

## Thermo Scientific Orion

### ROSS Ultra, ROSS Ultra Triode and ROSS pH Electrodes

263745-001 • Revision B • November 2014



# Contents

<b>Introduction</b> .....	<b>4</b>
<b>ROSS Electrode Families</b> .....	<b>4</b>
ROSS Ultra Electrodes.....	4
ROSS Ultra pH/ATC Triode Electrodes.....	4
ROSS Electrodes.....	5
ROSS Sure-Flow Electrodes.....	5
ROSS Semi-micro Electrodes.....	5
ROSS micro pH Electrodes.....	5
<b>Required Equipment</b> .....	<b>5</b>
<b>Electrode Preparation</b> .....	<b>6</b>
Preparation for Refillable ROSS Electrodes.....	6
Preparation for ROSS Sure-Flow Electrodes.....	7
Preparation for Gel-Filled ROSS Ultra Triode Electrodes.....	8
<b>Sample Requirements</b> .....	<b>8</b>
<b>Measuring Hints</b> .....	<b>9</b>
<b>Electrode Calibration</b> .....	<b>10</b>
General Calibration Procedure.....	10
One Buffer Calibration.....	10
Two Buffer Calibration.....	11
<b>pH Measurements</b> .....	<b>12</b>
<b>Electrode Storage</b> .....	<b>12</b>
<b>Electrode Maintenance</b> .....	<b>12</b>
<b>Electrode Cleaning Procedures</b> .....	<b>12</b>
General Cleaning.....	12
Cleaning Solutions.....	13
<b>Electrode Characteristics</b> .....	<b>13</b>
Temperature Effects.....	13
Sure-Flow Electrode Leak Rate.....	14
ROSS Micro pH Electrode.....	14
ROSS Ultra pH/ATC Triode Electrodes.....	15
<b>ROSS Electrode Operation with Orion VERSA STAR pH/ LogR Meters</b> .....	<b>15</b>
<b>Electrode Interferences</b> .....	<b>16</b>
<b>Troubleshooting</b> .....	<b>17</b>
pH Meter.....	17
Electrode.....	17
Sample/Application.....	17
Technique.....	17
<b>Assistance</b> .....	<b>18</b>
<b>Warranty</b> .....	<b>18</b>
<b>RoHS Statement</b> .....	<b>18</b>
<b>Ordering Information</b> .....	<b>19</b>
<b>Specifications</b> .....	<b>21</b>

# Introduction

This user manual contains information on the preparation, operation and maintenance of the Thermo Scientific™ Orion™ ROSS Ultra™, Thermo Scientific™ Orion™ ROSS™, and Thermo Scientific™ Orion™ ROSS™ Triode™ electrodes.

All ROSS pH electrodes have a pH range of 0 to 14, pH precision of 0.01 and temperature range of 0 to 100°C. ROSS electrodes can be used in samples that contain TRIS, sulfides and proteins since they do not contain silver or mercury.

ROSS electrodes incorporate the distinctive ROSS internal reference system that provides superior measurement stability, faster response, greater accuracy and more reproducible results than conventional electrodes. ROSS electrodes have a double junction reference, so the fill solution can be modified to more closely match the sample composition in high pH, low pH or non-aqueous solutions.

ROSS electrodes provide readings stable to 0.01 pH in less than 30 seconds, even in the extreme case of samples varying from one another by 50°C or more. Results are three to five times more precise than those obtained with conventional electrodes. Over the lifetime of the electrode, ROSS reference potential drifts less than an average 0.12mV per day, which corresponds to 0.002 pH units, so recalibration is minimized.

- The majority of ROSS electrodes with a BNC waterproof or BNC connector have a one meter (three foot) long cable, except where noted.
- All electrodes with a screw cap connection require a separate cable.
- Electrodes with a waterproof BNC connector can be used on any pH meter with a BNC connection.
- The 800500U ROSS Ultra reference half-cell and 800300 ROSS reference half-cell can be used with the 8101BNWP and 8101SC ROSS pH half-cell electrodes or 8411BN ROSS sodium half-cell electrode.

## ROSS Electrode Families

### ROSS Ultra Electrodes

ROSS Ultra electrodes offer the ultimate measurement stability and the least long-term drift, plus a two year warranty for refillable models and an 18 month warranty for gel-filled models.

### ROSS Ultra pH/ATC Triode Electrodes

ROSS Ultra pH/ATC Triodes have a built-in temperature probe, so pH and temperature are measured with one electrode. Gel-filled ROSS Ultra pH/ATC Triode electrodes have an 18 month warranty and refillable ROSS Ultra pH/ATC Triode electrodes have a 24 month warranty.

## ROSS Electrodes

ROSS electrodes provide precise pH measurements and measurement stability regardless of temperature changes or sample composition.

## ROSS Sure-Flow Electrodes

ROSS Sure-Flow electrodes incorporate a free-flowing junction that is easy to clean and never clogs. These electrodes are ideal for dirty or viscous samples that clog traditional electrodes.

## ROSS Semi-micro Electrodes

ROSS semi-micro electrodes are designed for applications where sample volume is limited and can take measurements in samples of 0.2 ml volume. They are available with chemically-resistant glass (6 mm tip) or epoxy (8 mm tip) bodies, Sure-Flow junction and ROSS Ultra long-life models.

## ROSS micro pH Electrodes

ROSS micro pH electrodes have been designed to measure extremely small samples. The measuring tip is 3 mm in diameter and 40 mm long. The minimum depth of immersion is 4.5 mm and the minimum sample size is 15  $\mu$ L in 384 well plates.

