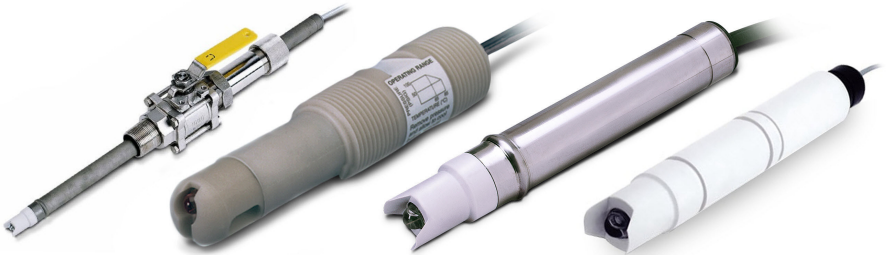


Rosemount™ pH/ORP Sensors

Models 389, 389VP, 396, 396VP, 397,
398, 398VP, 398R, 398RVP



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1 Essential instructions

Read this page before proceeding!

Emerson 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. You must adhere to the following instructions and integrate them into your safety program when installing, using, and maintaining Emerson's Rosemount products.

▲ WARNING

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.

Follow all warnings, cautions, and instructions marked on and supplied with the product.

If this Quick Start Guide is not the correct one, call 1-800-854-8257 or 949-757-8500 to request the correct Quick Start Guide. Save this Quick Start Guide for future reference.

Inform and educate your personnel in the proper installation, operation, and maintenance of the product.

Use only qualified personnel to install, operate, program, and maintain the product.

Install 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.

When replacement parts are required, ensure that qualified people use replacement parts specified by Emerson.

Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified people, to prevent electrical shock and personal injury.

NOTICE

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

⚠ 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 to 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**Special conditions for safe use**

All pH/ORP sensors have a plastic enclosure which must be cleaned with a damp cloth to avoid the danger due to a buildup of electrostatic discharge.

NOTICE**Sensor/process application compatibility**

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

Application compatibility is entirely the owner's responsibility.

2 Installation

2.1 Storing the sensor

- Emerson recommends storing pH/ORP sensors in their original shipping containers until needed.
- Store sensors in a temperature-controlled environment.
- If the sensor must be stored after it has been removed from its shipping container, store the sensor tip downward with the protective cap in place and containing KCL solution (PN 9210342).
- For overnight storage, immerse the sensor in tap water or a 4 pH buffer solution.
- pH glass electrodes slowly deteriorate in storage. There is no specific expiration date. Follow the calibration procedures in [Calibration and maintenance](#) to determine if the sensor calibrates properly.

2.2 Prepare sensor

Procedure

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

2.3 Installing sensors

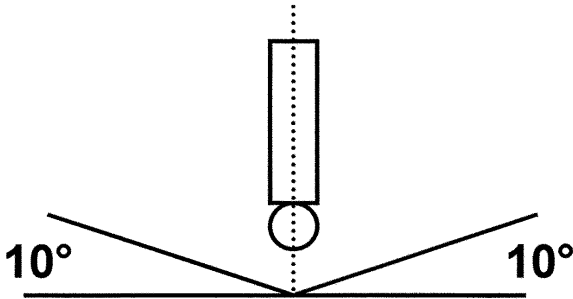
2.3.1 Installation accessories

See the [Liquid Analysis Sensor Mounting, Wiring, and Calibration Product Data Sheet](#) for a full list of accessories available from Emerson to enable convenient and reliable sensor installation for your application.

2.3.2 Sensor orientation

Install all Rosemount pH/ORP sensors within 80 degrees of vertical, as shown in [Figure 2-1](#). This ensures that the air bubble within the sensor does not stay at the sensor tip and disrupt the measurement.

Figure 2-1: Sensor orientation



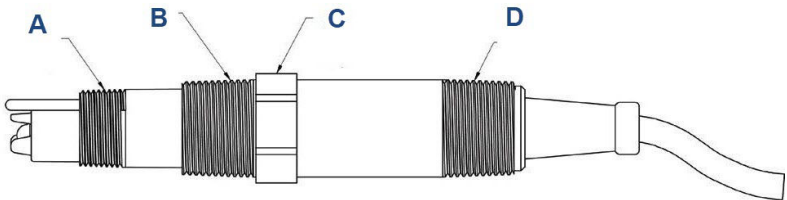
Install the sensor tip down within 80 degrees of vertical.

2.3.3 Install insertion style sensors

Emerson offers two primary mounting styles for pH/ORP sensors: insertion and retractable.

Insertion style sensors have NPT pipe threads that you can connect directly into the process or into a mounting adapter.

Figure 2-2: Example of a Rosemount insertion style sensor



- A. Forward facing 3/4-in. NPT are present on some Rosemount pH/ORP sensor models.
- B. Forward facing 1-in. NPT
- C. Wrench flats
- D. Rear facing 1-in. NPT

You can connect insertion style sensors to the process using the forward facing NPT threads or you can use the rear facing NPT threads for immersion mounting in a pond or basin.

For immersion mounting, connect the sensor to a pipe using the rear facing threads to keep the cable connection on the back of the sensor dry.

Procedure

1. When using the sensor's NPT threads to connect to your process, wrap the sensor threads with six or seven turns of PTFE tape to prevent leakage.
2. Hand tighten the sensor and then tighten one or two turns with a wrench.

Do not over tighten.

2.3.4 Installing retractable style sensors

Emerson offers two primary mounting style designs for pH/ORP sensors: insertion and retractable.

Retractable style sensors have 1-in. (25 mm) outer diameter metal bodies that you must connect to the process using an Emerson provided insertion adapter or a ball valve retraction mounting assembly.

Figure 2-3: Example of Rosemount retractable style sensor



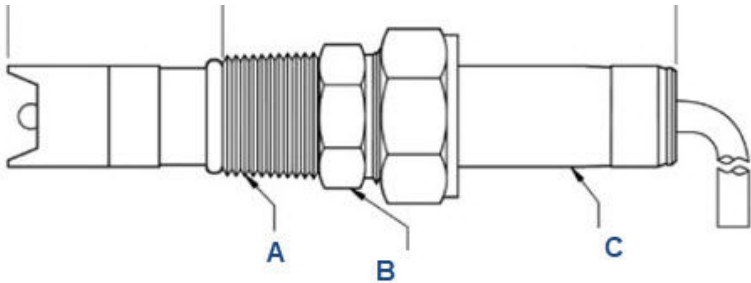
A. 1-in. (25 mm) outer diameter retractable sensor body

Retractable sensors are available in several different lengths. Retractable sensors with a length of less than 15 in. (381 mm) require the use of an insertion adapter (PN 23166-00, PN 23166-01, or PN 9510066).

You can install retractable sensors with lengths greater than 15 in. (381 mm) with an insertion adapter or with a Rosemount ball valve assembly (PN 23240-00 or PN 23765-00). Ball valve assemblies allow the sensor to be isolated from the process, so that you can remove the sensor for cleaning, service, or replacement while the process remains on-line.

Install retractable sensor with an insertion adapter

Figure 2-4: Insertion adapter (PN 23166-00 or PN 23166-01) with Rosemount retractable sensor



- A. 1-in. NPT
- B. Ferrule fitting process connector assembly: PN 23166-00 or PN 23166-01
- C. Sensor body

Procedure

1. Slide the fitting onto the sensor from the back of the sensor. Install the threads facing forward for insertion installations. Install the threads facing backward for connection to a submersion pipe.
2. Connect the NPT threads on the adapter to the process piping or submersion pipe.
3. Adjust the position of the fitting on the sensor to achieve the desired sensor insertion length.
4. While holding the sensor in position, tighten the hex nut of the male connector to firmly secure the sensor in place.

