

NEULOG OXYGEN LOGGER SENSOR GUIDE



NeuLog oxygen logger sensor NUL-205

The oxygen sensor can be used for any science experiment or activity where oxygen levels, dissolved or gaseous, are required. Some fields of study include Chemistry, Physiology, Exercise Science, Biochemistry, Biology, Earth Science, Environmental Science, etc.

Just a few of the thousands of possible experiments that can be done with the NUL-205 sensor are: Monitoring of ecological systems, combustion reactions, oxygen consumption rates, studying photosynthesis, testing chemical solutions, hydrogen peroxide decomposition, and many more.

This sensor is practical for testing both in school laboratories and in the field and has two modes of operation: open air mode to test gaseous oxygen concentration (percentage of oxygen in the air), and dissolved oxygen mode for the testing of liquids (mg/L and percentage dissolved oxygen in a liquid)

Units of measure this sensor measures are:

- % oxygen concentration in air: The concentration of gaseous oxygen present in the sample.
- Mg/L: Total mass of dissolved oxygen per liter of a given liquid sample.
- % oxygen in water: The percentage of dissolved oxygen present out of an entire liquid sample.

Sensor usage and storage:

Prior to use:

1. Remove the blue rubber cap from the NeuLog oxygen probe.
2. Unscrew the tip-end membrane cap of the probe, inside you will see a metal electrode.
3. Add 1mL of the "DO Filling Solution" directly into the tip-end which was just unscrewed.
4. Carefully reattach the tip-end of the probe by screwing it back into the probe.

5. Do not replace the blue rubber cap until after testing.

Storage:

Short-term (less than 24 hours):

For short term storage, fill a beaker with enough distilled water to cover the membrane cap of the oxygen probe. With the membrane cap still attached to the probe, place it tip side down in the distilled water. This easy storage method is ideal for short term storage, between trials or up to 24 hours.

Long-term (more than 24 hours):

1. Unscrew the membrane cap from the oxygen probe.
2. Discard the DO filling solution from the membrane cap.
3. Rinse the cap with distilled water and gently shake to air dry.
4. Rinse and dry the exposed metal electrode with distilled water; it can be dried with lab wipes.
5. For storage purposes: Loosely reattach the membrane cap to the oxygen probe.

Sensor calibration:

The NeuLog oxygen sensor does not need to be calibrated prior to each use because the prior calibration settings are stored in the sensors software. We recommend recalibrating prior to discrete data collection such as reading the specific oxygen content of water samples.

Open air mode:

The oxygen sensor needs to be calibrated before use. Calibration of the probe assumes a standard atmospheric oxygen concentration of 20.9% (assuming stable levels in the Earth's atmosphere at sea level). The simplest calibration is to hold the button on the oxygen sensor down for 3-4 seconds.

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Materials Needed:

- NUL-205 oxygen sensor
- 1 of the following (depending on experiment type)
 - USB-200 USB Module (*For On-line experiments*)
 - BAT-200 Battery (*For Off-line experiments*)
 - VIEW-101 Viewing Module and BAT-200 Battery (*For use with Neulog Viewer*)

Procedure:

1. The oxygen Sensor needs a voltage source to properly calibrate so connect the oxygen Sensor to:
 - a. **For On-line experiments:** USB-200 USB Module.
 - b. **For Off-line experiments:** BAT-200 Battery
 - c. **For use with the Neulog Viewer:** VIEW-101 Viewing Module and BAT-200 Battery.
2. The sensor now needs to be calibrated:
 - a. **For On-line experiments:**
 - i. Connect the oxygen Sensor to the left side of a USB-200 Module (which is connected to a computer via the USB to mini USB cable.)
 - ii. Open the Neulog software
 - iii. Once the oxygen sensor is detected click the “Module setup” button.
 - iv. Remove the blue rubber cap from the oxygen probe.
 - v. Hold the probe so that the sensing tip is facing the ground.
 - vi. Click the “reset” button to automatically calibrate the sensor.
 - b. **For Off-line experiments and for use with Neulog Viewer:**
 - i. Remove the blue rubber cap from the oxygen sensor.
 - ii. Press and hold the oxygen sensor’s push button for 3 seconds while pointing the blue rubber tip towards the ground.
3. The oxygen sensor is now calibrated for use.

Dissolved oxygen mode:

1. Connect the oxygen sensor to a PC, tablet, or smartphone and open the appropriate NeuLog software (follow the guides below for more instruction).
2. Click the “Module setup” button on the oxygen sensor’s icon.
3. Set the units to “%/liquid”
4. Remove the blue rubber cap from the oxygen sensor.
5. Submerge the sensor in water.
6. Saturate the water with oxygen using an air pump (manual or electric).
7. While holding the probe with the blue rubber tip facing down. Press and hold the sensor’s “Start/Stop” button for 3 seconds or click the “Calibrate” button in the software (if still connected), this will calibrate the sensor to 100%.

