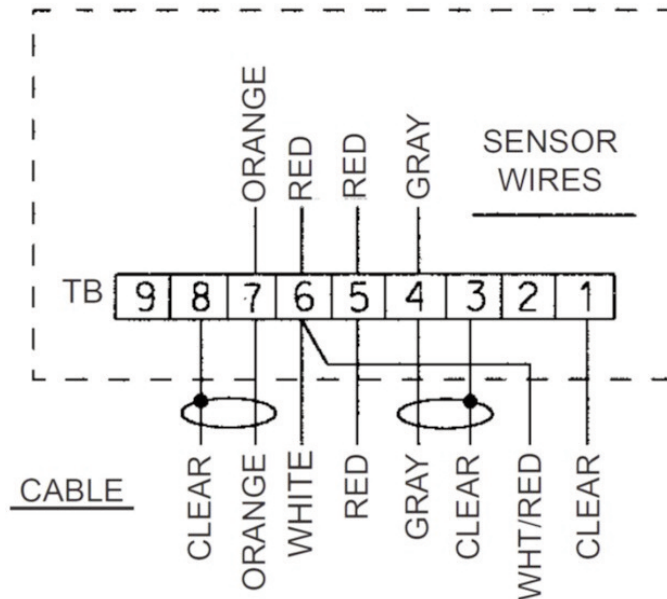
Color	Function
Gray	Connects to outer electrode
Clear	Coaxial shield for gray wire
Orange	Connects to inner electrode
Clear	Coaxial shield for orange wire
Red	
White with red stripe	
White	
Clear	Shield for all RTD lead wires

Figure 3-2: Wiring for integral junction box



**Note: Terminals in junction box are not numbered.**

Figure 3-3: Wiring for Rosemount 56 and 1056 transmitters

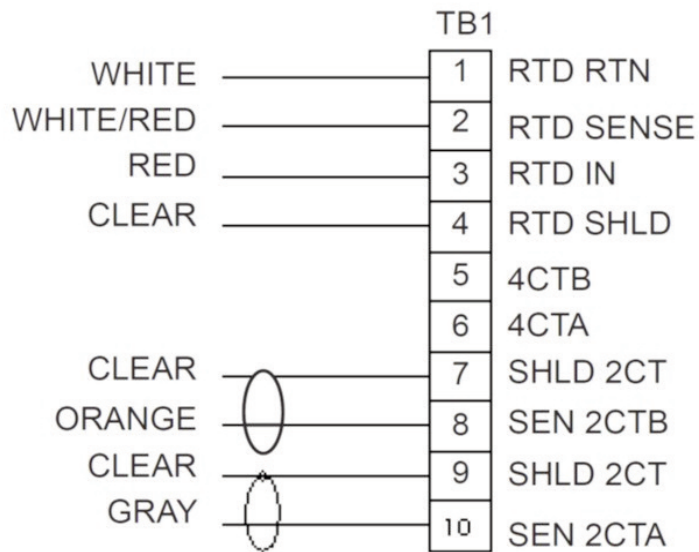
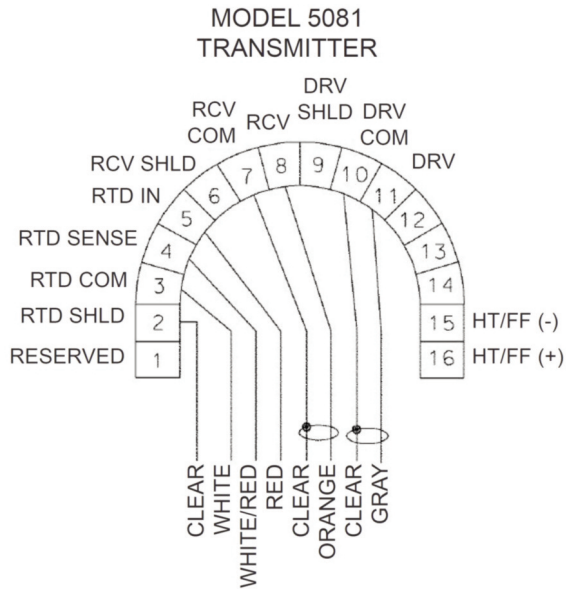


Figure 3-4: Wiring for Rosemount 56 and 1056 transmitters



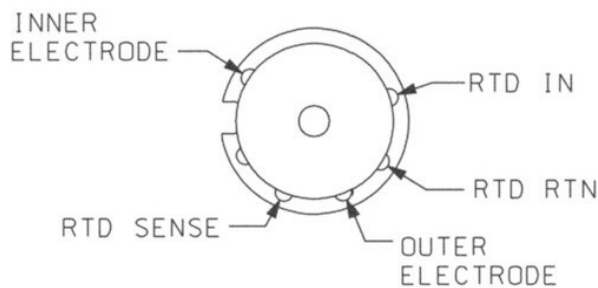
Figure 3-5: Wiring for Rosemount 5081 transmitter



### 3.1.1 Wiring through a Junction Box

If wiring connections are made through a remote junction box (PN 23550-00), wire point-to-point. Use interconnecting cable 23747-00 (factory-terminated) or 9200275 (no terminations).

Figure 3-6: Pin out diagram for Rosemount 402VP contacting conductivity sensors with Variopole cable connection







## Section 4: Calibration and Maintenance

### 4.1 Cleaning the sensor

Use a warm detergent solution and a soft brush or pipe cleaner to remove oil and scale. Isopropyl alcohol (rubbing alcohol) can also be used to remove oily films. Avoid using strong mineral acids to clean conductivity sensors.