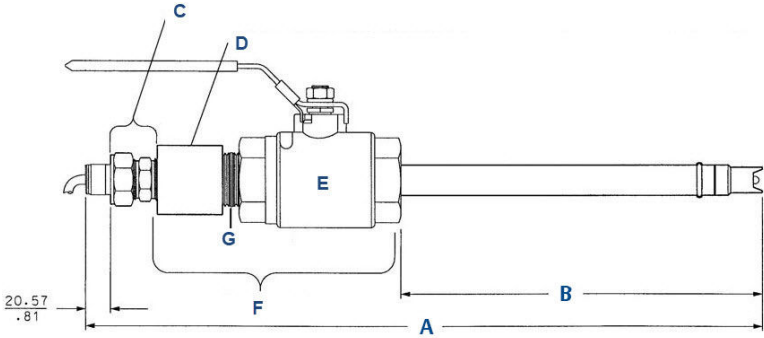
NOTICE

Over-tightening the hex nut may damage the ferrule.

When you tighten the hex nut, the PTFE ferrule inside the compression fitting clamps the sensor tube.

Install retractable sensor with ball valve assembly PN 23240-00

Figure 2-5: PN 23240-00 ball valve assembly and PN 23166-00 or PN 23166-01 adapter with Rosemount retractable sensor



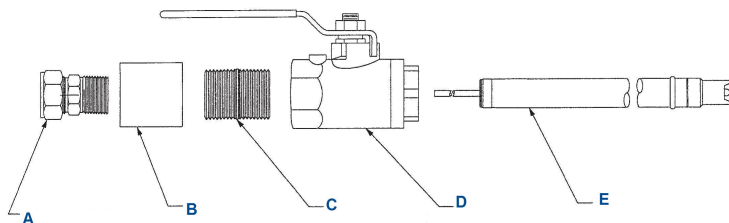
Dimension in drawing shows millimeters above and inches below.

- A. Dimension (see [Table 2-1](#))
- B. Dimension (see [Table 2-1](#))
- C. Process connector (PN 23166-00 or PN 23166-01). Not included with ball valve kit.
- D. 1.5-in. (38.1 mm) by 1-in. (25.4 mm) reducer (PN 9310104)
- E. Ball valve (PN 934065)
- F. Ball valve kit (PN 23240-00)
- G. 1.5-in. (38.1 mm) close nipple (PN 931012)

Table 2-1: Insertion lengths for retraction assembly PN 23240-00

Sensor tube length	A	B (maximum)
21 in. (533 mm)	23.1 in. (587 mm)	12.9 in. (328 mm)
36 in. (914 mm)	37.58 in. (955 mm)	27.4 in. (696 mm)

Figure 2-6: Exploded view ball valve assembly (PN 23240-00) used with process connector (PN 23166-00 or PN 23166-01)



- A. Kit, 1-in. (25.4 mm) ferrule fitting (PN 23166-00)
- B. 1.5-in. (38.1 mm) by 1-in. (25.4 mm) reducer (PN 9310104)
- C. 1.5-in. (38.1 mm) close nipple, 316 stainless steel (PN 9310103)
- D. 1.5-in. (38.1 mm) ball valve, 316 stainless steel (PN 9340065)
- E. Sensor

Procedure

1. Securely connect the ball valve assembly (ball valve, nipple, and reducer) to the process.
2. Make sure the ball valve is closed and the system pressure is at or below the maximum rated retraction pressure for the sensor length you are using before proceeding.

⚠ WARNING

Before removing the sensor, be absolutely certain that the process pressure is reduced to 0 psig (0 barg) and the process temperature is lowered to a safe level.

Do not insert or retract retractable sensors when process pressure is above the specified retraction pressure limit for the length of sensor being used.

For 21-in. (533 mm) length sensors the maximum allowed retraction pressure is 64 psig (5.4 barg).

For 36-in. (914 mm) length sensors the maximum allowed retraction pressure is 35 psig (3.4 barg).

3. Slide the ferrule fitting (PN 23166-00 or 23166-01) onto the sensor from the back of the sensor.
4. With the ferrule fitting on the sensor's body, insert the sensor into the ball valve until it gently touches the closed valve.

The electrode tip guard will protect the electrode glass from breakage.

5. Thread the ferrule fitting tightly into the ball valve assembly.

NOTICE

Do not tighten the hex nut on the ferrule fitting. Tightening the hex nut would not make it possible to insert the sensor through the ball valve.

6. Pull back hard on the sensor, as if trying to remove it, to be certain that the sensor cannot come free of the ball valve assembly.

If the sensor is properly installed, the built-in retraction stop will butt against the shoulder of the ferrule fitting.

NOTICE

The sensor must be captured by the valve assembly so that it cannot be blown free by process pressure if mishandled during insertion or retraction.

7. After confirming that the sensor assembly is properly secured by the valve assembly, open the ball valve and position the sensor into the process at the desired depth and orientation.
8. While holding the sensor in position, tighten the hex nut of the ferrule fitting to firmly secure the sensor in place.

NOTICE

Over-tightening the hex nut may damage the ferrule.

NOTICE

A stainless steel ferrule is available if the PTFE ferrule does not adequately grip. When using the metallic ferrule, take care to avoid over-tightening and damaging the sensor tube. If the ferrule fitting leaks during insertion or retraction, replace the O-ring in the ferrule fitting.

When the hex nut is tightened, the PTFE ferrule inside the ferrule fitting clamps the sensor tube.

Retract sensor with ball valve assembly PN 23240-00

⚠ WARNING

System pressure may cause the sensor to blow out with great force.

Take care when removing the sensor.

Make sure that the system pressure at the sensor is below the maximum allowed retraction pressure for the length of sensor you are using. For 21-in. (533.4 mm) length sensors, the maximum allowed retraction pressure is 64 psig (5.4 barg). For 36-in. (914.4 mm) length sensors, the maximum allowed retraction pressure is 35 psig (3.4 barg).

Wear a face shield.

Make sure your footing is stable.

Procedure

1. Push in on the sensor from the back end and slowly loosen the hex nut of the ferrule fitting.

NOTICE

Do not remove the nut at this time.

2. When the hex nut is loose enough, slowly ease the sensor back completely until it reaches the retraction stop collar.

NOTICE

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

3. Close the ball valve slowly. If there is resistance, the valve may be hitting the sensor. Double check that the sensor has been retracted to the retraction stop collar.

⚠ WARNING

Leakage from the ferrule fitting threads may indicate that the male connector is still under pressure. Leakage through a partially open ball valve could be hazardous; however, with the ball valve fully closed some residual process fluid may leak from the connector's pipe threads.

Before removing the sensor from the ball valve, make sure that the ball valve is fully closed.