## Required Equipment

1. Thermo Scientific™ Orion™ VERSA STAR™, Thermo Scientific™ Orion Star™ A300 series, Thermo Scientific™ Orion Star™ A200 series, Thermo Scientific™ Orion Star™ A100 series or Thermo Scientific™ Orion™ DUAL STAR™ meter with pH measurement capability, such as the VERSA STAR benchtop meter with pH module, Star A211 pH benchtop meter or Star A321 pH portable meter; except 8107BNURCA, 8157BNURCA and 8302BNURCA Triode electrodes which are designed for use with a meters which support a thermister with a 30K NTC curve and have an RCA plug, such as the Five and Seven Series METTLER TOLEDO™ pH meters.

ROSS electrodes can be used on any pH meter with a BNC connection. The electrodes can also be used on meters with a variety of inputs when an adapter cable is used. Visit [www.thermoscientific.com/water](http://www.thermoscientific.com/water) for details.

2. Orion ROSS Ultra, and ROSS Triode electrodes.
  - The 8302BNUMD, 8107BNUMD, 8107UWMMD, 8157BNUMD and 8157UWMMD pH/ATC Triode electrodes have a temperature connector that is compatible with Orion Star A series, VERSA STAR and DUAL STAR pH meters.
  - The 8107BNURCA, 8157BNURCA and 8302BNURCA pH/ATC Triode electrodes have a temperature connector that is compatible with meters which support a thermister with a 30K NTC curve and have an RCA plug, such as the Five and Seven Series METTLER TOLEDO pH meters.
3. ROSS fill solution, Cat. No. 810007.

**Note:** Do not use any fill solution that contains silver, as silver will damage ROSS electrodes.

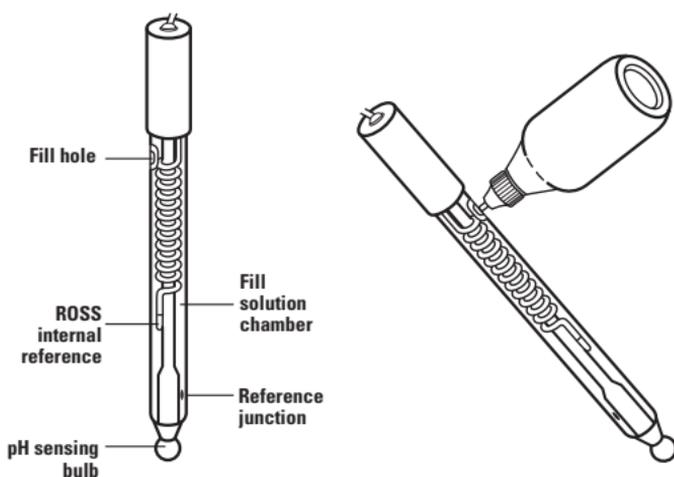
**Note:** The 8107BNUMD, 8107UWMMD and 8107BNURCA electrodes are gel-filled and do not require any fill solution.

4. ROSS pH electrode storage solution, Cat. No. 810001, or standard pH electrode storage solution, Cat. No. 910001. For enhanced electrode performance, use ROSS pH electrode storage solution.
5. pH buffers – at least two pH buffers are recommended for precise measurements. One buffer should be near pH 7 and buffers should be one to four pH units apart.
6. Beakers, plastic or glass.
7. Magnetic stirrer or Orion stirrer probe, Cat. No. 096019. The stirrer probe can be used with Orion Star A series, VERSA STAR and DUAL STAR benchtop meters.
8. Distilled or deionized water.

## Electrode Preparation

### Preparation for Refillable ROSS Electrodes

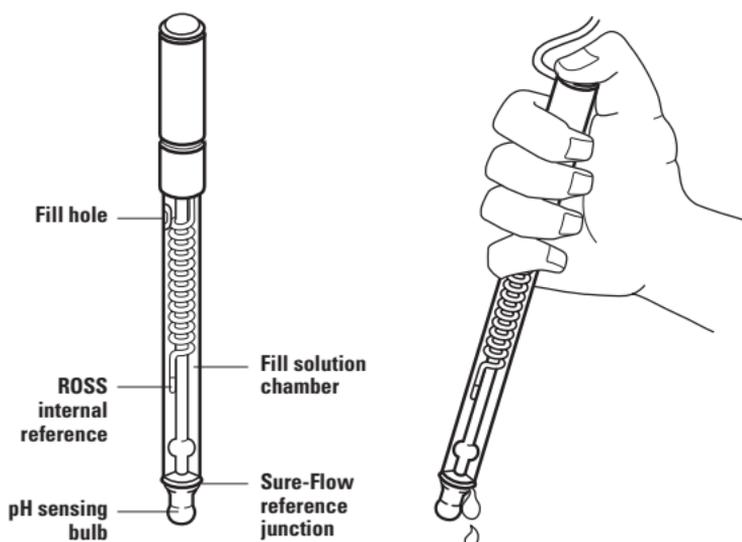
1. Remove the shipping cap, sleeve or bottle from the sensing bulb and save it for later storage of the electrode.
2. Clean any salt deposits from the exterior of the electrode by rinsing it with distilled water. Handle the 8220BNWP ROSS micro pH electrode with great care.
3. The electrode may arrive with the chamber partially filled with electrolyte solution. Please fill the chamber with electrolyte solution before use. Uncover the fill hole by removing the tape and add ROSS fill solution, Cat. No. 810007, to the electrode up to the fill hole. To maintain an adequate flow rate, the level of fill solution must always be above the reference junction and at least one inch above the sample level. The fill hole should remain open whenever the electrode is in use.
4. Place the electrode in an electrode holder and suspend the electrode in air for 5 minutes to thoroughly wet the reference junction. Omit this step for electrodes which come shipped in a storage bottle.
5. Shake the electrode downward (similar to a clinical thermometer) to remove any air bubbles. The 8220BNWP electrode is extremely fragile. Do not shake the 8220BNWP electrode unless there are air bubbles in the fill solution and then shake gently and with great care.
6. Soak electrode in ROSS pH electrode storage solution, Cat. No. 810001, or standard pH electrode storage solution, Cat. No. 910001, for 30 to 60 minutes. ROSS Ultra Triode electrodes do not need to be soaked prior to use, since they are shipped in a storage bottle with storage solution.
7. Connect the electrode to the meter.



