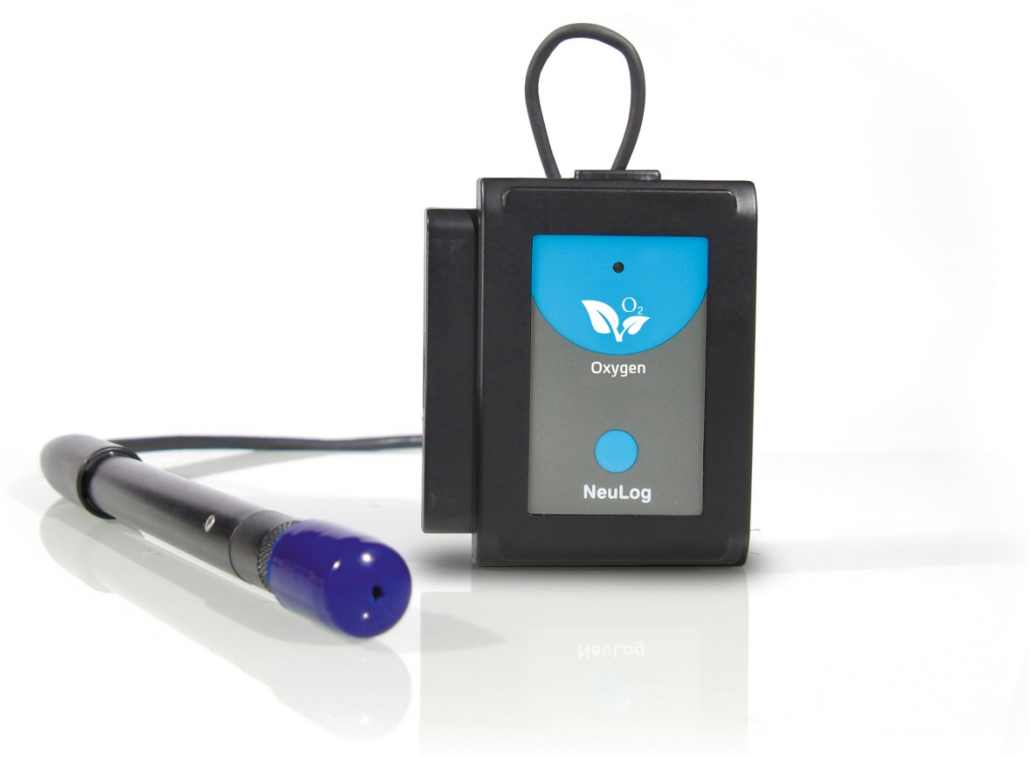
NeuLog

NeuLog Oxygen Logger Sensor Guide NUL-205



NeuLog oxygen logger sensor NUL-205

The NeuLog oxygen sensor can be used for any science experiment where oxygen levels, dissolved or gaseous, are required. It is used in the fields of Chemistry, Physiology, Exercise Science, Biochemistry, Biology, Earth Science, Environmental Science, etc.

The sensor comes pre-calibrated so you can start experimentation right out of the box using this guide.

Among hundreds of possible experiments that can be performed with the NUL-205 sensor are: monitoring of ecological systems, combustion reactions, and oxygen consumption rates, studying photosynthesis, testing chemical solutions and hydrogen peroxide decomposition, and oxygen solubility.

This sensor is practical for testing in school laboratories as well as 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 of dissolved oxygen in a liquid).

The measurement units for this sensor are:

- Oxygen % 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 versus the maximum level of oxygen saturation.

Sensor's usage and offset

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 1 mL (half of the cap) 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 (do not over tighten).
5. Do not replace the blue rubber cap until after testing.

Although the NeuLog oxygen sensor does not need to be calibrated prior to each use, it is recommended to offset its probe.

Open air mode:

Offset of the probe assumes a standard atmospheric oxygen concentration of 20.9% (assuming stable levels in the Earth's atmosphere at sea level).

1. Connect the oxygen sensor to a voltage source (USB-200, BAT-200, WIFI-201).
2. Wait about 5 minutes after connecting the sensor to the voltage source before you offset the sensor. For a more accurate measurement, look at the module window and wait for the reading to stabilize (it could take a little longer).
3. Press and hold the oxygen sensor’s push button for 3 seconds.

