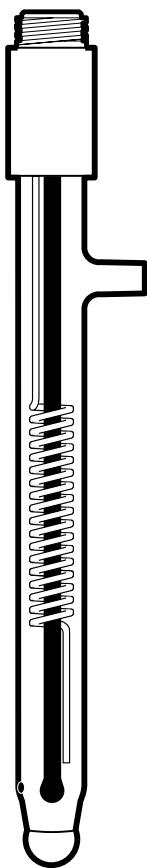


pH

Orion 2001SC

Orion Process ROSS™ Combination pH Electrode

INSTRUCTION MANUAL



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This publication supersedes all previous publications on this subject.

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GENERAL INFORMATION

General Description

The Process ROSS™ 2001SC is a combination pH electrode. The pH sensing electrode and reference electrode are combined into a single electrode. This electrode is designed to be used in the Orion 2001FC flow cell. This flow cell is designed to hold and position the electrode for optimal results.

The ROSS 2001SC combination pH electrode is a research grade electrode designed specifically for use in on-line pH measurement applications. It is designed with a side arm, 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.

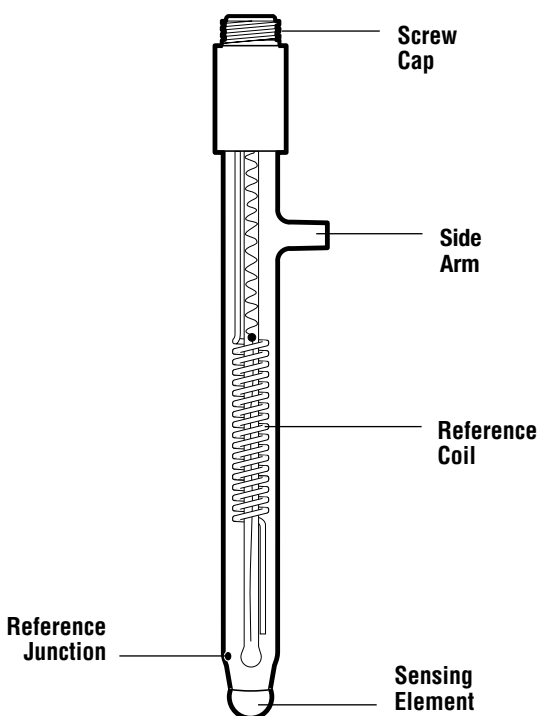


Figure 1 - Process ROSS Combination pH Electrode 2001SC

Theory of Operation

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

The redox 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. Furthermore, 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 redox system eliminates this problem as well.

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:	ROSS™
Electrode Diameter:	12 mm
Electrode Length:	125 mm
Electrode Cap	
Diameter:	16 mm
Length:	30 mm
Detachable Cable:	Coaxial
Length:	1 meter
Cap Length:	50 mm
Filling solution:	ROSS Reference Filling Solution

USING THE ELECTRODE

Electrode Preparation

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

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

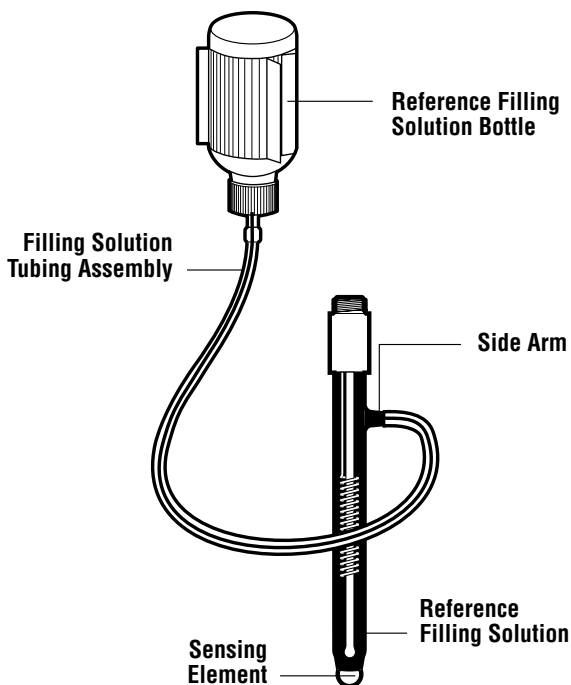


Figure 2 - Process ROSS pH Electrode with Reference Filling Solution Attached

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 Flow Cell 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 flow cell instruction sheet for details.

