HACH DOC023 pHD Analog Differential pH ORP Sensors User Manual

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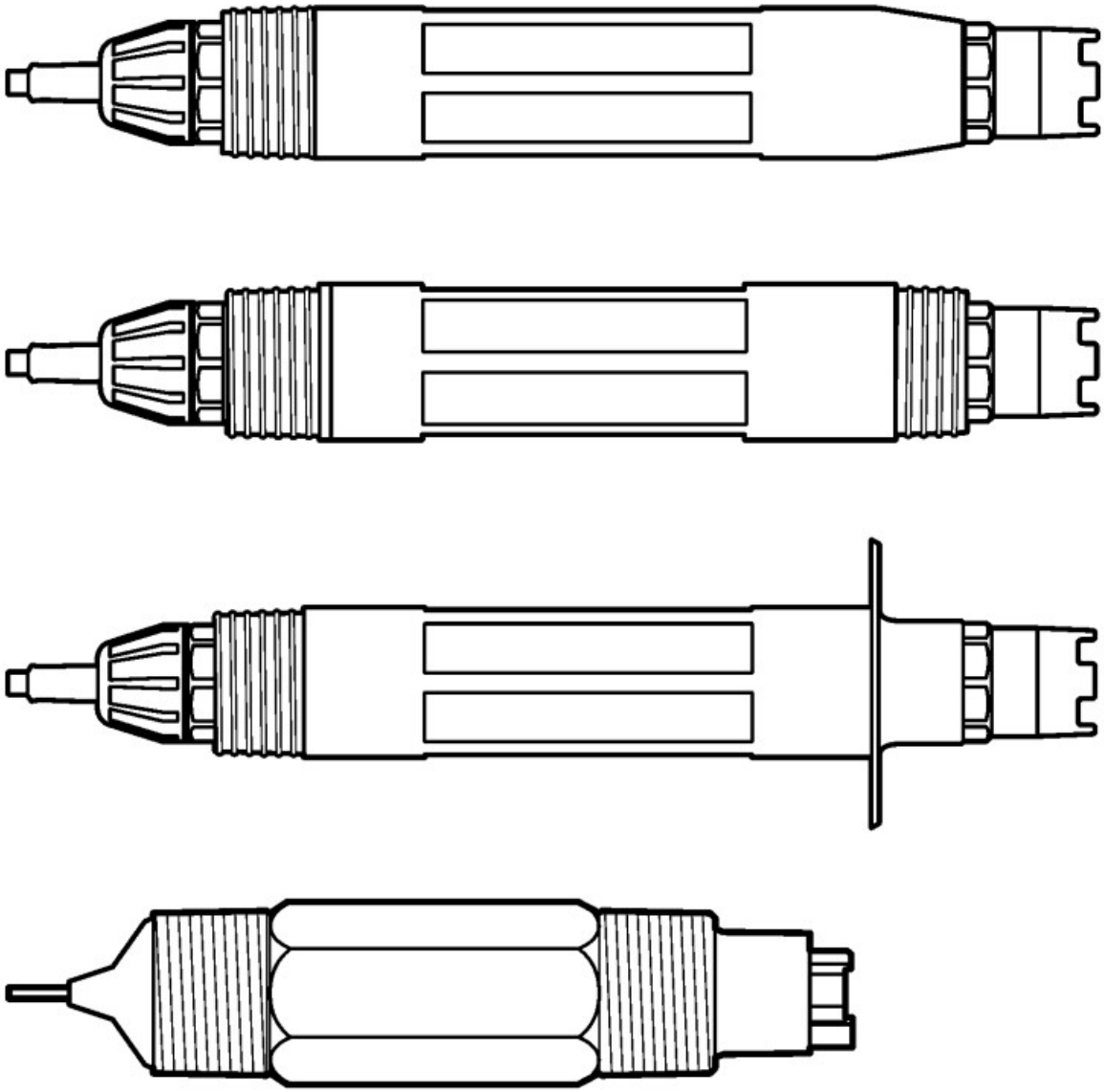
pHD Analog Differential pH/ORP Sensors
01/2023, Edition 5



Basic User Manual

Contents

Additional information

An expanded user manual is available on the manufacturer’s website.

Specifications

Specifications are subject to change without notice.
The product has only the approvals listed and the registrations, certificates and declarations officially provided

with the product. The usage of this product in an application for which it is not permitted is not approved by the manufacturer.

Specification	Details
Dimensions (length/diameter)	pHD: 271 mm (10.7 in.)/35 mm (1.4 in.); 1-in. NPT; LCP (liquid crystal polymer): 187 mm (7.35 in.)/51 mm (2 in.); 1-½ in. NPT
Weight	316 g (11 oz)
Pollution degree	2
Overvoltage category	I
Protection class	III
Altitude	2000 m (6562 ft) maximum
Operating temperature	5 to 105 °C (23 to 221 °F)
Storage temperature	4 to 70 °C (40 to 158 °F), 0 to 95% relative humidity, non-condensing
Wetted materials	PEEK or PPS Polyphenylensulfid (PVDF) body, glass process electrode, tita nium ground electrode and FKM/FPM O-ring seals Note: The pH sensor with optional HF-resistant glass process electrode has 316 stainless steel ground electrode and perfluoroelastomer wetted O-rings.
Measuring range	pH sensor: -2 to 14 pH[1] (or 2.00 to 14.00) ORP sensor: -1500 to +1500 mV
Sensor cable	pHD: 5-conductor (plus 2 shields), 6 m (20 ft); LCP: 5-conductor (plus 1 shie ld), 3 m (10 ft)
Components	Corrosion-resistant materials, fully-submersible
Resolution	pH sensor: ±0.01 pH ORP sensor: ±0.5 mV
Maximum flow rate	3 m/s (10 ft/s) maximum
Pressure limit	6.9 bar at 105 °C (100 psi at 221 °F)
Transmission distance	100 m (328 ft) maximum 1000 m (3280 ft) maximum with a termination box
Temperature element	NTC 300 Ω thermistor for automatic temperature compensation and analyzer temperature readout
Temperature compensation	Automatic from -10 to 105 °C (14.0 to 221 °F) with NTC 300 Ω thermistor, Pt 1000 Ω RTD, or Pt 100 Ω RTD temperature element, or manually fixed at a userentered temperature
Calibration methods	1- or 2-point automatic or manual
Sensor interface	Modbus RTU from sc digital gateway or pH/ORP module
Certifications	Listed by ETL (US/Canada) for use in Class 1, Division 2, Groups A, B, C, D, Temperature Code T4 – Hazardous Locations with Hach SC Controller. Conforms to: CE, UKCA, FCC, ISED, ACMA, KC, CMIM, NM

[1]Most pH applications are in the 2.5 to 12.5 pH range. The pHD Differential pH sensor with the wide-range glass

process electrode operates very well in this range. Some industrial applications require accurate measurement and control below 2 or above 12 pH. In these special cases, please contact the manufacturer for further details.

