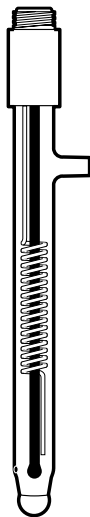


## User Guide

ROSS® Process  
Combination pH  
Electrode



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ORION Series A meters and 900A printer are protected by U.S. patents 5,198,093, D334,208 and D346,753.

ionplus electrodes and Optimum Results solutions are protected by US Patent 5,830,338.

ROSS Ultra electrodes are protected by US patents 6,793,787.

Orion ORP Standard is protected by US Patent 6,350,367.

Orion NoCal electrodes with stabilized potential patent pending.

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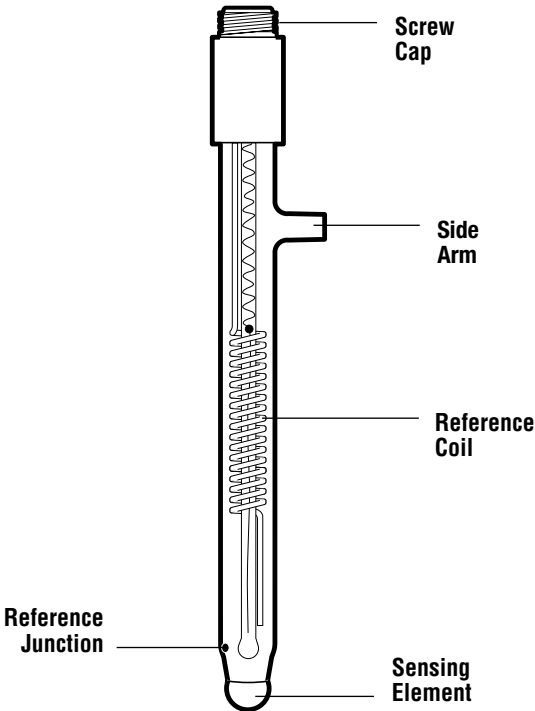
# Introduction

## General Information

The ROSS process pH electrode, Cat. No. 2001SC, is a combination electrode designed for online applications. The pH sensing electrode and reference electrode are combined into a single electrode. This electrode is designed to be used in the Orion flow cell, Cat. No. 2001FC. This flow cell is designed to hold and position the electrode for optimal results.

The 2001SC ROSS combination pH electrode is a research-grade electrode designed specifically for use in online pH measurement applications. It is designed with a sidearm, which allows it to be attached to a reservoir of specially formulated ROSS reference filling solution. This ensures that the outer reference chamber is always full, allowing the ceramic liquid junction to flow freely.

**Figure 1 – ROSS Process Combination pH Electrode**



## Theory of Operation

With its unique internal element system, the 2001SC ROSS process combination pH electrode provides far better stability, faster response and greater accuracy than can be obtained from any conventional electrode with silver chloride or calomel internal systems. The electrode response is fast; even in samples varying by 50 °C or more in temperature. Drift is less than 0.02 pH units per day, which eliminates the need for frequent standardization.

The ROSS internal system is designed to have virtually zero temperature coefficient, that is, the potential difference between the elements is zero regardless of the difference in the temperature of the elements. This is of great importance since the internal elements of combination pH electrodes are housed in an electrode body that, in use, is partially immersed in the sample and partially exposed to the ambient air. This means that the internal elements may be at different temperatures. As a consequence, conventional pH electrodes will drift and give inaccurate readings when being used to measure solutions with varying temperatures. On the other hand, the ROSS electrode gives stable readings and accurate results regardless of differences in sample and ambient temperatures.

The silver chloride or calomel used in conventional pH electrodes tends to dissolve in the filling solution (usually KCl), eventually precipitating in the ceramic frit that forms the liquid junction. This, in turn, results in electrode failure. Differences in solubility of the silver chloride or calomel with temperature also gives rise to thermal hysteresis problems in conventional electrodes, so that re-standardization is usually necessary after temperature cycling. The ROSS system eliminates these problems as well.