4. Unthread the ferrule fitting completely from the reducing coupling and remove the sensor for servicing.

NOTICE

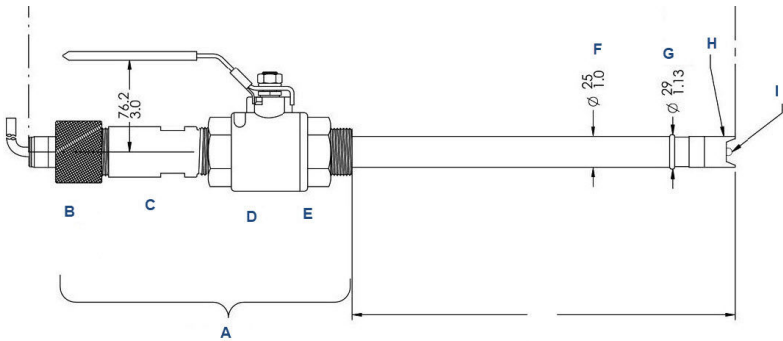
If the ferrule fitting leaks during insertion or retraction, replace the O-ring (PN 25394-1) in the ferrule fitting.

Install retractable sensor with ball valve assembly PN 23765-00

Contents of ball valve assembly kit (PN 23765-00)

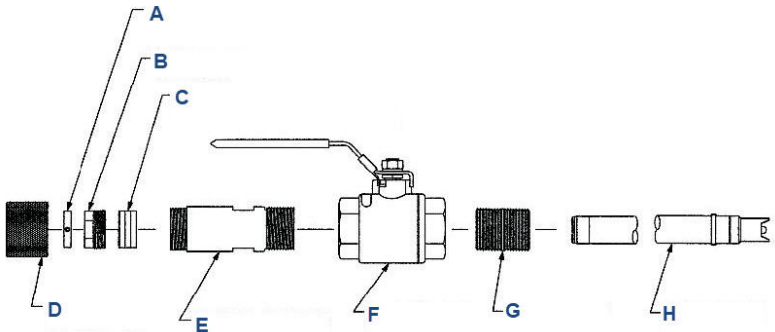
- 1¼-in. male NPT nipple
- 1¼-in. ball valve
- Packing adapter (includes packing rings and busing)
- Stop ring
- Retainer

Figure 2-7: Ball valve assembly kit (PN 23765-00) and sensor



Dimensions in drawing are in millimeters with inches below.

- A. Ball valve kit, PN 23765-00
- B. Knurl retainer
- C. Packing adapter
- D. Ball valve
- E. 1¼-in. male NPT close nipple
- F. Housing titanium
- G. Retraction stop collar
- H. Electrode housing
- I. pH electrode

Figure 2-8: Exploded view of ball valve assembly kit (PN 23765-00)

Ball valve kit (PN 23765-00) includes a 1¼-in. by 1¼-in. nipple, 1¼-in. ball valve, and all packing adapter pieces shown.

- A. Stop ring with three set screws (PN 33579-00)
- B. Packing bushing (PN 4357M)
- C. Packing rings (PN 9160410). Install metal ring last.
- D. Retainer (PN 33577-00)
- E. Packing adapter (PN 33578-00)
- F. 1¼-in. NPT ball valve (PN 9340078)
- G. 1¼-in. male NPT nipple (PN 4342M)
- H. Retractable pH sensor

Procedure

1. Securely connect the ball valve to the process.
2. Make sure the ball valve is closed and the system pressure is at or below the maximum rated retraction pressure for the sensor length you are using before proceeding.

⚠ WARNING

Before removing the sensor, be absolutely certain that the process pressure is reduced to 0 psig (0 barg) and the process temperature is lowered to a safe level.

Do not insert or retract retractable sensors when process pressure is above the specified retraction pressure limit for the length of sensor being used.

For 21-in. (533 mm) length sensors the maximum allowed retraction pressure is 64 psig (5.4 barg).

For 36-in. (914 mm) length sensors the maximum allowed retraction pressure is 35 psig (3.4 barg).

3. Slide the packing adapter (including packing rings and packing bushing), stop ring, and retainer onto the sensor from the back in the order shown in [Figure 2-8](#).
4. Slide the stop ring to the desired position on the sensor and tighten the stop ring set screw.
The position of the stop ring will set the distance the sensor is inserted into the process.
5. Insert the sensor into the ball valve until it gently touches the closed valve.
The electrode tip guard will protect the electrode glass from breakage.
6. Securely connect the front of the packing adapter to the ball valve.
7. Pull back hard on the sensor, as if trying to remove it, to be certain that the sensor cannot break free of the ball valve assembly.
The built-in retraction stop will butt against the packing adapter.

NOTICE

The sensor must be captured by the valve assembly and packing adapter so that it cannot be blown free by process pressure if it is mishandled during insertion or retraction.

8. After confirming that the sensor assembly is properly secured by the valve assembly, open the ball valve and push the sensor into the process until the stop ring rests against packing bushing.
9. Connect the retainer to the back of the packing adapter (hand tighten only).

Retract sensor with ball valve assembly PN 23765-00

Prerequisites

Make sure that the system pressure at the valve is below the maximum retraction pressure for the length of the sensor being used before proceeding.

⚠ WARNING

Before removing the sensor, be absolutely certain that the process pressure is reduced to 0 psig (0 barg) and the process temperature is lowered to a safe level.

Do not insert or retract retractable sensors when process pressure is above the specified retraction pressure limit for the length of sensor being used.

For 21-in. (533 mm) length sensors the maximum allowed retraction pressure is 64 psig (5.4 barg).

For 36-in. (914 mm) length sensors the maximum allowed retraction pressure is 35 psig (3.4 barg).

Provide adequate working area for retraction.

Procedure

1. Unscrew the retainer from the packing adapter.
If it is difficult to unscrew the retainer, system pressure may be forcing the clamp stop ring into the retainer. The packing bushing may not be tight enough to hold the sensor in place. To prevent a sudden retraction of the sensor as the retainer is removed, hold onto the back of the sensor to restrain it.
2. If the sensor does not slide back as the retainer is unscrewed, pull from the back of the sensor to release it.
3. If you cannot retract the sensor, loosen the clamp stop ring using the hex key. Pull the stop ring back and slowly loosen the packing bushing in $\frac{1}{8}$ turn increments.
System pressure may cause the sensor to retract. If the sensor still does not retract, pull on the back of the sensor to retract it.
4. Withdraw the sensor until the sensor guard contacts the stop inside the packing adapter.

NOTICE

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

-
5. Unscrew the packing adapter from the ball valve to remove the sensor.

3 Wiring

The wire connections required between the sensor and transmitter depend on the transmitter model, the sensor model, the sensor cable color, and whether the sensor has a preamplifier.

To determine if your sensor has a preamplifier, look up the model string description in the sensor Product Data Sheet.

For additional wiring information for your product, including wiring diagrams for sensor and transmitter combinations not shown here and for sensor wiring using a remote junction box and extension cable please refer to [Emerson.com/RosemountLiquidAnalysisWiring](https://www.emerson.com/RosemountLiquidAnalysisWiring).

