



HACH DOC023.98.80076 pHD sc Analog Differential pH ORP Sensor User Manual

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Specifications

Specifications are subject to change without notice.

Specification	Details
Operating temperature	−5 to 105 °C (23 to 221 °F)
Storage temperature	4 to 70 °C (40 to 158 °F)
Temperature element	NTC300 thermistor
Sensor cable	pHD: 5-conductor (plus 2 shields), 6 m (20 ft); LCP: 5-conductor (plus 1 shield), 3 m (10 ft)
Dimensions (length/diameter)	pHD: 271 mm (10.7 in.)/35 mm (1.4 in.); 1-in. NPT; LCP: 187 mm (7.35 in.)/51 mm(2 in.); 1-½ in. NPT
Components	Corrosion-resistant materials, fully- submersible
Pressure limit	6.9 bar at 105 °C (100 psi at 221 °F)
Maximum flow rate	3 m/s (10 ft/s)

General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this 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.

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 solely 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.

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.

Precautionary labels

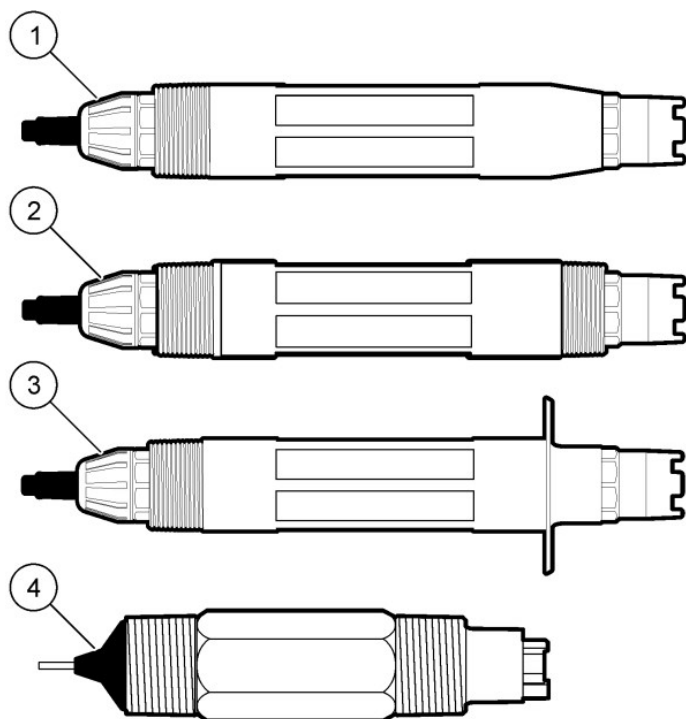
Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	This symbol indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicates that care must be taken to prevent damage with the equipment.
	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.

Product overview

This sensor is designed to work with a controller for data collection and operation. Multiple controllers can be used with this sensor. This document assumes sensor installation and use with an sc200 controller. To use the sensor with other controllers, refer to the user manual for the controller that is used.

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



Sensor styles

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

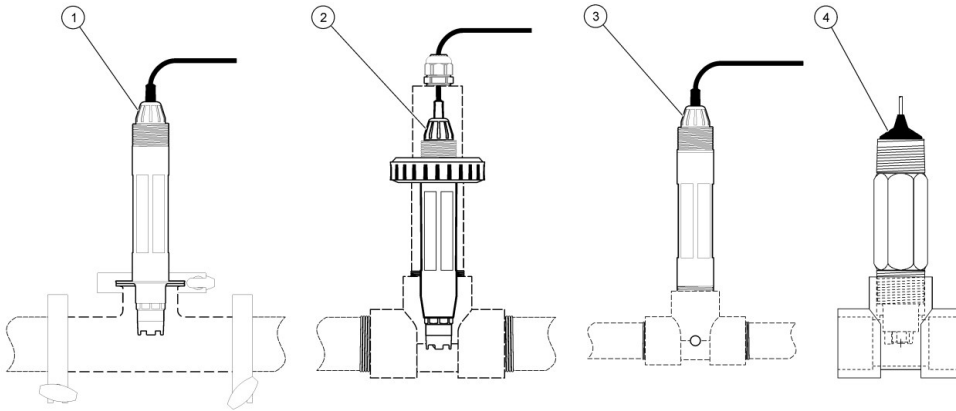
Installation

Mounting

⚠ WARNING

Personal injury hazard. Removal of a sensor from a pressurized vessel can be dangerous. Installation and removal of these sensors should be done by individuals trained in proper high pressure and temperature installation. Always use industry approved hardware and safety procedures when dealing with high pressure and/or temperature fluid transport systems.

