

# Users Guide

Gel-Filled  
pH Electrode



Analyze • Detect • Measure • Control™

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This publication supersedes all previous publications on this subject.

# Introduction

This manual contains instructions for the use of the Orion Gel-Filled pH Electrodes. Operation and maintenance instructions for the following electrodes are included:

Cat. No.	Description
9107BN, 9107WP, 9107BNMD, 9107WMMD, 9107WLMD	Triodes™ 3-in-1 pH/ATC Electrodes for routine pH, Field, or plant use.
9206BN*	PerpHecT® Combination gel pH Electrode for general-purpose measurement.
9207BN*	PerpHecT Low Maintenance™ Gel Triode™ pH Electrode
910500, 910600 9106BNWP	Conventional Electrode for general purpose measurement
911500, 911600	Semi-micro Electrode for pH measurement in test tubes.
912500, 912600	Flask Electrode for pH measurement in a tall-necked flask
913500, 913600	Flat-Surface Electrode for pH measurement on solids or semi-solid Substances

\* The Orion PerpHecT series electrodes can only be used on an Orion PerpHecT series meter.

## Required Equipment

- pH Meter
  - (i.e. Orion 3 Star pH, Orion 4 Star pH/ISE meter, Orion 5 Star pH/ISE/DO/Cond.)
- Orion Gel-Filled pH Electrodes
  - 9206BN, 9207BN, 910500, 910600, 9106BNWP, 911500, 911600, 912500, 912600, 913500, 913600, 9107BN, 9107WP, 9107WL, 9107BNMP, 9107WMMD, 9107WLMD
- Beakers
- Magnetic Stirrer
  - ionplus® stirrer accessory Orion 900060

5. pH Buffers
  - (A minimum of two calibrating buffers are recommended for precise measurement.)
6. Storage solutions
  - Orion 910001
7. Distilled or Deionized water
8. pH Cleaning solutions
  - Orion 900020, 900021, 900022, 900023, 900024

## Electrode Preparation

1. Remove the protective shipping cap from the sensing element and save for storage.
2. Clean any salt deposits from the exterior by rinsing with distilled water.
3. Soak the electrode in pH Electrode Storage Solution, Orion 910001, at least one hour. If Orion Storage Solution is not available, use 200 mL pH 7 buffer to which about 1 g KCl has been added, as a temporary substitute.
4. Connect the electrode to the meter as described in the meter instruction manual.

**Note:** When connecting the mini DIN Triodes™, it is best to attach the mini DIN ATC first and then the BNC. To remove, detach the BNC first, and then remove the mini DIN ATC connector from the meter. ▲

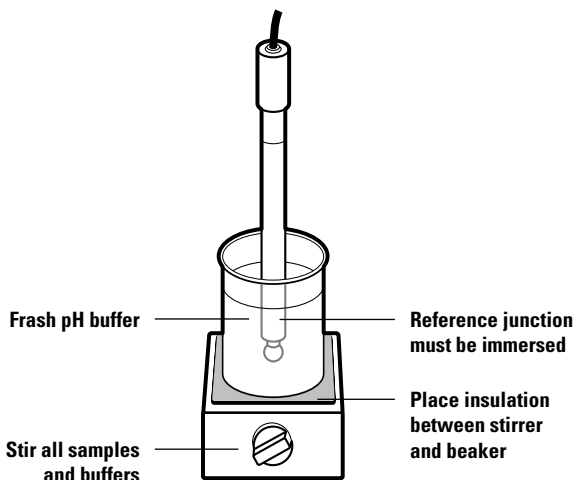
## Sample Requirements

These electrodes have an epoxy outer body and should not be used in samples containing organic solvents.

Ag/AgCl reference and combination electrodes are incompatible with samples containing silver complexing or binding agents such as tris, proteins, and sulfides. To measure pH in such samples, use a ROSS™ pH electrode. Proteins cause the additional problem of coating the sensing bulb and extra care should be taken. Epoxy body electrodes should not be used in samples containing organic solvents.

## Measuring Hints

- Always use fresh buffers for calibration. Choose buffers that are no more than 3 pH units apart.
- Check electrode slope daily by performing a two-buffer calibration. Slope should be 92 to 102%.
- Between measurements, rinse electrodes with distilled water and then with the next solution to be measured.
- Stir all buffers and samples.
- Keep buffers and samples at equal temperatures. If samples are at different temperatures, perform temperature compensation, as described in the meter instruction manual.
- Place a piece of insulating material (e.g., Styrofoam cardboard) between magnetic stirrer and beaker to prevent error from transfer of heat to sample.
- Avoid rubbing or wiping electrode bulb, to reduce chance of error due to polarization.



**Figure 1**  
Measuring Hints

# pH Calibration and Measurement

## General Calibration Procedure

For detailed calibration and temperature compensation procedures, consult your meter instruction manual. When using these electrodes with a PerpHecT® pH meter, consult the meter's instruction manual for procedures in three buffer calibration, manual calibration, temperature calibration, or LogR™ compensated pH measurements.

## Single-Buffer Calibration

1. Set up meter according to meter instruction manual.
2. Rinse electrode first with distilled water and then with buffer being used for calibration (the buffer should be near the expected sample pH). Place the electrode in the buffer.
3. Wait for a stable display (indicated by a "ready" signal on Orion meters). Autocalibration is a feature on ALL the Orion Star series meters. The meter automatically recognizes the standard buffers 4.01, 7.00, 10.01 as well as the NIST buffers 1.68, 4.01, 6.86, 9.18, 10.01, 12.46 and DIN buffers 1.68, 6.86 and 9.18. Simply select the buffer sequence that best fits your application. During calibration, wait for a stable pH reading. Once the electrode is stable, the meter automatically recognizes and displays the temperature-corrected value for that buffer. Pressing yes enters the value into memory.