General information

In no event will the manufacturer be liable for damages resulting from any improper use of product or failure to comply with the instructions in the manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation.
Revised editions are found on the manufacturer's website.

3.1 Safety information

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is soley responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.
Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.
Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

3.1.1 Use of hazard information

⚠ DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE
Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

3.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

⚠ This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

3.2 Product overview

This sensor is designed to work with a controller for data collection and operation. Different controllers can be used with this sensor. This document assumes sensor installation and use with an SC4500 Controller. To use the sensor with other controllers, refer to the user manual for the controller that is used.
Optional equipment, such as mounting hardware for the sensor, is supplied with installation instructions. Several mounting options are available, allowing the sensor to be adapted for use in many different applications.

3.3 Sensor styles

The sensor is available in different styles. Refer to Figure 1.

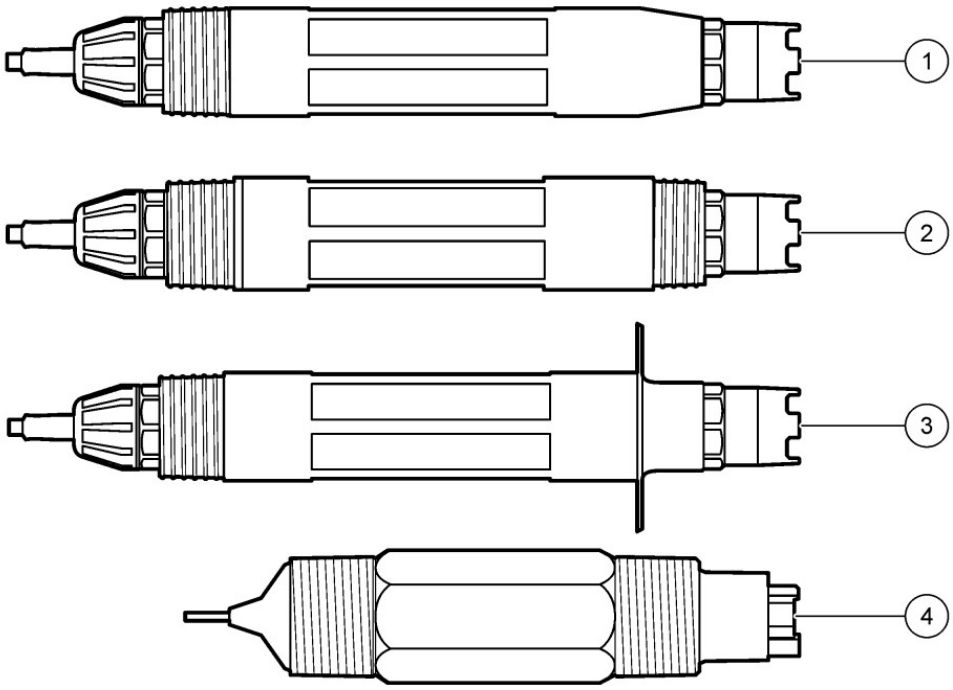


Figure 1 Sensor styles

1. Insertion—allows removal without stopping the process flow
2. Convertible—for a pipe tee or immersion in an open vessel
3. Sanitary—for install in a 2-inch sanitary tee
4. Convertible—LCP type

Installation

4.1 Mounting

⚠ WARNING

Explosion hazard. For installation in hazardous (classified) locations, refer to the instructions and control drawings in the controller Class 1, Division 2 documentation. Install the sensor according to local, regional and national codes. Do not connect or disconnect the instrument unless the environment is known to be non-hazardous.

⚠ WARNING

Explosion hazard. Make sure that the mounting hardware for the sensor has a temperature and pressure rating sufficient for the mounting location.

⚠ CAUTION

Personal injury hazard. Broken glass can cause cuts. Use tools and personal protective equipment to remove broken glass.

NOTICE

The process electrode at the pH sensor tip has a glass bulb, which can break. Do not hit or push on the glass bulb.

NOTICE

The gold or platinum process electrode at the tip of the ORP sensor has a glass shank (hidden by the salt bridge), which can break. Do not hit or push on the glass shank.

- Install the sensor where the sample that comes into contact with the sensor is representative of the entire process.

- Refer to the expanded user manual on the manufacturer’s website for the available mounting hardware.
- Refer to the instructions supplied with the mounting hardware for installation information.
- Install the sensor at least 15° above horizontal.
- For immersion installations, put the sensor at least 508 mm (20 inches) from the aeration basin wall and immerse the sensor at least 508 mm (20 inches) into the process.
- Remove the protective cap before the sensor is put into the process water. Keep the protective cap for future use.
- (Optional) If the process water is near the boiling temperature, add gel powder[2] to the standard cell solution in the sensor. Refer to step 2 of Replace the salt bridge on page 16. Do not replace the salt bridge.
- Calibrate the sensor before use.

For examples of sensors in different applications, refer to Figure 2 and Figure 3.
[2]The gel powder decreases the evaporation rate of the standard cell solution.