ROSS Refillable Combination pH Electrode

## Preparation for ROSS Sure-Flow Electrodes

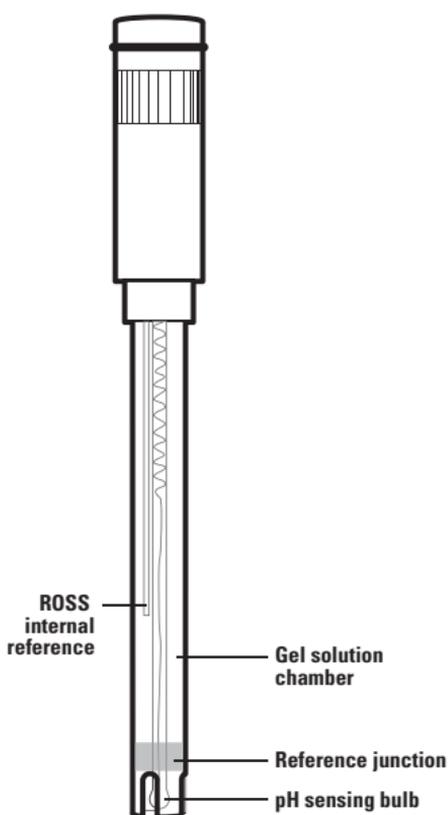
1. Remove the shipping cap, sleeve or bottle from the sensing bulb and save it for later storage of the electrode.
2. Clean any salt deposits from the exterior of the electrode by rinsing it with distilled water.
3. Uncover the fill hole by removing the tape and add ROSS fill solution, Cat. No. 810007, to the electrode up to the fill hole. To maintain an adequate flow rate, the level of fill solution must always be above the reference junction and at least one inch above the sample level. The fill hole should remain open whenever the electrode is in use.
4. Wet the junction by pressing down on the electrode cap to let a few drops of the ROSS fill solution flow out of the electrode and then replenish any lost fill solution.
5. Shake the electrode downward (similar to a clinical thermometer) to remove any air bubbles.
6. Soak electrode in ROSS pH electrode storage solution, Cat. No. 810001, or standard pH electrode storage solution, Cat. No. 910001, for 30 to 60 minutes. For enhanced electrode performance, use ROSS pH electrode storage solution.
7. Connect the electrode to the meter.



## Preparation for Gel-Filled ROSS Ultra Triode Electrodes

1. Remove the electrode storage bottle from the sensing bulb and save it for later storage of the electrode.  
**Note:** Unscrew the cap on the electrode storage bottle before removing the electrode.
2. Clean any salt deposits from the exterior of the electrode by rinsing it with distilled water.
3. Connect the electrode to the meter.
4. If the electrode will not be used immediately, soak it in ROSS pH electrode storage solution, Cat. No. 810001, or standard pH electrode storage solution, Cat. No. 910001.

ROSS Gel-filled Combination pH Electrode



## Sample Requirements

A benefit of the ROSS pH electrodes is that the fill solution composition may be changed depending on the sample requirements. The ROSS pH electrode fill solution, Cat. No. 810007, is 3 M KCl. For solutions that precipitate in the presence of chloride ions, the electrode can be filled with 10%  $\text{KNO}_3$ , Cat. No. 900003.

Electrodes with an epoxy body should only be used in aqueous solutions.

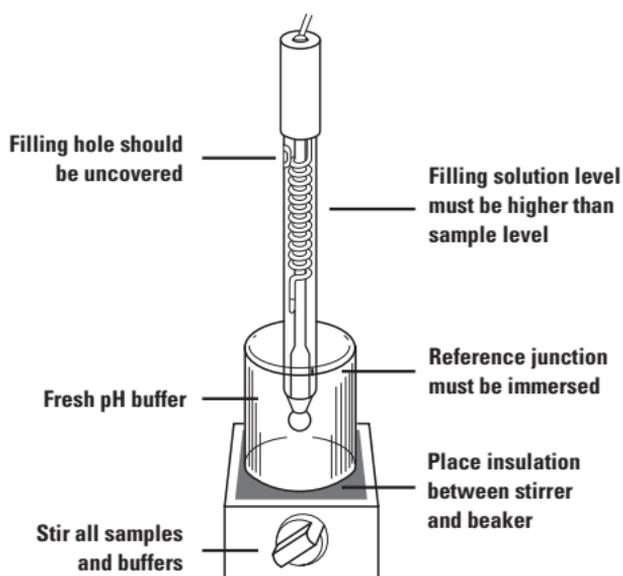
Electrodes with a glass body may be used in non-aqueous solutions and solutions that contain organic solvents. A minimum of 20% water must be present in the sample for the best measurement results. If there is a great deal of drift when using the ROSS electrode filled with ROSS fill solution, try filling the electrode with a mixture of methanol

and water saturated with KCl. The ratio of methanol to water should be similar to the sample composition. For tips on measuring pH in non-aqueous samples, see Thermo Scientific Water Analysis Instruments Application Note 007.

If using the 8220BNWP ROSS micro pH electrode, great care must be taken to thoroughly rinse out the reference chamber and junction before changing the reference solutions.