Quick start procedure:

PC or Mac Computer

Materials needed:

- NUL-205 Oxygen Sensor
- USB-200 USB Module
- A USB to mini USB cable (which comes with the USB-200)

Prior to initial use the Neulog oxygen sensor needs to be calibrated, please review the “Sensor calibration” section of this document starting on page 2 for detailed instructions. Connect the oxygen Sensor to a USB-200 Module. The USB-200 Module then connects to a computer via USB to mini USB cable. Please note that you cannot plug the oxygen probe directly to the computer.

Resident PC software or browser base software can be downloaded for free at www.neulog.com/download as well as a full software user guide. Make sure not to download and install both types of software as they will conflict on the computer.

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Procedure:

1. Install the Neulog software
2. Connect the USB-200 Module to the PC or Mac
3. Connect the oxygen Sensor to the USB-200 Module (they directly plug together).
4. Open the Neulog software.
5. Once the oxygen Sensor logo appears on the left side of the screen the probe has been automatically identified and you can begin experimentation.
6. If the oxygen sensor is not automatically identified then click the search sensors icon to find the sensor.
7. Select the "On-line experiment" button; this will open a graph below.
8. Click on the "Module setup" button located on the oxygen sensor icon in the Module window to change the oxygen probe settings if need be. (open air or dissolved oxygen mode for example)
9. Click on the "experiment setup" button to change the experiment settings if need be (Experiment duration for example).
10. Remove the blue rubber cap on the end of the oxygen probe.
11. The oxygen sensor will give a live reading in the box to the left of the screen when running.
12. To run an experiment and collect data click "Run experiment".
13. To end data collection early, click "Stop experiment"

Tablet, smart phone device

Materials needed:

- NUL-205 Oxygen Sensor
- WIFI-201 WIFI module
- BAT-200 Battery

Prior to initial use the Neulog oxygen Sensor needs to be calibrated, please review the "Sensor Calibration" section of this document for detailed instructions. Your oxygen sensor needs to be connected to a WIFI-201 Module. The WIFI-201 Module will create a closed Neulog wifi network which will stream the Neulog data to a device of your choosing. Once your device is wirelessly connected to the Neulog network you can run experiments and collect data through a browser of your choosing.

Procedure:

1. Calibrate the oxygen sensor. (Follow the 'Sensor Calibration" guide in this document)
2. Connect the oxygen sensor directly to the left side WIFI-201 (no wires required).
3. Connect BAT-200 to the right side of the WIFI-201
4. Although not required, we recommend plugging the BAT-200 to an outlet using a USB to micro USB charger (such as a typical cell phone charger). The wifi201 will run for X minutes (depending on the sensor) without being plugged in.
5. For further WIFI-201 instructions or the WIFI-201 quick start guide please visit www.Neulog.com/download.
6. The WIFI-201 indicator lights will flash; take no action until the LED to the far left turns blue.
7. Take your tablet or smart phone and go to Wi-Fi settings and select the Neulog network which matches the WIFI Module ID found on the back of the WIFI-201 device. (NeuLogXXXX for example)
8. Give your device 1-2 minutes to connect to the WIFI-201.
9. Once the device is connected go to your browser and type the website wifi201.com into the URL, then wait for 30-60 seconds.
10. You will see a "Control mode" icon in the browser, click on this icon.
11. The browser will then load a new screen and begin to auto detect the sensors, this can take a few minutes.
12. If the browser does not auto detect, select "Search for Sensors"
13. Once the sensor is found you will see an icon on the left side of the screen for the oxygen sensor. The icon will display real time data.
14. To set the oxygen Probe settings click on the "Module setup" button located on the oxygen Sensor icon on the left side of your screen (open air or dissolved oxygen mode for example)
15. To change the experimental settings click on the "Experiment settings" button (Experiment duration for example).
16. Remove the blue rubber cap on the end of the oxygen probe.
17. To run an experiment and collect data select "On-Line" experiment, then select run.

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Operation with NeuLog viewer

Prior to initial use the NeuLog oxygen sensor needs to be calibrated, please review the "Sensor Calibration" section of this document for detailed instructions.

Materials needed:

- NUL-205 Oxygen Sensor
- VIEW-101 Viewing Module
- BAT-200 Battery

Procedure:

1. Calibrate the oxygen sensor. (Follow the 'Sensor Calibration' guide in this document)
2. Connect the oxygen sensor to the left side of the viewer.
3. Connect the BAT-200 to the right side of the viewer.
4. The VIEW-101 will auto detect the sensor and you will see it appear on the left side of the screen.
5. Once the sensor appears it will be monitoring data in real time.
6. Remove the blue rubber cap on the end of the oxygen probe.
7. To run an experiment and collect data click the run button (little green person)

Off-line experiments

(Off-line experiments are for when you do not have a sensor connected directly to a computer, tablet, smartphone, or NeuLog viewer).

