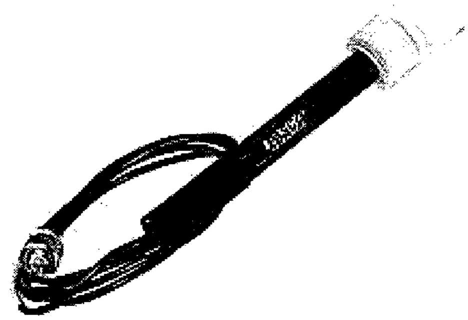
Oxidation Reduction Potential (ORP) Probe

(CI-6716)



Specifications

Measurements	Oxidation Reduction Potential
Range	-2000 mV to + 2000 mV
Accuracy	± 0.1 mV
Resolution	0.05 mV
Sampling Rate	50 Hz (max), 2 Hz (default)

Theory

Oxidation reduction potential is the ability of species in a solution to act as an oxidizing or reducing agent. To determine the oxidation reduction potential of a solution, an electrode composed of two metals is placed in the solution. The measurement electrode is made of an inert metal (platinum) that will not react with the solution, yet generates a voltage as a result of the reactions taking place in the solution. The measurement electrode must be compared with the voltage of a reference electrode (Ag/AgCl), which returns the same voltage regardless of the activity of the solution.The difference in these two voltages is the oxidizing/reducing capacity of the solution, as measured in millivolts. If the solution has more oxidizing capacity, the voltage will increase. Conversely, if the solution being tested has greater reducing capacity, voltage will decrease.

The Nernst equation represents the process thusly:

$$E = E_0 + \frac{2.3RT}{nF} \times \log\left(\frac{[\text{oxidant}]}{[\text{reductant}]}\right)$$

Where:
E= the voltage potential measured by the ORP electrode
E_0= a constant characteristic of the system in question
R= the universal gas constant
T= absolute temperature (in Kelvin)
n= number of electrons participating in the reaction
F= Faraday's constant

Calibration: Check the electrode slope

Materials

- pH 4 buffer solution
- pH 7 buffer solution
- quinhydrone (1:1 mixture of benzoquine and hydroquinone)
- 3 beakers
- magnetic stirrer and stir bar
- spatula
- deionized H_20 (for rinse water)

Safety Note
CAUTION: Quinhydrone can be very toxic. Take precaution to avoid inhalation!

Procedure

Prepare the Calibration Solutions

1. Add a small amount of quinhydrone to the ph 7.0 buffer solution in a beaker and mix thoroughly. This is the ~90mV solution.

2. Continue to add quinhydrone to the solution until no more will dissolve. Adding quinhydrone beyond the saturation point will not affect the calibration procedure.

Note: Combining these substances will create two solutions of known voltage, since quinhydrone's solubility in these solutions is fixed and very low.

3. Follow the same procedure for creating the ~265mV solution by adding quinhydrone to the pH 4.0 buffer. Label each beaker.

4. Connect the ORP probe to the PASPORT pH/ORP/ISE Amplifier.

5. Open a Digits Display. Set the sampling rate to manual sampling.

6. Place the beaker on the magnetic stirrer. Place the stir bar in the solution and turn on the stirrer. Be careful not to stir too vigorously.

7. Immerse the tip of the probe in one of the quinhydrone solutions. Click **Start**.

8. When the reading stabilizes, click **Keep**.

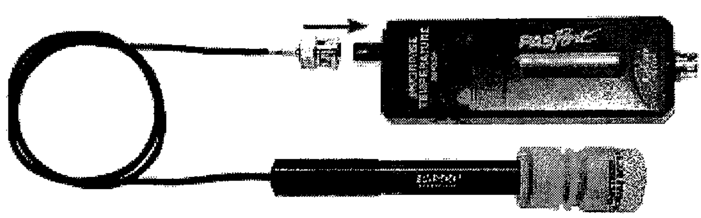
9. Rinse the probe with distilled water and blot dry.