## Measuring Hints

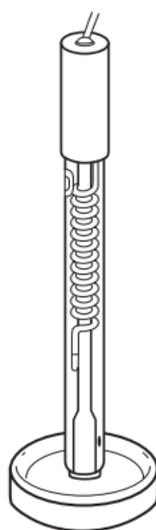
- Always use fresh buffers for calibration. Choose buffers that are one to four pH units apart.
- Check the electrode slope daily by performing a two buffer calibration. The slope should be 92 to 102%.
- Except as noted in the *Sample Requirements* section, only use ROSS fill solution, Cat. No. 810007. Do not use any fill solution that may contain silver.
- If a refillable electrode is used, always remove the fill hole cover during measurements to ensure a uniform flow of fill solution.
- If a ROSS Ultra Triode is used, immerse the electrode at least 2 inches (5 cm) in solution for best temperature response.
- Between measurements, rinse the electrode with distilled water and then with the next solution to be measured.
- Stir all buffers and samples at a uniform rate.
- Place a piece of insulating material, such as polystyrene foam or cardboard, between the magnetic stir plate and beaker to prevent measurement errors from the transfer of heat to the sample. Since ROSS electrodes respond quickly to temperature changes, pH changes due to temperature variations will be noticed.
- To reduce the chance of error due to polarization, avoid rubbing or wiping the sensing bulb. Use a lint-free tissue and gently blot the sensing bulb.
- If a refillable electrode is used in dirty or viscous samples or the electrode response becomes sluggish, empty the electrode completely and hold the junction under running water. Empty any water from the electrode and refill it with fresh ROSS fill solution. For a thorough cleaning method, refer to the *Electrode Cleaning Procedures* section.
- If a Sure-Flow electrode is used in dirty or viscous samples or the electrode response becomes sluggish, empty the electrode completely and hold the junction open under running water. Empty any water from the electrode and refill it with fresh ROSS fill solution. Press down on the electrode cap to let a few drops of the ROSS fill solution flow out of the electrode and then replenish any lost solution. For a thorough cleaning method, refer to the *Electrode Cleaning Procedures* section.
- Handle the 8220BNWP ROSS micro pH electrode with care. Do not touch the pH bulb and stem against the bottom or walls of the sample containers.



#### Measuring Hints

- Flat surface ROSS pH electrodes may be used on any moist surface or in liquids.

#### Using a Flat Surface Electrode



## Electrode Calibration

### General Calibration Procedure

For detailed instructions on pH calibration, manual pH calibration and temperature compensation, consult your meter user guide. When using ROSS electrodes with a VERSA STAR pH/LogR meter, refer to the VERSA STAR pH/LogR meter user guide for instructions on temperature calibration and LogR temperature compensated pH measurements.

**Note:** If the meter is set to automatically recognize the pH buffer at the measured temperature and an ATC probe is used, you do not need to manually adjust the pH values of the buffers.

### One Buffer Calibration

1. Choose a buffer near expected sample pH.
2. The buffer should be at same temperature as the sample. If the buffer and samples are at varying temperatures, temperature compensation is recommended.
3. Prepare the meter according to the meter user guide.
4. Rinse the electrode first with distilled water and then with the buffer being used for calibration.

- Place the electrode into the buffer. When the reading is stable, set the meter to the pH value of the buffer at the measured temperature. Refer to the meter user guide for a detailed procedure. *Table 1* provides pH buffer values at various temperatures.
- Proceed to the *pH Measurement* section.

## Two Buffer Calibration

This procedure is recommended for precise measurements.

- Select two buffers that bracket the expected sample pH. The first buffer should be near the electrode isopotential point (pH 7) and the second should be near the expected sample pH (pH 4 or pH 10). Buffers should be one to four pH units apart.
- The buffers should be at same temperature as the sample. If the buffers and samples are at varying temperatures, temperature compensation is recommended.
- Rinse the electrode first with distilled water and then with the first buffer.
- Place the electrode into the first buffer. When the reading is stable, set the meter to the pH value of the buffer at the measured temperature. Refer to the meter user guide for a detailed procedure. *Table 1* provides pH values at various temperatures.
- Rinse the electrode first with distilled water and then with the second buffer.
- Place the electrode into the second buffer. When the reading is stable, set the meter to the pH value of the buffer at the measured temperature. Refer to the meter user guide for a detailed procedure. *Table 1* provides pH buffer values at various temperatures.

Nominal Buffer Value at 25 °C	Temperature										
	0°C	5°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C
1.68	1.67	1.67	1.67	1.68	1.68	1.69	1.71	1.72	1.74	1.77	1.79
4.01	4.00	4.00	4.00	4.00	4.02	4.03	4.06	4.09	4.12	4.16	4.21
6.86	6.98	6.95	6.92	6.87	6.85	4.03	6.83	6.84	6.85	6.86	6.88
7.00	7.11	7.08	7.06	7.01	6.98	6.97	6.96	6.97	6.99	7.03	7.08
9.18	9.46	9.40	9.33	9.23	9.14	9.07	9.01	8.96	8.92	8.89	8.85
10.01	10.32	10.25	10.18	10.06	9.97	9.89	9.83	9.79	9.78	9.78	9.80
12.46	13.47	13.24	13.03	12.64	12.29	11.99	11.73	11.50	11.30	11.13	11.98

Table 1: pH Values of Buffers at Various Temperatures

## pH Measurements

1. Calibrate the electrode as described in the *Electrode Calibration* section.
2. Rinse the electrode with distilled water and then with the sample.
3. Place the electrode into the sample.
4. When the reading is stable, record the pH and temperature of the sample.

## Electrode Storage

To ensure a quick response and free flowing junction, the sensing bulb and reference junction must not dry out.