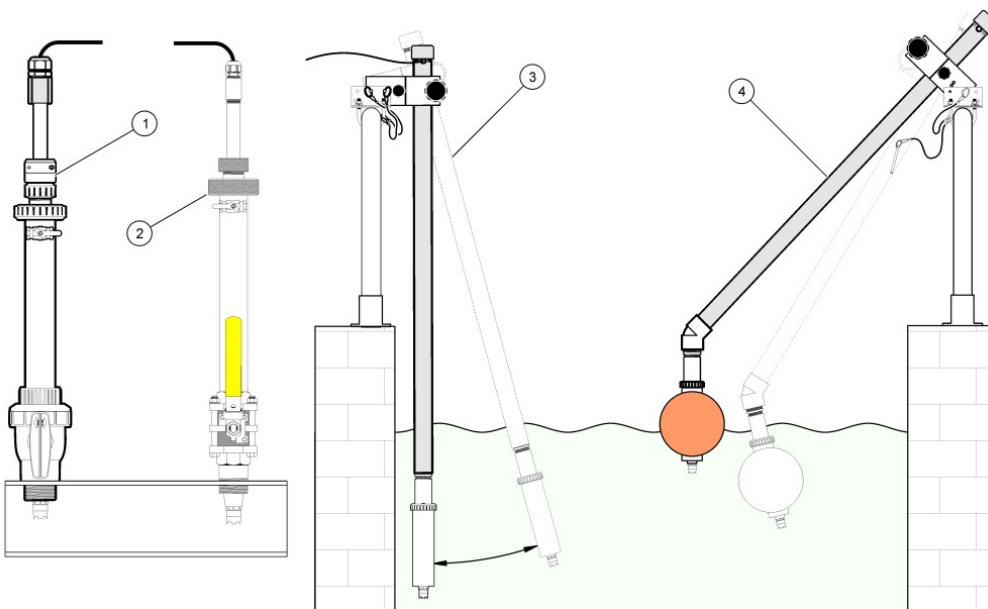
Figure 2 Mounting examples (1)



1 Sanitary mount	3 Flow-through mount
2 Union mount	4 Flow-through mount—LCP sensor

For examples of sensors in different applications, refer to Figure 2 and Figure 3. The sensor must be calibrated before use. Refer to Calibrate the sensor on page 12.

Figure 3 Mounting examples (2)



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

Connect the sensor to the module

⚠ Warning



Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.



Warning

Electrocution Hazard. High voltage wiring for the controller is conducted behind the high voltage barrier in the controller enclosure. The barrier must remain in place except when installing modules, or when a qualified installation technician is wiring for power, relays or analog and network cards.

NOTICE



Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

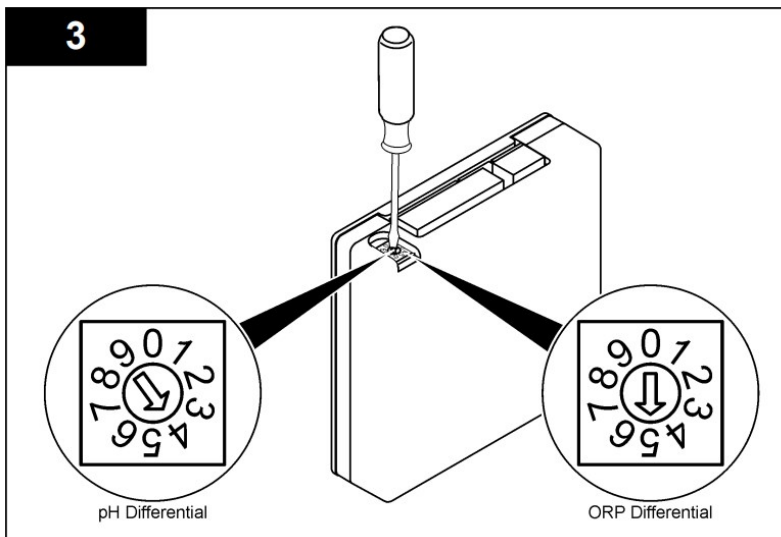
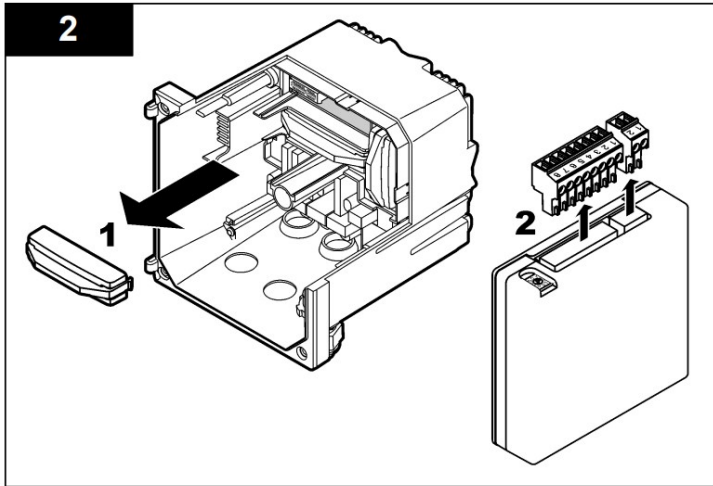
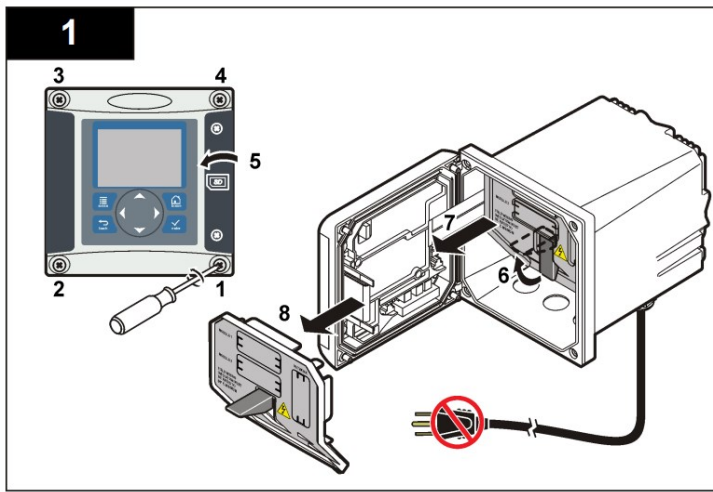
To install the module and connect the sensor, refer to the illustrated steps on page 9 and Table 2.

