

Instruction Sheet

pH Sensor

Part Number 0059510

Description

The In-Situ® Inc. pH sensor is a combination, single-junction electrode that contains a replaceable junction and refillable reference electrolyte solution. The pH sensor is designed and manufactured for long-lasting, accurate results in a variety of environmental waters.

Installation

The TROLL 9500 may be shipped with a pH sensor installed. If installation is necessary, unpack and install the sensor in port 1 or 3 of the TROLL 9500, Figure 1.

1. Remove the restrictor or Cal Cup from the front end of the TROLL 9500. This allows access to the sensor block.
2. Remove the sensor hydration bottle and set aside for future storage of the sensor.
3. Rinse the sensor with clean water.
4. Remove any moisture or dirt from the area around the port where you will install the sensor, then use the sensor removal tool to remove the plug from the port. Retain the plug for future use.
5. Remove any moisture or dirt from the port connector with a clean swab or tissue.
6. Remove the cap from the sensor connector. Check lubrication of the sensor o-rings. If the o-rings appear dry, apply silicone lubricant, provided in the sensor box, before installation.
7. Visually align the sensor connector pins with the port connector pins.
8. Press the sensor firmly into the port until you feel it dock with the port connector. When properly inserted, a small gap (the width of the sensor removal tool) remains between the instrument body and the widest part of the sensor, for ease of removal.

Calibration

Although pH may be calibrated with Quick Cal (1 point at pH 7), for best results In-Situ recommends a 2- or 3-point calibration. These options are available in the software:

- **Traditional calibration–1 point:** requires a single solution; results in calculation of sensor offset for a single pH value (pH 4, 7, or 10). Select a calibration solution for the pH range you expect to measure.
- **Traditional calibration–2 point:** requires 2 solutions; results in calculation of sensor slope and offset for one pH range (pH 4-7 or pH 7-10). Choose solutions for the pH range you expect to measure.
- **Traditional calibration–3 point:** requires 3 solutions; results in calculation of slope and offset for 2 ranges (pH 4-7 and pH 7-10). The correct slope for the pH values being monitored will automatically be applied.
- **Default Coefficients:** Resets factory defaults to the sensor. No solutions are required.

Calibration Procedure

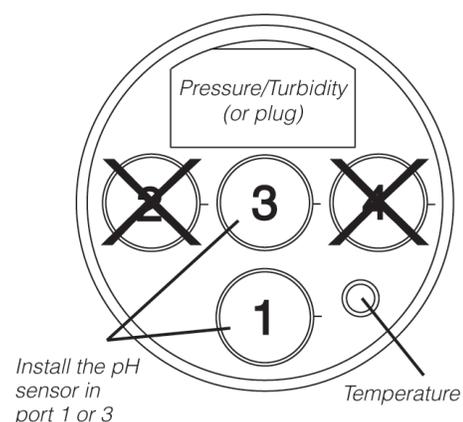


Figure 1. TROLL 9500 pH Sensor Positions

1. Fill the Cal Cup to the fill line with the selected calibration solution and attach to the instrument.
 - a. With a full set of sensors installed, fill to the lower line. With one or two sensors installed, fill to the upper line.
2. Connect the instrument to a PC, open Win-Situ 4 or Pocket-Situ 4 software, and click Find to connect to the device. Select the instrument in the Navigation tree. The software will automatically detect and display the installed sensors.
3. Click Parameters, select pH, then click Calibrate.

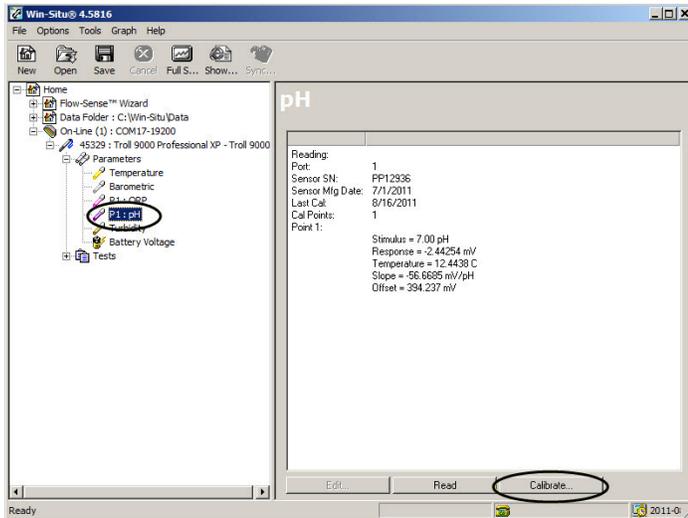


Figure 2. Win-Situ 4 Calibration

4. In the pH Calibration Wizard, specify how many calibration points you intend to use, and the solution for each. Click Next and follow the wizard to perform a 2- or 3-point calibration. Be sure to rinse the Cal Cup and sensors between solutions.
5. At the end of the Wizard, click Finish to write the newly calculated calibration coefficients to the sensor. The pH sensor is now calibrated and ready to use.