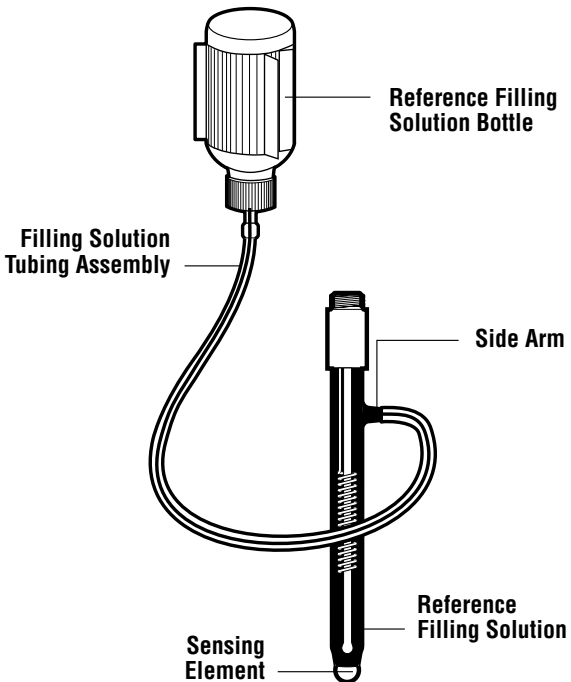
# Using the Electrode

## Electrode Preparation

**Caution:** Wear gloves and protective clothing. ROSS reference filling solution can stain clothing and skin.

1. Unpack the electrode and reference filling solution tubing assembly from the shipping box. Carefully remove the protective shipping caps from the electrode sensing element and sidearm and save the caps for storage.
2. Clean any salt deposits from the electrode exterior by rinsing the electrode with distilled water. With a damp cloth, gently wipe around the sidearm area. Do not get water into the sidearm.
3. Take the tubing assembly and pass the smaller 1/8 inch tubing into the electrode sidearm, while sliding the larger 1/4 inch tubing over the sidearm. The outside tubing should extend 1/4 to 1/2 inch over the sidearm.