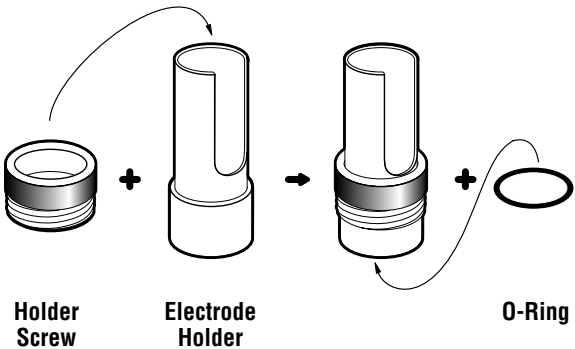
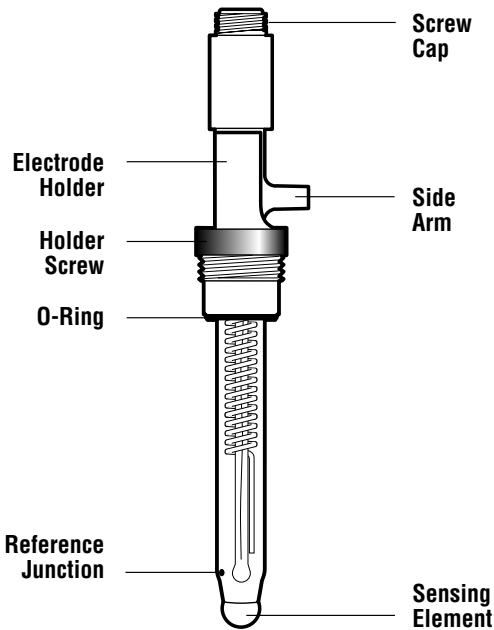


Figure 3 - Process ROSS™ Combination pH Electrode 2001SC with Electrode Holder and O-Ring

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 side arm 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**)

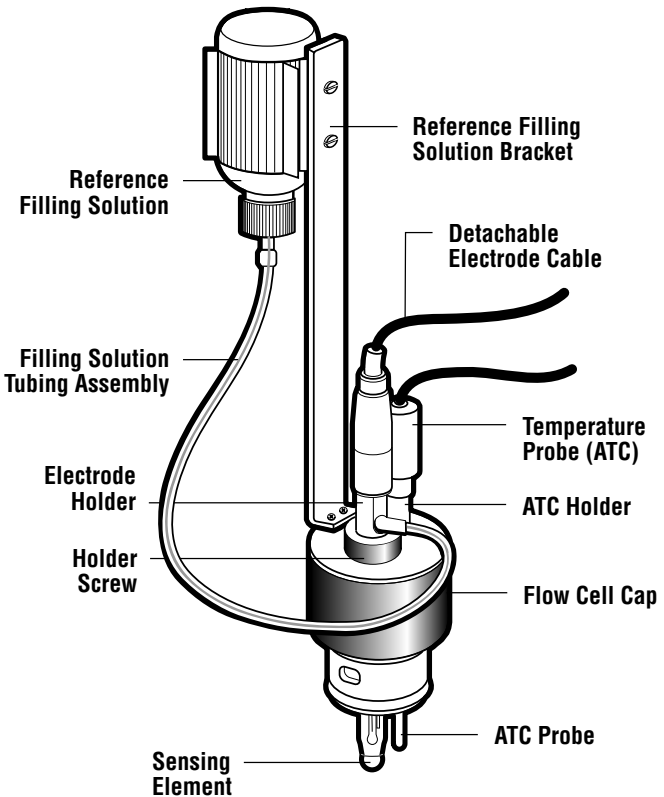


Figure 4 - Assembled Flow Cell Cap with Sensors

5. Align the side arm 180° 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 over tighten!**
7. Invert the filling solution bottle and insert it into the bottle holder. Use 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.

