

## Beckman Coulter ORP Platinum Combination Electrode

### A57197

The Beckman Coulter ORP Platinum Combination Electrode is a metallic combination electrode to be used for ORP testing. This electrode has an attached cable with BNC connector.

#### Theory of Measurement

Oxidation-reduction potential (ORP) measurements are used to monitor chemical reactions, quantify ion activity, or determine the oxidizing or reducing properties of solutions. While ORP measurements are somewhat similar to those of pH, the potential value must be carefully interpreted to achieve meaningful results. Using the millivolt mode of a pH meter with an appropriate metallic or ORP electrode, it is possible to monitor the change in the potential of a solution.

In many chemical reactions, electrons are transferred from one substance to another. By definition, a substance gains electrons in a reduction reaction and loses electrons in an oxidation reaction. Both reactions occur together, until an equilibrium condition is reached. The terms ORP and REDOX have both been used to describe these measurements.

Two types of measurements are commonly used with ORP electrodes: direct measurement and ORP titration. Direct measurements are made by taking a measurement of a sample and reporting a result. Titrations are made by adding an oxidizing or reducing agent to a solution, and reporting the change in values, which usually end with a large change in value at the equilibrium stage.


#### Before Using the Electrode

Remove the storage solution cap from the electrode. This cap keeps the reference junction in a fresh, ready-to-use condition. Hold the electrode and pull the cap straight off. Save the cap for long-term storage.

Connect the electrode to the BNC input of your pH meter.

#### Measuring the Sample

Insert the electrode into the sample to be measured.



#### NOTE

For most ORP tests, it is not necessary to run or prepare standards except to test the functionality of the electrode.

#### Direct Measurement

Take a reading in mVs by following the directions in the operator manual for the pH meter. When the reading stabilizes, record the mV value displayed on the meter and compare it to the expected normal value for the solution.

#### ORP (REDOX) Electrode Calibration/Verification

##### Solution Procedure

The performance of the ORP electrode can be determined by use of ORP Calibration/Verification Solutions.

Preparation of solutions can be accomplished by adding quinhydrone to standard pH 4 or 7 buffers according to the following procedure:

##### Materials Required

- pH4 Buffer
- pH 7 Buffer
- Three 4 oz beakers
- Quinhydrone
- Deionized water
- Stirring stick (magnetic stirrer recommended)



#### WARNING

Always follow laboratory safety procedures, including wearing protective gloves and eye wear. Avoid consuming, inhaling, or coming into direct contact with chemicals or solutions.



#### 警告

始终按照实验室安全程序操作，包括佩戴防护手套和眼罩。避免吞食、吸入或直接接触化学物质或溶液。

1. Fill one beaker with deionized water for rinsing the electrode.
2. Fill a second beaker with ½ oz pH 7 buffer.
  - a. Add approximately 0.5 grams of quinhydrone.
  - b. Stir solution to dissolve quinhydrone.
  - c. A small amount of quinhydrone **MUST** remain undissolved. If it all dissolves, add a small amount of quinhydrone and stir.
3. Fill a third beaker with ½ oz of pH 4 buffer.
  - a. Repeat steps 2a–c with the pH4 buffer.
4. Rinse the ORP electrode and pat dry with a soft tissue.
  - a. Place the electrode in the beaker filled with pH 7 buffer/quinhydrone mixture and stir gently. Let the electrode rest against the side of the beaker.

## Beckman Coulter ORP Platinum Combination Electrode

### Materials Required

- b. Allow the reading to stabilize for 30–60 seconds and note the reading. The reading should be within  $\pm 15$  mV from the values in Table 1.
5. Rinse the ORP electrode and pat dry with a soft tissue.
  - a. Place the electrode in the beaker filled with pH 4 buffer/quinhydrone mixture and stir gently. Let the electrode rest against the side of the beaker.
  - b. Allow the reading to stabilize for 30–60 seconds and note the reading. The reading should be +170 to +185 mV above the reading you received in Step 4. (Ex. – If the reading from Step 4 is +90 mV Nominal, the reading in this step will be between +260 to +275 mV.)
  - c. With time and/or use, the mV values of the quinhydrone-saturated pH 4 and pH 7 buffers may change; however, the +170 to +185 mV delta between the two buffers should remain the same. Obtaining this reading means that the electrode has a verified good span and can be calibrated (if the instrument allows ORP calibration) to the meter to reflect the proper residual chlorine concentration or ORP (REDOX) potential.
6. If a short span is found (less than a +170 mV change between the pH 7 and pH 4 buffers), the platinum measuring surface may be coated. Remove the coating by doing one of the following:
  - a. Wipe the surface clean with a soft cloth or tissue.
  - b. Soak the electrode in a chemical known to dissolve the suspected coating material.
  - c. As a last resort, very gently polish the surface with 600-grade wet silicone carbide paper.
  - d. After cleaning, let the electrode soak in one of the calibration solutions for about five minutes before recalibrating.
7. The buffer/quinhydrone mixture should be made each time the ORP electrode is calibrated. Do not store the mixture or use after two hours, as its values may change.
8. Dispose of solution according to local regulations.

**Table 1.** Temperature readings in pH 7 buffer/quinhydrone mixture

Temperature	Reading
20°C (68°F)	+96 mV Nominal
25°C (77°F)	+90 mV Nominal
30°C (86°F)	+83 mV Nominal

### Storing the Electrode

For short-term storage, such as the same day between samples, soak the electrode in pH buffer or deionized water.

For long-term storage (three days or longer), replace the cap filled with electrode storage solution, pH 4 or 7 buffer, or deionized water.

### How to Achieve the Best Results

ORP measurements are usually very quick and stable reactions. It is recommended that the solutions be stirred with a magnetic stirrer during measurements.

If a problem is encountered, it is likely due to interfering substances in the solution, a contaminated electrode, or the need for a different filling solution. Interfering substances are specific to each compound being tested and cannot be fully detailed here.

A contaminated electrode may be tested as per the ORP (REDOX) *Electrode Calibration/Verification Solution Procedure* section. If necessary, clean the electrode as discussed in the section entitled *Maintaining the Electrode*.

### Maintaining the Electrode

Most problems encountered with the ORP electrode are a result of deposits on the platinum sensing element or from a blockage of the junction.

### Cleaning the Sensing Element

1. Soak the electrode in 1 M HCl for up to one hour. Rinse thoroughly in deionized water.
2. Prepare a solvent solution (or detergent) known to remove deposits. Wipe the sensing surface with a laboratory wipe soaked with the solution. Rinse with deionized water.

### Cleaning the Junction

1. Soak the electrode in a 3–4M  $\text{NH}_4\text{OH}$  (Ammonium Hydroxide) for twenty to thirty minutes. Rinse thoroughly with deionized water, and soak for fifteen minutes in pH 4 buffer.
2. Heat a solution of KCl to 50°C. Soak the electrode in the solution until the solution cools to room temperature. This also eliminates salt buildup inside.

### ORP Platinum Combination Electrodes

#### A57197 ORP Platinum Combination Electrode, Sealed Epoxy Body

#### NOTE

Please visit [www.beckmancoulter.com](http://www.beckmancoulter.com) for a complete list of electrochemistry meters, electrodes, and accessories.

#### NOTE

For MSDS information, visit [www.beckmancoulter.com](http://www.beckmancoulter.com) and click on Customer Support, then MSDS.

#### NOTE

If you experience problems with your Beckman Coulter electrode that these procedures cannot resolve, call your local Beckman dealer. In the U.S., please call the toll-free Product Support line at (800) 742-2345.