**Figure 2 – Electrode with Attached Reference Filling Solution**

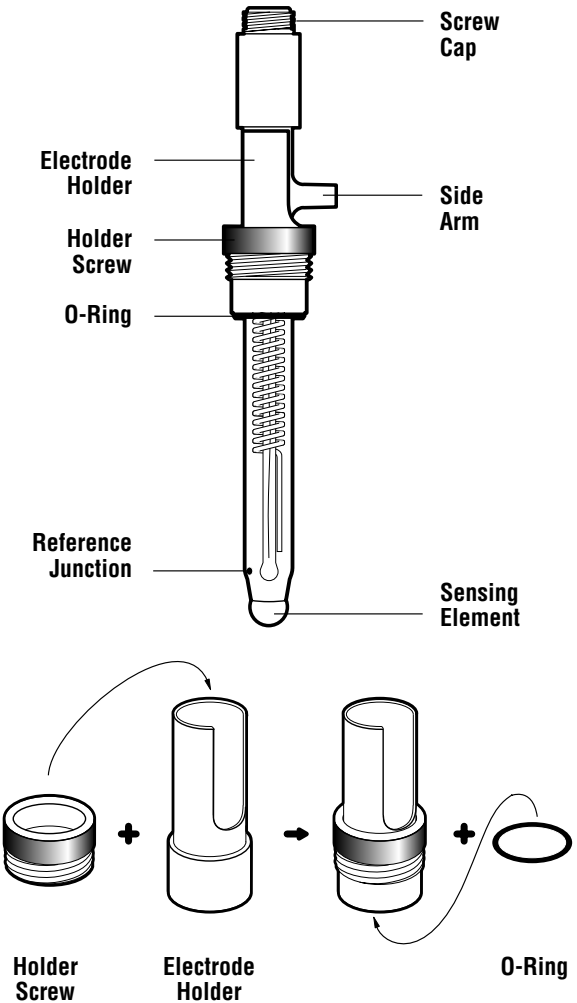


4. Remove cap and cap plug from the ROSS reference filling solution bottle (Cat. No. 2001FS). Hold the bottle in the upright position. Then connect the cap end of the tubing assembly to the bottle. The 1/8- inch smaller tubing should extend into the bottle.
5. Hold the filling solution bottle above the electrode in an inverted position until the electrode is completely filled with solution. Gently shake the electrode to allow any trapped air bubbles to rise into the bottle. For proper operation, the electrode should not have any air in it.
6. Dry off the ceramic frit reference junction by gently dabbing it with lint free tissue paper. To reduce errors due to polarization, do not rub or wipe the electrode sensing element. Squeeze the filling solution bottle for a few seconds. A small amount of filling solution should bead up on the surface of the reference junction, indicating good electrolyte flow. If no moisture is visible, the electrode may be clogged and should be cleaned.

# Electrode Installation into the Flow Cell, Cat. No. 2001FC

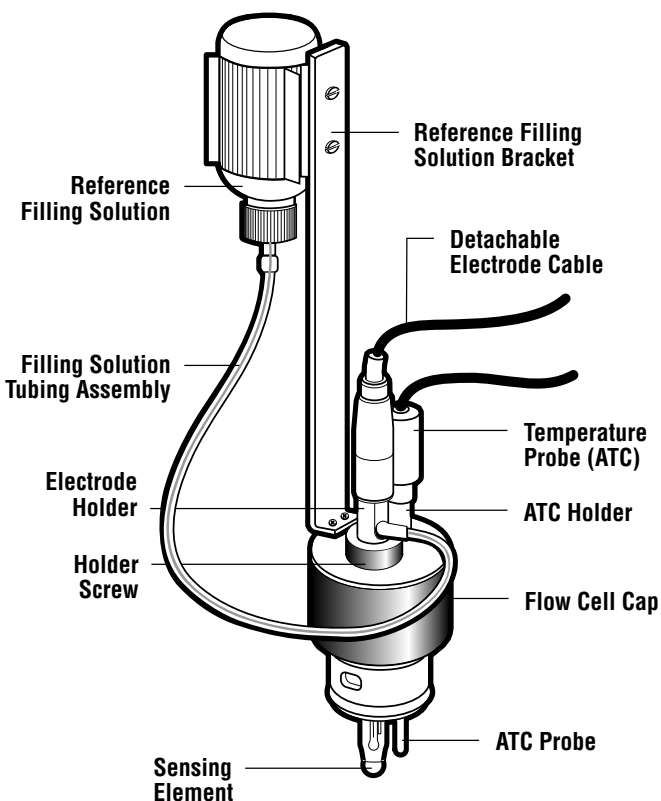
The flow cell housing needs to be cleaned and installed into an appropriate area with its mounting bracket. The reference filling solution bracket and clip should be assembled on the flow cell cap before installing the electrode. See the flow cell instruction sheet for details.

Figure 3 – ROSS Electrode with Electrode Holder and O-ring



1. Take the electrode holder and slide the holder screw onto it with the thread side down. The screw should be just below the notch on the holder. See **Figure 3**.
2. Take the electrode holder and screw and slide it all the way onto the electrode. The top of the holder should touch the bottom of the electrode cap, and the sidearm should fit into the notched area. See **Figure 3**.
3. Slide the large black O-ring onto the electrode up to the bottom of the holder. See **Figure 3**.
4. Insert the holder with electrode, into the flow cell cap. See **Figure 4**.

