ORP Sensor

ENORP-A

Overview

The ORP sensor measures the ability of a solution to either release or accept electrons during chemical reactions. This potential is expressed in millivolts (mV) and indicates whether a solution is oxidizing (positive ORP) or reducing (negative ORP). The sensor uses a measuring electrode to detect the electrical potential of a solution. ORP sensor is widely used in water quality monitoring, environmental testing and chemical experiments. It is particularly useful in studies involving disinfection (e.g., chlorine or hydrogen peroxide), fermentation, and redox chemistry. A high ORP value typically signals strong oxidizing conditions, while a low or negative value indicates a reducing environment. The ORP sensor provides valuable information about the chemical balance and reactivity of solutions. It is an essential tool for several educational applications.

Typical experiments

Biology

- Measuring the redox state of pond water before and after adding aquatic plants (to study photosynthesis and oxygen levels).
- Monitoring ORP during fermentation (e.g., in yogurt or yeast cultures) to observe microbial activity.
- Investigating the effect of hydrogen peroxide on living tissues (e.g., a piece of potato) as a model for enzymatic breakdown (catalase activity).

Environmental Science

- Testing the water quality of different sources (tap, rain, pond, bottled) by comparing ORP levels.
- Examining the effect of pollution or detergents on water redox potential.
- Evaluating the role of plants in water purification by monitoring ORP changes over time.

Chemistry

- Studying the decomposition of hydrogen peroxide with and without catalysts like MnO_2 or baking soda.
- Comparing the ORP of different household solutions, such as bleach, vinegar, soda water, and vitamin C.
- Observing changes in ORP during oxidation-reduction reactions, such as iron corrosion or copper displacement reactions.

Sensor specification

Range:	-1500-1500 mV
Accuracy:	0.1 mV
Recommended Sampling Rate:	25 samples per second

Note: sensor cables sold separately

Required Equipment and Solutions

- pH/mV meter
- pH buffer 4.01 saturated with Quinhydrone (Solution has 2-4 hours of use life after mixing)
- pH buffer 7.00 saturated with Quinhydrone (Solution has 2-4 hours of use life after mixing)
- Wash bottle filled with de-ionized (DI) or distilled water
- Lab wipes
- Laboratory magnetic stirrer and magnetic stir bars
- Clean beakers

Storing the Electrode

Mono ORP electrodes should be stored clean and dry. Combination ORP electrodes should always remain immersed in storage solution. When storing for long periods, store the electrode in the storage bottle or boot which cames with the electrode.

Electrode Cleaning

Contamination of the sensing element often results in slow response and inaccurate readings. Clean the element by one of the following procedures:

- Inorganic Deposits: Immerse electrode tip in 0.1N HCl for 10 minutes. Rinse the tip with distilled water afterwards.
- Organic Oil and Grease Films:
    o Wash electrode tip in a liquid detergent and water.
    o After above treatment, soak the electrode tip in alcohol for 5 minutes and wipe dry.
    o Soak in quinhydrone saturated pH 4.01 for 15 minutes.
    o Rinse with distilled water.

NOTE: DO NOT ATTEMPT TO SAND OR POLISH THE SENSING ELE- MENT WITH SAND PAPER OR OTHER POLISHING MATERIAL!

Data logging and analysis

Android

1. Take your einstein™ Tablet OR pair your einstein™ LabMate with your Android or iOS tablet via Bluetooth
2. Insert the sensor cable into one of the sensor ports
3. Launch MiLABEx and then tap on LAB Start an Experiment
4. MiLABEx will automatically detect the sensor
5. Make sure the icon next to the sensor is checked to enable it for logging
6. To calibrate follow the instruction in the dedicated chapter below
7. Tap V to save the calibration and sensor selection
8. You are ready to start an experiment

Click Setup, to program the data logger's sample rate, number of samples and the measuring method.

Desktop

1. Pair your einstein™ LabMate with your PC, MAC, or Linux machine via Bluetooth, or connect it via the USB cable.
2. Insert the sensor cable into one of the sensor ports
3. Launch MiLABEx and then Click LAB Start an Experiment
4. MiLABEx will automatically detect the sensor and show it in the Current Setup Summary window

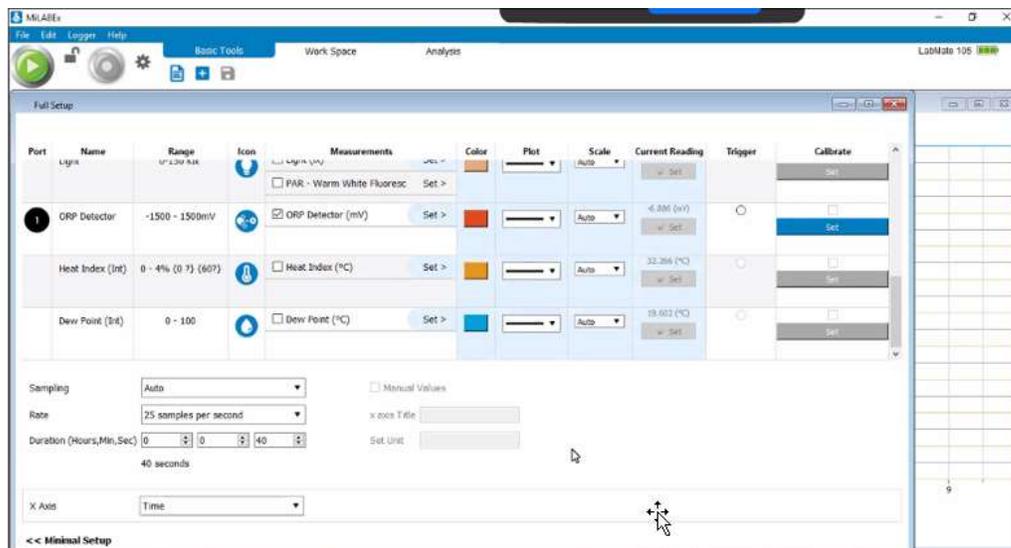5. You are ready to start the experiment.