3.1 Wiring diagrams for Variopol (VP) sensors with preamplifier

Figure 3-1: Rosemount 389VP, 396VP, or 398RVP Sensor with preamplifier to Rosemount 56, 1056, 1057, or 1058 Transmitter wiring

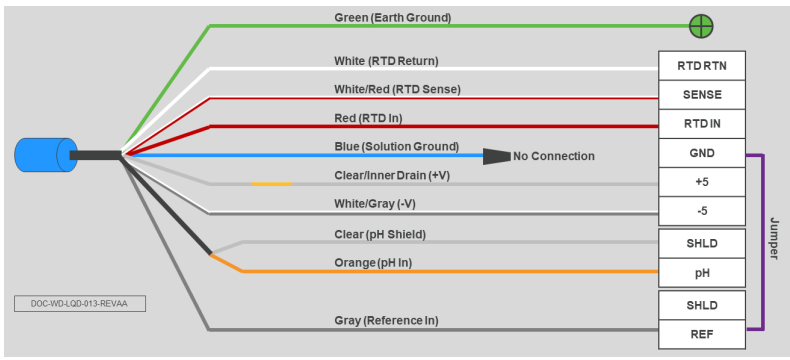


Figure 3-2: Rosemount 389VP, 396VP, or 398RVP pH/ORP Sensor with preamplifier to Rosemount 1066 Transmitter wiring

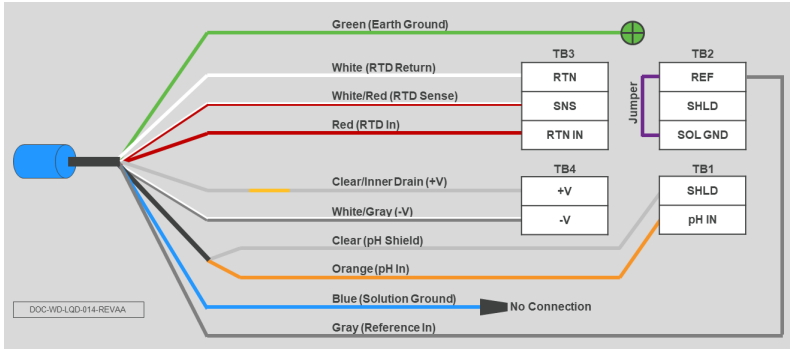
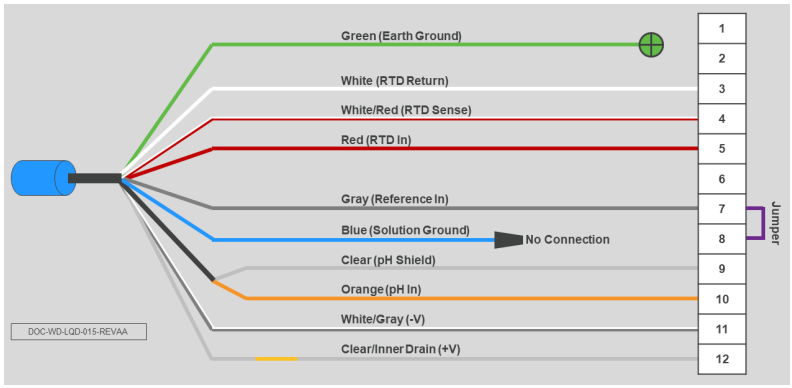


Figure 3-3: Rosemount 389VP, 396VP, or 398RVP pH/ORP Sensor with preamplifier to Rosemount 5081 Transmitter wiring



3.2 Wiring diagrams for Variopol (VP) sensors without preamplifier

Figure 3-4: Rosemount 389VP, 396VP, 398VP or 398RVP pH/ORP Sensor without preamplifier to Rosemount 56, 1056, 1057, or 1058 Transmitter wiring

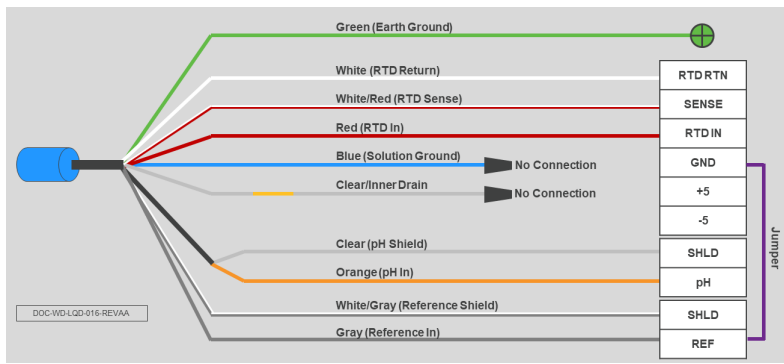


Figure 3-5: Rosemount 389VP, 396VP, 398VP, or 398RVP pH/ORP Sensor without preamplifier to Rosemount 1066 Transmitter wiring

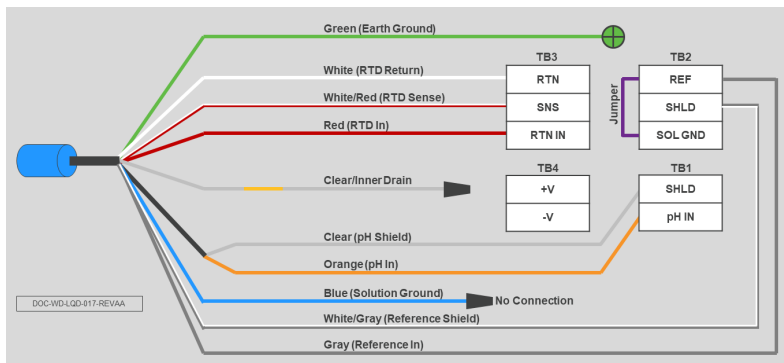
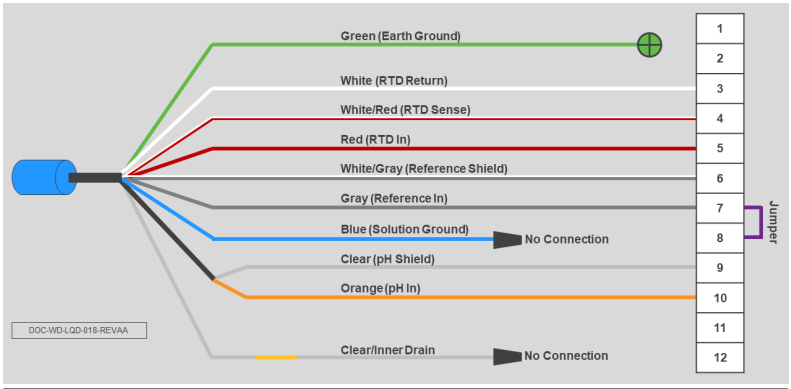
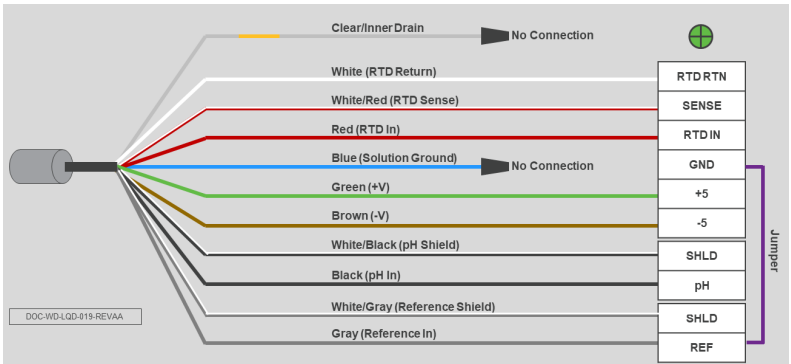


Figure 3-6: Rosemount 389VP, 396VP, 398VP, or 398RVP pH/ORP Sensor without preamplifier to Rosemount 5081 Transmitter wiring



3.3 Wiring diagrams for integral cable sensors with preamplifier

Figure 3-7: Rosemount 389 pH/ORP Sensor with preamplifier to Rosemount 56, 1056, 1057, or 1058 Transmitter wiring



If there is a shrink sleeve on the gray reference wire, remove it before connecting the wire to the terminal.

