

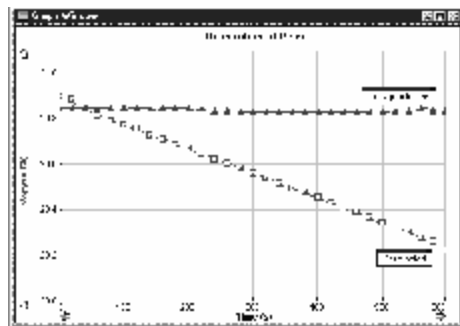
O₂ Gas Sensor

(Order Code 02-BTA or 02-DIN)

The Vernier O₂ Gas Sensor is used to monitor gaseous oxygen levels in a variety of biology and chemistry experiments. The O₂ Gas Sensor can be used for the following experiments:



- Monitor human respiration during exercise.
- Measure concentration of oxygen gas generated during decomposition of hydrogen peroxide by catalase.
- Monitor changes in oxygen concentration during photosynthesis and respiration of plants.
- Monitor respiration of animals, insects, or germinating seeds.
- Monitor oxidation of metals such as iron.
- Monitor consumption of oxygen by yeast during respiration of sugars.



Cell Respiration of Germinated Peas

The O₂ Gas Sensor is designed for use with the following interfaces:

- Vernier LabPro[®] (for use with computers, TI graphing calculators, or Palm OS[®] handhelds)
- Go![™] Link
- Texas Instruments CBL 2[™] or original CBL[™] System
- Universal Lab Interface (ULI)
- Serial Box Interface

Inventory of Items Included with the O₂ Gas Sensor

Check to be sure that each of these items is included with your O₂ Gas Sensor:

- O₂ Gas Sensor
- 250 mL gas sampling bottle (Nalgene bottle with lid)
- O₂ Gas Sensor booklet

Note: This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.

Using the O₂ Gas Sensor with a Computer

This sensor can be used with a LabPro, Go! Link, ULI, or Serial Box Interface. Here is the general procedure to follow when using the O₂ Gas Sensor with a computer:

1. Connect the O₂ Gas Sensor to any of the analog ports on LabPro (in most cases, Channel 1 is used) or to Go! Link, a ULI or SBI.
2. Start the Logger Pro[®] or Logger Lite[™] software on a computer.
3. You are now ready to collect data. Logger Pro or Logger Lite will identify the O₂ Gas Sensor and load a calibration. Click on Collect and begin collecting data.
4. If you are using Logger Pro software, an alternative to Step 3 is to open an experiment file in the Logger Pro Probes & Sensors folder.

Using the O₂ Gas Sensor with TI Handhelds

This sensor can be used with a TI graphing calculator and any of the following lab interfaces: LabPro, CBL 2, or the original CBL system.

1. Using LabPro or CBL 2 and the DataMate program:
 - a. Connect the TI graphing calculator, interface, and O₂ Gas Sensor.
 - b. Start DataMate, and the O₂ Gas Sensor will be identified automatically.¹
 - c. You are now ready to collect data.
2. Using the original CBL and the CHEMBIO program:
 - a. Connect the TI graphing calculator, interface, and O₂ Gas Sensor.
 - b. Start CHEMBIO. **Note:** If the date on the opening screen is older than September 2002, you will need to download a newer version from www.vernier.com.
 - c. Choose SETUP PROBES, enter the number of probes, and then choose OXYGEN SENSOR. You are now ready to collect data

Using the O₂ Gas Sensor with Palm OS Handhelds

This sensor can be used with a Palm OS handheld and the LabPro.

1. Connect the Palm OS handheld, LabPro, and the O₂ Gas Sensor.
2. Start Data Pro.
3. Tap New, or choose New from the Data Pro menu. Tap New again. The O₂ Gas Sensor will be identified automatically.²
4. You are now ready to collect data.

How the O₂ Gas Sensor Works

The Vernier O₂ Gas Sensor measures the oxygen concentration in the range of 0 to 27% using an electrochemical cell. The cell contains a lead anode and a gold cathode immersed in an electrolyte. When oxygen molecules enter the cell, they get

¹ If your system does not support auto-ID, choose SETUP and set up an experiment.

² If your sensor does not auto-ID, tap Setup and set up an experiment.

electrochemically reduced at the gold cathode. This electrochemical reaction generates a current that is proportional to the oxygen concentration between the electrodes. The current is measured across a resistance to generate a small voltage output. The voltage output is conditioned and read by a Vernier interface or the CBL System.