**Figure 4 – Assembled Flow Cell Cap with Sensors**



5. Align the sidearm 180 degrees away from the bracket holding the reference filling solution to insure correct positioning of the reference junction.
6. Hold the electrode in position while screwing the holder into the flow cell cap until finger tight. Do not overtighten.
7. Invert the filling solution bottle and insert it into the bottle holder. Use the supplied pushpin to puncture three air vents into the inverted bottom of the bottle. Venting the bottle will help to avoid noisy and drifting output signals.
8. Mark the level of the solution in the bottle and note the date. The solution level should be checked regularly and replaced as required.
9. For inserting an optional ATC probe, take the ATC holder and slide onto the ATC probe until it is under the ATC cap. Take the smaller black O-ring and slide onto the ATC probe until it fits snugly against the ATC holder. Place this ATC assembly into the flow cell cap and turn the screw on the holder until finger tight.
10. If no ATC probe is to be used, place the smaller black O-ring into the ATC probe well on the flow cell cap. Take the ATC holder and screw on until finger tight.
11. Take the flow cell cap assembly and gently place it straight into the flow cell housing. The assembled cap needs to be firmly placed straight into the cell. Do not tap the sensing electrode against the flow cell housing.
12. Twist the cap so that the lock screw is aligned with the notch on the cap and tighten the lock screw to position the cap properly on the flow cell housing.

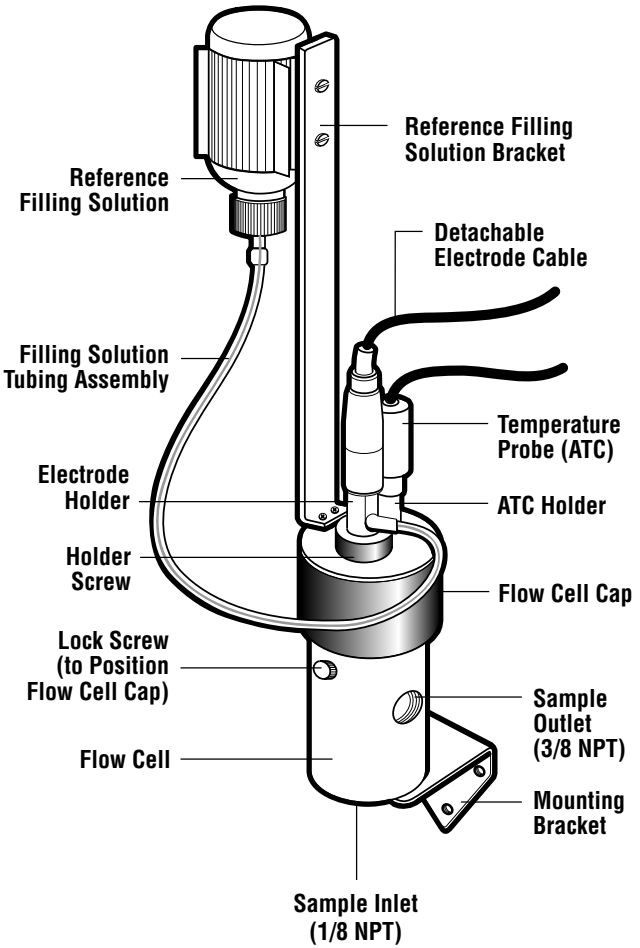
### **Flow Cell Cautions**

When removing the cap from the flow cell, always unscrew the lock screw first. Slowly pull the cap straight up from the housing. Do not hit the sensing element against the housing.

When removing the electrode or ATC from the flow cell cap, unscrew the holder screw or ATC holder first. Do not pull the electrode or ATC out of the holder without first removing the O-rings. Be careful not to lose the O-rings.

When placing the cap with assembled electrode into the flow cell, place it in straight. Do not hit the sensing element against the housing.

**Figure 5 – Assembled Flow Cell with Sensors**

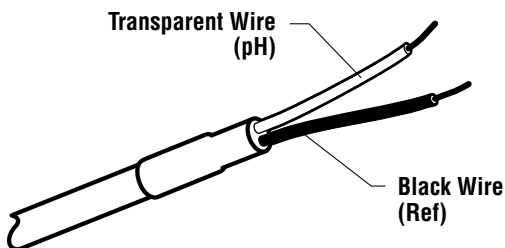


## Attaching the Electrode to a Monitor

Attach the 2001SC ROSS process pH electrode to the monitor or amplifier using the interface cable, Cat. No. 2001EC.

