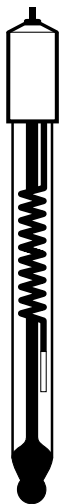


Users Guide

ROSS™ pH &
ROSS Sure-Flow®
pH Electrode



Analyze • Detect • Measure • Control™

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Orion NoCal electrodes with stabilized potential patent pending.

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This publication supersedes all previous publications on this subject.

Introduction

This manual contains instructions for the ROSS™ Series, the ROSS Sure-Flow® and ROSS Ultra® series of pH electrodes. The Ross series of electrodes provide readings stable to 0.01 pH in a buffer solution in less than 30 seconds, even in the extreme case of buffers varying from one another by 50 °C or more. Results are three to five times more precise than those obtained with conventional electrodes.

Operation and maintenance instructions for the following electrodes are included:

Orion No.	Description
81-02 ¹ , 81-02U, 8102BNUWP	ROSS Combination, glass body
81-03 ¹ , 81-03U, 8103BNUWP	ROSS Combination, glass body, semi-micro
81-04 ¹ , 81-04U, 8104BNUWP	ROSS Combination, glass body, rugged bulb
81-15 ¹ , 81-15U, 8115BNUWP	ROSS Combination, epoxy body, semi-micro
81-35 ¹ , 81-35U, 8135BNUWP	ROSS Combination, epoxy body, flat surface
81-56 ¹ , 81-56U, 8156BNUWP	ROSS Combination, epoxy body
81-62 ³	ROSS Combination, glass body, 14/15 std. taper
81-63 ^{1,2,3}	ROSS Combination, glass body, spear tip
81-66 ³	ROSS Combination, Sleeve Junction
81-65 ^{1,2}	ROSS Sure-Flow Combination, epoxy body
81-72 ^{1,2}	ROSS Sure-Flow Combination, glass body
81-75 ^{1,2}	ROSS Sure-Flow Semi-Micro Combination, epoxy body
80-03-00	ROSS Sure-Flow Reference Half-Cell, glass body
80-05, 80-05U	ROSS Reference Half-Cell, glass body
81-01 ^{1,2,3}	ROSS pH Half-Cell, glass body
82-02 ^{1*}	ROSS Combination, glass body
82-03 ^{1*}	ROSS Combination, glass body, semi-micro
82-35 ^{1*}	ROSS Combination, epoxy body, flat surface
82-56 ^{1*}	ROSS Combination, epoxy body
82-63 ^{1*}	ROSS Combination, glass body, spear tip
82-72 ^{1*}	ROSS Sure-Flow Combination, glass body
98-30 ¹	ROSS Combination, glass body, micro

1. BN – BNC connector
2. BNUWP – waterproof BNC connector
3. SC – screw cap connector

* The Orion PerpHecT® series electrodes for use with Orion PerpHecT meters

ROSS™ Sure-Flow® Electrodes provide a free-flowing sleeve junction especially designed for measurement in general pH samples as well as viscous or colloidal samples whenever best performance is desired. The junction can be cleaned easily between measurements; pressing down on the cap allows filling solution to flow through the junction, carrying away any contamination that may interfere with measurement.

The Orion 81-65 and 81-75 combine the Sure-Flow junction with a rugged epoxy body. A bulb guard protects the pH sensing bulb and is removable for easy cleaning. The rugged epoxy body is resistant to strong acids and strong bases. Organic compounds should be strictly avoided (Orion 81-72, 82-72 are recommended for use in organics).

ROSS Sure-Flow Electrodes are supplied with BNC connectors or water proof BNC connectors. Adaptors are available for conversion to U.S. Standard connectors.