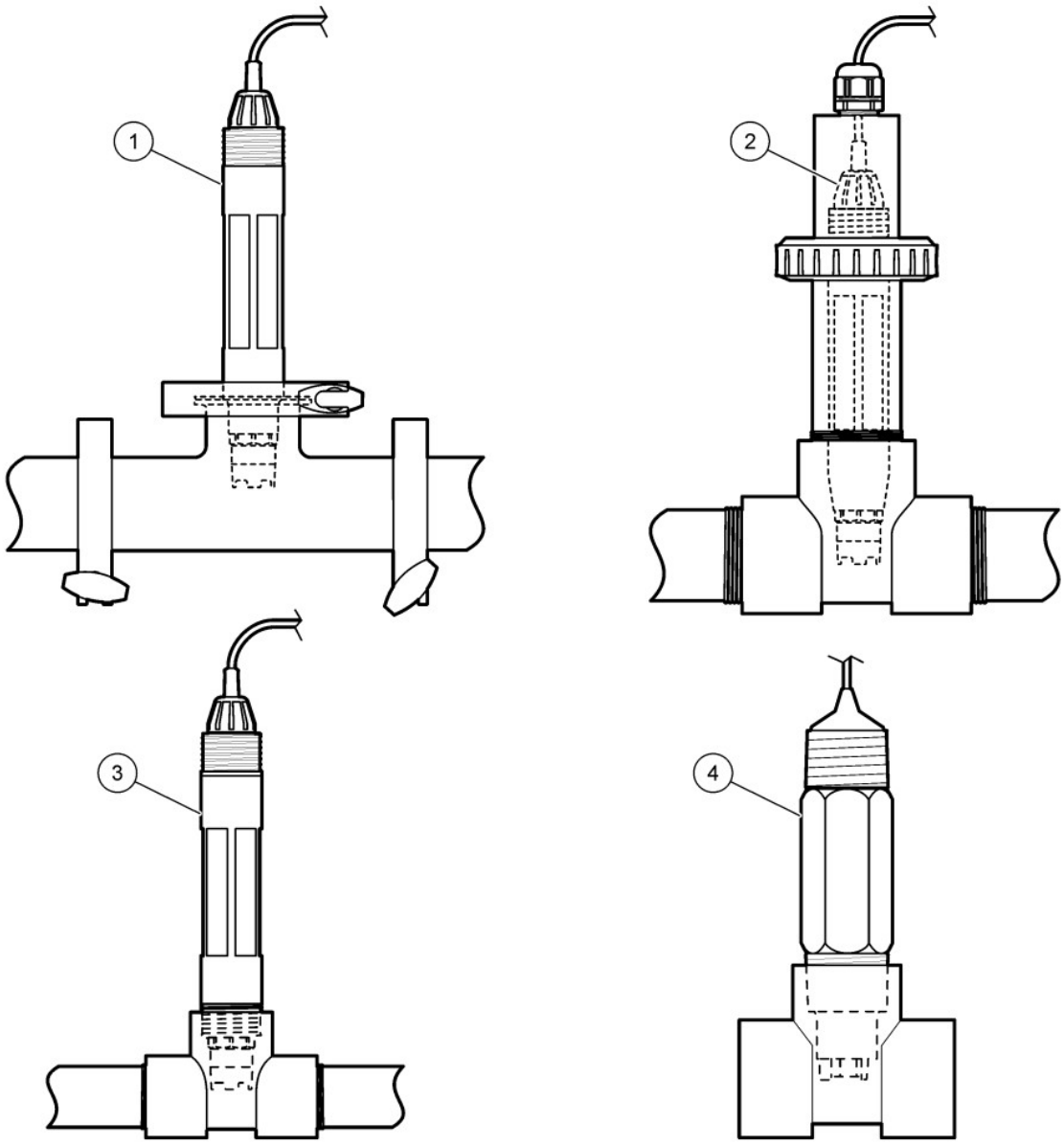


Figure 2 Mounting examples (1)

1. Sanitary mount
2. Union mount
3. Flow-through mount

4. Flow-through mount—LCP sensor

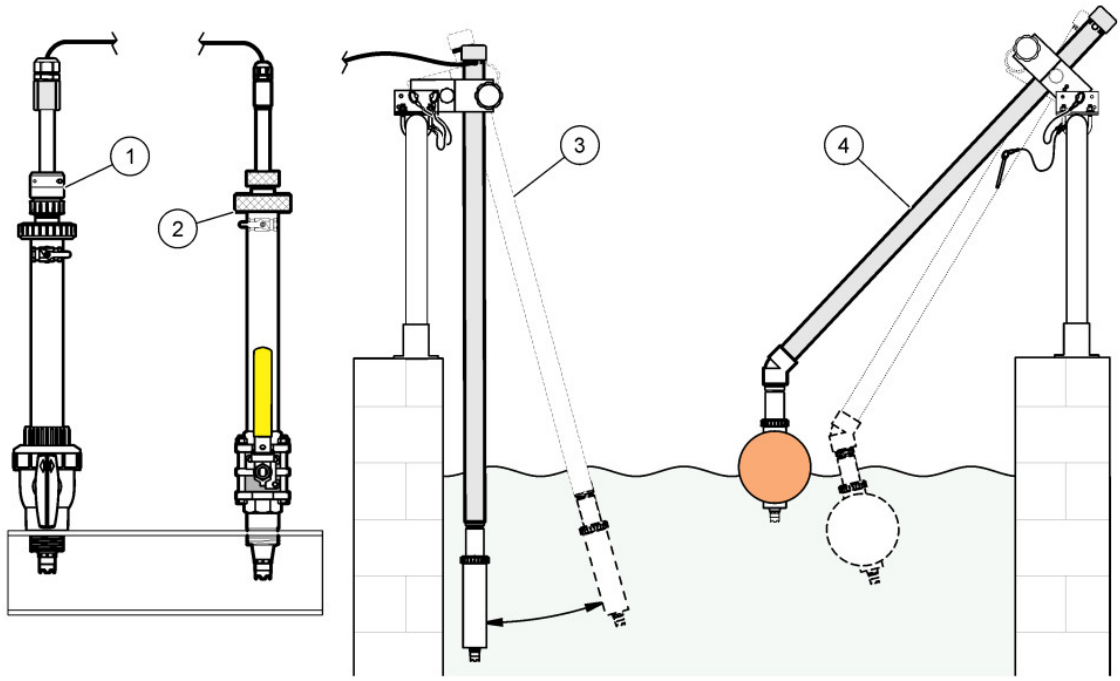


Figure 3 Mounting examples (2)

1. PVS insertion mount
2. Insertion mount
3. Immersion mount
4. Immersion mount, ball float

4.2 Connect the sensor to an SC Controller

Use one of the options that follows to connect the sensor to an SC Controller:

- Connect the sensor to an sc digital gateway, then connect the sc digital gateway to the SC Controller. The digital gateway converts the analog signal from the sensor to a digital signal.
- Install a sensor module in the SC Controller. Then, connect the sensor to the sensor module. The sensor module converts the analog signal from the sensor to a digital signal.

Refer to the instructions supplied with the sensor module or sc digital gateway.

Operation

5.1 User navigation

Refer to the controller documentation for the touchscreen description and navigation information.

5.2 Configure the sensor

Use the Settings menu to enter identification information for the sensor and to change options for data handling and storage.

1. Select the main menu icon, then select Devices. A list of all of the available devices shows.
2. Select the sensor and select Device menu > Settings.
3. Select an option.

• For sensors connected to a pH/ORP module, refer to Table 1.
• For sensors connected to an sc digital gateway, refer to Table 2.

Table 1 Sensors connected to pH/ORP module

Option	Description
Name	Changes the name that corresponds to the sensor on the top of the measurement screen. The name is limited to 16 characters in any combination of letters, numbers, spaces or punctuation.
Sensor S/N	Lets the user enter the serial number of the sensor. The serial number is limited to 16 characters in any combination of letters, numbers, spaces or punctuation.
Format	For pH sensors only—Changes the number of decimal places that are shown on the measurement screen to XX.XX (default) or XX.X
Temperature	Sets the temperature units to °C (default) or °F.
Temperature element	pH sensors—Sets the temperature element for automatic temperature compensation to PT100, PT1000 or NTC300 (default). If no element is used, the type can be set to Manual and a value for temperature compensation can be entered (default: 25 °C). ORP sensors—Temperature compensation is not used. A temperature element can be connected to the controller to measure temperature.
Filter	Sets a time constant to increase signal stability. The time constant calculates the average value during a specified time—0 (no effect, default) to 60 seconds (average of signal value for 60 seconds). The filter increases the time for the sensor signal to respond to actual changes in the process.
Pure H2O compensation	For pH sensors only—Adds a temperature-dependent correction to the measured pH value for pure water with additives. Options: None (default), Ammonia, Morpholine or User defined. For process temperatures above 50 °C, the correction at 50 °C is used. For user-defined applications, a linear slope (default: 0 pH/°C) can be entered.
ISO point	For pH sensors only—Sets the isopotential point where the pH slope is independent of temperature. Most sensors have an isopotential point of 7.00 pH (default). However, sensors for special applications may have a different isopotential value.
Data logger interval	Sets the time interval for sensor and temperature measurement storage in the data log—5, 30 seconds, 1, 2, 5, 10, 15 (default), 30, 60 minutes.
Reset to default values	Sets the Settings menu to the factory default settings and resets the counters. All sensor information is lost.

