1 YEAR
WARRANTY

OMEGA®

User's Guide

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PHTX-275/PHEH-275 AND 276 SERIES

pH/ORP Sensor Electronics

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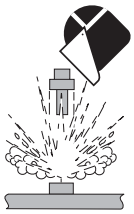
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature/pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.
6. When using chemicals or solvents care should be taken and appropriate eye, face, hand, body, and/or respiratory protection should be used.



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2. Description

Omega PHE 272X pH and ORP series sensors used with Omega PHTX-275Y, PHTX-275G, PHEH-275G (ISO) or PHEH-275Y (ISO) Sensor Electronics provide two-wire, 4 to 20 mA loop output for pH and ORP measurements. Preamplification is built-in ensuring absolute signal integrity up to 305 m (1,000 ft).

These sophisticated field-mount devices also provide digital output; the latest development in leading-edge technology from Omega. The PHTX-275 / PHEH pH/ORP Sensor Electronics self-configure for pH or ORP operation via automatic recognition of electrode type, and the electrode connector quickly forms a robust assembly for submersible and in-line installations.

NEMA 4X Junction Boxes are integral parts of the in-line version and are available as accessories for the submersible version. The optional EasyCal feature allows simple push-button calibration and includes an LED for visual feedback.

3. Specifications

General

Compatible Electrodes PHE-2724, ORE-2725, PHE-2726
(3k Ohm Balco temperature sensor versions for pH)

Operational Range ..... 0.00 to 14.00 pH, ±2000 mV ORP 0 °C to 85 °C (32 °F to 185 °F)

Response Time (includes electrode response):
- pH ..... <6 s for 95% of change
- ORP ..... application dependent
- pH Temp T90 ..... 200 s (PHE-2724), 132 s (PHE-2726)

Materials:

PHTX-275 / PHEH-275Y (in-line) . PBT (thermal plastic polyester)
PHEH-275G(ISO) (submersible) .. CPVC

Cable for PHEH-275G and PHEH-275G-ISO submersible versions:
5 m (15 ft) 3-conductor shielded, 22 AWG
- May be extended up to 305 m (1000 ft) with current output
- May be extended up to 305 m (1000 ft) with digital output

Weight:
PHTX-275 / PHEH-275Y (in-line) . 0.75 kg (1.75 lb)
PHEH-275G(ISO) (submersible) .. 0.64 kg (1.4 lb)

Environmental

Ambient Temp. ..... 0 °C to 85 °C (32 °F to 185 °F)
Storage Temp. ..... -20 °C to 85 °C (-4 °F to 185 °F)
Relative Humidity ..... 95% max, non-condensing
Immunity EN50082-2
Emissions EN50081-1
Enclosure Rating:
PHTX-275 / PHEH-275Y (in-line) . NEMA 4X/IP65 (with electrode connected)
PHEH-275G(ISO) (submersible) .. NEMA 6P/IP68 (with electrode and watertight extension pipe connected)

Electrical

Input Impedance ..... $>10^{11}\ \Omega$
Input response time ..... 500 ms
Temperature drift ..... ±0.002 pH per ºC
±0.1 mV ORP per ºC
Input resolution ..... 0.02 pH, 1 mV ORP, 0.3 ºC

Current output:

Description:
- pH ..... Fixed 4 to 20 mA, isolated, 0 to 14 pH (custom scaling available)
- ORP ..... Fixed 4 to 20 mA, isolated, -1000 to 2000 mV (custom scaling available, -2000 to 2000 mV)

Power ..... Regulated 12-24 VDC ± 10%, 20 mA max.
Max Loop Resistance ..... 50 Ω max. @ 12V
325 Ω max. @ 18V
600 Ω max. @ 24V
Accuracy ..... ±32 µA @ 25 ºC
Temperature drift ..... ±1 µA per ºC
Output resolution ..... ± 5 µA
Error indication ..... 3.6 mA

Digital output:

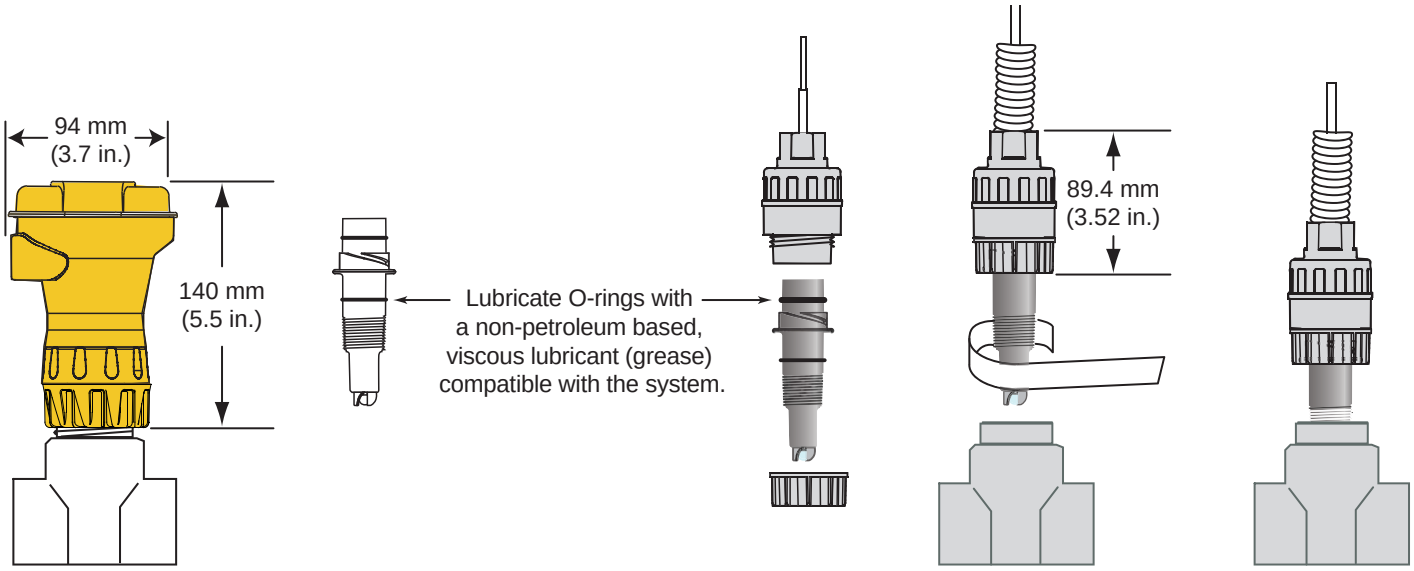
Description ..... Serial ASCII, TTL level 9600 bps
Power ..... 5 VDC ± 10% regulated, 3 mA max
Accuracy:
- pH ..... ± 0.03 pH @ 25 °C
- ORP ..... ± 2 mV @ 25 °C

Resolution:
- pH ..... 0.01 pH
- ORP ..... 1 mV
- Temp ..... 0.2 °C

Error indication ..... Temp output "+999.9"

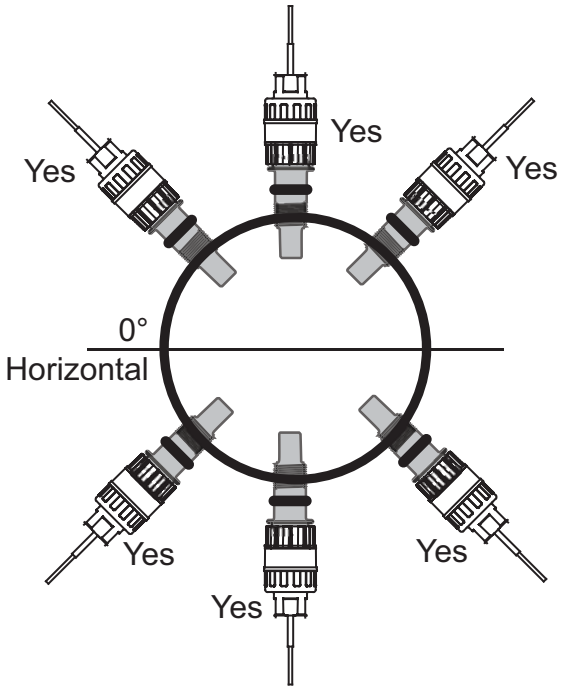
4. In-line Dimensions

- The PHEH-275Y in-line sensor electronics (without EasyCal) is designed for applications where electrode calibration is facilitated by remote equipment.
- The PHTX-275Y in-line sensor electronics includes EasyCal.
- Omega installation fitting (1/2 in. to 4 in.) or Omega pipe adapter is required to secure the electrode in the pipe.