Click Full Setup, located at the bottom of the Current Setup Summary window to program the data logger's sample rate, number of samples and the measuring method.
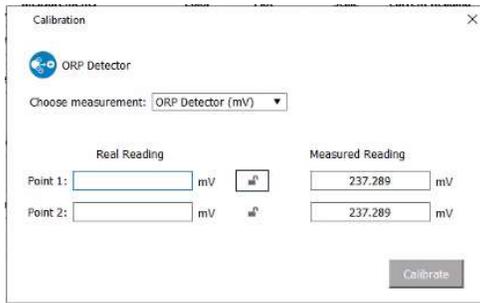
Calibration

Desktop

Two Point Calibration

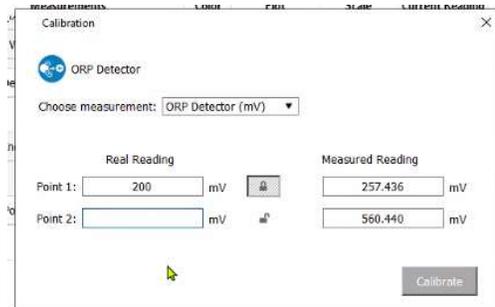1. Go to the Full Setup window and in the Calibrate column click Set

2. The Calibration window will appear

3. Insert the ORP electrode into th solution and wait for the readings to stabilize. Enter the value according to the solution and click the lock button.

4. Rinse the electrode with distilled water, blot dry. Do not rub dry.

5. Insert the ORP electrode into a different solution, wait for the readings to stabilize. Enter the relevant value. and click the lock button
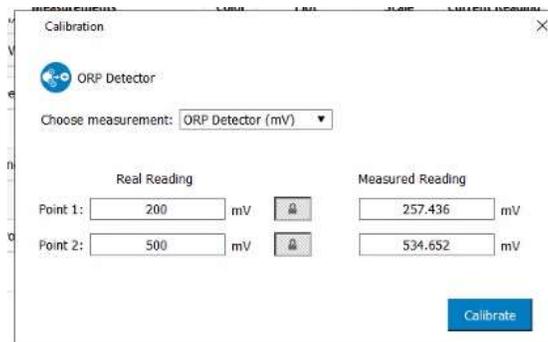
6. Click Calibrate

Android
Two Point Calibration

1. Tap on Arrow icon in the sensor selection screen
2. Tap Manual Calibration
3. Insert the ORP electrode into th solution and wait for the readings to stabilize. Enter the value according to the solution and click the lock button.
4. Rinse the electrode with distilled water, blot dry. Do not rub dry.
5. Insert the ORP electrode into a different solution, wait for the readings to stabilize. Enter the relevant value. and click the lock button
6. Click Calibrate.

An example of using the Sensor

Comparing ORP in Distilled Water, Tap Water, and Vitamin C Solution

Objective:
Comparing the Oxidation-Reduction Potential (ORP) of different water samples and observe the effect of an antioxidant (vitamin C) on ORP.

Materials:
- Fourier ORP sensor and einstein™ Tablet or LabMate with MiLABEx software
- 3 clear cups
- Distilled water
- Tap water
- Vitamin C tablet or powder
- Spoon for stirring

Procedure:
1. Fill three cups:
   o Cup 1: Distilled water
   o Cup 2: Tap water
   o Cup 3: Distilled water + dissolved vitamin C tablet
2. Connect the ORP to the MiLABEx and set the experiment on manual sampling.
3. Place the ORP sensor in Cup 1. Wait for the reading to stabilize and record the value.
4. Rinse the sensor, place it in Cup 2, and record the ORP.
5. Repeat with Cup 3 (vitamin C solution) and record the ORP.

Expected Results:
- Distilled water → ORP close to 0 mV (neutral)
- Tap water → Positive ORP (typically +100 to +300 mV)
- Vitamin C solution → Low or negative ORP (reducing environment)

Conclusion:
Vitamin C, a known antioxidant, lowers the ORP of the solution, indicating a shift toward a reducing environment.

Troubleshooting

checking the electrode Operation

1. Connect the ORP electrode to the input connector on the pH/mV meter. Ensure the electrode connection is secure.
2. Place the electrode into a beaker containing quinhydrone saturated pH 7.00 buffer. Stir gently. The mV reading E1 should be 86 ± 20 mV.
3. Remove the electrode from the buffer. Rinse with DI water and blot with a lab wipe.
4. Place the electrode into a beaker containing quinhydrone saturated pH 4.01 buffer. Stir gently. Record the mV reading E2. The difference between E2 and E1, (E2-E1), should be 175 ± 20 mV. Alternatively, use other ORP Check Solutions such as Zobells Solution (230+ 20mV) for this step

Reading a Sample with the Electrode
1. Rinse the electrode with DI water and blot with a lab wipe.
2. Place the electrode in a beaker containing the sample and a stir bar. Stir as before.
3. Record the mV reading when the reading is stable.

Technical support

For technical support, you can contact the Fourier Education's technical

support team at: Web: www.einsteinworld.com/support
Email: support@fourieredu.com

Copyright and Warranty

All standard Fourier Systems sensors carry a one (1) year warranty, which states that for a period of twelve months after the date of delivery to you, it will be substantially free from significant defects in materials and workmanship.

This warranty does not cover breakage of the product caused by misuse or abuse.

This warranty does not cover Fourier Systems consumables such as electrodes, batteries, EKG stickers, cuvettes and storage solutions or buffers.