### Short Term Storage (up to one week)

Soak the electrode in ROSS pH electrode storage solution, Cat. No. 810001, or standard pH electrode storage solution, Cat. No. 910001. For enhanced electrode performance, use ROSS pH electrode storage solution.

To minimize the chance of breakage, the 8220BNWP ROSS micro pH electrode should be attached to an electrode stand and suspended in a beaker that contains storage solution. The electrode should not touch the side or bottom of the beaker.

### Long Term Storage (more than one week)

For refillable pH electrodes, fill the reference chamber and securely cover the fill hole. Cover the sensing bulb and reference junction with the protective cap, sleeve or storage bottle containing a few drops of 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 buildup or membrane/junction deposits.
2. Rinse off any salt buildup with distilled water. Remove any membrane/junction deposits as directed in the General Cleaning section.
3. If a refillable electrode is used, drain the reference chamber, flush it with fresh ROSS fill solution and refill the chamber with fresh ROSS fill solution.

## Electrode Cleaning Procedures

### General Cleaning

We offer a variety of Orion pH cleaning solutions for your convenience, including solutions for general cleaning, protein removal, bacteria removal, and oil and grease removal. See the list of Orion cleaning solutions below the General Cleaning section of this manual. If you would like to prepare your own cleaning solutions, the general cleaning procedures contain several recommendations.

- For general cleaning, prepare a 0.1 M hydrochloric acid (HCl) or 0.1 M nitric acid (HNO<sub>3</sub>) solution.
  - For cleaning oil or grease, prepare a 0.1 to 0.5 % liquid detergent solution mixed with hot water.
  - For cleaning bacterial contaminants, prepare a 1:10 dilution of household laundry bleach.
- Soak the electrode in the 0.1 M HCl or HNO<sub>3</sub> for half an hour and stir the solution at a moderate rate.
  - Soak the electrode in the 1:10 dilution of household laundry bleach or the 0.1 to 0.5% liquid detergent solution mixed with hot water for 15 minutes and stir the solution at a moderate rate.
- If a refillable electrode is used, drain the reference chamber and refill the electrode with fresh ROSS fill solution.
- Soak the electrode in ROSS pH electrode storage solution, Cat. No. 810001, or standard pH electrode storage solution, Cat. No. 910001, for at least one hour.

## Cleaning Solutions

Cat. No. 900021-WA: pH cleaning solution A for removing protein contaminants.

Cat. No. 900022-WA: pH cleaning solution B for removing bacterial contaminants.

Cat. No. 900023: pH cleaning solution C for general cleaning.

Cat. No. 900024: pH cleaning solution D for removing oil and grease contaminants.

Cat. No. 900020: pH cleaning solution kit, includes cleaning solutions A, B, C and D.

## Electrode Characteristics

### Temperature Effects

The most common cause of error in pH measurements is temperature. There are at least five ways that temperature variations can affect pH: electrode slope, buffers, samples, reference element drift, and temperature sensor errors.

### Electrode Slope Changes

The electrode slope will change with variations in temperature. Slope changes may be compensated manually, automatically with an automatic temperature compensation (ATC) probe or with LogR technology using a LogR enabled meter and any Orion electrode.

Thermo Scientific Orion pH meters calculate the slope based on the measured temperature and automatically adjust the pH value based on the temperature.

## Buffer and Sample pH Changes

Buffer and sample pH values change with temperature because of their temperature dependent chemical equilibria. The pH electrode should be calibrated with buffers that have known pH values at different temperatures. Buffer values at different temperatures are given in *Table 1*.

Orion pH meters automatically calibrate with the correct pH buffer values based on the measured temperature. All pH meters are unable to correct sample pH values back to a reference temperature because every sample has a unique pH value versus temperature relationship. Therefore, calibration and measurements should be performed at the same temperature and pH values should be reported with temperature.

## Reference Element Drift

Drift can occur when the internal reference elements inside the pH and reference portions of the electrode are reaching thermal equilibrium after a temperature change. Long-term drift or slow response can last until the sample and electrode are at the same temperature.

ROSS electrodes use a unique internal reference to minimize the equilibration time.

## Temperature Sensor Errors

When a pH and ATC probe are placed into a sample that varies significantly in temperature, the readings can drift for two reasons. First, the temperature response of the electrode and temperature probe may not be similar, which prolongs equilibration and drift. Second, a sample may not have a uniform temperature. Therefore, the pH electrode and temperature probe are responding to different environments. Stirring the sample will minimize this effect.

Using LogR technology, Orion VERSA STAR and Orion DUAL STAR meters calculate the temperature by measuring the resistance value of the ROSS pH electrode's sensing bulb. The pH and temperature response is identical and both measurements occur at the sensing bulb. Drift is minimized and errors due to environmental differences are eliminated.

## Sure-Flow Electrode Leak Rate

The junction of the ROSS Sure-Flow electrodes has been designed to leak at a rate of approximately 1 mL per 24 hours. To keep the junction from clogging, the leak rate is slightly higher than conventional electrodes. During the average pH measurement time the loss of fill solution is minimal and the fill solution does not contaminate the sample.

## ROSS Micro pH Electrode

The 8220BNWP ROSS micro pH electrode has been designed to measure extremely small samples. The measuring tip is 3 mm in diameter and 40 mm long. The minimum depth of immersion is 4.5 mm and the minimum sample size is 15  $\mu$ L in 384 well plates.

## ROSS Ultra pH/ATC Triode Electrodes

The ROSS Ultra Triode electrode operating temperature range is 0 to 100°C and the temperature accuracy is  $\pm 1^\circ\text{C}$  at 2 minutes when immersed at least 2 inches in solution. The temperature equilibration due to the rate of heat transfer can take up to 2 minutes in a stirred, aqueous solution.