If the instrument will be used in a day or so, leave the sensors installed. Remove the Cal Cup and rinse it and the sensors. Add about 50-100 mL of tap water to the Cal Cup. Return the probe to the Cal Cup for transport to the field site.

Calibration Notes:

- pH 4, pH 7, and pH 10 buffers are available from In-Situ Inc. for pH calibration. Always begin with the lowest buffer value when performing a multi-point calibration.
- Ensure that every port is filled with a sensor or a plug before calibrating.

- For best results, try to calibrate at the same temperature as the expected sample temperature.
- Prior to calibrating, rinse the Cal Cup and the front end of the TROLL 9500 in clean water, and shake dry. For best results, follow this with a second rinse in a portion of the calibration solution.
- The Cal Cup fill line indicates the approximate amount of solution to use. Fill to the upper line with 1-2 sensors installed; fill to the lower line with more sensors installed. The temperature sensor should be submerged at least one half inch.
- Most sensors stabilize in 1 to 3 minutes if properly hydrated before calibration. To minimize stabilization time, do not handle the instrument during calibration readings.
- To shorten the calibration time, you have the option to accept the calibration when stability is "Nominal." If the early value is accepted, the calibration point will be designated "USER SET" in the calibration report. If the calibration was performed through to stability then the sensor will operate according to specifications.
- Cal solutions may be flushed down the drain with running water, or saved in a separate container and used to rinse the next time you calibrate with the same solution.
- A calibration report in HTML format is created for each calibration—even one that was cancelled. You can view the report right after calibrating, or at any time. See "Calibration History" in Section 10 of the TROLL 9500 Operator's Manual for details.
- Calibrate the sensor after replacing the reference junction and/or the filling solution, during routine, scheduled maintenance, or every 2-6 weeks in the absence of other indicators.

Indicators During Calibration:

NOT TESTED is displayed until Run is selected.

UNSTABLE indicates the sensor response does not meet the criteria for a valid calibration point.

NOMINAL indicates the sensor deviation meets early stabilization criteria. The Accept button becomes available when stability is nominal. You may accept the early value, or wait for complete stability. If you accept the early value, the calibration point will be designated "USER SET" in the calibration report.

STABLE is displayed when the readings have stabilized. The calibration automatically proceeds to the next screen.

- Temperature and barometric pressure may be displayed for some calibrations.
- Sensor Reading: The current sensor response in indicated units.
- Sensor Deviation: Change in sensor response between the last two readings.

Resetting Default Coefficients

Sensor calibration may be reset to factory defaults at any time. This option is most effective when the sensor is new.

1. With a pH sensor installed, establish a connection to the instrument in Win-Situ 4 or Pocket-Situ 4.
2. Select pH in the Parameters list and click Calibrate.
3. In the first screen, select Use Default Coefficients, then Next.
4. In the final screen, click Finish to send the values to the sensor.

Sensor Slope and Offset

The pH calibration curve pivots around pH 7 (0 mV response). The offset calculated by the software when calibrating at pH 7 will typically be between 350-450 mV. If the offset falls outside these limits, replace the filling solution or the junction.

The slope should fall between -54 mV/pH and -62 mV/pH. A calculated slope greater than -50 mV/pH or less than -66 mV/pH indicates that the sensor requires maintenance.

Usage Recommendations

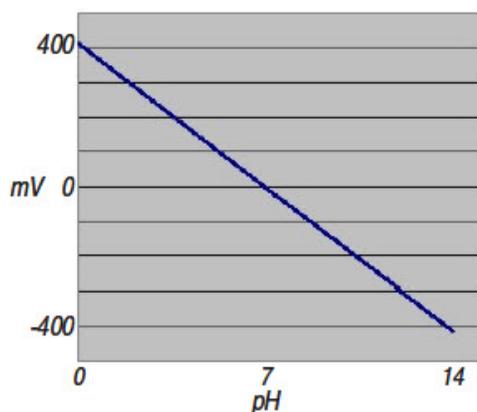


Figure 3. pH sensor calibration graph

- Temperature compensation is provided in the software to account for measurements taken at temperatures different from the calibration temperature. For most accurate results, try to calibrate at the same temperature as the expected sample temperature.
- After an initial 1-2 week settling period, during which the sensor should be calibrated weekly, calibration frequency will depend on the nature of the sample and degree of accuracy required. In clean water samples, the pH sensor should retain its accuracy specification for 2-6 weeks before requiring calibration.
- A small error in pH will occur in basic solutions (>pH 10) that contain high levels of sodium salts (>0.01M) due to sodium interference.
- pH readings in pure water samples (<100 μ S/cm conductivity—also known as “low ionic strength” samples) require up to 20 minutes after calibration to stabilize and begin producing accurate results. After calibration, condition the sensor in a low conductivity solution.

Sensor Handling and Storage

Routine Maintenance

After the pH sensor is moistened, it must be kept moist for the life of the sensor.