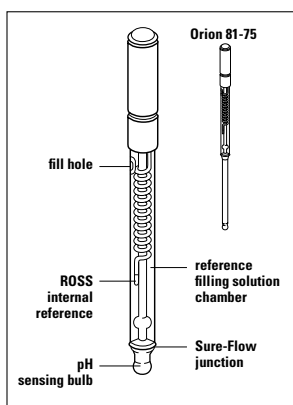


Figure 1:
Orion 81-72
ROSS Sure-Flow Combination

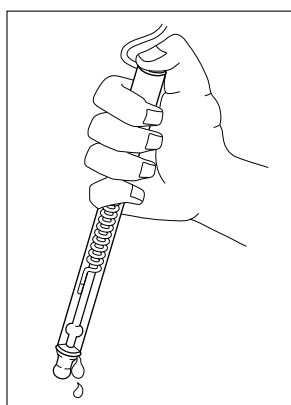


Figure 2:
ROSS Sure-Flow
Electrode Being Flushed

Required Equipment

1. pH Meter
 - (i.e. Orion 3 Star pH, Orion 4 Star pH/ISE meter, Orion 5 Star pH/ISE/DO/Cond., 920A, 720A, 710A, or 290A)
2. Orion ROSS™ pH Electrodes
 - 81-02, 81-02U, 8102BNUWP, 81-03, 81-03U, 8103BNUWP, 81-04, 81-04U, 8104BNUWP, 81-15, 81-15U, 8115BNUWP, 81-35, 81-35U, 8135BNUWP, 81-56, 81-56U, 8156BNUWP, 80-05, 80-05U, 80-03, 81-01, 81-62, 81-63, 81-65, 81-66, 81-72, 81-75, 82-02, * 82-03, * 82-35, * 82-56, * 82-63, * 82-72, * 98-30
 - * **The Orion PerpHecT® series electrodes for use with Orion PerpHecT meters.**
3. Beakers
4. Magnetic Stirrer
5. pH Buffers
 - A minimum of two calibrating buffers are recommended for precise measurement.
6. Reference filling solutions – Use only Orion 810007. **Do not use any filling solution containing silver, electrode damage may result.**
7. Storage solutions - Orion 810001
8. Distilled or Deionized water
9. pH Cleaning Solutions
 - Orion 900020, 900021, 900022, 900023, 900024

Electrode Preparation

1. Remove the protective shipping cap from sensing element and save for storage.
2. Clean any salt deposits from exterior by rinsing with distilled water.

3. Uncover fill hole by removing plastic sleeve and add ROSS Reference Filling Solution, Orion 810007, to electrode. See **Figure 2**. To maintain an adequate flow rate, the level of filling solution must cover the end of coil and be at least one inch above the sample level when immersed. The fill hole should be open whenever the electrode is in use.
- 4a. **Sure-Flow® Models only:**
Thoroughly wet the junction by pressing down on the electrode cap and allowing some of the ROSS™ Reference Filling Solution to flow out of the electrode through the junction. Replenish lost filling solution. See **Figure 3**.

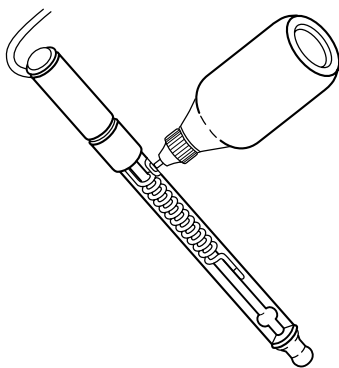


Figure 3:
Filling the Electrode

- 4b. **Non Sure-Flow Models:**
Fill electrode chamber with reference filling solution (Orion 810007) to just below fill hole.
5. Shake down the electrode (as a clinical thermometer) to remove air bubbles.
6. Soak combination electrode, pH half cell and reference electrode in pH Electrode Storage Solution, Orion 910001, for one hour. If Orion pH Storage Solution is not available, use 200 mL pH 7 buffer to which about 1 g KCl has been added, as a temporary substitute.
7. Connect electrodes to meter.

Sample Requirements

Electrodes that have an epoxy outer body **should not be used in samples containing organic solvents.**

One of the benefits of the ROSS™ pH Electrodes is that the filling solution composition may be changed depending on sample requirements because of the double junction construction. **Do not use solutions containing silver.**

The ROSS pH Electrode Filling Solution, Orion 810007, is 3 M KCl. For solutions which precipitate in the presence of chloride ion, the ROSS pH Electrode could be filled with 10% KNO₃, Orion 900003.