Figure 3-8: Rosemount 389 pH/ORP Sensor with preamplifier to Rosemount 1066 Transmitter wiring

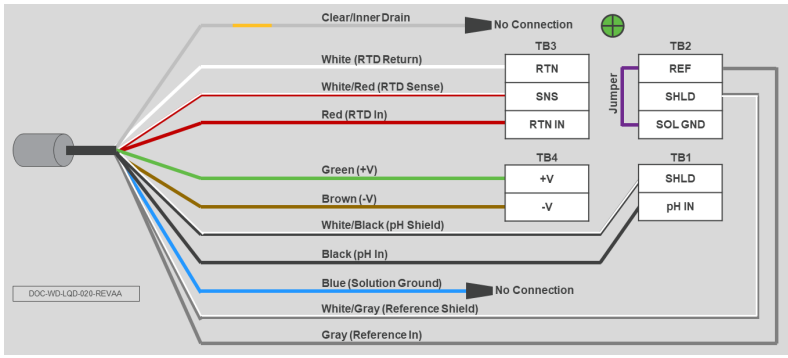
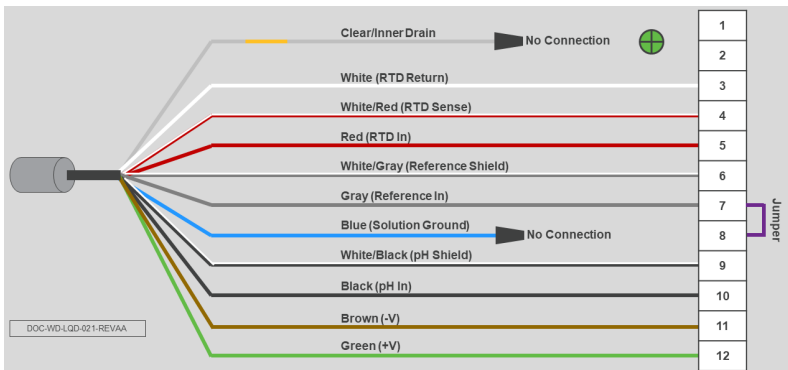


Figure 3-9: Rosemount 389 pH/ORP Sensor with preamplifier to Rosemount 5081 Transmitter wiring



If there is a shrink sleeve on the gray reference wire, remove it before connecting the wire to the terminal.

3.4 Wiring diagrams for integral cable sensors without preamplifier

NOTICE

If ground lead is present, terminate it to the green ground screw on the inner enclosure.

Figure 3-10: Rosemount 389, 396, 397, 398, or 398R pH/ORP Sensor without preamplifier to Rosemount 56, 1056, 1057, or 1058 Transmitter wiring

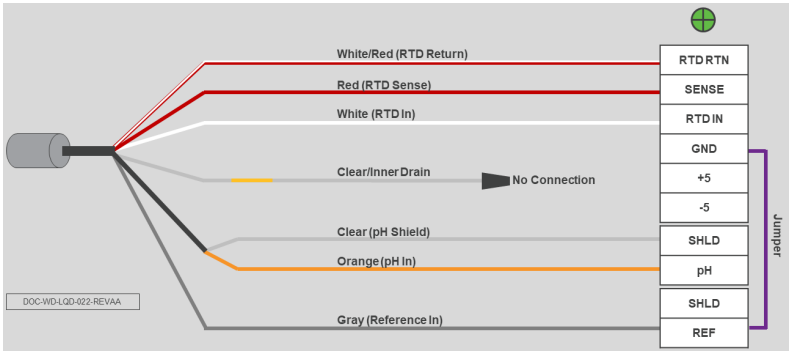


Figure 3-11: Rosemount 389, 396, 397, 398, or 398R pH/ORP Sensor without preamplifier to Rosemount 1066 Transmitter wiring

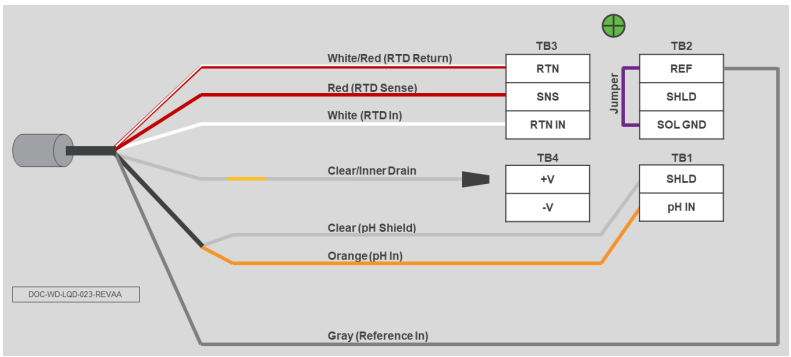
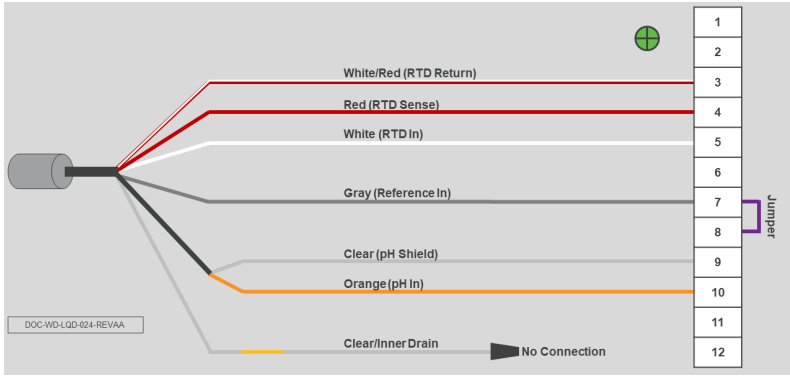


Figure 3-12: Rosemount 389, 396, 397, 398, or 398R pH/ORP Sensor without preamplifier to Rosemount 5081 Transmitter wiring



4 Calibration and maintenance

Calibrate pH/ORP sensors at start-up to obtain the best accuracy.

Consult the appropriate Rosemount liquid analysis transmitter manual for specific calibration and standard procedures or see [Calibrate a pH sensor with two buffer solutions](#), [Standardize pH sensor](#), or [Calibrate Rosemount oxidation reduction potential \(ORP\) sensor](#) for recommended procedures.

4.1 Calibrate a pH sensor with two buffer solutions

A two-point buffer calibration is the only way to ensure that a pH sensor is providing accurate measurements. During a two-point calibration, the transmitter calculates new values for slope (mV/pH) and zero offset (mV) based on the mV response of the sensor when it is in the pH standard solutions.

Procedure

1. Immerse the sensor in the first buffer solution. Allow the sensor to adjust to the buffer temperature (to avoid errors due to temperature differences between the buffer solution and sensor temperature) and wait for readings to stabilize.
2. Once the transmitter has acknowledged the first buffer, rinse the buffer solution off the sensor by pouring a small amount of the second buffer solution over the tip of the sensor.
3. Repeat [Step 1](#) using the second buffer solution.

Once the transmitter has acknowledged both buffer solutions, a sensor slope (mV/pH) is established.

