

NEULOG NITRATE LOGGER SENSOR GUIDE



NeuLog nitrate logger sensor NUL-241

The NeuLog nitrate ion sensor can be used for any science experiment or activity which can utilize nitrate concentration readings such as in the fields of Environmental Science, Ecology, Chemistry, Biology, etc.

Just a few of the thousands of possible experimental subjects that can be done with the NUL-241 sensors are: chemical reactions, water quality, environmental health, small animal behavior, ecological studies, and many more

The nitrate sensor uses the following units of measure:

- Milligrams per liter (mg/L): SI unit of measure for density of a solid dissolved in a liquid.
- Parts per million (ppm): The total amount of a specific molecule (nitrate for example) per million molecules in a sample.

Nitrate sensor usage:

The nitrate sensor's electrode uses a PermaFil (non-refillable), ion-selective electrode. The reference chamber is gel filled and sealed and therefore no reference fill solution is required.

Usage guide:

Concentration range	1M to 7×10^{-6} M 0.1 to 14,000 ppm as N
pH range	2.5 to 11 pH
Temperature range	0 to 50°C
Minimum sample size	3mL in a 50 mL beaker
Reproducibility	±4%
Electrode resistance	1 to 4 megaohms

Required equipment:

- Wash bottle with distilled or deionized water.
- Several clean beakers.
- 1 mL, 10 mL, and 100 mL pipettes.

Technical notes:

- All standard solutions should be prepared fresh.
- The standards should be at the same temperature as the sample.
- Use ISA in all solutions.
Note: ISA is added to all solutions to ensure the samples and standards have the same ionic strength. The ratio is 1:50

Electrode preparation:

1. Remove the protective cap encasing the nitrate probe's electrode. **CAUTION: Do not touch the PVC membrane at the end of the probe with your fingers**
2. Rinse the electrode with deionized water and blot dry. Be sure not to rub as this will harm the sensor.
3. Soak the electrode in deionized water for 10 minutes, then in a diluted nitrate standard solution (either 0.0001 M or 1 ppm) until ready for use.

Calibration:

Be sure to calibrate the nitrate sensor once daily during periods of regular usage.

1. Prepare the electrode as described in the "Electrode preparation" guide above.
2. Place 97 mL of deionized water into a 150 mL beaker.
3. Add 2 mL of Ionic Strength Adjustor (ISA) (comes with sensor).
4. Rinse the electrode with deionized water and blot dry and place in the 150 mL beaker.
5. Pipette 1 mL of 1000 ppm nitrate standard solution (comes with sensor) and stir thoroughly.
6. In the NeuLog software, once the sensor has been detected, click on the nitrate sensor icon.
7. After a stable reading has been reached, click on the calibrate button, or hold the "Start/Stop" button located on the sensors faceplate down for 4 seconds.
8. Rinse electrode once more with deionized water and blot dry.
9. The nitrate sensor is now calibrated and ready for use.

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Electrode storage:

Short term (overnight or weekend):

Rinse the electrode thoroughly with deionized water and place the tip in a diluted standard solution (around 10 ppm) between measurements

Long term:

Rinse the electrode thoroughly with deionized water and blot dry. Attach the hard plastic protective electrode cap again to protect the sensing element.

Quick start procedure:

PC or Mac Computer

Materials needed:

- NUL-241 Nitrate Sensor
- USB-200 USB Module
- A USB to mini USB cable (which comes with the USB-200)

Before use, please review the "Nitrate sensor usage", "Electrode preparation", "Electrode storage", and "Calibration" sections of this document above to ensure the proper use and longevity of the NeuLog nitrate ion sensor.

Your nitrate sensor needs to be connected to a USB-200 module. The USB-200 module then connects to a computer via a USB to mini-USB cable. Please note that you cannot plug the nitrate sensor directly into the computer.

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

Procedure:

1. Install the NeuLog software
2. Connect the USB-200 module to the PC or Mac
3. Connect the nitrate sensor to the USB-200 module (they directly plug together).
4. Open the NeuLog software.

5. Once a nitrate sensor logo appears on the left side of the screen the probe has been automatically identified and you can begin experimentation.
6. If the nitrate sensor is not automatically identified then click the "Search for 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 nitrate sensor icon in the module window to change the sensor settings if need be.
9. Click on the experiment set up button to change the experiment settings if need be (experiment duration for example).
10. The nitrate sensor will give a live reading in the box to the left of the screen while plugged in.
11. To run an experiment and collect data click "Run experiment".
12. To end data collection early, click "Stop experiment".

Tablet, smart phone device

Materials needed:

- NUL-241 Nitrate Sensor
- WIFI-201 WIFI module
- BAT-200 Battery

Before use, please review the "Nitrate sensor usage", "Electrode preparation", "Electrode storage", and "Calibration" sections of this document above to ensure the proper use and longevity of the NeuLog nitrate ion sensor.