If there is a great deal of drift in organic solutions when using the ROSS Electrode filled with ROSS Reference Filling Solution (Orion 810007), try filling the ROSS Electrode with a mixture of methanol and water saturated with KCl.

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 two-buffer calibration. Slope should be 92 - 102%.
- Except as noted in Sample Requirements, only use ROSS Reference Filling Solution, Orion 810007, for ROSS Combination pH and Reference Electrodes. **Do not use any filling solution which may contain silver.**
- **Remove fill hole cover during measurement to ensure uniform flow of filling solution.**
- Between measurements, rinse the electrodes with distilled water and then with the next solution to be measure.
- Stir all buffers and samples

- Place a piece of insulating material (e.g. styrofoam or cardboard) between magnetic stirrer and beaker to prevent error from transfer of heat to sample. Since ROSS™ Electrodes respond faster than conventional electrodes, changes in pH which result from temperature changes will be noticed.
- Avoid rubbing or wiping electrode bulb, to reduce chance of error due to polarization.
- After use in especially dirty or viscous samples or when electrode response becomes sluggish, empty the electrode completely and hold the junction open under running water. Empty any water from the electrode and refill with fresh ROSS Filling Solution. For Sure-Flow®, briefly flush the junction to ensure that the junction contains fresh filling solution. Maintain a proper level of filling solution.

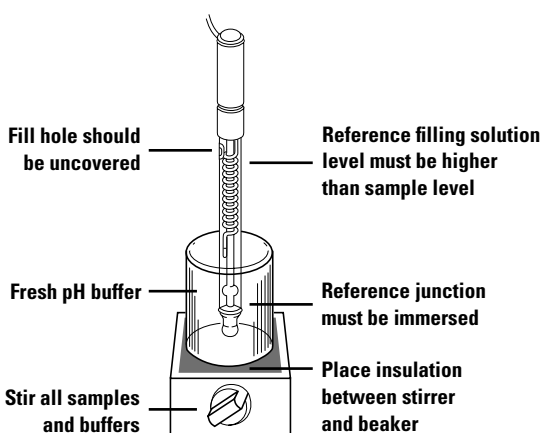


Figure 4:
Measuring Hints

pH Calibration & Measurement

General Calibration Procedure

For detailed calibration and temperature compensation procedures, consult your meter instruction manual.

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, 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 first with distilled water and then with first buffer. Place the electrode in the 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 first 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 above procedure.
2. Rinse the electrode with distilled water and then with sample.
3. Place the electrode in the sample.
4. When the display is stable, record sample pH.

Electrode Storage

To ensure a quick response and free-flowing liquid junction, the sensing element and reference junction must not be allowed to dry out.

Short-Term Storage: (up to one week)

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

Long-Term Storage: (more than one week)

The reference chamber should be filled and the fill hole covered. Cover the sensing element and reference junction with its protective cap containing a few drops of pH Storage Solution. Before returning the electrode to use, prepare it as a new electrode.

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 by holding junction open under running distilled water.
3. Drain the reference chamber, flush it with fresh ROSS™ Reference Filling Solution, Orion 810007, and refill chamber.

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. Drain and refill electrode filling solution, soak the electrode in storage solution for at least one hour. ▲

Troubleshooting

To test electrode operation:

1. Connect electrode to working meter and set meter to mV mode.
2. Place electrode in fresh pH 7 buffer.
3. Displayed value should be in - 30 mV to + 30 mV range.
4. Rinse electrode and place in fresh pH 4 buffer.
5. Displayed value should be in 150 mV to 210 mV range.
6. Actual mV values may change as electrode ages, but mV difference should be 160 to 180 mV between pH 4 and pH 7 buffers.
7. If electrode fails this procedure, clean electrode as directed in Maintenance section.

Assistance

After troubleshooting all components of your measurement system, contact The Technical EdgeSM 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 or email info.water@thermo.com.

Warranty

For the most current warranty information, visit www.thermo.com/water.

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