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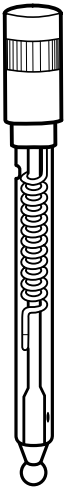
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User Guide

Thermo Scientific Orion ROSS Ultra®, ROSS Ultra Triode™, ROSS® and PerpHecT® ROSS Electrodes



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This publication supersedes all previous publications on this subject.

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Introduction

This user guide contains information on the preparation, operation and maintenance of the Thermo Scientific Orion ROSS Ultra, ROSS and PerpHecT ROSS 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 patented 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. Electrode drift is less than 0.002 pH per day, so recalibration is minimized.

- All electrodes with a waterproof BNC, BNC or U.S. standard connector have one meter cable lengths, except for the 8107UWMMD and 8157UWMMD electrodes that have a three meter cable length.
- 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.

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 two year 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.

PerpHecT® ROSS® Electrodes

PerpHecT ROSS electrodes are designed to be used with PerpHecT meters to provide both pH and temperature measurements. The PerpHecT meters use patented LogR technology that allows temperature to be measured using the resistance of the PerpHecT ROSS electrode.

Required Equipment

1. Thermo Scientific Orion pH meter, such as the 3-Star pH meter, 4-Star pH/ISE meter, 4-Star pH/DO meter, 4-Star pH/conductivity meter or 5-Star pH/ISE/DO/conductivity meter.

   ROSS electrodes can be used on any pH meter with a BNC or U.S. standard connection. The electrodes can also be used on meters with a variety of inputs when an adapter cable is used. Visit www.thermo.com/water for details.

2. Thermo Scientific Orion ROSS Ultra, ROSS or PerpHecT ROSS electrode.

   - The 8302BNUMD, 8107BNUMD, 8107UWMMD, 8157BNUMD and 8157UWMMD pH/ATC Triodes have a temperature connector that is compatible with the Star series pH meters.

   - The 8107BNU and 8157BNU pH/ATC Triodes have a temperature connector that is compatible with the A+ series meters.

   - The 8207BNU and 8257BNU pH/ATC Triodes have a temperature connector that is compatible with the PerpHecT 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 8107BNU, 8107BNUMD, 8107UWMMD and 8207BNU 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 Thermo Scientific Orion stirrer probe, Cat. No. 096019. The stirrer probe can be used with 3-Star, 4-Star and 5-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 PerpHecT ROSS micro pH electrode with great care.

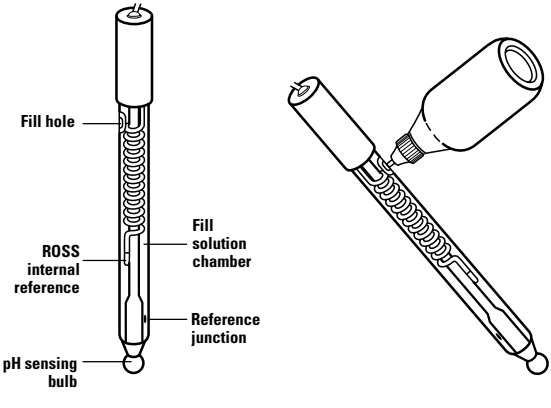
3. Uncover the fill hole by removing the tape and add ROSS fill solution, Cat. No. 810007, to the electrode up to the fill hole. To maintain an adequate flow rate, the level of fill solution must always be above the reference junction and at least one inch above the sample level. The fill hole should remain open whenever the electrode is in use.

4. Place the electrode in an electrode holder and suspend the electrode in air for 5 minutes to thoroughly wet the reference junction. The 8220BNWP electrode and ROSS Ultra Triode electrodes do not need to be suspended in air.

5. Shake the electrode downward (similar to a clinical thermometer) to remove any air bubbles. 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.