IMPORTANT: The O₂ Gas Sensor must be stored upright when not being used. This is necessary to maintain the sensor. Failure to store upright will reduce the life of the sensor.

Do I Need to Calibrate the O₂ Gas Sensor?

For many measurements, it will not be necessary to calibrate the O₂ Gas Sensor. We have set the sensor to match our stored calibration before shipping it. You can simply use the appropriate calibration file, which is stored in your data-collection program from Vernier.

For more accurate measurements, the sensor can be calibrated at 0 and 20.9% oxygen. Follow the normal 2-point calibration procedure. For the first point, push and hold the zero button located on the top of the sensor. Enter a value of 0 for this reading. Release the button and take a second reading. Enter a value of 20.9% oxygen or a corrected value from the table below. Once finished, the sensor should now read 20.9 (or the value entered from the table below) while resting in the gas sampling bottle. To calibrate in parts per thousand, multiply the second value by 10 (for example, you would enter 209 instead of 20.9).

If your O₂ Gas sensor is several years old, you may see readings in air that are considerably lower than 20.9%. This does not mean the sensor is no longer functional; rather, it simply requires that you perform the easy two-point calibration described in the previous paragraph.

Atmospheric Considerations

Because the % of oxygen varies with the amount of water vapor in the atmosphere, you may want to adjust your atmospheric oxygen calibration value to improve accuracy when using the O₂ Gas Sensor. The accepted value of 20.9% for atmospheric oxygen levels is calculated in dry air (0% humidity). If you know the relative humidity of the location at which you are calibrating, you can substitute one of the values below in place of 20.9%.

Relative Humidity	0%	25%	50%	75%	100%
Oxygen in % by volume	20.9	20.7	20.5	20.3	20.1

Specifications

Measurement Range of O ₂ Gas Sensor	0%-27%
Accuracy (@ Standard Pressure 760 mmHg)	+/- 1% volume O ₂
Resolution	12 bit (ULI, Serial Box, LabPro) = 0.01% 10 bit (CBL, CBL2) = 0.04%
Response Time	~12 seconds to 90% of final value
Warm-Up Time	Less than 5 seconds to 90% of final value
Pressure Effect	Directly proportional $V_{out} = V_{out}(\text{standard}) \times (P/1013)$ Pressure range: 0.5 atm to 1.5 atm
Output Signal Range	0 to 4.8 VDC, 2.7 to 3.8 VDC @ 21% O ₂
Output Impedance	1 K
Input Voltage	5 VDC +/-0.25 VDC
Gas Sampling Mode	Diffusion
Operating Temperature Range	5 to 40°C
Operating Humidity Range	0 to 95% RH
Storage Temperature Range	-20 to +60°C
Dimensions	Sensor Tube: 76 mm length (32 mm largest OD)

Suggested Experiments

Experiments for the O₂ Gas Sensor can be found in our *Biology with Computers*, *Biology with Calculators*, and *Science with Handhelds* lab books. Experiments include:

- Photosynthesis and Respiration
- Enzyme Action
- Cell Respiration
- Oxygen Gas and Human Respiration
- Effect of Temperature on Cold-Blooded Organisms

Tips

- Even though the sensor responds rather quickly to changes in O₂ concentration, remember that gas has to diffuse into the electrochemical cell located at the top of the sensor shaft before any changes in concentration can be detected. Since diffusion of gases is a fairly slow process, there can be some delay in readings. This is especially important to keep in mind when using this sensor with the CO₂-O₂ Tee.
- To collect data in a controlled environment, we recommend that you use the 250 mL Nalgene collection bottle that is included with your sensor. Place the tip of the sensor into the opening of the bottle and push the sensor into the bottle. When the sensor will go no further, you have a seal. **Very important:** Do not place the sensor into any liquid. The sensor is intended only for measuring *gaseous*, not aqueous, O₂ concentration.
- The O₂ Gas Sensor must be stored upright when not being used. This is necessary to maintain the sensor. Failure to store upright will reduce the life of the sensor.

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 sensor is equipped with circuitry that supports auto-ID. When used with LabPro, Go!Link, or CBL2, the data collection software identifies the sensor and uses pre-defined parameters to configure an experiment appropriate to the recognized sensor. This greatly simplifies the setup procedures for many experiments. Auto-ID is required for the Quick Setup feature of LabPro and CBL2 when the unit operates remotely from the computer or calculator. If you purchased an O₂-DIN to connect to the sensor to a ULI or Serial Box Interface, the auto-ID feature is not supported in these interfaces.



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Rev. 6/21/04

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