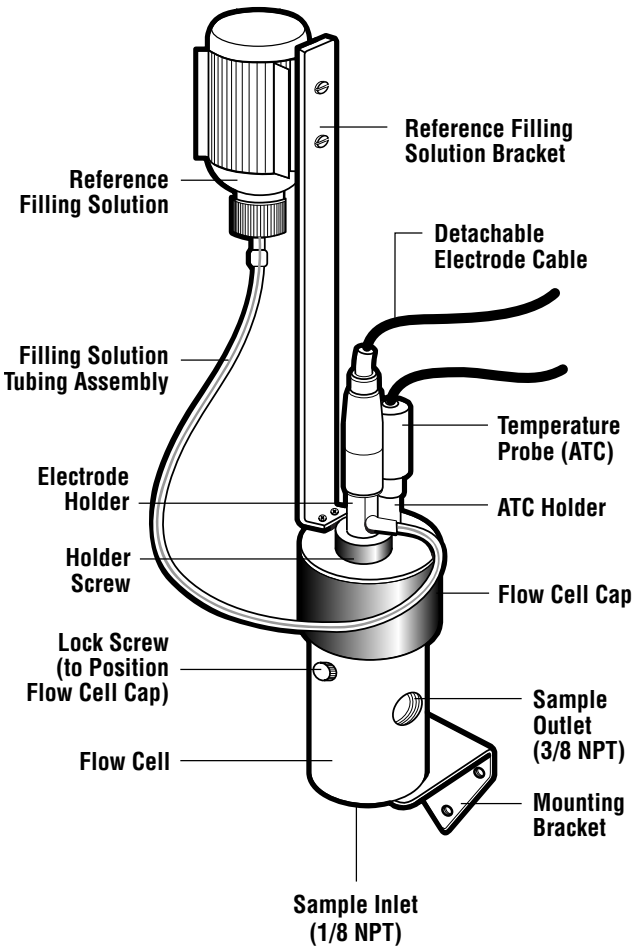


Figure 5 - Assembled Flow Cell with Sensors

Caution:

- 1) *When removing the flow cell cap from the flow cell, always unscrew the lock screw first. Slowly pull the cap straight up from the cell housing while taking care not to hit the sensing element against the flow cell housing.*
- 2) *When removing the electrode/ATC from the flow cell cap, unscrew the holder screw or ATC holder first. Do not pull the electrode or ATC out of the holders without first removing the O-rings. Be careful not to lose the O-rings.*
- 3) *When placing the cap with assembled electrode into the flow cell, place it in straight and take care not to hit the sensing element against the flow cell housing.*

Attaching the Electrode to a Monitor

Attach the Orion 2001SC Process ROSS™ pH electrode to the monitor/amplifier by using cable 2001EC.

To Attach to Orion pH Monitor 2001:

1. Attach screw cap end to the electrode.
2. Attach stripped unterminated ends to the monitor. Refer to monitor instruction manual.

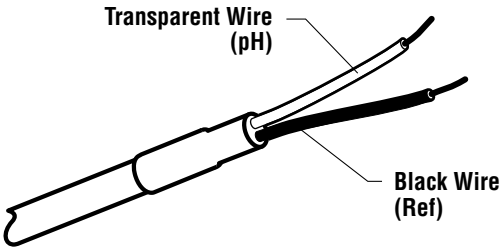


Figure 6 - Electrode Connector (Stripped Unterminated Ends) for Orion Monitor 2001

To Attach to Other Monitors:

Refer to your monitor instruction manual. The stripped unterminated ends are easily identified (See diagram above) and can be inserted to any monitor's terminal strip.

For Best 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. Use Orion precision buffers: pH 4 (Orion 200104), pH 7 (Orion 200107) or pH 10 (Orion 200110). Choose buffers that are no more than 3 pH units apart. For detailed calibration and temperature compensation procedures, consult the Orion 2001 Process pH Monitor instruction manual.
- Use only ROSS™ Reference Filling Solution (Orion 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 precipitates by rinsing 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 2001 Process pH Monitor (Orion 200100) and Flow Cell (Orion 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

Orion	Description
2001SC	Process ROSS™ Combination pH Electrode (screw cap with side arm)
2001FC	Flow Cell for Process ROSS Combination pH Electrode (Stainless steel housing with mounting bracket, PVC holders and cap, & solution mounting bracket)
2001EC	Detachable cable for Process ROSS Combination pH Electrode, 1 meter (Coaxial cable with screw cap attachment (electrode) & tinned, stripped unterminated ends for attachment to monitor.) Additional cables available upon request.
2001CP	6 Month Consumables Package for ROSS Process Combination pH Electrode (Includes five 2 ounce (60 mL) bottles of ROSS Reference Filling Solution, one pint (475 mL) of each pH Buffer, pH 4, 7 & 10)
2001FS	Reference Filling Solution for ROSS Process Combination pH Electrode Five 2 ounce (60 mL) bottles
200104	pH 4.01 Buffer, 1 pint (475 mL)
200107	pH 7.00 Buffer, 1 pint (475 mL)
200110	pH 10.01 Buffer, 1 pint (475 mL)
2001TP	Process Temperature Probe ATC, 1 meter cable
200100	Process pH Monitor Only with Mounting Bracket & Heyco Connectors
200101	Process pH Monitor Complete (Includes Monitor, Flowcell, ROSS™ Electrode, ATC, Electrode Cable and Buffers)

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.

NOTES

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