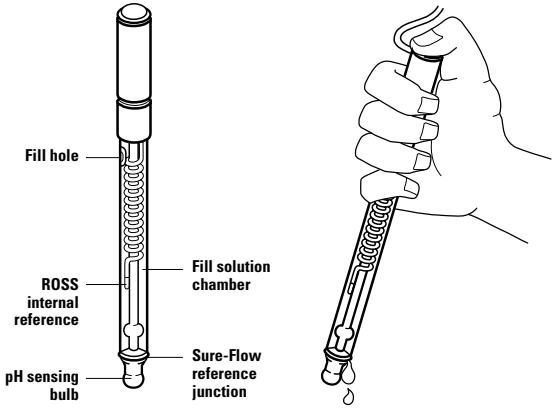
3. Uncover the fill hole by removing the tape and add ROSS fill solution, Cat. No. 810007, to the electrode up to the fill hole. To maintain an adequate flow rate, the level of fill solution must always be above the reference junction and at least one inch above the sample level. The fill hole should 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.



ROSS Sure-Flow Combination pH Electrode

Preparation for Gel-Filled ROSS Ultra Triode Electrodes

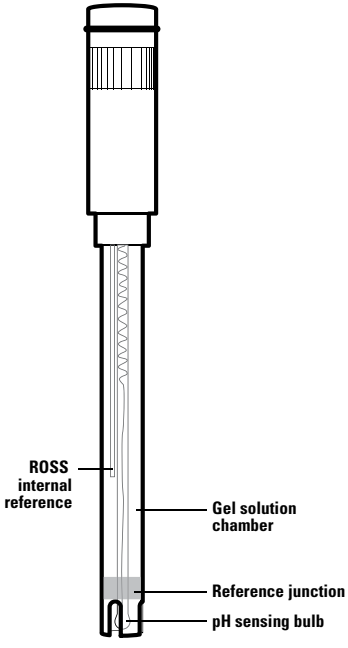
1. Remove the electrode storage bottle from the sensing bulb and save it for later storage of the electrode.

   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% KNO_3, Cat. No. 900003.

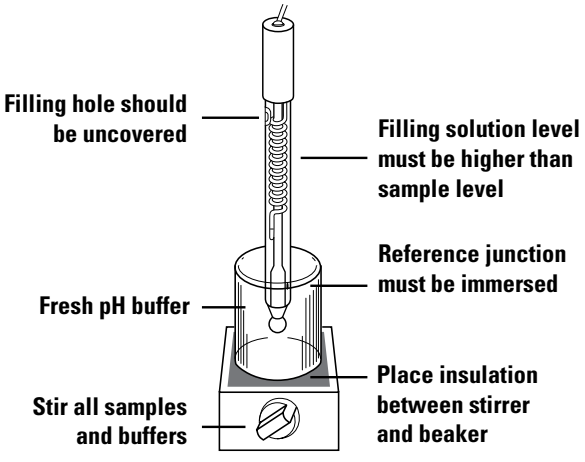
Electrodes with an epoxy body should only be used in aqueous solutions.

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.

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

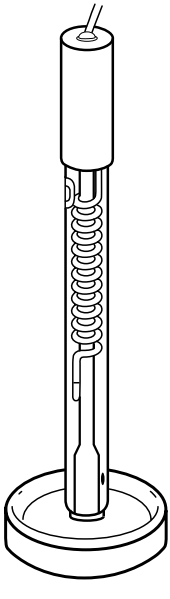
Measuring Hints

- 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 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 Styrofoam 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 PerpHecT 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 PerpHecT ROSS electrodes with a PerpHecT pH meter, refer to the PerpHecT 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.

5. 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.

6. Proceed to the **pH Measurement** section.

Table 1
pH Values of Buffers at Various Temperatures

Nominal Buffer Value at 25 °C	Temperature				
	0 °C	5 °C	10 °C	20 °C	30 °C
1.68	1.67	1.67	1.67	1.67	1.68
3.78	3.86	3.84	3.82	3.79	3.77
4.01	4.00	4.00	4.00	4.00	4.02
6.86	6.98	6.95	6.92	6.87	6.85
7.00	7.11	7.08	7.06	7.01	6.98
7.41	7.53	7.50	7.47	7.43	7.40
9.18	9.46	9.40	9.33	9.23	9.14
10.01	10.32	10.25	10.18	10.06	9.97

Two Buffer Calibration

This procedure is recommended for precise measurements.

1. 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.

2. The buffers should be at same temperature as the sample. If the buffers and samples are at varying temperatures, temperature compensation is recommended.

3. Rinse the electrode first with distilled water and then with the first buffer.

4. 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.