1. Attach the screw cap end of the cable to the electrode.
2. Attach the stripped, unterminated ends to the monitor. Refer to the monitor user guide for more detail. The stripped, unterminated ends are easily identified and can be inserted to any monitor's terminal strip.

**Figure 6 – Electrode Connector (Stripped Unterminated Ends)**



## 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/contactwater](http://www.thermo.com/contactwater).

## Warranty

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

## For Best Measurement Results

To maintain optimal electrode performance, use the following guidelines.

- Check electrode slope by performing two buffer calibration. Slope should be 92 to 102%.
- Always use fresh pH buffers when calibrating. Choose buffers that are no more than three pH units apart. For detailed calibration and temperature compensation procedures, consult the monitor user guide.
- Use only ROSS reference filling solution, Cat. No. 2001FS. Use of other filling solutions may result in electrode failure.
- Inspect the electrode for scratches, cracks, salts or other deposits on the sensing element or reference junction. Rinse off any precipitate by rinsing the electrode with distilled water.
- To reduce errors due to polarization, do not rub or wipe the electrode sensing element.
- Best results will be achieved if the electrode is used with the Orion flow cell, Cat. No. 2001FC.
- The first time a new electrode is installed, allow the electrode to equilibrate for 1 hour up to 24 hours.
- Change the reference filling solution tubing assembly once every three to six months.
- Make sure that ROSS reference filling solution bottle is properly vented.
- Periodically check that there is sufficient reference filling solution and replace bottle as needed.
- Keep electrode and electrode holder areas clean.

## Ordering Information

<b>Cat. No.</b>	<b>Description</b>
2001SC	ROSS process combination pH electrode with screw cap and sidearm
2001FC	Flow cell for ROSS process pH electrode, includes stainless steel housing with mounting bracket, PVC holders and cap, and solution mounting bracket
2001EC	Detachable 1 meter cable for ROSS process pH electrode, coaxial cable with screw cap attachment for electrode and tinned, stripped, unterminated ends for attachment to monitor
20015M	Detachable 5 meter cable for ROSS process pH electrode
2001XM	Detachable 10 meter cable for ROSS process pH electrode
2001CP	6 month consumables pack for ROSS process pH electrode, includes 5 x 2 oz (60 mL) bottles of ROSS filling solution and 1 pint (475 mL) bottle each of pH 4.01, 7.00 and 10.01 buffers
2001FS	ROSS reference filling solution for ROSS process pH electrode, 5 x 2 oz (60 mL) bottles
910104	pH 4.01 buffer, 1 pint (475 mL) bottle
910107	pH 7.00 buffer, 1 pint (475 mL) bottle
910110	pH 10.01 buffer, 1 pint (475 mL) bottle
2001TP	Process ATC temperature probe (30 kohm) with 1 meter cable
2001XT	Process ATC temperature probe (30 kohm) with 10 meter cable
2001LN	Process ATC temperature probe (8.5 kohm) with 5 meter cable
2001TM	Process ATC temperature probe (1 kohm) with 5 meter cable
2001EK	ROSS process pH electrode kit, includes ROSS electrode (2001SC), flow cell (2001FC), ATC probe (2001XT) and cable (20015M)

# Specifications

## **pH Range**

0 to 14 pH

## **Temperature Range**

0 to 100 °C

## **Drift**

Less than 0.5 pH units for 30 days

## **Slope**

92 to 102% (54.4 to 60.3 mV/dec)

## **Isopotential Point**

pH 7

## **Junction**

Ceramic frit

## **Internal Reference**

ROSS

## **Size**

Electrode Diameter: 12 mm

Electrode Length: 125 mm

Electrode Cap Diameter: 16 mm

Electrode Cap Length: 30 mm

## **Detachable Cable**

Coaxial

## **Cable Length**

1 meter

## **Filling Solution**

ROSS reference filling solution

*\* Specifications are subject to change without notice*

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