The pH sensor fill solution has a shelf life of 2 years. Replace the fill solution every 5 to 6 months or when:

- The sensor fails to calibrate within the acceptable slope and offset range.
- Sensor readings vary.
- Readings during calibration at pH 7 are greater than +30 mV or less than -30 mV.
- Sensor is slow to respond.

Note: If the sensor fails to calibrate after you replace the fill solution, replace the reference junction.

Replacing the Filling Solution

1. Use the sensor removal tool to pry the sensor up and out of the instrument.
2. Unscrew the reference junction. See Figure 4.
3. Protect the connector end of the sensor with



Figure 4. pH sensor with reference junction removed

- the dust cap it shipped with, or wrap the sensor in a paper towel to prevent filling solution from entering the electrical connector.
4. Hold the sensor at an angle and shake out the old filling solution.
 5. Using the dispenser cap on the filling solution bottle, insert the tube into the bottom of the empty reservoir as shown. Squeeze a steady stream of solution into the reservoir until it overflows and no bubbles are observed. Continue to add solution while pulling the tube out of the reservoir.
 6. Attach the reference junction to the sensor and

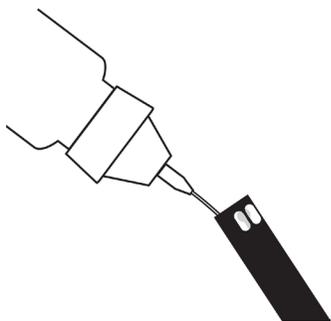


Figure 5. Fill the pH reservoir

- hand-tighten until snug, firmly seating the junction. Some filling solution will overflow. Wipe the excess off the sensor body.
7. Soak the sensor in tap water for at least 15 minutes.
 8. Calibrate the sensor.

Note: If necessary, thoroughly clean the sensor connector to remove filling solution: Using a disposable pipette, fill the connector with isopropyl alcohol (70% - 100%). Shake to dry. Repeat 3 times. Dry overnight. When thoroughly dry, calibrate the sensor.

Replacing the Junction

Replace the junction when the sensor fails to calibrate with a reasonable slope and offset, even after replacing the filling solution.

1. Unscrew the reference junction and discard.
2. Replace the filling solution and screw in a new reference junction.
3. Soak for 15 minutes, then calibrate the sensor.

Note: Keep the junction damp at all times to avoid a lengthy rewetting process.

Cleaning

Begin with the most gentle cleaning method and continue to the other methods only if necessary. Do not directly wipe the glass bulb.

To clean the pH sensor, gently rinse with cold water. If further cleaning is required, consider the nature of the fouling.

To remove crystalline deposits:

- Clean the sensor with warm water and mild soap.
- Soak the sensor in 5% HCl solution for 10 to 30 minutes.
- If deposits persist, alternate soaking in 5% HCl and 5% NaOH solutions.

To remove oily or greasy residue:

- Clean the sensor with warm water and mild soap.
- Methanol or isopropyl alcohol may be used for short soaking periods, up to 1 hour.
- Do not soak the sensor in strong solvents, such as chlorinated solvents, ethers, or ketones, including acetone.

To remove protein-like material, or slimy film:

- Clean the sensor with warm water and mild soap.
- Soak the sensor in 0.1M HCl solution for 10 minutes and then rinse with deionized DI water.

After performing any of these cleaning methods, rinse the sensor with water, then soak overnight in pH 4 buffer.

Sensor Removal

You can store the pH sensor on the TROLL 9500, or you can remove the sensor. If you remove the sensor from the instrument, seal the port with a port plug and place a dust cap on the port side of the pH sensor.

To remove the sensor, use the sensor removal tool to pry the sensor upward and outward.

Short-term Storage

Up to 1 week: Fill the electrode storage bottle with pH 4 buffer and immerse the sensor tip in the buffer. Tighten the cap to prevent drying. Alternatively, pH 7 buffer can be used for a few days.

Long-term Storage

Greater than 1 week: Fill the electrode storage bottle with 10-20 mL of storage solution (Order No. 0065370) and immerse the sensor. Tighten the cap to prevent drying.

Storage Recommendations

Prior to using the pH sensor after long-term storage, rinse the sensor with DI water and then soak it in pH 4 buffer for 1 or 2 hours. This will saturate the glass bulb with hydrogen ions and prepare it for use.

Do not store the pH sensor in DI water because it will deplete the reference solution and drastically reduce the life of the sensor.

Specifications

Type:	Glass sensing bulb with Ag/AgCl reference half-cell, replaceable single junction, replaceable reference filling solution
Range:	0 to 12 pH units
Pressure Rating:	211 m (692 ft)
Accuracy:	± 0.1 pH unit
Resolution:	0.01 pH unit
Operating Temperature:	0 to 50° C (32 to 122° F)

Replacement Parts

Reference Filling Solution (60 mL).....	0056900
pH Calibration Kit (1 L each pH 4, pH 7, pH 10, DI water).....	0032080
Quick Cal (4 x 250 mL).....	0033250
Reference Junction Kit (3 junctions, 60 mL reference filling solution).....	0059620
Storage Solution (500 mL).....	0065370



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