4.2 Standardize pH sensor

For maximum accuracy, you can standardize the sensor in-line or with a process grab sample after performing a buffer calibration and conditioning the sensor to the process. Standardization accounts for the sensor junction potential and other interferences. Standardization does not change the sensor's slope, but simply adjusts the transmitter's reading to match that of a known process pH.

Procedure

1. While obtaining a process solution sample, record the pH value that is shown on the transmitter display.
Emerson recommends taking the sample close to the sensor.

2. Measure and record the pH of the process solution sample with another temperature compensated and calibrated pH instrument.
For best results, perform standardization at the process temperature.
3. Adjust the transmitter to the standardized value.

4.3 Calibrate Rosemount oxidation reduction potential (ORP) sensor

Calibrate an ORP sensor using an ORP standard solution.

Prerequisites

Saturated quinhydrone ORP standard solution is available from Emerson (PN R508-8OZ) (460 ± 10 mV). You can also make ORP standard solution by adding a few crystals of quinhydrone to either a pH 4 or pH 7 buffer. Quinhydrone is only slightly soluble; therefore, only a few crystals are required.

⚠ WARNING

Corrosive substance

The solution used during calibration is an acid; handle it with care. Follow the directions of the acid manufacturer.

Wear the proper protective equipment.

Do not let the solution come into contact with skin or clothing.

If contact with skin is made, immediately rinse with clean water.

Procedure

1. Make a temporary electrical connection between the sensor and the transmitter to dissipate any accumulated electrical charge.
2. Immerse the sensor in the standard solution. Allow one to two minutes for the ORP sensor to stabilize.
3. Adjust the ORP value on the transmitter to the solution value shown in [Table 4-1](#).
The resulting potentials, measured with a clean platinum electrode and saturated KCl/AgCl reference electrode, should be within ± 20 millivolts of the value shown in [Table 4-1](#).
Note solution temperature to ensure accurate interpretation of results. The ORP value of saturated quinhydrone solution is not stable over long periods of time. Therefore, make these standards fresh each time they are used.

Table 4-1: ORP of saturated quinhydrone solution (millivolts)

	pH 4 solution			pH 7 solution		
Temperature: °F (°C)	68 (20)	77 (25)	86 (30)	68 (20)	77 (25)	86 (30)
mV potential	168	264	260	94	87	80

- Remove the sensor from the buffer, rinse, and install in the process.

4.4 When to service or replace a sensor

The usable life of a pH/ORP sensor depends on the application. Common indicators that a pH/ORP sensor needs to be serviced or has reached the end of its useful life include:

- pH slope during a two-point buffer calibration is too low. Typically, the lower limit is 40 to 50 mV/pH. If the slope is lower than that, it indicates that the pH glass has reached the end of its useful life and that the sensor needs to be replaced.
- Zero offset during calibration is too high. The typical upper limit is an absolute value of 60 mV. If the offset is higher than that, it indicates that the reference system has reached the end of its useful life and that the sensor needs to be replaced.
- Sensor responds slowly to changes in process pH or has erratic readings. This may be resolved by cleaning the sensor electrodes or may indicate that the sensor needs to be replaced.

4.5 Clean pH/ORP sensor electrodes

Erratic readings or sluggish response may indicate that the sensor is dirty and needs to be cleaned. The following are the recommended cleaning procedures for pH/ORP sensors.

Procedure

Clean the electrodes.

- To remove oil deposits, clean the electrodes with a mild, non-abrasive detergent.
- To remove scale deposits, soak the electrodes for one to five minutes in a five percent hydrochloric acid solution.

⚠ WARNING**Corrosive substance**

Hydrochloric acid is toxic and highly corrosive.

Avoid skin contact.

Wear protective gloves.

Use only in a well-ventilated area.

Do not inhale fumes.

In case of an accident, consult a doctor immediately.

- For ORP (metallic) electrodes only, polish with moistened baking soda.

4.6 Replace pH/ORP sensor reference junction and recharge sensor electrolyte

Emerson has designed certain Rosemount pH/ORP sensor models (3300HT, 3300HTVP, 3400HT, 3400HTVP, 3500P, and 3500VP) to allow the reference junction and reference fill gel solution to be replaced.

Emerson has designed the Rosemount 350A pH/ORP Sensor to allow the reference junction and reference fill air solution to be replaced.

Replacing the reference junction and recharging the electrolyte may be an alternative to replacing the entire sensor when you observe a high zero offset error during a calibration.

Prerequisites

Use the junction replacement kit and replacement fill gel.

Procedure

1. Remove the junction cap by turning it counter clockwise.
2. Remove the liquid junction by pulling the junction straight out.

⚠ WARNING

The reference electrolyte may cause skin or eye irritation.

Avoid contact with skin and eyes.

3. Rinse with water to remove the old reference fill gel.
4. Fill the reference fill chamber with the reference fill gel using the syringe, and remove any air bubbles. Top off the reference fill chamber until it is completely filled.

5. Replace the junction O-ring and liquid junction by sliding them over the glass electrode.
Excess reference gel should flow out.
6. Replace junction cap by turning clockwise.
Hand tighten the junction cap only; do not use pliers to tighten the cap.
7. Calibrate the sensor as described in [Calibrate a pH sensor with two buffer solutions](#).

5 Rosemount pH/ORP sensor(s) product certifications

Rev 0.5

5.1 European directive information

A copy of the EU Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the EU Declaration of Conformity can be found at [Emerson.com](https://www.emerson.com).

5.2 Ordinary location certification

As standard, the transmitter has been examined and tested to determine that the design meets the basic electrical, mechanical, and fire protection requirements by a Nationally Recognized Test Laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

5.3 Installing equipment in North America

The US National Electrical Code® (NEC) and the Canadian Electrical Code (CEC) permit the use of Division marked equipment in Zones and Zone marked equipment in Divisions. The markings must be suitable for the area classification, gas, and temperature class. This information is clearly defined in the respective codes.

5.4 USA

5.4.1 USA Intrinsic Safety

Certificate FM17US0198X

Standards FM Class 3600:1998, FM Class 3610:2010, FM Class 3611:2004, FM Class 3810: 2005

Markings IS/I,II,III/1/ABCDEFG/T6 Ta = -20 °C to 60 °C
I/0/AEx ia IIC/T6 Ta = -20 °C to 60 °C
NI/I/2/ABCD/T6 Ta = -20 °C to 60 °C
S/II,III/2/EFG/T6 Ta = -20 °C to 60 °C

Specific Conditions for Safe Use (X):

1. Sensors with Model 1700702 preamplifier:
 - a. Model 385+-a-b-c. Triple junction pH/ORP sensor
 - b. Model 389-a-b-c-d-e. pH/ORP sensor
 - c. Model 389VP-a-b-c-d. pH/ORP sensor

- d. Model 396VP-a-b-c-d. Submersion/insertion pH/ORP sensor
- e. Model 396P-a-b-c-d-e. Submersion/insertion pH/ORP sensor
- f. Model 396PVP-a-b-c-d-e. Submersion/insertion pH/ORP sensor
- g. Model 396RVP-a-b-c-d-e. Retraction/submersion/insertion pH/ORP sensor
- h. Model 398RVP-a-b-c-d-e-f. pH/ORP sensor
- i. Model 3200HP-00. High purity water pH sensor
- j. Model 3300HTVP-a-b-c-d. High performance pH and ORP sensor
- k. Model 3400HTVP-a-b-c-d-e. High performance pH and ORP sensor
- l. 3500P-a-b-c-d-e-f. High performance pH and ORP sensor
- m. 3500VP-a-b-c-d-e-f. High performance pH and ORP sensor
- n. Model 3900-a-b-c. General purpose pH/ORP sensor
- o. Model 3900VP-a-b. General purpose pH/ORP sensor

The polymeric surface of all the apparatus listed above may store electrostatic charge and become a source of ignition. Clean surface should only be done with a damp cloth.