Note: If the sensor cable is not long enough to reach the controller, an interconnect cable and junction box are required to extend the distance.

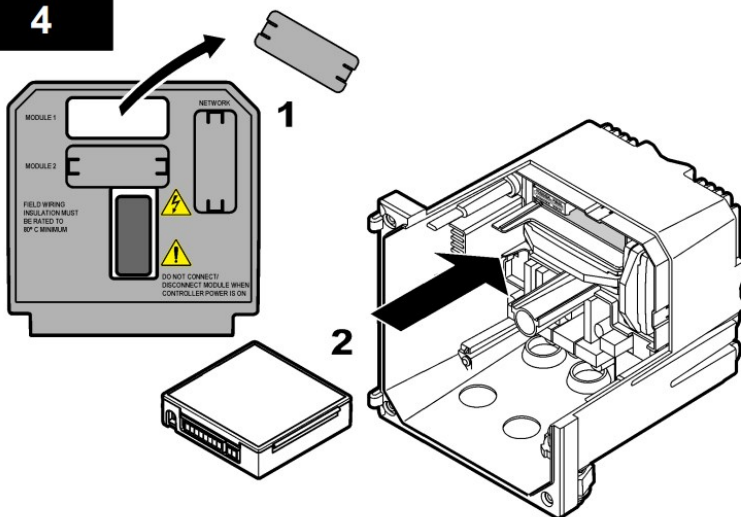
Table 2 pH and ORP differential sensor wiring

Connector	Pin no.	Signal	Sensor wire
8-pin	1	Reference	Green
	2	Inner shield	Clear
	3	–V supply	White
	4	—	—
	5	—	—
	6	Temp +	Yellow
	7	Temp – /Circuit low	Black
	8	—	—
2-pin	1	Active	Red
	2	—	—
Sensor shield wires – Connect all sensor ground/shield wires to the controller enclosure grounding screws.			Clear with black band

