

# Rosemount™ pH/ORP Sensors

Model 396A





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# 1 Safety messages

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.

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.

### **⚠ WARNING**

Sensors should not be used with flammable liquids.

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### **⚠ 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.

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### **NOTICE**

#### **Pressure and temperature limits**

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### **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.

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### **NOTICE**

#### **Nominal Operating Parameters**

For situations where the sensor gets installed without a barrier in ordinary locations:

$U_i = 15.5V$

$C_i = 1.2\mu F$

$L_i = 0$

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## 2 Installation

### 2.1 Storing the sensor

- Open the box and inspect sensor upon receipt. 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).

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**Note**

Keep the cotton ball in the boot wet and sealed well. Keeping cotton wet will extend shelf life of sensor.

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- 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.

### 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.

### 2.3 Installing sensors

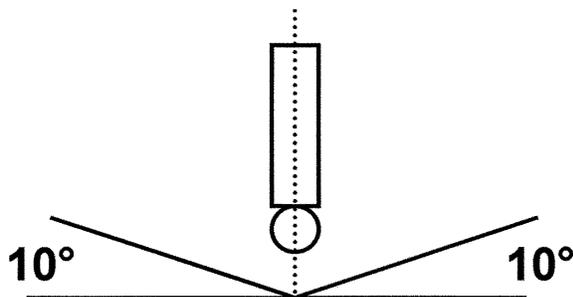
#### 2.3.1 Installation accessories

See the [Liquid Analysis Sensor Mounting, Wiring, and Calibration Accessories 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 at least 10 degrees over horizontal, 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**



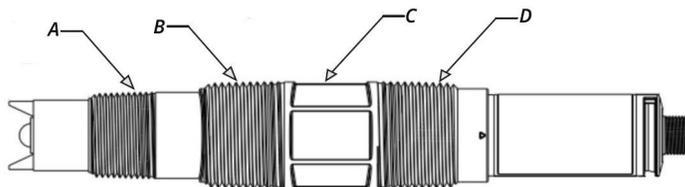
Mount sensor at least 10 degrees over horizontal.

## 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

Connect insertion style sensors to the process using the forward facing NPT threads. Or 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 PTFE tape to prevent leakage.
2. Hand tighten the sensor and then tighten.  
Do not over tighten.

## 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 output is digital, analog with a preamplifier, or analog without a preamplifier.

To determine the output of your sensor, look up the model string description in the 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, refer to [Emerson.com/RosemountLiquidAnalysisWiring](https://www.emerson.com/RosemountLiquidAnalysisWiring).

### 3.1 Wiring for digital sensors

You can connect the Rosemount Digital pH Sensors directly to the ports on the bottom of the Rosemount 1058 Transmitter. For the integral versions of the sensor, the sensor will already have a cable attached, which can be directly connected to the transmitter. For the M12 versions of the sensor, you will also need a corresponding Rosemount 102C digital cable in order to connect the sensor to the transmitter.

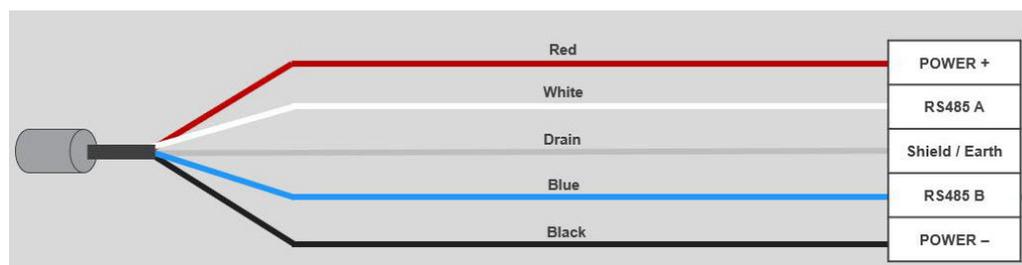
#### ⚠ WARNING

##### M12 Cable Installation

Install the 102C M12 cable onto the sensor by hand only. Emerson does not recommend using wrenches, pliers, or other tools, as excessive torque may damage the sensor or cable assembly.

If you wish to strip the M12 quick connect into flying leads in order to land the wires directly onto the transmitter board, please use the following wiring diagram.

**Figure 3-1: Rosemount Sensor (Stripped M12 Flying Leads) to Rosemount 1058 Transmitter Wiring**



## NOTICE

### **Electromagnetic compatibility**

Meets all industrial environment requirements of EN61326. Maximum deviation < 0.1 pH during electromagnetic compatibility (EMC) disturbance.

During surge event, device may exceed maximum EMC deviation limit or reset; however device will self-recover and return to normal operation within specified start-up time.

During electrostatic discharge (ESD) event, device may exceed maximum EMC deviation limit or reset; however, device will self-recover and return to normal operation within specified start-up time.

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## 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 R508-80Z) ( $460 \pm 10$  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  $\pm 20$  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

4. 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.



## 5 Confirming correct software version

### NOTICE

Verify that the latest software version is loaded on the sensor to ensure proper communications.

**Table 5-1: Software Revision Information**

Release Date	NAMUR Software Revision <sup>(1)</sup>	NAMUR hardware Revision <sup>(1)</sup>	Change Description
September 2025	01.00.00	01.00.00	Initial Release

*(1) NAMUR hardware and software revision of the sensor can be accessed by connecting the sensor to the 1058 transmitter, then pressing **i** and selecting **Sensor Information**. Differences in level 3 changes, signified above by the "xx", represents minor product changes as defined by NE53. Compatibility and functionality are preserved, and you can use the product interchangeably.*

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

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