- 2. Sensors without Model 1700702 preamplifier (simple apparatus):
 - a. Model 385-a-b-c-d-e. Retractable pH/ORP sensor
 - b. Model 385+-a-b-c Triple junction pH/ORP sensor
 - c. Model 389-a-b-c-d-e. pH/ORP sensor
 - d. Model 389VP-a-b-c. pH/ORP sensor
 - e. Model 396-a-b-c. Submersion/insertion pH sensor
 - f. Model 396VP-a-b. Submersion/insertion pH sensor
 - g. Model 396P-a-b-c-d-e. Submersion/insertion pH/ORP sensor
 - h. Model 396PVP-a-b-c-d. Submersion/insertion pH/ORP sensor

- i. Model 396R-a-b-c-d-e. Retraction/submersion/insertion pH/ORP sensor
- j. Model 396RVP-a-b-c-d. Retraction/submersion/insertion pH/ORP sensor
- k. Model 397-a-b-c-d-e. pH sensor
- l. Model 398-a-b-c-d-e. pH/ORP sensor
- m. Model 398VP-a-b-c. pH/ORP sensor
- n. Model 398R-a-b-c-d-e-f. pH/ORP sensor
- o. Model 398RVP-a-b-c-d-e-f. pH/ORP sensor
- p. Model 3200HP-00. High purity water pH sensor
- q. Model 3300HT-a-b-c-d. High performance pH and ORP sensor
- r. Model 3300HTVP-a-b-c-d. High performance pH and ORP sensor
- s. Model 3400HT-a-b-c-d-e-f. High performance pH and ORP sensor
- t. Model 3400HTVP-a-b-c-d-e-f. High performance pH and ORP sensor
- u. Model 3500P-a-b-c-d-e-f. High performance pH and ORP sensor
- v. Model 3500VP-a-b-c-d-e-f. High performance pH and ORP sensor
- w. Model 3800-a. Autoclaveable and steam sterilizable pH sensors
- x. Model 3800VP-a. Autoclaveable and steam sterilizable pH sensors
- y. Model 3900-a-b-c. General purpose pH/ORP sensor
- z. Model 3900VP-a-b. General purpose pH/ORP sensor

The polymeric surface of all the apparatus listed above may store electrostatic charge and become a source of ignition. Clean surface should only be done with a damp cloth.

5.4.2 USA Intrinsic Safety

Certificate 70164066

- Standards** C22.2 No 0-10, C22.2 No 0.4-M2004, C22.2 No 94-M1991, C22.2 No 142 – M1987, C22.2 No 157-M1992, CAN/CSA E60079-0:07, CAN/CSA E60079-11:02, UL 50-11th Edition, UL 508-17th Edition, UL 913-7th Edition, UL 60079-0: 2005, UL 60079-11: 2002
- Markings** Preamplifier assembly:
Class I, Division 1, Groups ABCD; Class II, Division 1, Groups EFG; Class III; Class I, Division 2, Groups ABCD; ambient temperature rating –20 °C to +60 °C; Ex ia IIC; T6: Class I, Zone 0, AEx ia IIC; T6
- Sensor apparatus with preamplifier:
Class I, Division 1, Groups ABCD; Class II, Division 1, Groups EFG; Class III; Class I, Division 2, Groups ABCD; ambient temperature rating –20 °C to +60 °C; Ex ia IIC; T6: Class I, Zone 0, AEx ia IIC; T6
- Sensor apparatus:
Class I, Division 1, Groups ABCD; Class II, Division 1, Groups EFG; Class III; Class I, Division 2, Groups ABCD; Ex ia IIC; T6; ambient temperature rating –20 °C to +60 °C: (simple apparatus)

5.5 Canada





5.5.1 Canada Intrinsic Safety

- Certificate** 70164066
- Standards** C22.2 No 0-10, C22.2 No 0.4-M2004, C22.2 No 94-M1991, C22.2 No 142 – M1987, C22.2 No 157-M1992, CAN/CSA E60079-0:07, CAN/CSA E60079-11:02, UL 50-11th Edition, UL 508-17th Edition, UL 913-7th Edition, UL 60079-0: 2005, UL 60079-11: 2002
- Markings** Preamplifier assembly:
Class I, Division 1, Groups ABCD; Class II, Division 1, Groups EFG; Class III; Class I, Division 2, Groups ABCD; ambient temperature rating –20 °C to +60 °C; Ex ia IIC; T6: Class I, Zone 0, AEx ia IIC; T6
- Sensor apparatus with preamplifier:
Class I, Division 1, Groups ABCD; Class II, Division 1, Groups EFG; Class III; Class I, Division 2, Groups ABCD; ambient temperature rating –20 °C to +60 °C; Ex ia IIC; T6: Class I, Zone 0, AEx ia IIC; T6
- Sensor apparatus:
Class I, Division 1, Groups ABCD; Class II, Division 1, Groups EFG; Class III; Class I, Division 2, Groups ABCD;

Ex ia IIC; T6; ambient temperature rating -20 °C to +60 °C: (simple apparatus)

5.6 Europe

5.6.1 ATEX/UKEX Intrinsic Safety

ATEX certificate	Baseefa10ATEX0156X
UKEX certificate	BAS21UKEX0396X
Standards	EN IEC 60079-0: 2018 EN 60079-11: 2012
Markings	<p>pH/ORP sensors with no preamplifier fitted  II 1 G Ex ia IIC T4 Ga (-20 °C to +60 °C)</p> <p>pH sensors with integral smart preamplifier fitted  II 1 G Ex ia IIC T4 Ga (-20 °C to +60 °C)</p> <p>ORP sensors with integral standard preamplifier fitted  II 1 G Ex ia IIC T4 Ga (-20 °C to +80 °C) Ex ia IIC T5 Ga (-20 °C to +40 °C)</p> <p>pH sensors with integral standard preamplifier fitted  II 1 G Ex ia IIC T4 Ga (-20 °C to +80 °C) Ex ia IIC T5 Ga (-20 °C to +40 °C)</p>

Special Conditions for Safe Use (X):

1. All pH/ORP sensor models with a plastic enclosure or exposed plastic parts may provide an electrostatic ignition hazard and must only be cleaned with a damp cloth to avoid the danger of ignition due to build-up of electrostatic charge.
2. All pH/ORP sensor models with a metallic enclosure may provide a risk of ignition by impact or friction. Care should be taken during installation to protect the sensor from the risk.
3. External connections to the sensor must be suitably terminated and provide a degree of protection of at least IP20.
4. All pH/ORP sensor models are intended to be in contact with the process fluid and may not meet the 500V r.m.s. test to earth. This must be taken into consideration at installation.