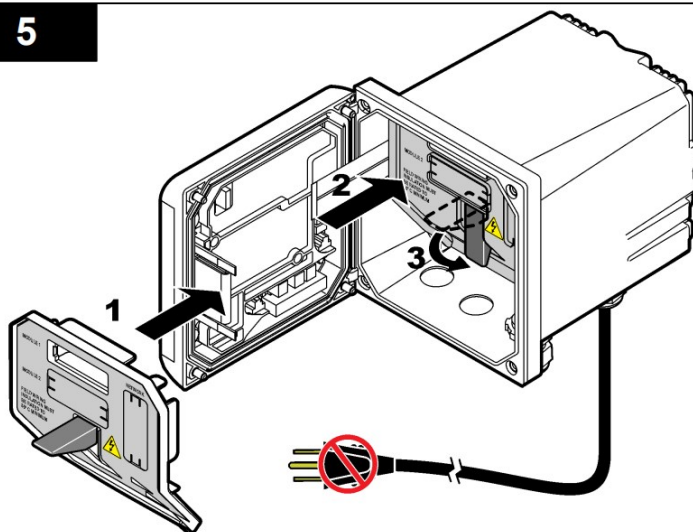
Installation Instruction



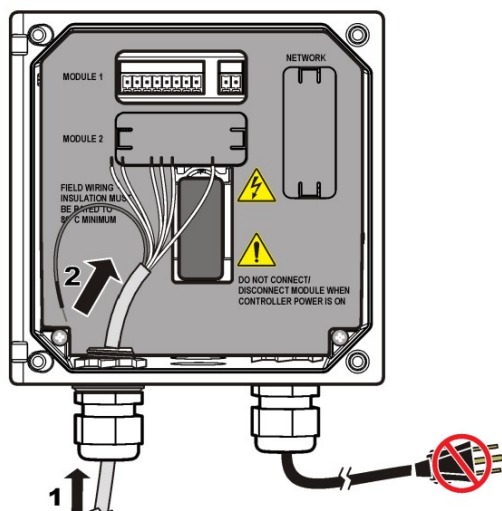
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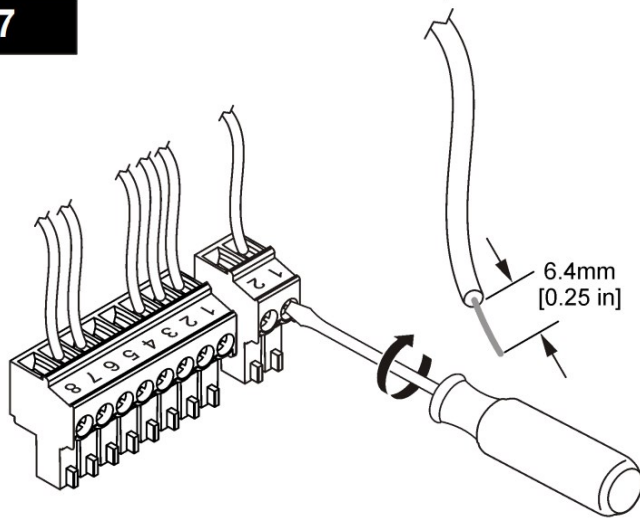
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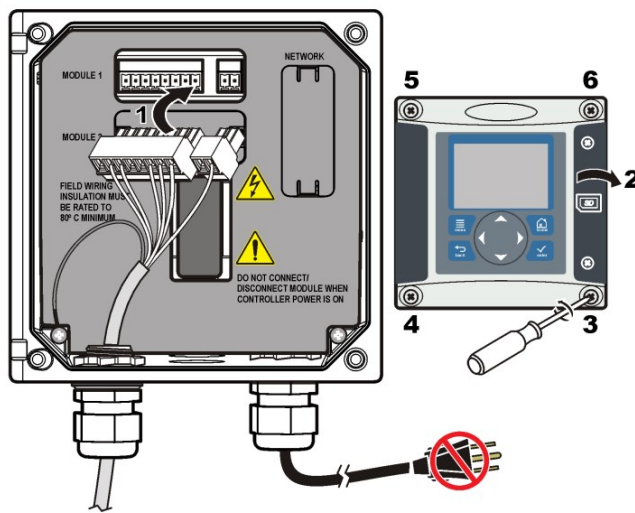
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7



8



Operation

Guidelines for operation



CAUTION

Personal injury hazard. The glass bulb or shank on the sensor can break. Handle the sensor carefully to prevent injury.

- Remove the protective cap before the sensor is put into the process.
- When the sensor is removed from the process for >1 hour, fill the protective cap with pH 4 buffer (recommended) or tap water and put the cap on the sensor. Repeat every 2–4 weeks for extended storage.

User navigation

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

Push the RIGHT arrow key on the controller multiple times to show more information on the home screen and to show a graphical display.

Configure the sensor

Use the Configure menu to enter identification information for the sensor and to change options for data handling and storage. The following procedure can be used to configure pH or ORP sensors.

1. Push the MENU key and select Sensor Setup, [Select Sensor], Configure.
2. Use the arrow keys to select an option and push **ENTER**. To enter numbers, characters or punctuation, push and hold the **UP** or **DOWN** arrow keys. Push the RIGHT arrow key to advance to the next space.

Option	Description
EDIT NAME	Changes the name that corresponds to the sensor on the top of the measure screen. The name is limited to 10 characters in any combination of letters, numbers, spaces or punctuation.
SENSOR S/N	Allows the user to enter the serial number of the sensor, limited to 16 characters in any combination of letters, numbers, spaces or punctuation.
DISPLAY FORMAT	For pH sensors only—changes the number of decimal places that are shown on the measure screen to XX.XX (default) or XX.X
TEMP UNITS	Sets the temperature units to °C (default) or °F
TEMP 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 (manual default: 25 °C). ORP sensors—temperature compensation is not used. A temperature element can be connected 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 COMP	For pH sensors only—adds a temperature-dependent correction to the measured pH value for pure water with additives—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.
SET ISO POINT	At the isopotential point, 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.
LOG SETUP	Sets the time interval for data storage in the data log—5, 30 seconds, 1, 2, 5, 10, 15 (default), 30, 60 minutes
RESET DEFAULTS	Sets the configuration menu to the default settings. All sensor information is lost.

Calibrate the sensor

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.

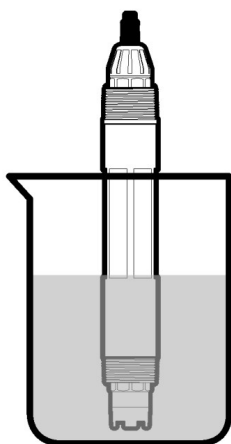
During calibration, data is not sent to the datalog. Thus, the datalog can have areas where the data is intermittent.

pH calibration procedure

Sensors can be calibrated with 1 or 2 reference solutions (1-point or 2-point calibration). Standard buffers are automatically recognized. Make sure that the correct buffer set is used (refer to Change calibration options on page 15).

1. Put the sensor in the first reference solution. 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. Push the MENU key and select Sensor Setup, [Select Sensor], Calibrate.