Dissolved oxygen mode:

Inserting air into water with an air pump or a 50 ml syringe will saturate the water to 100% of its capacity in the specific temperature of water you are working in (using an air pump will get more accurate readings).

1. Connect the oxygen sensor to a voltage source (USB-200, BAT-200, WIFI-201).
2. Submerge the sensor in water. Make sure that the internal metal thermistor that is 4.5 cm above the oxygen probe's tip is also submerged in the water. Use water with the same temperature for offsetting and for further readings (oxygen is less soluble in high temperatures).
3. Wait about 5 minutes after connecting the sensor to the voltage source before you offset the sensor. For a more accurate measurement, look at the module window and wait for the reading to stabilize (it could take a little longer).
4. Saturate the water with oxygen using an air pump or a 50 ml syringe.
5. If you are in the "mg/L" mode, wait until you do not see any change in the oxygen concentration. This means that you pumped the maximum amount of air into the water (in the specific temperature you are working in).
6. Press and hold the oxygen sensor’s push button for 3 seconds. You will see that the oxygen concentration that appears on the module window changes to the concentration that correlates to the water temperature.
7. If you are in the "% in dissolved" mode, wait until you do not see any change in the oxygen percentage. This means that you pumped the maximum amount of air into the water (in the specific temperature you are working in).
8. Press and hold the oxygen sensor’s push button for 3 seconds. You will see that the oxygen percentage that appears on the module window changes to 100%.
9. When the oxygen concentration/percentage has stabilized, it means that all excess oxygen has come out of the water (as shown in the following graph).

Included with sensor

- NeuLog General Guide.
- NeuLog oxygen sensor probe attached to the sensor's body by a durable rubber-coated wire.
- 30 mL oxygen sensor filling solution (1 M KCl).
- Replacement membrane cap for the oxygen sensor.

Sensor specifications			
	In air	**Dissolved (%)**	**Dissolved (mg/L)**
Range and operation modes	0 to 27%	0 to 125%	0 to 20 mg/L
ADC resolution	13 bit		
Resolution	0.1%	0.1%	0.01 mg/L
Max sample rate (S/sec)	100		

Experiment Duration: 1 second to 31 days.

Sensor's features

- Fully digital data.
- Rugged plastic ergonomic case.
- Pushbutton switch for Start/Stop experiments in off line mode.
- LED indicator of experiment status (blinks while collecting data).
- Attached probe cased in durable plastic.
- Thermistor for temperature compensation.

Note: NeuLog products are intended for educational use.

Videos and experiment examples

- Videos, literature and other probes can be found at www.neulog.com.
- In order to access the oxygen sensor's page, choose "Products" on the main menu and then "Oxygen logger sensor".
- In order to access the oxygen sensor's experiments, choose "Example Labs":

  Respiration (B-3)
  Combustion (C-5)
  Gas Solubility (C-6)

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 (for example: ^{o}C, ^{o}F, Lux, %, ppm).

The sensor is pre-calibrated at the factory. The built-in software in the logger can be upgraded for free at any time using the provided firmware update. In spite of that, the probe needs to be offset prior to initial use. Please review the "Sensor offset" guide at the beginning of this document for detailed instructions.

The sensor is based on a Clark type probe that includes a platinum electrode and an AgCl electrode placed in a KCl electrolyte; all is covered by a Teflon membrane.

Oxygen molecules diffuse through the membrane oxidizing the AgCl electrode; this accepts positive potential while the electrolyte accepts negative potential according to the following equations:

$2AgCl \rightarrow 2AgCl^{+} + 2e^{-}$
$O + H_2O + 2e^{-} \rightarrow 2OH^{-}$

The potential difference of the electrodes is converted into an oxygen measurement by the sensor's controller using the temperature compensation calculation.

The sensor offset process also depends on the internal temperature readings.

Maintenance and storage

Short-term storage (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 its tip side down in the distilled water. This easy method is ideal for short term storage, between trials for up to 24 hours.

Long-term storage (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.

Maintenance:

- 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. Do not leave the membrane cap with filling solution for more than two days.
- 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 acid or base.
- 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.

Warranty

We promise to deliver our module free of defects in materials and workmanship for a period of 2 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 module will be repaired or replaced.

Thank you for using NeuLog.