Table 2 Sensors connected to sc digital gateway

Option	Description
Name	Changes the name that corresponds to the sensor on the top of the measurement screen. The name is limited to 12 characters in any combination of letters, numbers, spaces or punctuation.
Select sensor	Selects the type of sensor (pH or ORP).
Format	Refer to Table 1.
Temperature	Refer to Table 1.
Data logger interval	Sets the time interval for sensor and temperature measurement storage in the data log—5, 10, 15, 30 seconds, 1, 5, 10, 15 (default), 30 minutes, 1, 2, 6, 12 hours.
Alternating current frequency	Selects the power line frequency to get the best noise rejection. Options: 50 or 60 Hz (default).
Filter	Refer to Table 1.
Temperature element	Refer to Table 1.
Select standard buffer	For pH sensors only—Sets the pH buffers used for auto correction calibration. Options: 4.00, 7.00, 10.00 (default set) or DIN 19267 (pH 1.09, 4.65, 6.79, 9.23, 12.75) Note: Other buffers can be used if the 1-or 2-point manual correction is selected for calibration.
Pure H2O compensation	Refer to Table 1. 1-,2-,3- or 4-point matrix correction can also be selected. The 1-,2-,3- or 4-point matrix correction are compensation methods pre-programmed in the firmware.
Last calibration	Sets a reminder for the next calibration (default: 60 days). A reminder to calibrate the sensor shows on the display after the selected interval from the date of the last calibration. For example, if the date of the last calibration was June 15 and Last calibration is set to 60 days, a calibration reminder shows on the display on August 14. If the sensor is calibrated before August 14, on July 15, a calibration reminder shows on the display on September 13.
Sensor days	Sets a reminder for sensor replacement (default: 365 days). A reminder to replace the sensor shows on the display after the selected interval. The Sensor days counter shows on the Diagnostics/Test > Counter menu. When the sensor is replaced, reset the Sensor days counter on the Diagnostics/Test > Counter menu.
Impedance limits	Sets the low and high impedance limits for the Active electrode and Reference electrode.
Reset setup	Sets the Settings menu to the factory default settings and resets the counters. All sensor information is lost.

5.3 Calibrate the sensor

⚠ WARNING

Fluid pressure hazard. Removal of a sensor from a pressurized vessel can be dangerous. Reduce the process pressure to below 7.25 psi (50 kPa) before removal. If this is not possible, use extreme caution. Refer to the documentation supplied with the mounting hardware for more information.

WARNING

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

CAUTION

Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

5.3.1 About sensor calibration

Calibration adjusts the sensor reading to match the value of one or more reference solutions. The sensor characteristics slowly shift over time and cause the sensor to lose accuracy. The sensor must be calibrated regularly to maintain accuracy. The calibration frequency varies with the application and is best determined by experience.

A temperature element is used to provide pH readings that are automatically adjusted to 25 °C for temperature changes that affect the active and reference electrode. This adjustment can be manually set by the customer if the process temperature is constant.

During calibration, data is not sent to the datalog. Thus, the datalog can have areas where the data is intermittent.

5.3.2 Change calibration options

For sensors connected to a pH/ORP module, the user can set a reminder or include an operator ID with calibration data from the Calibration options menu.

Note: This procedure is not applicable to sensors connected to an sc digital gateway.

1. Select the main menu icon, then select Devices. A list of all of the available devices shows.
2. Select the sensor and select Device menu > Calibration.
3. Select Calibration options.
4. Select an option.

Option	Description
Select standard buffer	For pH sensors only—Sets the pH buffers used for auto correction calibration. Options: 4.00, 7.00, 10.00 (default set), DIN 19267 (pH 1.09, 4.65, 6.79, 9.23, 12.75) or NIST 4.00, 6.00, 9.00 Note: Other buffers can be used if the 1-or 2-point value calibration is selected for calibration.
Calibration reminder	Sets a reminder for the next calibration (default: Off). A reminder to calibrate the sensor shows on the display after the selected interval from the date of the last calibration. For example, if the date of the last calibration was June 15 and Last calibration is set to 60 days, a calibration reminder shows on the display on August 14. If the sensor is calibrated before August 14, on July 15, a calibration reminder shows on the display on September 13.
Operator ID for calibration	Includes an operator ID with calibration data—Yes or No (default). The ID is entered during the calibration.

5.3.3 pH calibration procedure

Calibrate the pH sensor with one or two reference solutions (1-point or 2-point calibration). Standard buffers are automatically recognized.

1. Put the sensor in the first reference solution (a buffer or sample of known value). Make sure that the sensor portion of the probe is fully immersed in the liquid (Figure 4).

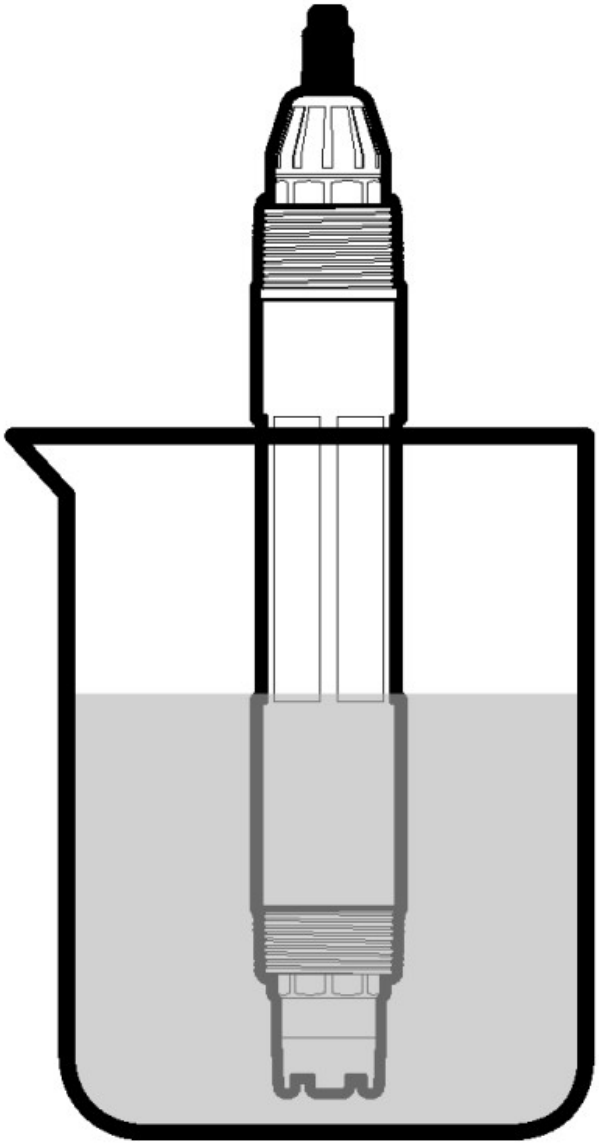


Figure 4 Sensor in reference solution

2. Wait for the sensor and solution temperature to equalize. This can take 30 minutes or more if the temperature difference between the process and reference solution is significant.
3. Select the main menu icon, then select Devices. A list of all of the available devices shows.
4. Select the sensor and select Device menu > Calibration.
5. Select the type of calibration:

Option	Description
1-point buffer calibration (or 1-point auto correction)	Use one buffer for calibration (e.g., pH 7). The sensor automatically identifies the buffer during calibration. **Note:** Make sure to select the buffer set in the Calibration > Calibration options > Select standard buffer menu (or Settings > Select standard buffer menu).
2-point buffer calibration (or 2-point auto correction)	Use two buffers for calibration (e.g., pH 7 and pH 4). The sensor automatically id entifies the buffers during calibration. **Note:** Make sure to select the buffer set in the Calibration > Calibration options > Select standard buffer menu (or Settings > Select standard buffer menu).
1-point value calibration (or 1-point manual correct ion)	Use one sample of a known value (or one buffer) for calibration. Determine the pH value of the sample with a different instrument. Enter the pH value during cali bration.
2-point value calibration (or 2-point manual correct ion)	Use two samples of known value (or two buffers) for calibration. Determine the p H value of the samples with a different instrument. Enter the pH values during calibration.

6. Select the option for the output signal during calibration:

Option	Description
Active	The instrument sends the current measured output value during the calibration p rocedure.
Hold	The sensor output value is held at the current measured value during the calibra tion procedure.
Transfer	A preset output value is sent during calibration. Refer to the controller user man ual to change the preset value.

7. With the sensor in the first reference solution, push OK.
   The measured value is shown.
8. Wait for the value to stabilize and push OK.
   Note: The screen may advance to the next step automatically.
9. If applicable, enter the pH value and push OK.
   Note: If the reference solution is a buffer, find the pH value on the buffer bottle for the temperature of the buffer. If the reference solution is a sample, determine the pH value of the sample with a different instrument.
10. For a 2-point calibration, measure the second reference solution as follows:
    a. Remove the sensor from the first solution and rinse with clean water.
    b. Put the sensor in the next reference solution, then push OK.
    c. Wait for the value to stabilize and push OK.
    Note: The screen may advance to the next step automatically.
    d. If applicable, enter the pH value and push OK.

11. Review the calibration result:
    • “The calibration was successfully completed.”—The sensor is calibrated and ready to measure samples. The slope and/or offset values are shown.
    • “The calibration failed.” —The calibration slope or offset is outside of accepted limits. Repeat the calibration with fresh reference solutions. Clean the sensor if necessary.
12. Push OK.
13. Return the sensor to the process and push OK.
    The output signal returns to the active state and the measured sample value is shown on the measurement screen.

5.3.4 ORP calibration procedure

Calibrate the ORP sensor with one reference solution (1-point calibration).

1. Put the sensor in the reference solution (a reference solution or sample of known value). Make sure that the sensor portion of the probe is fully immersed in the solution (Figure 5).

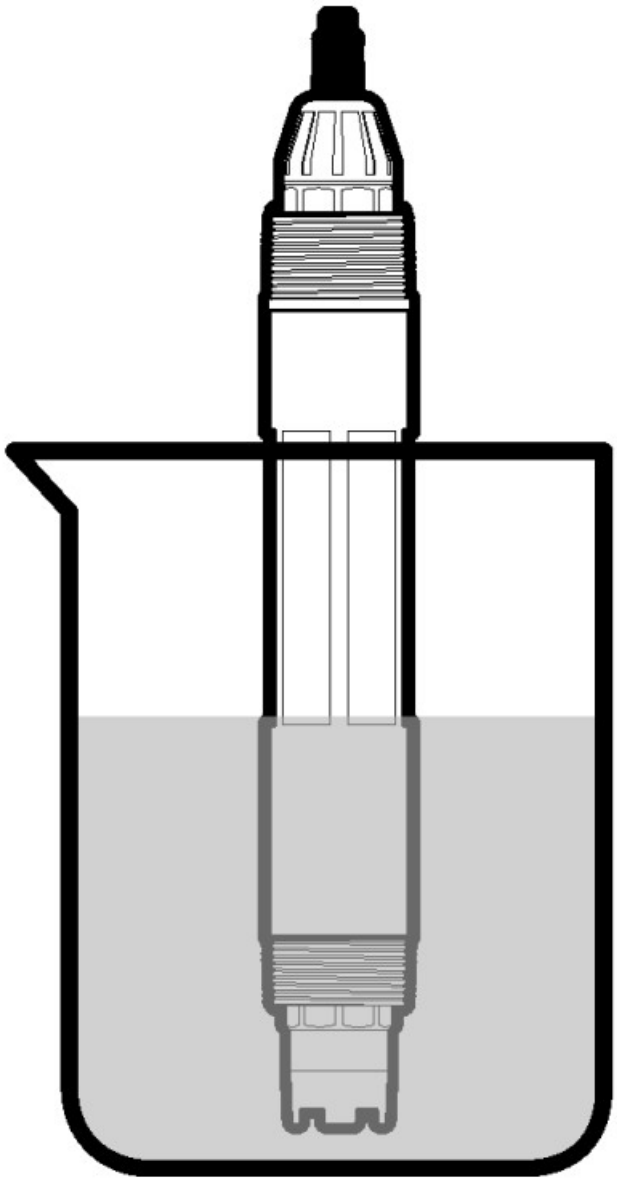


Figure 5 Sensor in reference solution

2. Select the main menu icon, then select Devices. A list of all of the available devices shows.
3. Select the sensor and select Device menu > Calibration.
4. Select 1-point value calibration (or 1-point manual correction).

5. Select the option for the output signal during calibration:

Option	Description
Active	The instrument sends the current measured output value during the calibration procedure.
Hold	The sensor output value is held at the current measured value during the calibration procedure.
Transfer	A preset output value is sent during calibration. Refer to the controller user manual to change the preset value.

6. With the sensor in the reference solution or sample, push OK.
   The measured value is shown.
7. Wait for the value to stabilize and push OK.
   Note: The screen may advance to the next step automatically.
8. If a sample is used for calibration, measure the ORP value of the sample with a secondary verification instrument. Enter the measured value, then push OK.
9. If a reference solution is used for calibration, enter the ORP value marked on the bottle. Push OK.
10. Review the calibration result:
    • “The calibration was successfully completed.”—The sensor is calibrated and ready to measure samples. The slope and/or offset values are shown.
    • “The calibration failed.” —The calibration slope or offset is outside of accepted limits. Repeat the calibration with fresh reference solutions. Clean the sensor if necessary.
11. Push OK.
12. Return the sensor to the process and push OK.
    The output signal returns to the active state and the measured sample value is shown on the measurement screen.