## ROSS Electrode Operation with Orion VERSA STAR pH/LogR Meters

When ROSS electrodes are used with Orion VERSA STAR pH/LogR Meters, enhanced temperature compensation is achieved without the need of a separate ATC probe. Using LogR technology, the temperature of the solution is measured through the resistance value of the pH electrode's sensing bulb.

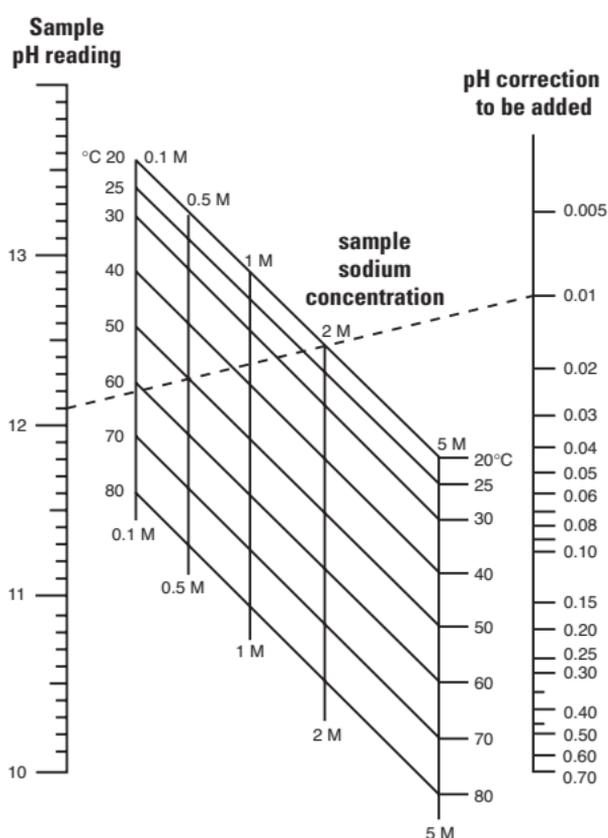
Each ROSS pH electrode must be calibrated for temperature before a pH measurement is performed using LogR technology. Refer to the Orion VERSA STAR pH/LogR meter user guide for details. For maximum precision, a three point temperature calibration is recommended. Do not perform a one point temperature calibration if measured solutions will be below 20°C. The following tables illustrate the expected pH compensation error for one, two and three point temperature calibrations. The accuracy values are valid only when the temperature calibration is performed within the stated temperature range. The higher temperature range data will apply to measurements made above that temperature range, provided that calibration points are within 20°C of each other. When highly accurate pH results are desired, a separate ATC probe is recommended.

One Point Temperature Calibration				
Electrode	Average Temp. Error 20-30°C	Average Temp. Error 30-50°C	Average pH Error 20-30°C	Average pH Error 30-50°C
8202BN	0.13	0.07	0.002	0.001
8203BN	0.24	0.17	0.003	0.002
8235BN	0.91	0.95	0.011	0.011
8256BN	0.09	0.10	0.001	0.001
Two Point Temperature Calibration				
Electrode	Average temp. error 0-25°C	Average temp. error 20-40°C	Average pH error 0-25°C	Average pH error 20-40°C
8202BN	0.13	0.07	0.002	0.001
8203BN	0.24	0.17	0.003	0.002
8235BN	0.91	0.95	0.011	0.011
8256BN	0.09	0.10	0.001	0.001

Three Point Temperature Calibration				
Electrode	Average temp. error 0-25°C	Average temp. error 20-40°C	Average pH error 0-25°C	Average pH error 20-40°C
8202BN	0.04	0.03	0.000	0.000
8203BN	0.04	0.01	0.000	0.000
8235BN	0.07	0.06	0.001	0.001
8256BN	0.04	0.06	0.000	0.001

## Electrode Interferences

Sodium ions are the principal interference of the pH electrode and cause increasing error at higher pH (lower hydrogen ion activities) and at higher temperatures. Because the pH membrane is composed of special low sodium error glass, error due to sodium is negligible when measuring at pH values less than 12. When measuring at pH values greater than 12, add the correction value from the nomograph below to the observed pH reading.



Typical Sodium Error

### Example:

pH reading: 12.10  
 Sodium concentration: 0.5 M  
 Temperature: 50°C  
 Correction: 0.01  
 Corrected pH reading: 12.11

# Troubleshooting

Follow a systematic procedure to isolate the problem. The pH measuring system can be divided into four components: pH meter, electrode, sample/application and technique.

## pH Meter

The meter is the easiest component to eliminate as a possible cause of error. Orion pH meters include an instrument checkout procedure and shorting cap for convenience in troubleshooting. Refer to the pH meter user guide for directions.

## Electrode

To test electrode operation:

1. Connect the electrode to a working meter that has a mV measuring mode. Set the meter to the mV mode.
2. Rinse the electrode with distilled water and then insert the electrode into fresh pH 7 buffer. When the reading is stable, record the mV value of the pH 7 buffer. The mV value should be in the range of -30 to +30 mV.
3. Rinse the electrode with distilled water and then insert the electrode into fresh pH 4 buffer. When the reading is stable, record the mV value of the pH 4 buffer. The mV value should be in the range of +150 to +210 mV.
4. Calculate the absolute mV difference between the two buffers. The mV difference should be 160 to 180 mV. The actual mV values will change as the electrode ages, but the mV difference between the two buffers should always be 160 to 180 mV.
5. If the electrode fails this procedure, clean the electrode thoroughly as directed in the *Electrode Maintenance* section and repeat the procedure.

If the electrode response is slow or drifting and the electrode is refillable, drain and refill the electrode with fresh ROSS fill solution, Cat. No. 810007.