**Manual Calibration:** Set the meter to the pH value of the buffer at its measured temperature. Proceed to pH Measurement. Refer to meter manual for instruction. ▲

## Two-Buffer Calibration

This procedure is recommended for precise measurements.

1. Select two buffers that bracket the expected sample pH. The first should be near the electrode isopotential point (pH 7) and the second near the expected sample pH (e.g. pH 4 or pH 10).
2. Rinse electrode with distilled water and then with first buffer. Place the electrode in first buffer.
3. Wait for stable display (indicated by a “ready” signal on Orion meters). Autocalibration is a feature on ALL the Orion Star series meters. The meter automatically recognizes the standard buffers 4.01, 7.00, 10.01 as well as the NIST buffers 1.68, 4.01, 6.86, 10.01, 12.46 and DIN buffers 1.68, 6.86 and 9.18. Simply select the buffer sequence that best fits your application. During calibration, wait for a stable pH reading. Once the electrode is stable, the meter automatically recognizes and displays the temperature-corrected value for that buffer. Pressing yes enters the value into memory.

**Manual Calibration:** *Set the meter to the pH value of the buffer at its measured temperature. Proceed to pH Measurement. Refer to meter manual for instruction. ▲*

4. Rinse electrode with distilled water and then with the second buffer. Place the electrode in the second buffer.
5. When the display is stable, set the meter to the pH value of the buffer at its measured temperature
6. If all steps are performed correctly, and the slope is between 92 and 102%, proceed to pH Measurement.

## pH Measurement

1. Calibrate the electrode as described in previous section.
2. Rinse the electrode with distilled water and then with sample.
3. Place the electrode in the sample.
4. When the “ready” signal is displayed, record sample pH.

# Electrode Storage

## **Short-term Storage:** (up to one week)

Soak electrode in pH Electrode Storage Solution, Orion 910001. If Orion Storage Solution is not available, use 200 mL pH 7 buffer to which about 1 g KCl has been added, as a temporary substitute. Do not store in distilled water, as this will shorten electrode life.

## **Long-term Storage:** (more than one week)

Rinse off any salt build-up with distilled water, and remove any membrane/junction deposits as directed in cleaning procedures below. Cover the sensing surface with protective cap and store dry.

# Electrode Maintenance

1. Inspect the electrode for scratches, cracks, salt crystal build-up, or membrane/junction deposits.
2. Rinse off any salt build-up with distilled water, and remove any membrane/junction deposits as directed in cleaning procedures below.

## Cleaning Procedures

- General
  - Soak electrode in Orion Cleaner C 900023 for 30 minutes
  - A second general cleaning procedure involves soaking the electrode in Orion Cleaner B 900022 or Orion Cleaner D 900024, stirring for 15 minutes
- Removal of Membrane/Junction Deposits Protein
  - Soak in Orion Cleaner A 900021 for 15 minutes
- Inorganic
  - Soak in 0.1 M tetrasodium EDTA solution for 15 minutes
- Grease and Oil
  - Rinse with mild detergent or methanol solution

**Note:** After any of these cleaning procedures, rinse well with distilled water and soak in storage solution for at least one hour. ▲

# Troubleshooting Guide

The most important principle in troubleshooting is to isolate the components of the system and check each in turn. The components of the system are: 1) Meter 2) Electrode(s) 3) Standard 4) Sample and 5) Technique.

## Meter

The meter is the easiest component to eliminate as a possible cause of error. Orion meters are provided with an instrument checkout procedure in the instruction manual and a shorting cap for convenience in troubleshooting. Consult the manual for complete instructions and verify that the instrument operates as indicated and is stable in all steps.

## Electrode(s)

1. Rinse electrode(s) thoroughly with distilled water.
2. Conduct a 2 point calibration with fresh standards.
3. If electrode fails this procedure, clean the electrode. See the **Electrode Maintenance** section.
4. Repeat step 2.
5. If the stability and slope check out properly, but measurement problems persist, the sample may contain interferences or complexing agents, or the technique may be in error (Consult with Thermo technical service department).
6. Before replacing a "faulty" electrode, or if another electrode is not available for test purposes, review the instruction manual and be sure to:
  - Clean the electrode thoroughly
  - Condition the electrode properly
  - Measure correctly

## Standard

The quality of results depends greatly upon the quality of the standards. ALWAYS prepare fresh standards or buffers when problems arise – it could save hours of frustrating troubleshooting!

## Sample

If the electrodes work properly in buffers but not in the sample, look for possible interferences, complexing agents, or substances that could affect response or physically damage the electrode. If possible, determine the composition of the samples and check for problems.

## Technique

Check the method of analysis for compatibility with your sample. Be sure to calibrate with buffers in the pH range of interest. If problems persist, review operational procedures and instruction manuals to be sure that proper technique has been followed.

## Assistance

After troubleshooting all components of your measurement system, contact The Technical Edge<sup>SM</sup> for Orion products. Within the United States call 1.800.225.1480, outside the United States call 978.232.6000 or fax 978.232.6031. In Europe, the Middle East and Africa, contact your local authorized dealer. For the most current contact information, visit [www.thermo.com/water](http://www.thermo.com/water) or email [info.water@thermo.com](mailto:info.water@thermo.com).

## Warranty

For the most current warranty information, visit [www.thermo.com/water](http://www.thermo.com/water).

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