Option	Description
2 point buffer	Use 2 buffers for calibration, for example pH 7 and pH 4 (recommended method). The buffers must be from the buffer set that is specified in the Cal Options menu (refer to Change calibration options on page 15).
1 point buffer	Use 1 buffer for calibration, for example pH 7. The buffer must be from the buffer set that is specified in the Cal Options menu.
2 point sample	Use 2 samples or buffers of known pH value for calibration. Determine the pH value of samples with a different instrument.
1 point sample	Use 1 sample or buffer for calibration. Determine the pH value of samples with a different instrument

4. Select the type of calibration:

If the passcode is enabled in the security menu for the controller, enter the passcode. 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

1. With the sensor in the first reference solution, push ENTER. The measured value is shown.

Wait for the value to stabilize and push ENTER.

Note:

The screen may advance to the next step automatically.

If the reference solution is a sample, measure the pH value with a secondary verification instrument. Use the arrow keys to enter the measured value and push ENTER.

Note:

If a pH buffer not listed the Cal Options menu is used, refer to the buffer bottle to find the pH value that corresponds to the temperature of the buffer.

For a 2-point calibration, measure the second reference solution (or sample):

Remove the sensor from the first solution and rinse with clean water.

Put the sensor in the next reference solution and push

ENTER

Wait for the value to stabilize. Push

ENTER.

Note:

The screen may advance to the next step automatically.

If the reference solution is a sample, measure the pH value with a secondary verification instrument. Use the arrow keys to enter the measured value and push

ENTER.

2. Review the calibration result:

- Passed—the sensor is calibrated and ready to measure samples. The slope and/or offset values are shown.
- Failed—the calibration slope or offset is outside of accepted limits. Repeat the calibration with fresh reference solutions. Refer to **MAINTENANCE** on page 16 and **Troubleshooting** on page 17 for more information.

3. If the calibration passed, push **ENTER** to continue.

4. If the option for operator ID is set to Yes in the Calibration Options menu, enter an operator ID. Refer to **Change calibration options** on page 15.

5. On the New Sensor screen, select whether the sensor is new:

Option	Description
Yes	The sensor was not calibrated previously with this controller. The days of operation and previous calibration curves for the sensor are reset.
No	The sensor was calibrated previously with this

6. Return the sensor to the process and push **ENTER**.

The output signal returns to the active state and the measured sample value is shown on the measure screen.

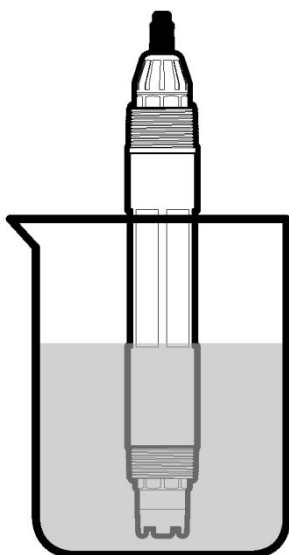
Note: If the output mode is set to hold or transfer, select the delay time when the outputs return to the active state.

ORP calibration procedure

Sensors can be calibrated with an ORP reference solution or with the process sample.

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

Figure 5 Sensor in reference solution



2. Push the **MENU** key and select Sensor Setup, [Select Sensor], Calibrate.
3. Push **ENTER** to select 1 Point Sample calibration.
4. If the passcode is enabled in the security menu for the controller, enter the passcode.

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

5. Select the option for the output signal during calibration:
6. With the sensor in the reference solution or sample, push **ENTER**. The measured value is shown.
7. Wait for the value to stabilize and push **ENTER**.

Note: The screen may advance to the next step automatically.
8. If the process sample is used for calibration, measure the ORP value with a secondary verification instrument. Use the arrow keys to enter the value and push **ENTER**.
9. Review the calibration result:
 - Passed the sensor is calibrated and ready to measure samples. The slope and/or offset values are shown.
 - Failed the calibration slope or offset is outside of accepted limits. Repeat the calibration with fresh reference solutions. Refer to Maintenance on page 16 and Troubleshooting on page 17 for more information.
10. If the calibration passed, push **ENTER** to continue.
11. If the option for operator ID is set to Yes in the Calibration Options menu, enter an operator ID. Refer to Change calibration options on page 15.
12. On the New Sensor screen, select whether the sensor is new:

Option	Description
Yes	The sensor was not calibrated previously with this controller. The days of operation and previous calibration curves for the sensor are reset.
No	The sensor was calibrated previously with this

- Return the sensor to the process and push ENTER. The output signal returns to the active state and the measured sample value is shown on the measure screen.

Note: If the output mode is set to hold or transfer, select the delay time when the outputs return to the active state.

Temperature calibration

The instrument is calibrated at the factory for accurate temperature measurement. The temperature can be calibrated to increase accuracy.

- Put the sensor in a container of water that is at a known temperature. Measure the temperature of the water with an accurate thermometer or independent instrument.
- Push the **MENU** key and select Sensor Setup, [Select Sensor], Calibrate.
- Select 1 PT Temp Cal and push **ENTER**.
- Wait for the value to stabilize and push **ENTER**.
- Enter the exact value and push **ENTER**.
- Return the sensor to the process and push **ENTER**.

Exit calibration procedure

If the **BACK** key is pushed during a calibration, the user can exit the calibration.