Materials needed:

- NUL-205 Oxygen Sensor
- BAT-200 Battery

Materials needed to configure your offline experiment:

- USB-200 USB Module or WIFI-201 WIFI module or VIEW-101 Viewing Module
- A USB to mini USB cable (which comes with the USB-200)

Procedure:

1. Calibrate the oxygen sensor. (Follow the 'Sensor Calibration' guide in this document.
2. Connect oxygen sensor directly to the left side of the charged BAT-200 Module
3. Remove the blue rubber cap on the end of the oxygen probe.
4. When ready to collect data press the "Start/Stop" button on the oxygen Sensor, a red light will turn on for the duration of the experiment.
5. To change the experiment settings first connect to your chosen device (PC, Mac, tablet, smart device) and select the "Module setup" button. (For more information on how to change experiment settings view quick start procedure section for your chosen device in this document.)
6. After the experiment has concluded (when the "Start/Stop" button is pressed again or the data collection period ends) connect the sensor to your chosen device. (full instructions in each device's quick start procedure section)
7. Open NeuLog software.
8. Click the "Off-line experiment" button.
9. Click the "Load data from sensors" button.
10. Select which experimental data to upload. (5 experimental runs can be stored at one time on the NUL-205 oxygen Sensor)

Restoring sensor's factory default settings:

Procedure:

1. Connect the USB-200 to a PC, Mac, tablet, or smart device.
2. Connect the oxygen sensor to a USB-200 module (they directly plug together).
3. Open the NeuLog software.
4. Click the "Tools" icon.
5. Click "Restore sensor's factory defaults" icon.
6. If prompted to clear the graph, click either the "Off-line experiment" or "On-line experiment" (whichever you are using).
7. Click "Clear experiment results".
8. Resume from step 4.

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Included with sensor:

- NeuLog NUL-205 Oxygen Sensor Guide (this document).
- Neulog oxygen sensor probe which is attached to the sensor body by a durable rubber-coated wire.
- 30mL oxygen sensor filling solution.
- Replacement membrane cap for the oxygen sensor.

Sensor specifications			
	In air	Dissolved (%)	Dissolved (mg/L)
Range and operation modes	0 to 25%	0 to 125%	0.01 mg/L
ADC resolution	12 bit		
Resolution	0.01%	0.01%	0.01 mg/L
Max sample rate (S/sec)	100		

Sensor features:

- Fully digital data.
- Rugged plastic ergonomic case.
- Push button switch for Start/Stop experiments in off line mode.
- LED indicator of experiment status (blinks while collecting data).
- Attached probe cased in durable plastic.
- **Note:** Neulog products are intended for educational use.

Videos and experiment examples:

- Videos, literature and other probes can be found at www.neulog.com
- <http://www.neulog.com/Products/oxygenloggerSensor.aspx>
- **Respiration** - <http://www.neulog.com/Portals/3/Users/Experiment B-3 Respiration Ver 3.2.5.pdf>
- **Combustion** - www.neulog.com/Portals/3/Users/Experiment C-5 Combustion Ver 3.35.pdf

Gas solubility –

<http://www.neulog.com/Portals/3/Users/Experiment C-6 Gas Solubility Ver 3.2.4.pdf>

Technical background:

The philosophy behind Neulog's plug and play technology is based on each sensor's ability to store its own data due to an internal flash memory chip and micro-controller in each plastic Neulog body. This technology allows the sensor to collect and then store the digital data in the correct scientific units ($^{\circ}\text{C}$, $^{\circ}\text{F}$, Lux, %, ppm, for example).

The sensor needs to be calibrated prior to initial use, please review the "Sensor Calibration" guide in the beginning of this document for detailed instructions.

An electrochemical cell, containing a lead anode and a gold cathode which are submerged in electrolytes, reacts with oxygen molecules as they enter the cell. The oxygen is reduced at the gold cathode (meaning it donates spare electrons) to create a measurable electrical current. The strength of the current is directly proportional to the amount of oxygen being reduced. Based on the current strength, the oxygen concentration can be easily calculated

Maintenance and storage:

- Never submerge the Neulog sensor's plastic body in any liquid.
- Do not allow liquid into the Neulog plastic body.
- After using the probe wipe off all excess material, liquid or residue from the oxygen probe body.
- Store in a box at room temperature out of direct sunlight.
- Do not put the plastic case, or cord of the oxygen probe in an acids or bases.
- Store the oxygen sensor's probe upright with the blue rubber tip pointing downward.
- Do not use the sensor in acid or alkaline solutions with a molarity greater than 1.0.

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Warranty:

We promise to deliver our sensor free of defects in materials and workmanship for a period of 3 years from the date of purchase. Our warranty does not cover damage of the product caused by improper use, abuse, or incorrect storage. Sensors with a shelf life such as ion selective probes have a warranty of 1 year. Should you need to act upon the warranty please contact your distributor. Your sensor will be repaired or replaced.

Thank you for using NeuLog!



Flexible, simple, fast, forward thinking.

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