### 4.1 Calibrating the sensor

Rosemount 402 conductivity sensors are calibrated at the factory and do not need calibration when first placed in service. Simply enter the cell constant printed on the label into the transmitter. After a period of service, the sensor may require calibration. The sensor can be calibrated against a solution having known conductivity or against a referee meter and sensor. If using a standard solution, choose one having conductivity in the recommended operating for the sensor cell constant. Refer to the analyzer manual or product data sheet for recommended ranges. Do not use standard solutions having conductivity less than about 100  $\mu\text{S}/\text{cm}$ . They are susceptible to contamination by atmospheric carbon dioxide, which can alter the conductivity by a variable amount as great as 1.2  $\mu\text{S}/\text{cm}$  (at 25 °C). Because 0.01/cm sensors must be calibrated in low conductivity solutions, they are best calibrated against a referee meter and sensor in a closed system. For more information about calibrating refer to [Application Data Sheet](#).



## Section 5: Troubleshooting

### 5.1 Troubleshooting

Table 5-1: Troubleshooting

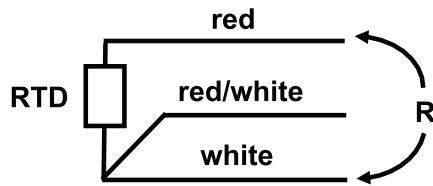
Trouble	Probable Cause	Remedy
Off-scale reading	Wiring is incorrect.	Verify wiring.
	Temperature element is open or shorted.	Check temperature element for open or short circuits. See <a href="#">Figure 5-1</a> .
	Sensor is not in process stream.	Be sure sensor is completely submerged in process stream.
	Variopol cable is not properly seated.	Loosen connector and reseal.
	Sensor has failed.	Perform isolation checks. See <a href="#">Figure 5-2</a> .
Noisy reading	Sensor is improperly installed in process stream.	Be sure sensor is completely submerged in process stream.
	Variopol cable is not properly seated.	Loosen connector and reseal.
Reading seems wrong (lower or higher than expected)	Bubbles trapped in sensor.	Be sure sensor is properly oriented in pipe or flow cell. See <a href="#">Figure 2-1</a> . Apply back pressure to flow cell.
	Wrong temperature correction algorithm.	Check that temperature correction is appropriate for the sample. See transmitter manual for more information.
	Wrong cell constant.	Verify that the correct cell constant has been entered in the analyzer and that the cell constant is appropriate for the conductivity of the sample. See transmitter manual.
Sluggish response	Electrodes are fouled.	Clean electrodes.
	Sensor is installed in dead area in piping	Move sensor to a location more representative of the process liquid.

Note: For any repair or warranty inquiries please contact our Customer Care group.

### 5.1.1 Checking the temperature element

Disconnect leads and measure resistance shown. The measured resistance should be close to the value in the table.

Figure 5-1 Checking the temperature element

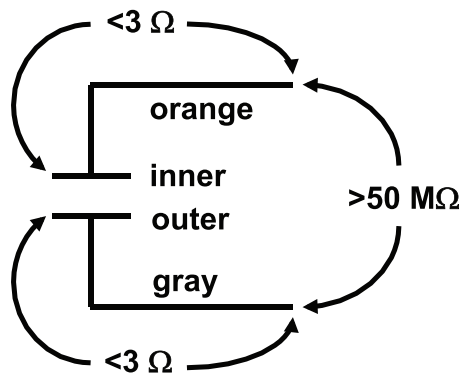


Temperature (°C)	Resistance in ohms	
	Pt 100	Pt 1000
0	100.0	1000
10	103.9	1039
20	107.8	1078
30	111.7	1117
40	115.5	1155
50	119.4	1194

### 5.1.2 Checking the continuity and leakage

Disconnect electrode leads and measure resistance and continuity as shown. Sensor must be dry when checking resistance between electrode leads.

Figure 5-2 Checking the continuity and leakage



## Section 6: Accessories

### 6.1 Accessories

Table 6-1: Accessories for Rosemount 402/402VP Contacting Conductivity Sensor accessories information

Part Number	Description
23550-00	Remote junction box without preamplifier
23747-00	Interconnect cable, prepped (must specify length)
9200275	Extension cable, unprepped (must specify length)
23765-00	Retraction assembly kit (includes nipple, ball valve, and retraction body)
23796-00	Retraction Body
9340078	1¼ in. NPT Full Port Ball Valve
05010781899	Conductivity standard SS-6, 200 µS/cm, 32 oz (0.95 L)
05010797875	Conductivity standard SS-6A, 200 µS/cm, 1 gal (3.78 L)
05010782468	Conductivity standard SS-5, 100k0 µS/cm, 32 oz (0.95 L)
05010783002	Conductivity standard SS-5A, 1000 µS/cm, 1 gal (3.78 L)
05000705464	Conductivity standard SS-1, 1409 µS/cm, 32 oz (0.95 L)
05000709672	Conductivity standard SS-1A, 1409 µS/cm, 1 gal (3.78 L)
05010782147	Conductivity standard SS-7, 5000 µS/cm, 32 oz (0.95 L)
05010782026	Conductivity standard SS-7A, 5000 µS/cm, 1 gal (3.78 L)
23747-06	2.5 ft (0.8 m) Interconnecting VP6 Cable
23747-04	6.4 ft (1.2 m) Interconnecting VP6 Cable
23747-02	10 ft (3.0 m) Interconnecting VP6 Cable
23747-07	15 ft (4.6 m) Interconnecting VP6 Cable
23747-08	20 ft (6.1 m) Interconnecting VP6 Cable
23747-09	25 ft (7.6 m) Interconnecting VP6 Cable
23747-10	30 ft (9.1 m) Interconnecting VP6 Cable
23747-03	50 ft (15.2 m) Interconnecting VP6 Cable
23747-11	100 ft (30.5 m) Interconnecting VP6 Cable





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