5.3.6 Exit calibration procedure

1. To exit a calibration, push the back icon.
2. Select an option, then push OK.

Option	Description
Quit calibration (or Cancel)	Stop the calibration. A new calibration must start from the beginning.
Return to calibration	Return to the calibration.
Leave calibration (or Exit)	Exit the calibration temporarily. Access to other menus is allowed. A calibration for a second sensor (if present) can be started.

5.3.7 Reset the calibration

The calibration can be reset to the factory default settings. All sensor information is lost.

1. Select the main menu icon, then select Devices. A list of all of the available devices shows.
2. Select the sensor and select Device menu > Calibration.
3. Select Reset to default calibration values (or Reset setup), then push OK.
4. Push OK again.

5.4 Impedance measurements

To increase the reliability of the pH measurement system, the controller determines the impedance of the glass electrodes. This measurement is taken every minute. During diagnostics, the pH measurement reading will be on hold for five seconds. If an error message appears, refer to Error list on page 20 for more details.
To enable or disable the sensor impedance measurement:

1. Select the main menu icon, then select Devices. A list of all of the available devices shows.
2. Select the device and select Device menu > Diagnostics/Test.
3. For sensors connected to a pH/ORP module, select Impedance status.
4. For sensors connected to an sc digital gateway, select Signals > Impedance status.
5. Select Enabled or Disabled and push OK.

To see the active and reference electrode impedance readings, select Sensor signals (or Signals) and push OK.

5.5 Modbus registers

A list of Modbus registers is available for network communication. Refer to the manufacturer's website for more information.

Maintenance

WARNING

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

WARNING

Explosion hazard. Do not connect or disconnect the instrument unless the environment is known to be non-hazardous. Refer to the controller Class 1, Division 2 documentation for hazardous location instructions.

WARNING

Fluid pressure hazard. Removal of a sensor from a pressurized vessel can be dangerous. Reduce the process pressure to below 7.25 psi (50 kPa) before removal. If this is not possible, use extreme caution. Refer to the documentation supplied with the mounting hardware for more information.

WARNING

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

CAUTION

Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

6.1 Maintenance schedule

Table 3 shows the recommended schedule of maintenance tasks. Facility requirements and operating conditions may increase the frequency of some tasks.

Table 3 Maintenance schedule

Maintenance task	1 year	As necessary
Clean the sensor on page 16		X
Replace the salt bridge on page 16	X	
Calibrate the sensor on page 10	Set by regulatory agencies or experience	

6.2 Clean the sensor

Pre-requisite: Prepare a mild soap solution with a non-abrasive dishwashing detergent that does not contain lanolin. Lanolin leaves a film on the electrode surface that can degrade the sensor performance.

Examine the sensor periodically for debris and deposits. Clean the sensor when there is a buildup of deposits or when performance has degraded.

1. Use a clean, soft cloth to remove loose debris from the end of the sensor. Rinse the sensor with clean, warm water.
2. Soak the sensor for 2 to 3 minutes in the soap solution.
3. Use a soft bristle brush to scrub the entire measuring end of the sensor.
4. If debris remains, soak the measuring end of the sensor in a dilute acid solution such as < 5% HCl for a maximum of 5 minutes.
5. Rinse the sensor with water and then return to the soap solution for 2 to 3 minutes.
6. Rinse the sensor with clean water.

Note: Sensors with antimony electrodes for HF applications may require additional cleaning. Contact technical support.

Always calibrate the sensor after maintenance procedures are done.

6.3 Replace the salt bridge

Replace the salt bridge and the standard cell solution at 1 year intervals or when calibration fails after the sensor has been cleaned.

Note: A video that shows how to replace the salt bridge is available on www.Hach.com. Go to the salt bridge webpage and click the Video tab.

Items to collect:

- Adjustable crescent wrench
- Large tweezers
- Salt bridge
- Standard cell solution
- Gel powder[3], ⅛ teaspoon

1. Clean the sensor. Refer to Clean the sensor on page 16.
2. Replace the salt bridge and the standard cell solution. Refer to the illustrated steps that follow.

   If the reservoir for the standard cell solution contains a gel (not usual), use a jet of water from a water pik-type device to remove the old gel at illustrated step 2.

   [3](Optional) Add gel powder to the standard cell solution if the process water is near the boiling temperature. The gel powder decreases the evaporation rate of the standard cell solution.

   (Optional) If the process water is near the boiling temperature, add gel powder to the new standard cell solution at illustrated step 4 as follows:

   a. Pour 1 level bottle cap (⅛ teaspoon) of gel powder into the reservoir for the standard cell solution.

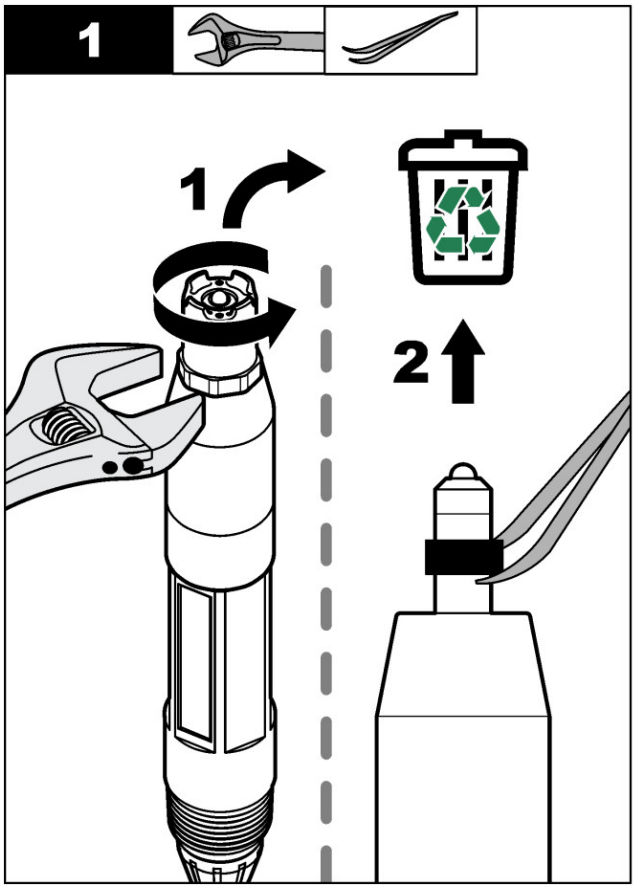
b. Pour a small amount of fresh standard cell solution into the reservoir.