Replace the electrode if cleaning and maintenance fail to rejuvenate it.

## Sample/Application

The electrode and meter may operate with buffers, but not with the sample. In this case, check the sample composition for interferences, incompatibilities or temperature effects. Refer to the *Interferences* section.

## Technique

If trouble persists, review operating procedures. Review the calibration and measurement sections to be sure proper technique has been followed.

# Assistance

After troubleshooting all components of your measurement system, contact Technical Support. Within the United States and Canada, call 1.800.225.1480 or 978.232.6000 or email

wai.techservbev@thermofisher.com. For countries outside of North America, contact your local authorized dealer.

# Warranty

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

# RoHS Statement

部件名称 Part Name	有毒或有害物质和元素 Toxic or Hazardous Substances and Elements		
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)
传感器体带电 电缆装配 Sensor body with cable assembly	X	0	0
塑料硬件 Plastic hardware	0	0	0
部件名称 Part Name	有毒或有害物质和元素 Toxic or Hazardous Substances and Elements		
	六价铬 Hexavalent Chromium (Cr(VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
传感器体带电 电缆装配 Sensor body with cable assembly	0	0	0
塑料硬件 Plastic hardware	0	0	0
<p><b>0:</b> 表明本部件的所有均相材料内该有毒或有害物质的含量低于根据 EIP-A, EIP-B, EIP-C 在 SJ/T11363-2006 里的限制规定。 Indicates that this toxic or hazardous substance contained in all homogeneous materials for this part, according to EIP-A, EIP-B, EIP-C is below the limit requirement in SJ/T11363-2006.</p> <p><b>X:</b> 表明本部件有至少一样均相材料内该有毒或有害物质的含量高于根据 EIP-A, EIP-B, EIP-C 在 SJ/T11363-2006 里的限制规定。 Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part, according to EIP-A, EIP-B, EIP-C is above the limit requirement in SJ/T11363-2006</p>			



# Ordering Information

Cat. No.	Description
8102BNUWP	ROSS Ultra combination pH electrode with glass body, waterproof BNC connector
8302BNUMD	ROSS Ultra refillable pH/ATC Triode with glass body, waterproof BNC and 8 pin miniDIN connectors
8302BNURCA	ROSS Ultra refillable pH/ATC Triode with glass body, waterproof BNC and RCA connectors (for use with Five and Seven Series METTLER TOLEDO pH meters)
8103BNUWP	ROSS Ultra combination pH electrode with glass body and semi-micro tip, waterproof BNC connector
8104BNUWP	ROSS Ultra combination pH electrode with glass body and rugged bulb, waterproof BNC connector
8107BNUMD	ROSS Ultra gel-filled pH/ATC Triode with epoxy body, waterproof BNC and 8 pin miniDIN connectors
8107BNURCA	ROSS Ultra gel-filled pH/ATC Triode with epoxy body, waterproof BNC and RCA connectors (for use with Five and Seven Series METTLER TOLEDO pH meters)
8107UWMMD	ROSS Ultra gel-filled pH/ATC Triode with epoxy body, waterproof BNC and 8 pin miniDIN connectors and 3 meter cable
8115BNUWP	ROSS Ultra combination pH electrode with epoxy body and semi-micro tip, waterproof BNC connector
8135BNUWP	ROSS Ultra combination pH electrode with epoxy body and flat surface tip, waterproof BNC connector
8156BNUWP	ROSS Ultra combination pH electrode with epoxy body, waterproof BNC connector
8157BNUMD	ROSS Ultra refillable pH/ATC Triode with epoxy body, waterproof BNC and 8 pin miniDIN connectors
8157BNURCA	ROSS Ultra refillable pH/ATC Triode with epoxy body, waterproof BNC and RCA connectors (for use with Five and Seven Series METTLER TOLEDO pH meters)
8157UWMMD	ROSS Ultra refillable pH/ATC Triode with epoxy body, waterproof BNC and 8 pin miniDIN connectors and 3 meter cable
800500U	ROSS Ultra reference half-cell electrode with glass body, pin tip connector
800300	ROSS Sure-Flow reference half-cell electrode with glass body, pin tip connector
8101BNWP	ROSS pH half-cell electrode with glass body, waterproof BNC connector
8101SC	ROSS pH half-cell electrode with glass body, screw cap connector
8102BN	ROSS combination pH electrode with glass body, BNC connector
8102SC	ROSS combination pH electrode with glass body, screw cap connector
8103BN	ROSS combination pH electrode with glass body and semi-micro tip, BNC connector
8103SC	ROSS combination pH electrode with glass body and semi-micro tip, screw cap connector