5.7 International

5.7.1 IECEx Intrinsic Safety

Certificate IECEx BAS 10.0083X

Standards IEC 60079-0: 2011, IEC 60079-11: 2011

Markings pH/ORP sensors with no preamplifier fitted
Ex ia IIC T4 Ga (-20 °C to +60 °C)

pH sensors with integral smart preamplifier fitted
Ex ia IIC T4 Ga (-20 °C to +60 °C)

ORP sensors with integral standard preamplifier fitted
Ex ia IIC T4 Ga (-20 °C to +80 °C)

Ex ia IIC T5 Ga (-20 °C to +40 °C)

pH sensors with integral standard preamplifier fitted
Ex ia IIC T4 Ga (-20 °C to +80 °C)

Ex ia IIC T5 Ga (-20 °C to +40 °C)

Special Conditions for Safe Use (X):

1. All pH/ORP sensor models with a plastic enclosure or exposed plastic parts may provide an electrostatic ignition hazard and must only be cleaned with a damp cloth to avoid the danger of ignition due to build-up of electrostatic charge.
2. All pH/ORP sensor models with a metallic enclosure may provide a risk of ignition by impact or friction. Care should be taken during installation to protect the sensor from the risk.
3. External connections to the sensor must be suitably terminated and provide a degree of protection of at least IP20.
4. All pH/ORP sensor models are intended to be in contact with the process fluid and may not meet the 500V r.m.s. test to earth. This must be taken into consideration at installation.

5.8 China

5.8.1 China Intrinsic Safety

Certificate GYB19.1035X

Standards GB 3836.1-2010, GB 3836.4-2010, GB 3836.20-2010

Markings Ex ia II C T4 Ga (-20 °C to +60 °C)

Special Conditions for Safe Use (X):

1. It is strictly forbidden to rub the plastic shell parts of the product to prevent the risk of static ignition.

2. When the product shell contains light metals, it should be prevented in a zone 0 environment.

5.9 EAC

5.9.1 EAC Intrinsic Safety

Certificate TC RU C-US .MIO62. B.06011


Markings pH/ORP sensors with no preamplifier fitted
Ex ia IIC T4 Ga (-20 °C to +60 °C)
pH sensors with integral smart preamplifier fitted
Ex ia IIC T4 Ga (-20 °C to +60 °C)
ORP sensors with integral standard preamplifier fitted
Ex ia IIC T4 Ga (-20 °C to +80 °C)
Ex ia IIC T5 Ga (-20 °C to +40 °C)
pH sensors with integral standard preamplifier fitted
Ex ia IIC T4 Ga (-20 °C to +80 °C)
Ex ia IIC T5 Ga (-20 °C to +40 °C)

Special Condition for Safe Use (X):


See certificate for special conditions.

5.10 Declaration of Conformity

No: 1119 Rev. E



Declaration of Conformity



We,

Rosemount Inc.
6021 Innovation Blvd
Shakopee, MN 55379
USA

declare under our sole responsibility that the product,

Rosemount™ Sensor Model Series:
328A, 385, 385+, 389, 389VP, 396, 396P, 396PVP, 396VP, 396R, 396RVP, 397, 398, 398VP, 398R,
398RVP, 3200HP, 3300HT, 3300HTVP, 3400HT, 3400HTVP, 3500P, 3500VP, 3800, 3800VP, 3900,
3900VP

Authorized Representative in Europe:

Emerson S.R.L., company No. J12/88/2006, Emerson 4 street, Parcul Industrial
Tetarom II, Cluj-Napoca 400638, Romania

Regulatory Compliance Shared Services Department
Email: europaeproductcompliance@emerson.com Phone: +40 374 132 035


For product compliance destination sales questions in Great Britain, contact Authorized Representative:

Emerson Process Management Limited at ukproductcompliance@emerson.com or +44 11 6282 23 64, Regulatory Compliance Department.

Emerson Process Management Limited, company No 00671 801, Meridian East, Leicester LE19 1UX, United Kingdom

to which this declaration relates, is in conformity with:

- 1) the relevant statutory requirements of Great Britain, including the latest amendments
- 2) the provisions of the European Union Directives, including the latest amendments



(signature & date of issue) 11/2/22

Mark Lee (name)	Vice President, Quality (function)	Shakopee, MN, USA (place of issue)
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ATEX Notified Body for EU Type Examination Certificate:
CSA Group Netherlands B.V. [Notified Body Number: 2813]
Ulrechtseweg 310
6812 AR ARNHEM
Netherlands

ATEX Notified Body for Quality Assurance:
SGS Fimko Oy [Notified Body Number: 0598]
Tukomitie 8
00380 Helsinki
Finland

UK Conformity Assessment Body for UK Type Examination Certificate:
CSA Group Testing UK Ltd [Approved Body Number: 0518]
Unit 6 Hawarden Industrial Park, Hawarden, CH5 3US
United Kingdom

UK Approved Body for Quality Assurance:
SGS Baseefa Ltd. [Approved Body Number: 1180]
Rockhead Business Park, Staden Lane
Buxton, Derbyshire, SK17 9RZ
United Kingdom

No: 1119 Rev. E



Declaration of Conformity



ATEX Directive (2014/34/EU)

Baseefa10ATEX0156X- Intrinsically Safe
 Equipment Group II,
 Category 1 G Ex ia IIC T4 Ga (-20°C ≤ Ta ≤ +60°C)
 Models with no Pre-amplifier Fitted or with Integral Smart
 Pre-amplifier fitted: 328A, 385, 385+, 389, 389VP, 396,
 396P, 396VP, 396PVP, 396R, 396RVP, 397, 396, 398RVP,
 398R, 398RVP, 3200HP, 3300HT, 3300HTVP, 3400HT,
 3400HTVP, 3500P, 3500VP, 3800, 3800VP, 3900, 3900VP

Equipment Group II, Category 1 G Ex ia IIC T4 Ga (-20°C ≤ Ta ≤ +60°C) or T5 (-20°C ≤ Ta ≤ +40°C)
 for these model strings: 385+XX-12, 389-XX-12, 389-XX-XX-54, 396P-XX-12, 396P-XX-XX-54, 3500P-XX-12, 3500VP-XX-12 (Excludes No Preamplifier Options: Preamplifier/Cable Options -02/07-08)

Harmonized Standards:
 EN IEC 60079-0:2018
 EN 60079-11:2012

Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016 (S.I. 2016/1107)

BAS21UKEX0396X – Intrinsically Safe
 Equipment Group II,
 Category 1 G Ex ia IIC T4 Ga (-20°C ≤ Ta ≤ +60°C)
 Models with no Pre-amplifier Fitted or with Integral Smart
 Pre-amplifier fitted: 328A, 385, 385+, 389, 389VP, 396,
 396P, 396VP, 396PVP, 396R, 396RVP, 397, 396, 398RVP,
 398R, 398RVP, 3200HP, 3300HT, 3300HTVP, 3400HT,
 3400HTVP, 3500P, 3500VP, 3800, 3800VP, 3900, 3900VP

Equipment Group II, Category 1 G Ex ia IIC T4 Ga (-20°C ≤ Ta ≤ +60°C) or T5 (-20°C ≤ Ta ≤ +40°C)
 for these model strings: 385+XX-12, 389-XX-12, 389-XX-XX-54, 396P-XX-12, 396P-XX-XX-54, 3500P-XX-12, 3500VP-XX-12 (Excludes No Preamplifier Options: Preamplifier/Cable Options -02/07-08)

Designated Standards:
 EN IEC 60079-0:2018
 EN 60079-11:2012





Quick Start Guide
00825-0200-3389, Rev. AA
May 2023

For more information: [Emerson.com/global](https://www.emerson.com/global)

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