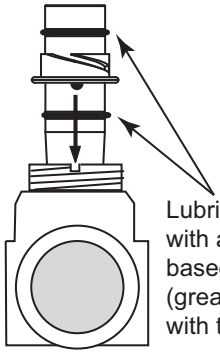
5. Mounting Position

- Recommended maximum flow rate (conductivity above 20 us): 3 m/s (10 ft/s).
- Bulb-style electrodes minimum flow rate: 1.5 m/s (5 ft/s).
- Flat surface electrodes minimum flow rate: 0.3 to 0.6 m/s (1 to 2 ft/s).
- Low Conductivity electrodes (conductivity below 20 us) recommended maximum flow rate: 150mL/min.
- PHE-2724 (ISO), PHE-2726 (ISO), and ORE-2725 (ISO) series electrodes can be mounted at any angle (see diagram below).



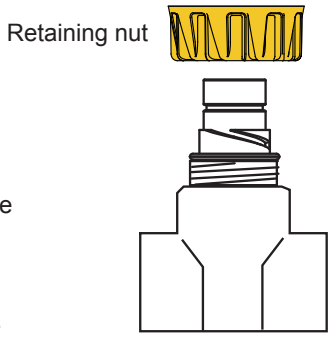
6. PHTX-275 / PHEH In-line pH Sensor Assembly

Note:
This procedure applies to systems using standard
PHE-2724 (ISO), PHE-2726 (ISO), and ORE-2725 (ISO) electrodes.



1. Insert electrode into Omega installation fitting.
Seat the electrode tabs into the alignment notches in the fitting.

2. Thread the in-line retaining nut onto fitting to secure the electrode into place.

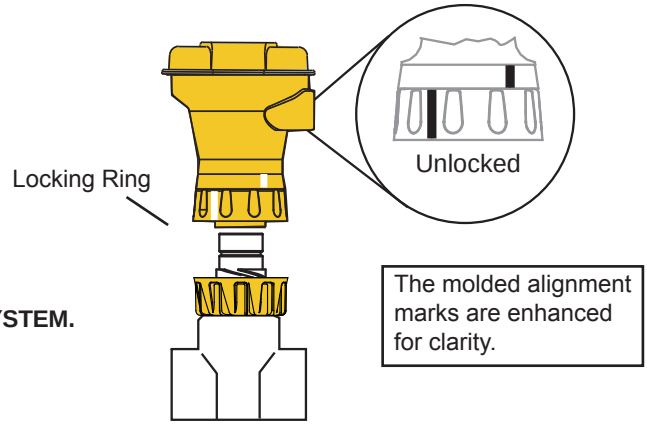


HAND-TIGHTEN THE THREADED NUT ONTO THE INSTALLATION FITTING. DO NOT USE TOOLS! DO NOT USE THREAD SEALANT OR LUBRICANTS ON THE FITTING THREADS OR THE SENSOR CAP.

Chemical Compatibility Warning
The retaining nuts of pH and ORP sensors are not designed for prolonged contact with aggressive substances. Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly serious consequences, such as damage to equipment and serious personal injury. Retaining nuts that may have been in contact with such substances e.g. due to leakage or spilling, must be replaced.

Note:
Keep the electrical interconnection between electrode and sensor electronics dry and clean at all times.

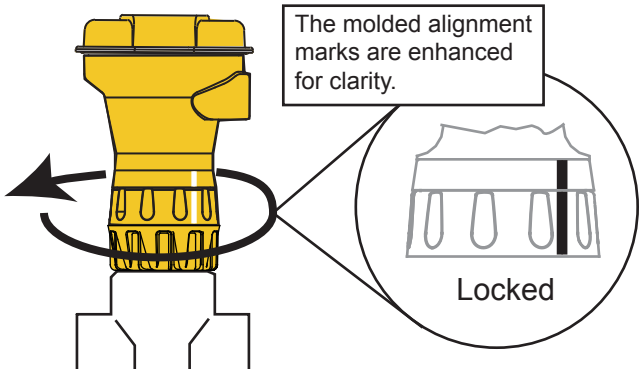
3. Unlock the ring on base of PHTX-275 / PHEH
(The ring is unlocked when the lines on the ring and body of the PHTX-275 / PHEH are not aligned)



LUBRICATE O-RINGS WITH A NON-PETROLEUM BASED, VISCOUS LUBRICANT (GREASE) COMPATIBLE WITH THE SYSTEM.