Cat. No.	Description
8104BN	ROSS combination pH electrode with glass body and rugged bulb, BNC connector
8104SC	ROSS combination pH electrode with glass body and rugged bulb, screw cap connector
8115BN	ROSS combination pH electrode with epoxy body and semi-micro tip, BNC connector
8115SC	ROSS combination pH electrode with epoxy body and semi-micro tip, screw cap connector
8135BN	ROSS combination pH electrode with epoxy body and flat surface tip, BNC connector
8135SC	ROSS combination pH electrode with epoxy body and flat surface tip, screw cap connector
815600	ROSS combination pH electrode with epoxy body, BNC connector
8155SC	ROSS combination pH electrode with epoxy body, screw cap connector
8162SC	ROSS combination pH electrode with glass body and 14/15 standard taper, screw cap connector
8163BNWP	ROSS combination pH electrode with glass body and spear tip, waterproof BNC connector
8163SC	ROSS combination pH electrode with glass body and spear tip, screw cap connector
8165BNWP	ROSS Sure-Flow combination pH electrode with epoxy body, waterproof BNC connector
8165DN	ROSS Sure-Flow combination pH electrode with epoxy body, E DIN waterproof connector
8172BNWP	ROSS Sure-Flow combination pH electrode with glass body, waterproof BNC connector
8175BNWP	ROSS Sure-Flow combination pH electrode with epoxy body, semi-micro tip and waterproof BNC connector
8220BNWP	ROSS combination pH electrode with glass body, micro tip and waterproof BNC connector
810007	ROSS pH electrode fill solution, 5 x 60 mL bottles
810001	ROSS pH electrode storage solution, 475 mL bottle
910001	pH electrode storage solution, 475 mL bottle
810199	All-in-One ROSS pH buffer kit, includes 475 mL bottle each of pH 4.01, 7.00 and 10.01 buffers, 475 mL bottle of ROSS pH electrode storage solution, 30 mL bottle of pH electrode cleaning solution C and 12 mm electrode storage bottle
910168	pH 1.68 buffer, 475 mL bottle
910104	pH 4.01 buffer, 475 mL bottle
910105	pH 5.00 buffer, 475 mL bottle
910686	pH 6.86 buffer, 475 mL bottle
910107	pH 7.00 buffer, 475 mL bottle
910918	pH 9.18 buffer, 475 mL bottle
910110	pH 10.01 buffer, 475 mL bottle
910112	pH 12.46 buffer, 475 mL bottle
900020	pH electrode cleaning solution kit, includes 1 x 30 mL bottle each of cleaning solution A and C, 1 x 60 mL bottle each of cleaning solution B and D, pipette and beaker

Cat. No.	Description
900021-WA	pH electrode cleaning solution A, includes 4 x 30 mL bottles, pipette and beaker
900022-WA	pH electrode cleaning solution B, includes 4 x 60 mL bottles, pipette and beaker
900023	pH electrode cleaning solution C, includes 4 x 30 mL bottles, pipette and beaker
900024	pH electrode cleaning solution D, includes 4 x 60 mL bottles, pipette and beaker
910005	Bulb guard for glass pH electrodes, pack of 5
910003	12 mm electrode storage bottle, pack of 3

Visit [www.thermoscientific.com/water](http://www.thermoscientific.com/water) for additional accessories, buffers and buffer sizes.

## Specifications

pH Range	0 to 14 pH
pH Precision	±0.01 pH
Temperature Range	0 to 100 °C
ROSS Ultra Triode Temperature Accuracy	±1°C at 2 minutes when immersed at least 2 inches in solution
Slope	92 to 102% theoretical Nernst slope
Isopotential Point	pH 7
Internal Reference	ROSS
Fill Solution (Gel-filled electrodes do not require fill solution)	3 M KCl, Cat. No. 810007
Accuracy of Measuring pH 6.86 Buffer After Calibration at 25 °C	Accurate within 0.03 pH for buffer at 0 to 100°C using automatic temperature compensation
Response Speed in 6.86 Buffer Between 25°C to 75°C	Response stable to 0.01 pH within 30 seconds
Response Speed Between 6.86 and 4.01 Buffers at 25°C	Response stable to 0.005 pH within 30 seconds

## Dimensions

8102BNUWP, 8302BNUMD, 8104BNUWP, 8107BNUMD, 8107UWMMD, 8135BNUWP, 8156BNUWP, 8157BNUMD, 8157UWMMD, 800500U, 8101BNWP, 8102BN, 8104BN, 8135BN, 815600, 8162SC, 8165BNWP, 8172BNWP, 8302BNURCA, 8107BNURCA, 8157BNURCA	120 mm (length) 12 mm (diameter)
8103BNUWP, 8103BN, 8103SC	165 mm (length) 95 mm (tip length) 6 mm (tip diameter)
8115BNUWP, 8115BN, 8115SC, 8175BNWP	165 mm (length) 95 mm (tip length) 8 mm (tip diameter)
8163BNWP, 8163SC	110 mm (length) 20 mm (tip length) 4.5 mm (tip diameter)
8220BNWP	155 mm (length) 40 mm (tip length) 3 mm (tip diameter)



[thermoscientific.com/water](http://thermoscientific.com/water)

© 2014 Thermo Fisher Scientific Inc. All rights reserved. METTLER TOLEDO is a trademark of Mettler-Toledo, LLC. All other trademarks are the property of Thermo Fisher Scientific and its subsidiaries.

---

#### Water Analysis Instruments

##### North America

Toll Free: 1-800-225-1480  
Tel: 1-978-232-6000  
[info.water@thermo.com](mailto:info.water@thermo.com)

##### Netherlands

Tel: (31) 020-4936270  
[info.water.uk@thermo.com](mailto:info.water.uk@thermo.com)

##### Singapore

Tel: (65) 6778-6876  
[wai.asia@thermofisher.com](mailto:wai.asia@thermofisher.com)

##### India

Tel: (91) 22-4157-8800  
[wai.asia@thermofisher.com](mailto:wai.asia@thermofisher.com)

##### China

Tel: (86) 21-68654588  
[wai.asia@thermofisher.com](mailto:wai.asia@thermofisher.com)

##### Japan

Tel: (81) 045-453-9175  
[wai.asia@thermofisher.com](mailto:wai.asia@thermofisher.com)

##### Australia

Tel: (613) 9757-4300  
in Australia (1300) 735-295  
[InfoWaterAU@thermofisher.com](mailto:InfoWaterAU@thermofisher.com)



Tel. 45 95 04 10  
[info@buhl-bonsoe.dk](mailto:info@buhl-bonsoe.dk)  
[www.buhl-bonsoe.dk](http://www.buhl-bonsoe.dk)

**Thermo**  
SCIENTIFIC

A Thermo Fisher Scientific Brand