10. Immerse the the tip of the probe in the other quinhydrone solution. When the reading stabilizes, click **Keep**. Click **Stop** to end data recording.

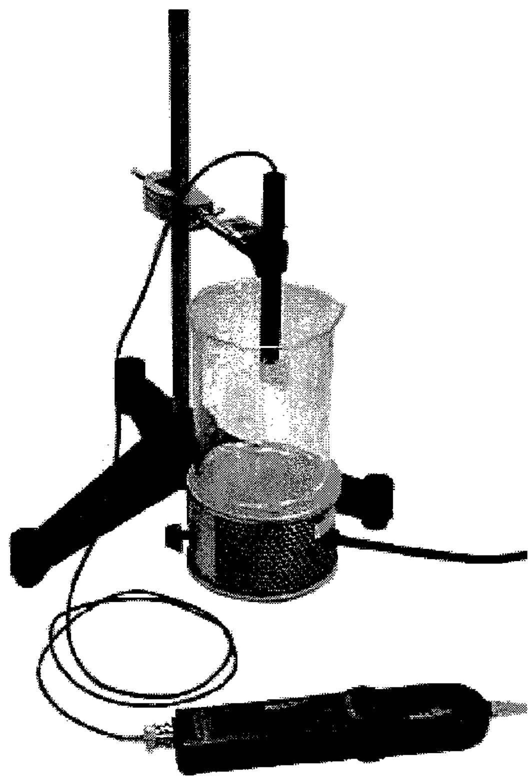
11. Compare the voltage readings for each solution. Whether the probe returns 90mV or 265mV the two points should be 173mV apart, ±4 mV. If the probe does not return these values or something close to them, clean the probe with dilute HCl solution, rinse with deionized water and repeat the calibration procedure.

Common Equipment Setup

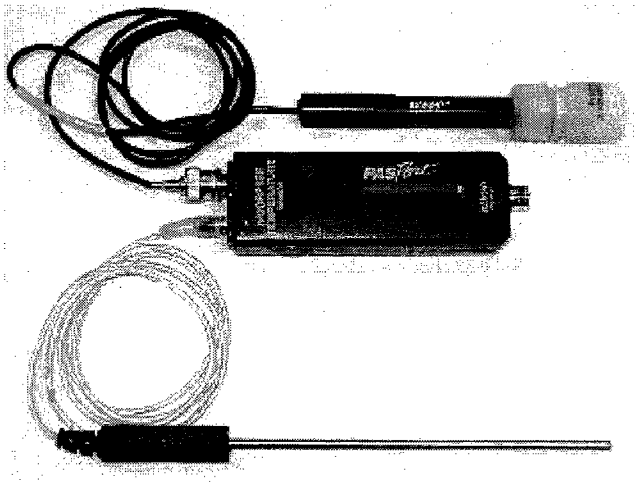
The ORP probe must be connected to the PASPORT pH/ORP/ISE Amplifier in order to work.



In solution, use a clamp to hold the sensor steady. The solution should always be flowing across the electrode membrane to ensure accurate readings. Use a magnetic stirrer to facilitate this.



In addition, ORP studies are temperature-dependent. To ensure that temperature is accounted for, it is best to use a Temperature probe in the pH/ORP/ISE Amplifier's stereo plug.



Storage

The ORP probe comes with a storage bottle attached to the exposed part of the housing. The solution in this bottle is a pH 4.0 buffer solution saturated with potassium chloride. In the event that the storage solution gets spilled, it is acceptable to refill the bottle with tap water for a short period of time. However, if the probe is to be stored over a long period of time, it is best to replace the KCl solution.

Typical Applications

- Redox titrations
- Water treatment and quality monitoring
- Ozone treatment
- Bleach production
- Fruit and vegetable washing
- Pulp bleaching
- Chlorine addition for swimming pools, spas, etc.