- Push the BACK key during a calibration. Three options are shown:

Option	Description
QUIT CAL	Stop the calibration. A new calibration must start from the beginning.
BACK TO CAL	Return to the calibration.
LEAVE CAL	Exit the calibration temporarily. Access to other menus is allowed. A calibration for a second sensor (if present) can be started. To return to the calibration, push the MENU key and select Sensor Setup, [Select Sensor]

- Use the arrow keys to select one of the options and push ENTER.

Change calibration options

The user can set a reminder or include an operator ID with calibration data from the CAL OPTIONS menu.

1. Push the MENU key and select Sensor Setup, [Select Sensor], Calibrate, Cal Options.
2. Use the arrow keys to select an option and push ENTER.

Option	Description
SELECT BUFFER	For pH sensors only—changes the set of buffer solutions that are recognized for calibration to pH 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 point sample or 2 point sample option is selected during calibration.
CAL REMINDER	Sets a reminder for the next calibration in days, months or years—Off (default), 1 day, 7, 30, 60, or 90 days, 6 or 9 months, 1 or 2 years
OP ID on CAL	Includes an operator ID with calibration data— Yes or No (default). The ID is entered during the calibration.

Reset calibration options

The calibration options can be reset to the factory default options.

1. Push the **MENU** key and select Sensor Setup, [Select Sensor], Calibrate, Reset Default Cal.
2. If the passcode is enabled in the security menu for the controller, enter the passcode.
3. Push **ENTER**. The Reset Cal? screen is shown.
4. Push **ENTER**. All calibration options are set to the default values.
5. If the option for operator ID is set to Yes in the Calibration Options menu, enter an operator ID. Refer to Change calibration options on page 15.
6. On the New Sensor screen, select whether the sensor is new:

Option	Description
Yes	The sensor was not calibrated previously with this controller. The days of operation and previous calibration curves for the sensor are reset.
No	The sensor was calibrated previously with this controller

7. Push the BACK key to return to the measure screen.

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 19 for more details.

To enable/disable the sensor impedance measurement:

1. Push the MENU key and select Sensor Setup.
2. Select Diag/test and push **ENTER**.
3. Select Imped Status and push **ENTER**.
4. Select Enable/Disable and push **ENTER**

To see both actual and reference sensor impedance readings:

1. Push the **MENU** key and select Sensor Setup.
2. Select Diag/test and push **ENTER**.
3. Select sensor signals and push **ENTER**

Modbus registers

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

Maintenance



WARNING

Personal injury hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

Maintenance schedule

The maintenance schedule shows minimum times for regular maintenance tasks. Perform maintenance tasks more frequently for applications that cause electrode fouling.

Maintenance task	90 days	Annually
Clean the sensor	X	
Inspect sensor for damage	X	
Replace salt bridge and fill solution		X
Calibrate sensor	Set by regulatory agencies or experience	

Clean the sensor

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.

WARNING

Personal injury hazard. Removal of a sensor from a pressurized vessel can be dangerous. Installation and removal of these sensors should be done by individuals trained in proper high pressure and temperature installation. Always use industry approved hardware and safety procedures when dealing with high pressure and/or temperature fluid transport systems.

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.

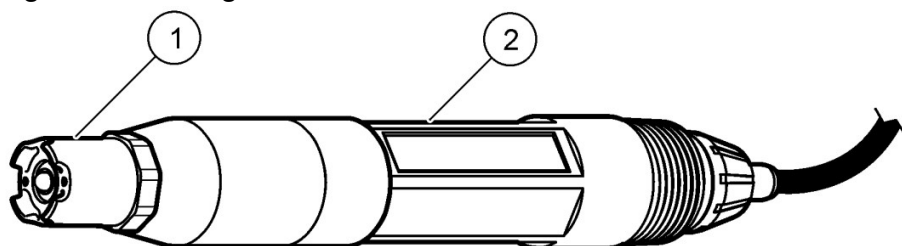
Note: Sensors with antimony electrodes for HF applications may require additional cleaning. Contact technical support.

Always calibrate the sensor after maintenance procedures are done.

Replace the salt bridge

Differential sensors have a removable salt bridge (Figure 6). If the sensor has been cleaned but fails calibration, replace the salt bridge and the standard cell solution. Refer to the instructions included with the salt bridge.

Figure 6 Salt bridge



Always calibrate the sensor after maintenance procedures.

Troubleshooting

Intermittent data

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

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 16.

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.
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 °C. 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.

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 16.

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.
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 °C. 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.

Sensor diagnostic and test menu

The sensor diagnostic and test menu shows current and historical information about the instrument. Refer to Table 3. To access the sensor diagnostic and test menu, push the MENU key and select Sensor Setup, [Select Sensor], DIAG/TEST.