5. Rinse the electrode first with distilled water and then with the second buffer.

6. 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.

7. Proceed to the **pH Measurement** section.

Temperature					
40 °C	**50 °C**	**60 °C**	**70 °C**	**80 °C**	**90 °C**
1.69	1.71	1.72	1.74	1.77	1.79
3.75	3.75				
4.04	4.06	4.09	4.13	4.16	4.21
6.84	6.83	6.84	6.85	6.86	6.88
6.97	6.97	6.97	6.99	7.03	7.08
7.38	7.37				
9.07	9.01	8.96	8.92	8.89	8.85
9.89	9.83				

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 PerpHecT 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

1. a. For general cleaning, prepare a 0.1 M hydrochloric acid (HCl) or 0.1 M nitric acid (HNO_3) solution.

   b. For cleaning oil or grease, prepare a 0.1 to 0.5 % liquid detergent solution mixed with hot water.

   c. For cleaning bacterial contaminants, prepare a 1:10 dilution of household laundry bleach.

2. a. Soak the electrode in the 0.1 M HCl or HNO_3 for half an hour and stir the solution at a moderate rate.

   b. 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.

3. If a refillable electrode is used, drain the reference chamber and refill the electrode with fresh ROSS fill solution.

4. 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– pH cleaning solution A for removing protein contaminants.

Cat. No. 900022– 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 PerpHecT meter and 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**.

Thermo Scientific 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 patented internal reference to minimize the equilibration time.

Temperature Sensor Errors

When a pH and temperature 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.

Using LogR technology, PerpHecT meters sense the temperature directly from the PerpHecT ROSS pH electrodes. 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.

PerpHecT ROSS Micro pH Electrode

The 8220BNWP PerpHecT 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 µL 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 ± 1.0 °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.

PerpHecT ROSS Electrode Operation with PerpHecT pH Meters

When PerpHecT ROSS electrodes are used with a PerpHecT pH meter, 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. PerpHecT ROSS pH electrodes are manufactured to meet the PerpHecT meter specifications, so optimum performance and accuracy are achieved in the LogR mode.

Each PerpHecT ROSS pH electrode must be calibrated for temperature before a pH measurement is performed using LogR technology. Refer to the PerpHecT 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	0.36	0.10	0.004	0.001
8203BN	0.13	0.02	0.002	0.000
8235BN	0.04	0.14	0.000	0.002
8256BN	0.22	0.06	0.003	0.001

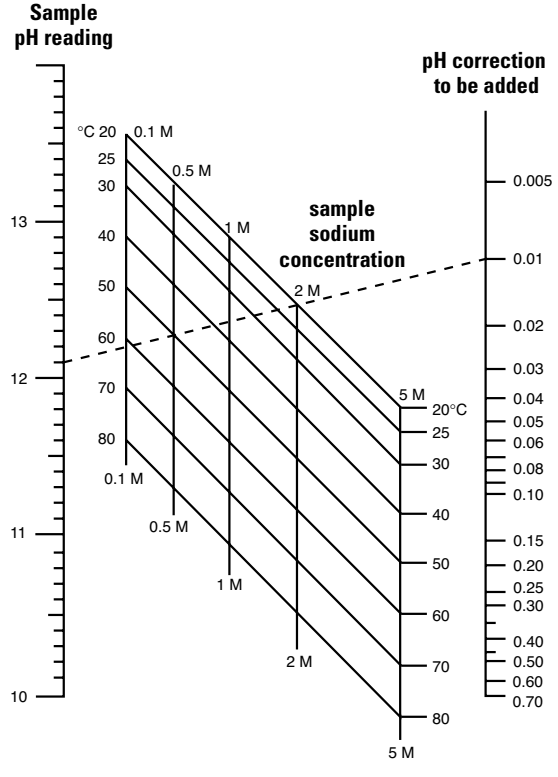
Three Point Temperature Calibration

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. Thermo Scientific 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 call 1.800.225.1480 and 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.