4. Place PHTX-275 / PHEH onto top of electrode and turn until the assembly drops into position.

5. Turn locking ring ¼ turn to secure the PHTX-275 / PHEH assembly.
(The ring is locked when the line on the ring and the line on the body of the PHTX/PHEH are aligned.)



In-Line Sensor and Electrode Removal

- **To remove electronics assembly only:**
  Turn locking ring ¼ turn; lift assembly straight up.
- **To remove electrode from the pipe:**
  Remove electronics assembly, then unthread retaining cap; pull electrode straight up.
- **To remove the complete PHTX-275 / PHEH system:**
  Hold locking ring in place. Unthread retaining cap and pull electrode straight up.

CAUTION!
- Do not remove the electrode from a pressurized pipe.
- Wear appropriate protective equipment when working with chemicals in a pressurized pipe.

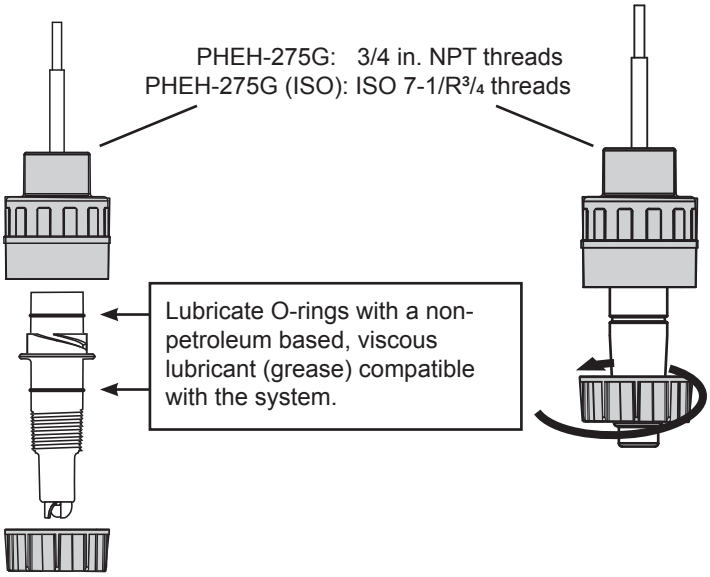
7. PHEH-275G (ISO) Submersible Sensor Assembly and Installation

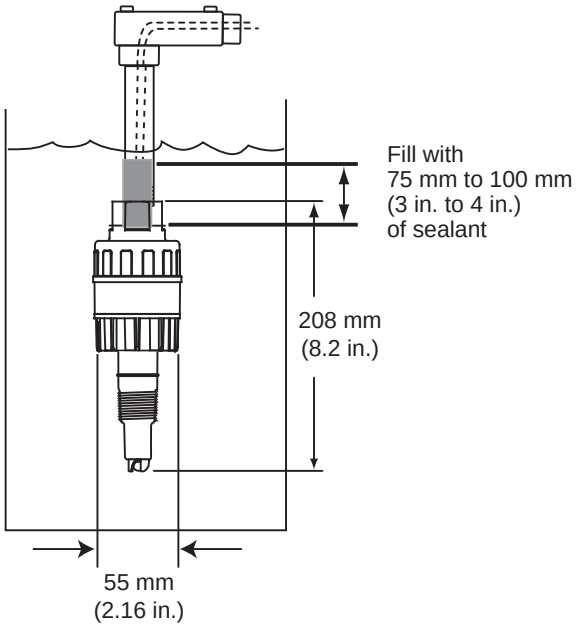
1. Insert electrode into base of the PHEH-275G (ISO) and turn until keyed contacts are seated.

2. Thread retaining cap over electrode and hand-tighten onto the PHEH-275G (ISO).

3. Attach ¾ in. watertight pipe to the top of the PHEH-275G (ISO). Secure the threaded connection to prevent any leakage.