Table 3 Sensor DIAG/TEST menu

Option	Description
MODULE INFORMATION	Shows the version and the serial number for the sensor module.
SENSOR INFORMATION	Shows the name and serial number that was entered by the user.
CAL DAYS	Shows the number of days since the last calibration.
CAL HISTORY	Shows a list of and details for each calibration.
RESET CAL HISTORY	Resets the calibration history for the sensor (requires service-level passcode). All previous calibration data is lost.
SENSOR SIGNALS	Shows the current reading in mV, the impedance of the active and reference electrodes and the temperature-compensated impedance. Shows predicted life when Predict Enable is on.
IMPED STATUS	Shows when the impedance of the sensor (measured every 3 hours) indicates malfunction. If enabled (recommended), a warning is shown when the impedance is outside of normal limits.
PREDICT ENABLE	Adds the predicted life of the pH sensor to the Sensor Signals screen. The Impedance Status must be enabled and the sensor must have a 2-point calibration for accurate prediction. When the predicted life has expired, a warning is shown on the measurement screen.

Table 3 Sensor DIAG/TEST menu (continued)

Option	Description
SENSOR DAYS	Shows the number of days that the sensor has been in operation.
RESET SENSOR DAYS	Resets the number of days that the sensor has been in operation.

Error list

When an error occurs, the reading on the measurement screen flashes and all outputs are held when specified in the controller menu. To show the sensor errors, press the **MENU** key and select Sensor Diag, [Select Sensor], Error List. A list of possible errors is shown in Table 4.

Table 4 Error list for pH and ORP sensors

Error	Description	Resolution
PH TOO HIGH	The measured pH is > 14	Calibrate or replace the sensor.
ORP TOO HIGH	The measured ORP value is > 2100 mV	
PH TOO LOW	The measured pH is < 0	Calibrate or replace the sensor.
ORP TOO LOW	The measured ORP value is < -2100 mV	
OFFSET 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 TOO LOW	The offset is < 5 (pH) or -200 mV (ORP)	
SLOPE TOO HIGH	The slope is >62 (pH)/1.3 (ORP)	Repeat the calibration with a fresh buffer or sample, or replace the sensor.

Table 4 Error list for pH and ORP sensors (continued)

Error	Description	Resolution
SLOPE TOO LOW	The slope is <50 (pH)/0.7 (ORP)	Clean the sensor, then repeat the calibration, or replace the sensor.
TEMP TOO HIGH	The measured temperature is >130 °C	Make sure that the correct temperature element is selected.
TEMP TOO LOW	The measured temperature is < -10 °C	
ADC FAILURE	The analog to digital conversion failed	Power off and power on the controller. Call technical support.
A ELEC TOO HIGH	The active electrode impedance is > 900 MΩ	The sensor is in air. Return the sensor to the process.
A ELEC TOO LOW	The active electrode impedance is < 8 MΩ	The sensor is damaged or dirty. Call technical support.
R ELEC TOO HIGH	The reference electrode impedance is > 900 MΩ	Buffer leaked or evaporated. Call technical support.
R ELEC TOO LOW	The reference electrode impedance is < 8 MΩ	The reference electrode is damaged. Call technical support.
SAME BUFFER	The buffers for 2 point buffer calibration have the same value	Complete the steps in Test the pH sensor on page 17.
SENSOR MISSING	The sensor is missing or disconnected	Examine the wiring and connections for the sensor and for the module.

Table 4 Error list for pH and ORP sensors (continued)

Error	Description	Resolution
TEMP MISSING	The temperature sensor is missing	Examine the wiring for the temperature sensor. Make sure that the correct temperature element is selected.
GLASS IMP LOW	The glass bulb is broken or reached end of life	Replace the sensor. Call technical support.

Warning list for sensors

A warning does not affect the operation of menus, relays and outputs. A warning icon flashes and a message is shown on the bottom of the measurement screen. To show the sensor warnings, press the **MENU** key and select Sensor Diag, [Select Sensor], Warning List. A list of possible warnings is shown in Table 5.

Table 5 Warning list for pH and ORP analog sensors

Warning	Description	Resolution
PH TOO HIGH	The measured pH is > 13	Calibrate or replace the sensor.
ORP TOO HIGH	The measured ORP value is > 2100 mV	
PH TOO LOW	The measured pH is < 1	Calibrate or replace the sensor.
ORP TOO LOW	The measured ORP value is < -2100 mV	
OFFSET TOO HIGH	The offset is > 8 (pH) or 200 mV (ORP)	Follow the maintenance procedures for the sensor and then repeat the calibration.
OFFSET TOO LOW	The offset is < 6 (pH) or -200 mV (ORP)	

Table 5 Warning list for pH and ORP analog sensors (continued)

Warning	Description	Resolution
SLOPE TOO HIGH	The slope is >60 (pH)/1.3 (ORP)	Repeat the calibration with a fresh buffer or sample.
SLOPE TOO LOW	The slope is <54 (pH)/0.7 (ORP)	Clean the sensor, then repeat the calibration.
TEMP TOO HIGH	The measured temperature is >100 °C	Make sure the right temperature element is used.
TEMP TOO LOW	The measured temperature is < 0 °C	
CAL OVERDUE	The Cal Reminder time has expired	Calibrate the sensor.
REPLACE SENSOR	The sensor has been in operation > 365 days, or the predicted life has expired (Refer to Sensor diagnostic and test menu on page 18)	Replace the sensor.
NOT CALIBRATED	The sensor has not been calibrated	Calibrate the sensor.
FLASH FAILURE	External flash memory failed	Contact technical support.
A ELEC TOO HIGH	The active electrode impedance is > 800 MΩ	The sensor is in air. Return the sensor to the process.
A ELEC TOO LOW	The active electrode impedance is < 15 MΩ	The sensor is damaged or dirty. Contact technical support.