Your nitrate 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. Connect the nitrate sensor directly to the left side of a WIFI-201 module (no wires required).
2. Connect a BAT-200 module to the right side of the WIFI-201 module.
3. 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 WIFI-201 module will run for 15-75 minutes (depending on the sensor) without being plugged in.

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4. For further WIFI-201 instructions or the WIFI-201 quick start guide please visit www.NeuLog.com/download.
5. The WIFI-201 indicator lights will flash; take no action until the LED to the far left turns blue.
6. Take your tablet or smart phone and go to the 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)
7. Give your device 1-2 minutes to connect to the WIFI-201 network.
8. Once the device is connected go to your browser and type in the website wifi201.com into the URL bar, then wait for 30-60 seconds.
9. You will see a "Control mode" icon in the browser, click on this icon.
10. The browser will then load a new screen and begin to auto detect the sensors, this can take a few minutes.
11. If the browser does not auto detect, select "Search for sensors"
12. Once the sensor is found you will see an icon on the left side of the screen for the nitrate sensor. The icon will display data in real time.
13. To set the nitrate sensor's settings click on "Module setup" button located on the nitrate sensor icon on the left side of your screen.
14. To change the experimental settings click the "Experiment setup" button (experiment duration for example).
15. To run an experiment and collect data click "Run experiment".

Operation with NeuLog viewer

Materials needed:

- NUL-241 Nitrate Sensor
- VIEW-101 Viewing Module
- BAT-200 Battery

Before use, please review the "Nitrate sensor usage", "Electrode preparation", "Electrode storage", and "Calibration" sections of this document above to ensure the proper use and longevity of the NeuLog nitrate ion sensor.

Procedure:

1. Connect the nitrate sensor to the left side of the viewer.
2. Connect the BAT-200 module to the right side of the viewer.

3. The VIEW-101 will auto detect the sensor and you will see it appear on the left side of the screen.
4. Once the sensor appears it will be monitoring data in real time.
5. 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-241 Nitrate Sensor
- BAT-200 Battery

Before use, please review the "Nitrate sensor usage", "Electrode preparation", "Electrode storage", and "Calibration" sections of this document above to ensure the proper use and longevity of the NeuLog nitrate ion sensor.

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. Connect the nitrate sensor directly to the left side of a charged BAT-200 module.
2. When ready to collect data press the "Start/Stop" button on the nitrate sensor, a red light will turn on for the duration of the experiment.
3. 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 the experiment settings view quick start procedure section for your chosen device in this document.)
4. 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)
5. Open NeuLog software.
6. Click the "Off-line experiment" button.

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7. Click the “Load data from sensors” button.
8. Select which experimental data to upload. (5 experimental runs can be stored at one time on the NUL-241 nitrate sensor)

Restoring sensor’s factory default settings:

Procedure:

1. Connect the USB-200 to a PC, Mac, tablet, or smart device.
2. Connect the nitrate 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.

Included with sensor:

- NeuLog NUL-241 Nitrate Sensor Guide (this document).
- NeuLog nitrate (NO₃⁻) sensor electrode.
- Nitrate (NO₃⁻) Ionic Strength Adjuster (ISA)
- Nitrate (NO₃⁻) 1000 ppm standard

Sensor specifications		
	Mg/L	Ppm
Range and operation modes	0.1 to 14,000	0.1 to 14,000 as N
ADC resolution	14 bit	
Resolution	0.1 at 0.1 to 1,000 mg/L 98 mg/L at 1,000 to 14,000 mg/L	1 ppm
Max sample rate (S/sec)	100	

Sensor features:

- Fully digital data.
- Rugged plastic ergonomic case.
- PermaFil ion selective electrode.
- Nitrate probe connected to the sensor body by a flexible rubber-coated wire.
- Protective hard-plastic storage cap.
- Push button switch for Start/Stop experiments in off line mode.
- LED indicator of experiment status (blinks while collecting data).
- **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/NitratelloggerSensor.aspx>

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 (°C, °F, Lux, %, ppm, for example).

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.

The nitrate sensor uses a permanently filled ion selective electrode to accurately measure the amount of nitrate ion in a solution. Nitrate ions interact directly with a specialized electrode membrane at the end of the probe. When the ions interact with the electrode’s membrane a small voltage is generated. This voltage is compared against the voltage in the internal reference electrode and measured using an internal voltmeter. Once the voltage is measured, a nitrate ion concentration is calculated using the sensors software.

The Ionic Strength Adjustor (ISA) is used to standardize the strength of the ions in various solutions to give the most accurate readings.

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Maintenance and storage:

Before use, please review the “Nitrate sensor usage”, “Electrode preparation”, “Electrode storage”, and “Calibration” sections of this document above to ensure the proper storage and longevity of the NeuLog nitrate ion sensor.

- Never submerge the NeuLog plastic body in any liquid.
- Do not allow liquid into the nitrate sensor’s body.
- After use, gently wipe away any foreign material from the nitrate sensor.
- Store in a box at room temperature out of direct sunlight.

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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