- For additional defense against possible accumulation of condensation at the back seal area of the sensor, fill the lower 75 mm to 100 mm (3 in. to 4 in.) of conduit or extension pipe with a flexible sealant such as silicone.





Note:
Keep the electrical interconnection between electrode and sensor electronics dry and clean at all times.

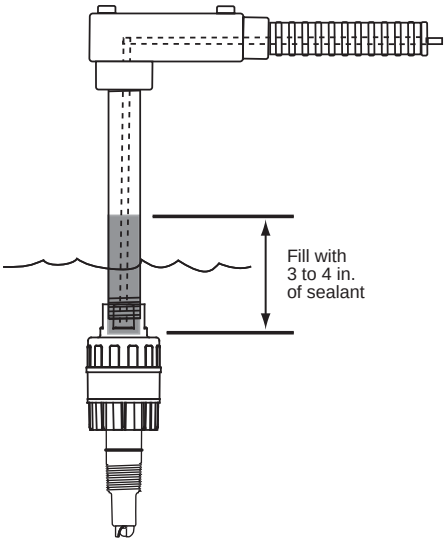
Use standard installation hardware to connect the submersible PHEH-275G (ISO) directly to external equipment.

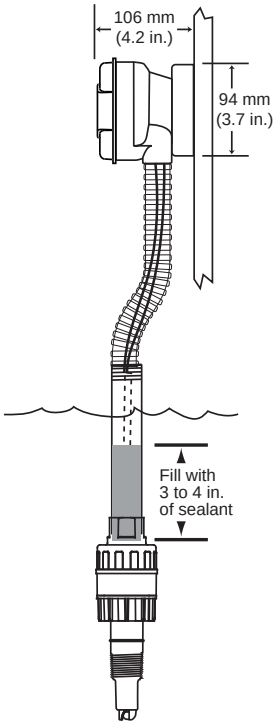
OR

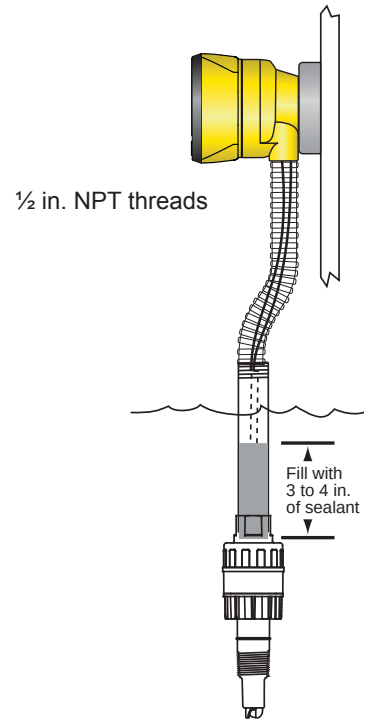
The PHTX-275G Universal Mount Junction Box with EasyCal mounts flat onto a tank or wall, or can be strapped to a post or pipe.

OR

The FP90UM Universal Mount Kit mounts a DPU91 onto a tank or wall, or can be strapped to a post or pipe.