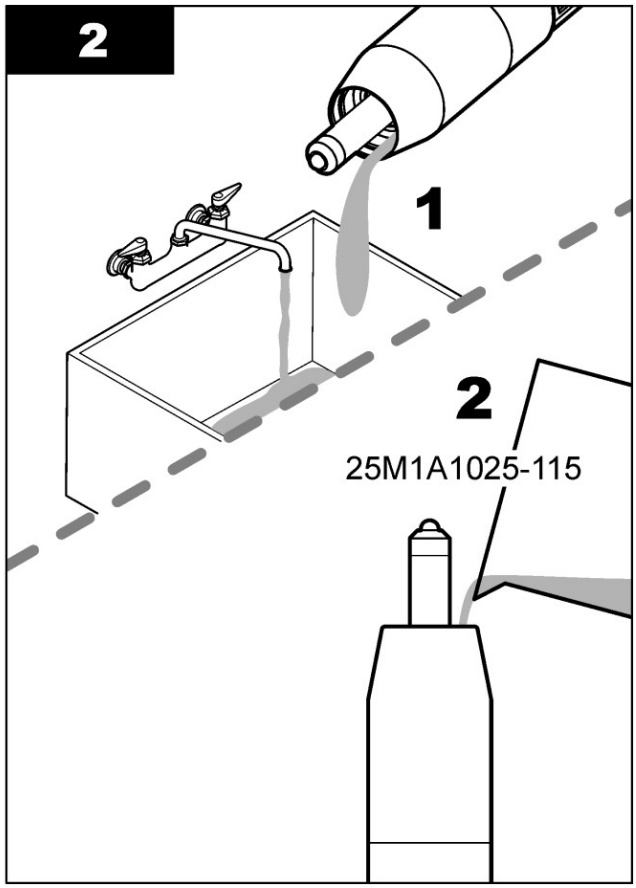
c. Mix with the powder until the solution becomes thick.

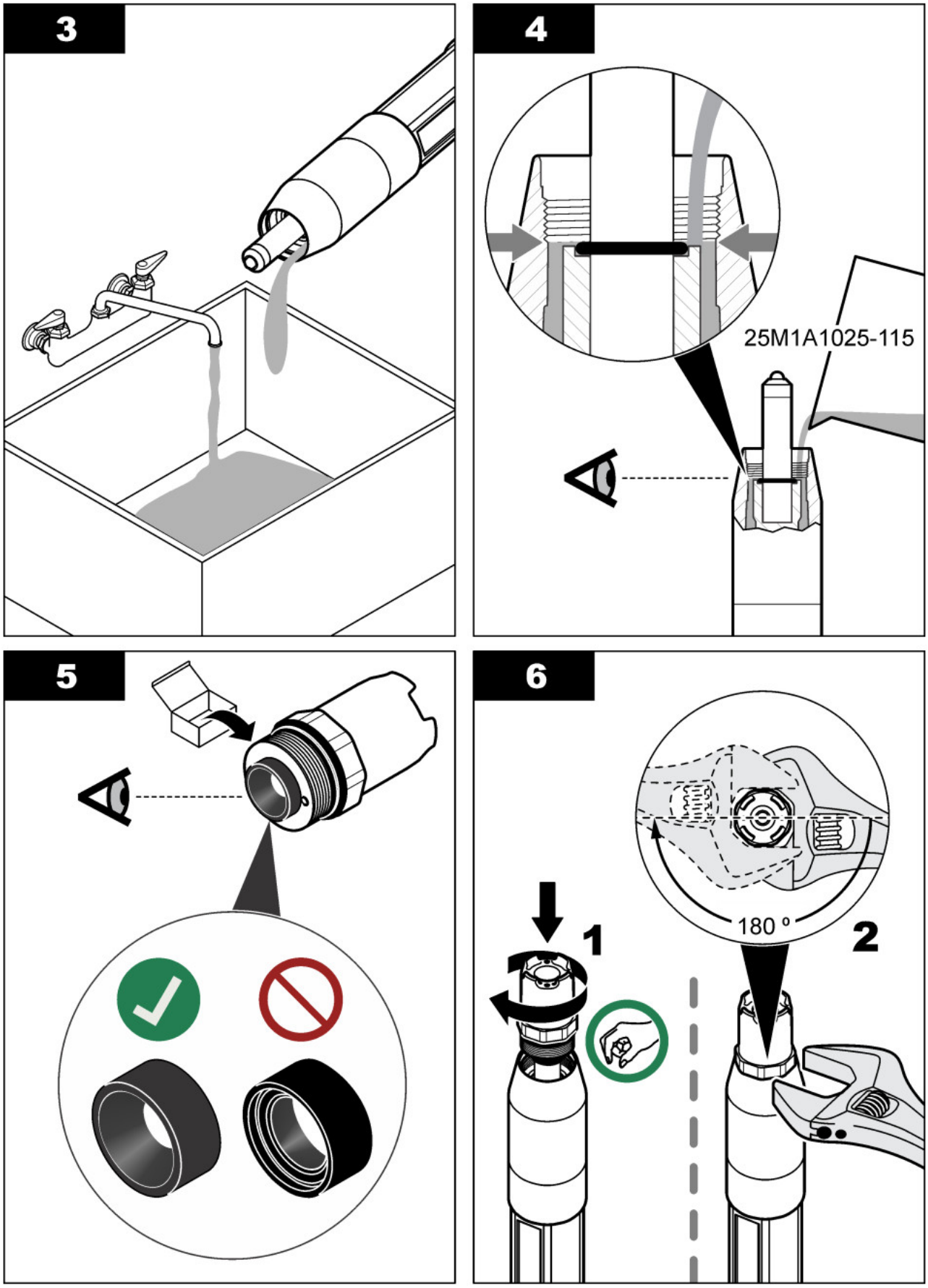
d. Add small amounts of solution and mix until the gel level is at the bottom of the salt bridge threads.

e. Check for proper gel level by installing and removing the new salt bridge. A salt bridge impression should remain on the gel surface.

3. Calibrate the sensor.







6.4 Prepare for storage

For short-term storage (when the sensor is out of the process for more than one hour), fill the protective cap with pH 4 buffer or distilled water and put the cap back on the sensor. Keep the process electrode and reference junction salt bridge moist to avoid slow response when the sensor is returned to operation.

For extended storage, repeat the short-term storage procedure every 2 to 4 weeks, depending on the environmental conditions. Refer to Specifications on page 3 for temperature storage limits.

Troubleshooting

7.1 Intermittent data

During calibration, data is not sent to the datalog. Thus, the datalog can have areas where the data is intermittent.

7.2 Test the pH sensor

Pre-requisites: Two pH buffers and a multimeter.

If a calibration fails, first complete the maintenance procedures in Maintenance on page 15.

1. Put the sensor in a pH 7 buffer solution and wait for the temperature of the sensor and buffer to reach room temperature.
2. Disconnect the red, green, yellow and black sensor wires from the module or digital gateway.
3. Measure the resistance between the yellow and black wires to verify the operation of the temperature element. The resistance should be between 250 and 350 ohms at approximately 25 ºC.
   If the temperature element is good, reconnect the yellow and black wires to the module.
4. Measure the DC mV with the multimeter (+) lead connected to the red wire and the (–) lead connected to the green wire. The reading should be between –50 and + 50 mV.
   If the reading is outside of these limits, clean the sensor and change the salt bridge and standard cell solution.
5. With the multimeter still connected the same way, rinse the sensor with water and put it in a pH 4 or pH 10 buffer solution. Wait for the temperature of the sensor and buffer to reach room temperature.
6. Compare the mV reading in the pH 4 or 10 buffer to the reading in the pH 7 buffer. The reading should differ by approximately 160 mV.
   If the difference is less than 160 mV, call technical support.