Table 5 Warning list for pH and ORP analog sensors (continued)

Warning	Description	Resolution
R ELEC TOO HIGH	The reference electrode impedance is > 800 MΩ	Buffer leaked or evaporated. Call technical support.
R ELEC TOO LOW	The reference electrode impedance is < 15 MΩ	The reference electrode is damaged. Call technical support.
CAL IN PROGRESS	A calibration was started but not completed	Return to calibration.

Event list for sensors

The event list shows current activities such as configuration changes, alarms, warning conditions, etc. To show the events, press the **MENU** key and select Sensor Diag, [Select Sensor], Event List. A list of possible events is shown in Table 6. Previous events are recorded in the event log, which can be downloaded from the controller. Refer to the controller documentation for data retrieval options.

Table 6 Event list for pH and ORP sensors

Event	Description
CAL READY	The sensor is ready for calibration
CAL OK	The current calibration is good
TIME EXPIRED	The stabilization time during calibration expired
NO BUFFER	No buffer is detected
SLOPE HIGH	The calibration slope is above the upper limit
SLOPE LOW	The calibration slope is below the lower limit

Table 6 Event list for pH and ORP sensors (continued)

Event	Description
OFFSET HIGH	The calibration offset value for the sensor is above the upper limit
OFFSET LOW	The calibration offset value for the sensor is below the lower limit
PTS CLOSE	The calibration points are too similar in value for a 2-point calibration
CAL FAIL	The calibration failed
CAL HIGH	The calibration value is above the upper limit
UNSTABLE	The reading during calibration was unstable
CHANGE IN CONFIG float	The configuration was changed—floating point type
CHANGE IN CONFIG text	The configuration was changed—text type
CHANGE IN CONFIG int	The configuration was changed—integer value type
RESET CONFIG	The configuration was reset to the default options
POWER ON EVENT	The power was turned on
ADC FAILURE	The ADC conversion failed (hardware failure)
FLASH ERASE	The flash memory was erased
TEMPERATURE	The recorded temperature is too high or too low
1PT MANUAL START	Start of 1-point sample calibration
1PT AUTO START	Start of 1-point buffer calibration for pH

Table 6 Event list for pH and ORP sensors (continued)

Event	Description
2PT MANUAL START	Start of 2-point sample calibration for pH
2PT AUTO START	Start of 2-point buffer calibration for pH
1PT MANUAL END	End of 1-point sample calibration
1PT AUTO END	End of 1-point buffer calibration for pH
2PT MANUAL END	End of 2-point sample calibration for pH
2PT AUTO END	End of 2-point buffer calibration for pH

Replacement parts and accessories

Note: Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.

Description	Quantity	Item no.
Buffer Solution, pH 4	500 mL	2283449
Buffer Solution, pH 7	500 mL	2283549
Buffer Solution, pH 10	500 mL	2283649
Gel Powder	2 g	25M8A1002-101
ORP Reference Solution, 200 mV	500 mL	25M2A1001-115
ORP Reference Solution, 600 mV	500 mL	25M2A1002-115
Standard Cell Solution for pH	500 mL	25M1A1025-115
Standard Cell Solution for LCP	500 mL	25M1A1001-115

pHD sensors

Description	Item no.
Salt Bridge, pHD PEEK/Kynar, with Santoprene gasket	SB-P1SV
Salt Bridge, pHD PEEK/Kynar, with perfluoroelastomer gasket	SB-P1SP
Salt Bridge, pHD PEEK/Ceramic with Santoprene gasket	SB-P2SV
Salt Bridge, pHD Ryton sensor with Santoprene gasket	SB-R1SV
Sensor Protector, pHD convertible style sensor, PEEK	1000F3374-002
Sensor Protector, pHD convertible style sensor, Ryton	1000F3374-003

LCP and Ryton encapsulated sensors

Description	Item no.
Salt Bridge, LCP/Kynar, with O-ring	60-9765-000-001
Salt Bridge, LCP/Ceramic, with O-ring	60-9765-010-001
Salt Bridge, Ryton/Kynar, with O-ring	60-9764-000-001
Salt Bridge, Ryton/Ceramic, with O-ring	60-9764-020-001

Customer Support

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Documents / Resources

	<p>HACH DOC023.98.80076 pH sc Analog Differential pH ORP Sensor [pdf] User Manual DOC023.98.80076, DOC023.98.80076 pH sc Analog Differential pH ORP Sensor, pH sc Analog Differential pH ORP Sensor, Analog Differential pH ORP Sensor, Differential pH ORP Sensor, pH ORP Sensor</p>
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References

-  [Geräte und Reagenzien für die Wasserqualitätsanalyse | Hach](#)
-  [Hach | Hach](#)

Manuals+.