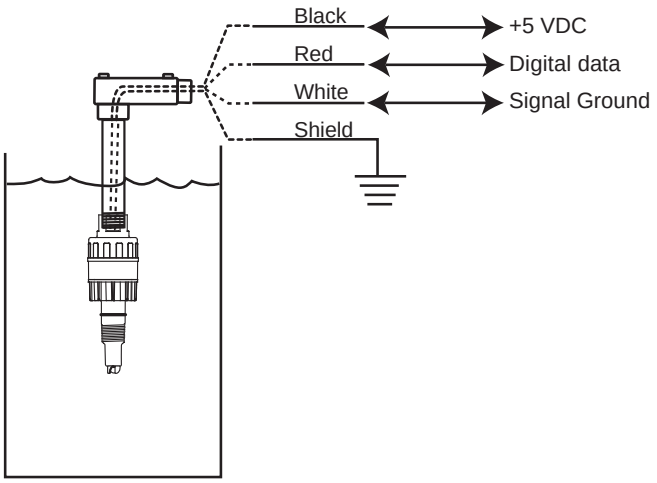




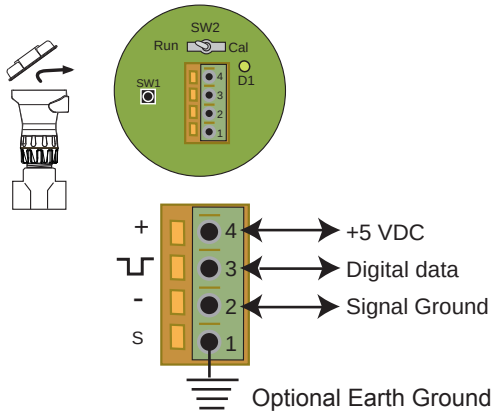
Cable supplied:
- 5 m (15 ft) 3-conductor + shld, 22 AWG.
- May be extended up to 305 m (1000 ft) with current output.
- May be extended up to 305 m (1000 ft) with digital output.

8. Digital Wiring

- When the PHTX-275 / PHEH is powered with 5 VDC, the digital serial data output is automatically selected.
- This digital data is used exclusively by Omega instruments.
- Remove approximately 10 mm (0.4 in.) of insulation and tin each conductor before inserting into connectors.



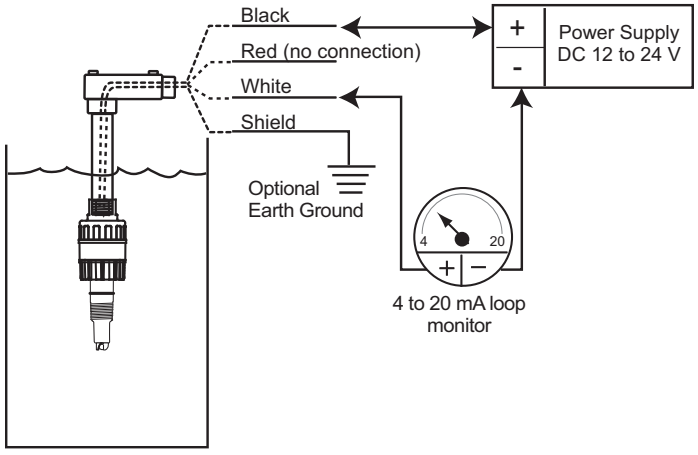
- Connect the PHEH-275G (ISO) cable directly to DPU91 terminals.



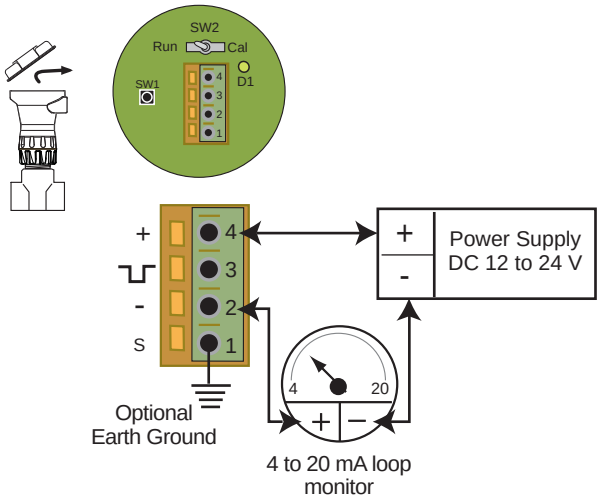
- The PHTX-275Y and PHTX-275G include a terminal block.
- Connect the terminals as shown to DPU91 digital I/O port.
- The PHTX-275Y includes the EasyCal accessory, use standard pH buffer values (pH 4, 7, or 10) to perform periodic calibration.

9. 4 to 20 mA Loop Wiring

- When the PHTX-275 / PHEH is powered with 12 to 24 VDC, the 4 to 20 mA loop output is automatically selected.
- Remove approximately 10 mm (0.4 in.) of insulation and tin each conductor before inserting into connectors.



- Connect the PHEH-275G (ISO) cable directly to a Loop device as shown.
- This configuration does not provide any calibration capability within the PHEH-275G (ISO) system. Periodic calibration must be performed at the external equipment.

