

Instruction Sheet

pH/ORP Sensor

Part Number 0059520 (TROLL® 9500 Instrument), 0060000 (Aqua TROLL® 400, SMARTROLL™ MP Instrument)

Description

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

Installation

Unpack and install the pH/ORP sensor into its designated port on the multiparameter instrument.

1. Remove the restrictor or Cal Cup from the front end of the instrument. This allows access to the sensor block.
2. Remove the sensor hydration bottle from the sensor and save it for future sensor storage.
3. Rinse the sensor with clean water.
4. Remove any moisture or dirt from the area and remove the plug from the port. Retain the plug for future storage.
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 join with the port connector.

Calibration

The pH/ORP sensor requires separate calibrations for pH and ORP.

ORP

A 1-point calibration in a solution with known potential at a given temperature is sufficient to calibrate ORP. Several options are provided.

- **Quick Cal:** A 1-point calibration in In-Situ Quick Cal solution results in calculation of sensor offset.
- **Traditional calibration:** A 1-point calibration in a solution specifically formulated for calibrating ORP, such as ZoBell's (reference mV value available in the software) results in calculation for sensor offset.
- **Default coefficients:** Resets the factory defaults, no solutions are required.

pH

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

The pH/ORP sensor requires separate calibrations for pH and ORP. In-Situ recommends the following process for calibrating both parameters.

ORP—Quick Cal

The Quick Cal procedure produces excellent results for ORP as long as the solution is stored as recommended and used before its expiration date.

1. Fill the Cal Cup with Quick Cal solution and place the instrument in the solution.
2. Follow the instructions in the Calibration Wizard until the calibration is complete.

pH—Traditional Calibration

The pH sensor is most accurate after a multi-point traditional calibration. After using the Quick Cal solution to calibrate ORP, empty the Cal Cup, rinse it and the sensors in clean water then in the lowest pH buffer you intend to use.

1. Fill the Cal Cup with the lowest pH buffer you intend to use for calibration.
2. Follow the Calibration Wizard in the software or on the Con TROLL® PRO.
3. 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.
4. At the end of the Wizard, click Finish to write the newly calculated calibration coefficients to the sensor. The pH/ORP 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. For longer storage, see Sensor Handling and Storage below.

Calibration Notes:

- Only one solution is required for ORP calibration. Quick Cal or ZoBell's solution are recommended and available from In-Situ Inc. The reference millivolt value is available in the software for a traditional calibration with ZoBell's. A custom solution may be used in a traditional calibration if the mV value at the calibration temperature is known.
- 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, calibrate at the same temperature as the expected sample temperature.
- Prior to calibrating, rinse the Cal Cup and the front end of the instrument in clean water, and shake dry.
- The Cal Cup fill line indicates the approximate amount of solution to use. 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.
- 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.
- Recalibrate the sensor after replacing the reference junction or the filling solution; during scheduled maintenance, or every 2-6 weeks if sensor readings drift.

Software Indicators During Calibration:

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.

STABLE is displayed when the readings have stabilized.

- 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. This is also a good option for the ORP sensor if the results of a recent calibration are suspect because the calibration solution has deteriorated. Results for each parameter must be set separately.

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.

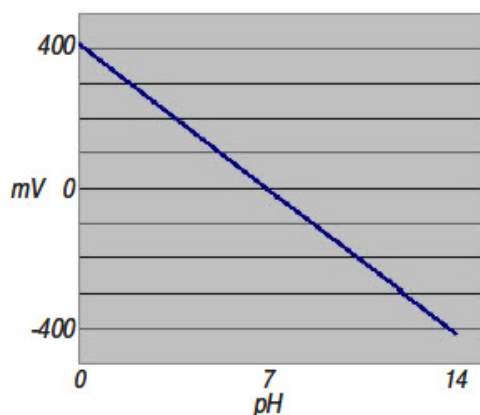


Figure 1. pH sensor calibration graph

The ideal slope is between (-54 mV/pH and -62 mV/pH). A calculated slope greater than (-50 mV/pH or less than -66 mV/pH) is acceptable but indicates that the sensor may soon require maintenance.

The offset for ORP is a “zero offset” and is typically (0 ± 20 mV). If the offset calculated during calibration is outside this range, inspect the sensor and clean it if necessary. Ensure that the calibration has been stored properly and has not expired.

Usage Recommendations

- The ORP sensor readings vary slightly due to temperature changes. These variations are not easily corrected because, unlike pH, the ORP value is dependant on the activity of many ions in solution. The pH values are more easily corrected because they are a result of the activity of one ion, H^+ .
- 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 ($<100\mu S/cm$ conductivity—also known as “low ionic strength” samples) may require up to 20 minutes after calibration to stabilize and begin producing accurate results. After calibration, condition the sensor in a low conductivity solution.
- Like all platinum ORP electrodes, the In-Situ pH/ORP sensor may provide unstable readings in solutions that contain chromous, vanadous, titanous, and other ions that are stronger reducing agents than hydrogen or platinum.

Sensor Handling and Storage

Routine Maintenance

If the ORP platinum electrode is dull or dirty, it can be cleaned with a swab and methanol or isopropyl alcohol. Rub the electrode gently until it is shiny.

The pH sensor must be kept moist for the life of the sensor.

The 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. TROLL 9500—Use the sensor removal tool to pry the sensor up and out of the instrument. Aqua TROLL 400—Grasp the sensor by the finger grip and pull out of the instrument.
2. Unscrew the reference junction. See Figure 2.



Figure 2. pH sensor with reference junction removed

3. Protect the connector end of the sensor with 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.

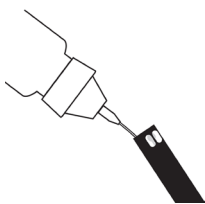


Figure 3. Fill the pH reservoir

6. Attach the reference junction to the sensor and hand-tighten until firmly attached. 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 you have replaced 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 debris.

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, such as 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 instrument, 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.

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: | Platinum wire and glass sensing bulb with Ag/AgCl reference half-cell, replaceable single junction, |
| Range: | 0 to 12 pH units, \pm 1400 mV ORP |
| Pressure Rating: | 211 m (692 ft) |
| Accuracy: | \pm 0.1 pH unit, \pm 5 mV (ORP) |
| Resolution: | 0.01 pH unit |
| Operating Temperature: | 0 to 50° C (32 to 122° F) |

Replacement Parts

| | |
|---|---------|
| Reference Filling Solution (60 mL)..... | 0056900 |
| ZoBell's Solution (1L)..... | 0032100 |
| 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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