ORP Sensor
(Order Code ORP-BTA)

The ORP Sensor measures the ability of a solution to act as an oxidizing agent or reducing agent. ORP stands for oxidation-reduction potential. For example, ORP electrodes are often used to measure the oxidizing ability of chlorine in swimming pools, or to determine when the equivalence point has been reached in an oxidation-reduction reaction.

Note: Vernier products are designed for educational use. Our products are not designed nor are they recommended for any industrial, medical, or commercial process such as life support, patient diagnosis, control of a manufacturing process, or industrial testing of any kind.

Compatible Software

See **www.vernier.com/manuals/orp-bta** for a list of software compatible with the ORP Sensor.

Getting Started

1. Connect the sensor to the interface (LabQuest Mini, LabQuest 2, etc.).
2. Start the appropriate data-collection software (Logger *Pro*, Logger Lite, LabQuest App) if not already running, and choose New from File menu. The software will identify the sensor and load a default data-collection setup. You are now ready to collect data.

If you are collecting data using a Chromebook™, mobile device such as iPad® or Android™ tablet, or a Vernier wireless sensor or interface, please see the following link for up-to-date connection information:

www.vernier.com/start/orp-bta

Note: Do not completely submerge the sensor. The handle is not waterproof.

Calibrating the Sensor

Optional Calibration Procedure

In most experiments done with an ORP Sensor the precise potential in mV is not critical; rather, the large change in potential is the most important factor. As a result, you should not have to perform a new calibration when using the ORP Sensor for most experiments. You can simply use the appropriate calibration that is stored with this auto-ID sensor.

If you are doing water quality testing or performing a chemistry experiment that requires a very accurate calibration, you will need two commercial ORP standards. Using these standards, perform the following calibration, using the 2-point calibration option in all Vernier data-collection programs (this calibration assumes you have two ORP calibration standards, one at 100 mV, another at 300 mV):

- For the first calibration point, rinse the tip of the electrode with distilled water, and place the electrode into the first standard. When the voltage reading displayed by the data-collection program stabilizes, enter the mV value of the first ORP standard (e.g., 100).
- For the second calibration point, remove the electrode from the first standard, rinse it with distilled water, and place it into the second standard. When the voltage stabilizes, enter the mV reading of the second standard (e.g., 300).
- Rinse the electrode with distilled water and place it into the sample. You are now ready to take measurements with the calibrated ORP Sensor.

When you are finished making measurements, rinse the electrode with distilled water. Slide the cap onto the electrode body, and then screw the cap onto the storage bottle so the tip of the electrode is immersed in the storage solution.

Specifications

ORP Electrode

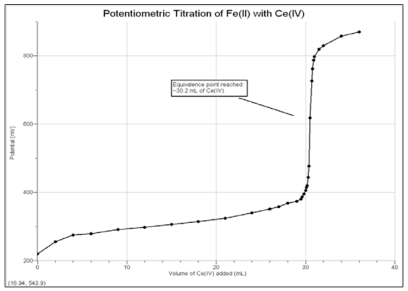
Type	Sealed, gel-filled, epoxy body, Ag/AgCl reference
Storage solution	pH-4/KCl solution (10 g KCl in 100 mL buffer pH-4 solution)
Cable	1 meter coaxial cable with BNC connector
Temperature Range	0 to 60°C 12mm OD Impedance: ~20 kΩ at 25°C
ORP element	99% pure platinum band sealed on a glass stem

Electrode Amplifier (included with each ORP Sensor)

Calibration	slope: 466.875 intercept: –559.793
Resolution	0.5 mV
Power	7 mA @ 5VDC
Input Range	–450 to 1100 mV

Suggested Experiments

The ORP Sensor can be used to perform a potentiometric titration. This is a fairly common experiment in AP Chemistry or college general chemistry classes. When a redox titration just exceeds its equivalence point volume, the potential measured by an ORP electrode will increase rapidly (if there is an excess of oxidizing agent) or decrease rapidly (with excess reducing agent), as seen in the graph below.

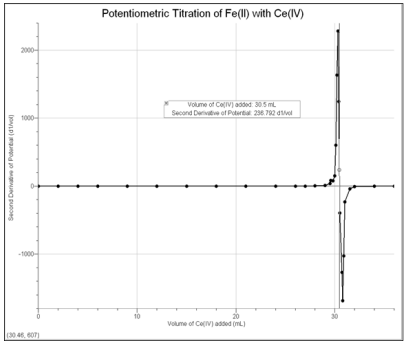


ORP titration of Fe^{2+} solution with Ce^{4+}

In the reaction for the titration curve shown previously

$$Ce^{4+} + Fe^{2}+ \rightarrow Fe^{3+} + Ce^{3+}$$

a solution containing Fe^{2+} of unknown concentration is titrated with an oxidizing agent, ~0.1 M Ce^{4+} standard solution (from $(NH_4)_2Ce(NO_3)_6$). When the equivalence point is reached, and excess Ce^{4+} is added, a large increase in potential results. By examining these data, or performing a second derivative (also shown) or Gran plot, the equivalence point of the titration can easily be determined. With Vernier Graphical Analysis 4 software, the experiment can be done in one of two ways: using the ORP Sensor in Events with Entry mode (where buret volumes are manually entered) or using the Vernier Drop Counter to measure titrant volumes.



Second derivative plot for the titration of Fe^{2+} solution with Ce^{4+}

Care and Maintenance

Do not completely submerge the sensor. The handle is not waterproof.

Do not wrap the cable tightly around the sensor for storage. Repeatedly doing so can irreparably damage the wires and is not covered under warranty.

How the Sensor Works

The electrode has two components: a *measuring* half cell comprised of platinum metal immersed in the solution in which the redox reaction is taking place, and a *reference* half cell (sealed gel-filled Ag/AgCl) to which the platinum half cell is referenced.

The Vernier ORP can measure redox potential in the range of –450 to +1100 mV. Readings toward the positive region of this range indicate a strong oxidizing agent, while readings toward the negative region indicate a strong reducing agent.

Troubleshooting

For best results when using the ORP sensor with a drop counter, add drops at a rate of one per two seconds.

For troubleshooting and FAQs, see **www.vernier.com/til/1437**

Repair Information

If you have followed the troubleshooting steps and are still having trouble with your ORP Sensor, contact Vernier Technical Support at support@vernier.com or call 888-837-6437. Support specialists will work with you to determine if the unit needs to be sent in for repair. At that time, a Return Merchandise Authorization (RMA) number will be issued and instructions will be communicated on how to return the unit for repair.

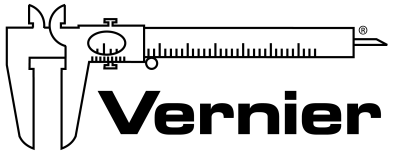
Warranty

Vernier warrants this product to be free from defects in materials and workmanship for a period of five years from the date of shipment to the customer. This warranty does not cover damage to the product caused by abuse or improper use. This warranty covers educational institutions only.

Disposal

When disposing of this electronic product, do not treat it as household waste. Its disposal is subject to regulations that vary by country and region. This item should be given to an applicable collection point for the recycling of electrical and electronic equipment. By ensuring that this product is disposed of correctly, you help prevent potential negative consequences on human health or on the environment. The recycling of materials will help to conserve natural resources. For more detailed information about recycling this product, contact your local city office or your disposal service.

The symbol, shown here, indicates that this product must not be disposed of in a standard waste container.



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