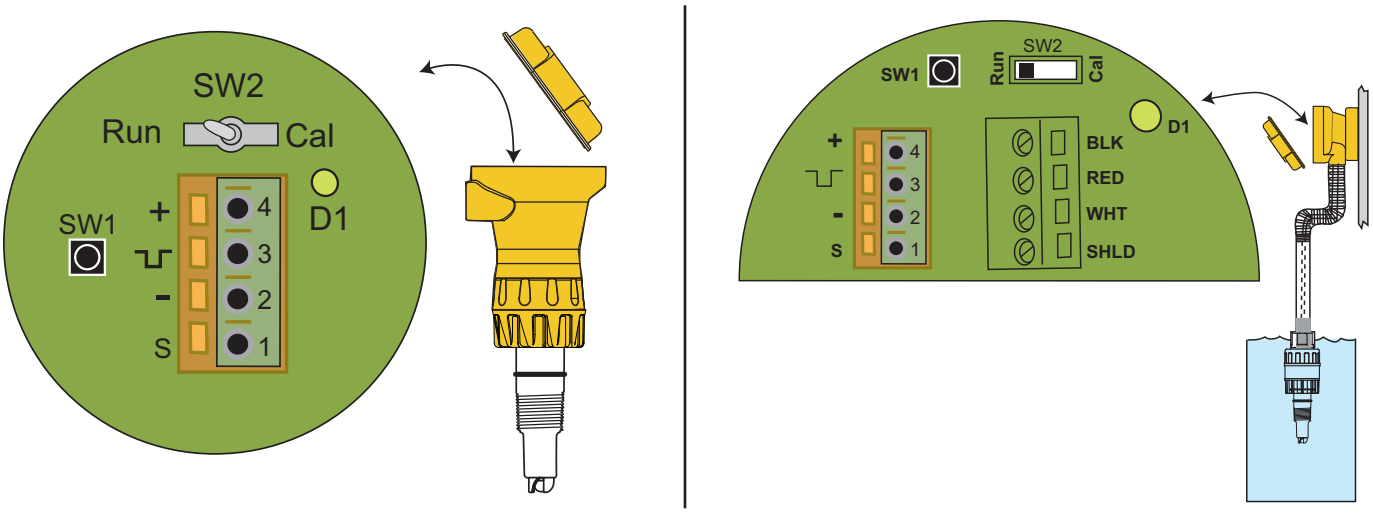


- The PHTX-275Y includes a terminal block.
- Connect the terminals to the Loop device as shown.
- The PHTX-275Y includes the EasyCal accessory, use standard pH buffer values (pH 4, 7, or 10) to perform periodic calibration.

10. Calibration

Periodic calibration is required to compensate for electrode aging.
All PHTX-275 and PHEH-275 and 276 pH/ORP Sensor Electronics are factory-calibrated for maximum out-of-the-box accuracy.
The PHTX-275Y and PHTX-275G optional EasyCal feature allows calibration to be performed locally at the sensor.

SW1 EasyCal button
SW2 RUN/CALIBRATE switch for S^{3}L system
D1 EasyCal Indicator (green LED)



11. EasyCal Procedure

The first step (Reset) is recommended each time an electrode is replaced, but is NOT necessary upon initial installation or periodic calibration. In fact, for periodic calibration it is best for the electrode/sensor assembly to remain intact to minimize the possibility of moisture or other contamination entering the electrical interconnection area. The electrode/sensor connection must remain dry and clean at all times.

1. Reset the PHTX-275 pH/ORP Electrode Electronics to factory calibration:
   With no electrode connected to the Sensor, press and hold SW1 until the LED (D1) comes on steady then goes off again (approx. 10 seconds). When the LED goes off, release SW1; reset is complete.

2. Connect an electrode to the PHTX-275 pH/ORP Electrode Electronics.

3. **If digital output is being used, place SW2 in the "Cal" position. If 4 to 20 mA output is being used, SW2 position is of no consequence.**

4. Place the electrode/sensor assembly into a calibration solution as follows: (If the electrode is "healthy", then the PHTX-275 will automatically recognize the solution. The order in which the solutions are used during the calibration procedure is of no consequence.)
   - For pH calibration, use any two of these international standards: pH 4.0, 7.0 or 10.0 buffer solutions.
   - To produce standards for ORP calibration, mix the chemical Quinhydrone into pH 7.0 and 4.0 buffers to saturation (1/8 g per 50 ml).
   - Regardless of the size of the container used for calibration, one inch of solution is adequate to completely submerge the tip of the electrode.
   - **Allow at least 30 seconds for the electrode response to stabilize before calibration.**

5. Press and hold SW1 for approximately 8 to 10 seconds. During this time, the LED (D1) will come on steady then go back off. Release SW1 (If the LED blinks several times rapidly, the calibration was not successful. See the troubleshooting section.)