7.3 Test the ORP sensor

Pre-requisites: 200 mV ORP reference solution, multimeter.

If a calibration fails, first complete the maintenance procedures in Maintenance on page 15.

1. Put the sensor in a 200 mV reference solution and wait for the temperature of the sensor and solution to reach room temperature.
2. Disconnect the red, green, yellow and black sensor wires from the module or digital gateway.
3. Measure the resistance between the yellow and black wires to verify the operation of the temperature element. The resistance should be between 250 and 350 ohms at approximately 25 ºC.
   If the temperature element is good, reconnect the yellow and black wires to the module.
4. Measure the DC mV with the multimeter (+) lead connected to the red wire and the (–) lead connected to the green wire. The reading should be between 160 and 240 mV.
   If the reading is outside of these limits, call technical support.

7.4 Diagnostics/Test menu

The Diagnostics/Test menu shows current and historical information about the sensor. Refer to Table 4. Push the main menu icon, then select Devices. Select the device and select Device menu > Diagnostics/Test.

Table 4 Diagnostics/Test menu

Option	Description
Module information	For sensors connected to a pH/ORP module only—Shows the version and the serial number for the sensor module.
Sensor information	For sensors connected to a pH/ORP module—Shows the sensor name and th e serial number entered by the user. For sensors connected to an sc digital gateway—Shows the sensor model number, and the sensor name entered by the user and the sensor serial numbe r. Shows the software version and driver version installed.
Last calibration	For sensors connected to a pH/ORP module only—Shows the number of days since the last calibration was done.
Calibration history	For sensors connected to a pH/ORP module—Shows the calibration slope and date of the previous calibrations. For sensors connected to an sc digital gateway—Shows the calibration slope a nd date of the last calibration.
Reset calibration history	For sensors connected to a pH/ORP module only—For service use only
Impedance status	For pH sensors only—Refer to Impedance measurements on page 15.
Sensor signals (or Signals)	For pH sensors connected to a pH/ORP module only—Shows the current readi ng in mV. For pH sensors connected to an sc digital gateway—Shows the current reading in mV and the analog to digital converter counters. If Impedance status is set to Enabled, shows the active and reference electrod e impedances.
Sensor days (or Counter)	For sensors connected to a pH/ORP module—Shows the number of days that the sensor has been in operation. For sensors connected to an sc digital gateway—Shows the number of days th at the sensor and electrode(s) have been in operation. The Electrode days cou nter is reset to zero when the firmware identifies that a defective electrode has been replaced with an electrode that operates correctly. To reset the Sensor days counter to zero, select Reset. Reset the Sensor days counter when the sensor (or salt bridge) is replaced.

7.5 Error list

When an error occurs, the reading on the measurement screen flashes and all outputs are held when specified in the Controller > Outputs menu. The screen changes to red. The diagnostics bar shows the error. Push on the diagnostic bar to show the errors and warnings. As an alternative, push the main menu icon, then select Notifications > Errors.

A list of possible errors is shown in Table 5.

Table 5 Error list

Error	Description	Resolution
pH value is too high!	The measured pH is > 14.	Calibrate or replace the sensor.
ORP value is too high!	The measured ORP value is > 2100 mV.	
pH value is too low!	The measured pH is < 0.	Calibrate or replace the sensor.
ORP value is too low!	The measured ORP value is < –2100 mV.	
Offset value is too high.	The offset is > 9 (pH) or 200 mV (ORP).	Follow the maintenance procedures for the sensor and then repeat the calibration, or replace the sensor.
Offset value is too low.	The offset is < 5 (pH) or –200 mV (ORP).	
Slope is too high.	The slope is > 62 (pH)/1.3 (ORP).	Repeat the calibration with a fresh buffer or sample, or replace the sensor.
Slope is too low.	The slope is < 50 (pH)/0.7 (ORP).	Clean the sensor, then repeat the calibration, or replace the sensor.
Temperature is too high!	The measured temperature is >130 °C.	Make sure that the correct temperature element is selected.
Temperature is too low!	The measured temperature is < –10 °C.	
The difference between the buffers is too small!	The buffers for 2-point auto correction have the same value.	Complete the steps in Test the pH sensor on page 19.
Sensor is missing.	The sensor is missing or disconnected.	Examine the wiring and connections for the sensor and for the module (or digital gateway).
Temperature sensor is missing!	The temperature sensor is missing.	Examine the wiring for the temperature sensor. Make sure that the correct temperature element is selected.
Glass impedance is too low.	The glass bulb is broken or reached end of life.	Replace the sensor. Contact technical support.

7.6 Warning list

A warning does not affect the operation of menus, relays and outputs. The screen changes to an amber color. The diagnostics bar shows the warning. Push on the diagnostic bar to show the errors and warnings. As an alternative, push the main menu icon, then select Notifications > Warnings.

A list of possible warnings is shown in Table 6.

Table 6 Warning list

Warning	Description	Resolution
pH is too high.	The measured pH is > 13.	Calibrate or replace the sensor.
ORP value is too high.	The measured ORP value is > 2100 mV.	
pH is too low.	The measured pH is < 1.	Calibrate or replace the sensor.
ORP value is too low.	The measured ORP value is < –2100 mV.	
Offset value is too high.	The offset is > 8 (pH) or 200 mV (ORP).	Follow the maintenance procedures for the sensor and then repeat the calibration.
Offset value is too low.	The offset is < 6 (pH) or –200 mV (ORP).	
Slope is too high.	The slope is > 60 (pH)/1.3 (ORP).	Repeat the calibration with a fresh buffer or sample.
Slope is too low.	The slope is < 54 (pH)/0.7 (ORP).	Clean the sensor, then repeat the calibration.
Temperature is too high.	The measured temperature is > 100 °C.	Make sure the right temperature element is used.
Temperature is too low.	The measured temperature is < 0 °C.	
Temperature is out of range.	The measured temperature is > 100 °C or < 0 °C.	
Calibration is overdue.	The Cal Reminder time has expired.	Calibrate the sensor.
The device is not calibrated.	The sensor has not been calibrated.	Calibrate the sensor.
Replace a sensor.	The Sensor days counter is more than the interval selected for sensor replacement. Refer to Configure the sensor on page 8.	Replace the sensor (or salt bridge). Reset the Sensor days counter on the Diagnostics/Test > Reset menu (or Diagnostics/Test > Counter menu.
Calibration is in progress…	A calibration was started but not completed.	Return to calibration.
Temperature is not calibrated.	The temperature sensor is not calibrated.	Do a temperature calibration.

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Documents / Resources

	HACH DOC023 pHD Analog Differential pH ORP Sensors [pdf] User Manual DOC023 pHD Analog Differential pH ORP Sensors, DOC023, pHD Analog Differential pH ORP Sensors, Analog Differential pH ORP Sensors, Differential pH ORP Sensors, ORP Sensors, Sensors

References

- User Manual