Warranty

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

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)
传感器体带电缆装配 Sensor body with cable assembly	**X**	**O**	**O**
塑料硬件 Plastic hardware	**O**	**O**	**O**
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)
传感器体带电缆装配 Sensor body with cable assembly	**O**	**O**	**O**
塑料硬件 Plastic hardware	**O**	**O**	**O**

O: 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

X: 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



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
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
8107BNU	ROSS Ultra gel-filled pH/ATC Triode with epoxy body, BNC and 8 pin DIN connectors
8107BNUMD	ROSS Ultra gel-filled pH/ATC Triode with epoxy body, waterproof BNC and 8 pin miniDIN connectors
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
8157BNU	ROSS Ultra refillable pH/ATC Triode with epoxy body, BNC and 8 pin DIN connectors
8157BNUMD	ROSS Ultra refillable pH/ATC Triode with epoxy body, waterproof BNC and 8 pin miniDIN connectors
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

Cat. No.	Description
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
810200	ROSS combination pH electrode with glass body, U.S. standard 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
810300	ROSS combination pH electrode with glass body and semi-micro tip, U.S. standard connector
8103SC	ROSS combination pH electrode with glass body and semi-micro tip, screw cap connector
8104BN	ROSS combination pH electrode with glass body and rugged bulb, BNC connector
810400	ROSS combination pH electrode with glass body and rugged bulb, U.S. standard 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
815500	ROSS combination pH electrode with epoxy body, U.S. standard connector
8155SC	ROSS combination pH electrode with epoxy body, screw cap connector

Cat. No.	Description
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
8172DN	ROSS Sure-Flow combination pH electrode with glass body, E DIN waterproof connector
8175BNWP	ROSS Sure-Flow combination pH electrode with epoxy body, semi-micro tip and waterproof BNC connector
8202BN	PerpHecT ROSS combination pH electrode with glass body and BNC connector
8203BN	PerpHecT ROSS combination pH electrode with glass body, semi-micro tip and BNC connector
8207BNU	PerpHecT ROSS Ultra gel-filled pH/ATC Triode with epoxy body and BNC and 3.5 mm phono jack connectors
8220BNWP	PerpHecT ROSS combination pH electrode with glass body, micro tip and waterproof BNC connector
8235BN	PerpHecT ROSS combination pH electrode with epoxy body, flat surface tip and BNC connector
8256BN	PerpHecT ROSS combination pH electrode with epoxy body and BNC connector
8257BNU	PerpHecT ROSS Ultra refillable pH/ATC Triode with epoxy body and BNC and 3.5 mm phono jack connectors
8272BN	PerpHecT ROSS Sure-Flow combination pH electrode with glass body and BNC connector

Cat. No.	Description
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
910199	All-in-One pH buffer kit, includes 475 mL bottle each of pH 4.01, 7.00 and 10.01 buffers, 475 mL bottle of pH electrode storage solution 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
900021	pH electrode cleaning solution A, includes 4 x 30 mL bottles, pipette and beaker
900022	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
910004	8 mm electrode storage bottle, pack of 3
910006	6 mm electrode storage bottle, pack of 3

Visit www.thermo.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	± 1.0 °C at 2 minutes when immersed at least 2 inches in solution
PerpHecT ROSS Temperature Accuracy (Requires PerpHecT Meter)	± 0.5 °C
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 0.002 pH within 15 seconds

Specifications (continued)

Dimensions 8102BNUWP, 8302BNUMD, 8104BNUWP, 8107BNU, 8107BNUMD, 8107UWMMD, 8135BNUWP, 8156BNUWP, 8157BNU, 8157BNUMD, 8157UWMMD, 800500U, 8101BNWP, 8102BN, 8104BN, 8135BN, 815600, 8162SC, 8165BNWP, 8172BNWP, 8202BN, 8207BNU, 8235BN, 8256BN, 8257BNU, 8272BN	120 mm (length) 12 mm (diameter)
Dimensions 8103BNUWP, 8103BN, 810300, 8103SC, 8203BN	165 mm (length) 95 mm (tip length) 6 mm (tip diameter)
Dimensions 8115BNUWP, 8115BN, 8115SC, 8175BNWP	165 mm (length) 95 mm (tip length) 8 mm (tip diameter)
Dimensions 8163BNWP, 8163SC	110 mm (length) 20 mm (tip length) 4.5 mm (tip diameter)
Dimensions 8220BNWP	155 mm (length) 40 mm (tip length) 3 mm (tip diameter)

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