6. Remove the electrode/sensor assembly from the first calibration solution, rinse the electrode with clean water, and place it in a second solution.
   - **Allow at least 30 seconds for the electrode response to stabilize before calibration.**

7. Press and hold SW1 for approximately 8 to 10 seconds. During this time, the LED will come on steady then go back off. Release SW1. (If the LED blinks several times rapidly, the calibration was not successful. See the troubleshooting section.)

8. **For digital systems ONLY: Return SW2 to the RUN position.**

Calibration is complete. Return the system to service.

12. Troubleshooting

LED and Output Condition	Possible Causes	Suggested Solutions
Current Out: **LED off, current output is 3.6 mA** **Digital: Temp out is +999.9**	• No electrode installed. • Bad/dirty contacts between electrode and PHTX-275Y.	• Install electrode. • Check interconnection between electrode and PHTX-275Y, clean contacts.
During EasyCal, the LED blinks rapidly for 4 seconds and the current output is frozen at a random fixed value.	• The buffer solution is outside of the accepted tolerance for the PHTX-275Y. • The electrode is depleted (> 1.1 pH or 65 mV offset).	• pH system: Use fresh 4 pH, 7 pH, or 10 pH buffer and restart the calibration. • ORP system: Use fresh 4pH and 7 pH buffer solution saturated with quinhydrone. • Replace the electrode.
After completing calibration procedure, the output values are inaccurate.	• Insufficient time allowed for electrode stabilization during calibration.	• Recalibrate; verify that test solutions are at room temperature and wait at least 30 seconds after placing electrode in solution before pressing S1 EasyCal button.

13. Ordering Information

PHTX-275 and PHEH-275/276 Series pH/ORP Sensor Electronics

Mfr. Part No.	Description
PHTX-275Y	In-line Sensor Electronics with EasyCal
PHEH-275Y	In-line Sensor Electronics, 15 ft cable, ¾ in. NPT threads
PHEH-275Y-ISO	In-line Sensor Electronics, 15 ft cable, ISO 7/1 R¾ threads
PHEH-275G	Submersible Sensor Electronics, ¾ in. NPT threads
PHEH-275G-ISO	Submersible Sensor Electronics, ISO 7/1 R¾ threads

Electrodes

pH Electrodes	
PHE-2724	Electrode, pH, flat glass, 3K Balco, ¾ in. NPT
PHE-2724-ISO	Electrode, pH, flat glass, 3K Balco, ISO 7/1 R¾
PHE-2726	Electrode, pH, bulb glass, 3K Balco, ¾ in. NPT
PHE-2726-ISO	Electrode, pH, bulb glass, 3K Balco, ISO 7/1 R¾
PHE-2726-HF	Electrode, pH, bulb glass, HF resistant, 3K Balco, ¾ in. NPT
PHE-2726-HF-ISO	Electrode, pH, bulb glass, HF resistant, 3K Balco, ISO 7/1 R¾
PHE-2726-LC	Electrode, pH, bulb glass, Low Cond, 3K Balco, ¾ in. NPT
PHE-2726-LC-ISO	Electrode, pH, bulb glass, Low Cond, 3K Balco, ISO 7/1 R¾
ORP (redox) Electrodes	
ORE-2725	Electrode, ORP, flat glass, 10 KΩ ID, ¾ in. NPT
ORE-2725-ISO	Electrode, ORP, flat glass, 10 KΩ ID, ISO 7/1 R¾

Parts and Accessories

PHE-2700-DLA	Dry Lock Adapter Cable (for use with PHEH-275/276 and PHTX-275)
PHTX-275G	Universal Mount Junction Box with EasyCal
FP90IM	Integral Mount Kit, NPT
FP90UM	Universal Mount, NPT

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

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- Wireless Sensors, Transmitters, & Receivers
- Signal Conditioners
- Data Acquisition Software

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- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

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