

## NEULOG SPIROMETER SENSOR GUIDE



### NeuLog spirometer logger sensor NUL-216

The NeuLog spirometer sensor can be used for any science experiment or activity which can utilize lung capacity such as in the fields of Psychology, Biology, Exercise Science, etc.

The sensor comes pre-calibrated so you can start experimentation right out of the box using any of the following guides.

Just a few of the thousands of possible experimental subjects that can be done with the NUL-216 sensors are: gas flow rates, the ideal gas law, exercise experiments, studying lung function, lung physiology, and many more.

The spirometer sensor uses the following units of measure:

- Liters per second (L/s): The amount of volume which passes through the sensor tube per second.

### Using the spirometer sensor:

The NeuLog spirometer sensor comes with laminated paper for use.

Prior to experimentation, roll a single piece of laminated paper into a tube which is then placed inside of the spirometer sensor (into the side with the wider internal opening). The paper will stick out from the metal sensor tube about one inch. By blowing into the paper instead of directly into the metal tube the sensor will remain more sanitary for later uses.

Using the software's "area" function, you can determine the total volume of your lungs easily.

### Quick start procedure:

#### PC or Mac Computer

#### Materials needed:

- NUL-216 Spirometer Sensor
- Laminated Paper (included)
- USB-200 USB Module

- A USB to mini USB cable (which comes with the USB-200)

Your spirometer 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 spirometer sensor directly into the computer.

Resident PC software and browser based software can be downloaded for free at [www.NeuLog.com/download](http://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. Prior to initial use, please review the "Using the spirometer sensor" section of the instructions starting on page 2 of this document.
2. Install the NeuLog software
3. Connect the USB-200 module to the PC or Mac
4. Connect the spirometer sensor to the USB-200 module (they directly plug together). Please note there is no calibration required for this sensor.
5. Open the NeuLog software.
6. Once a spirometer sensor logo appears on the left side of the screen the probe has been automatically identified and you can begin experimentation.
7. If the spirometer sensor is not automatically identified then click the "Search for sensors" icon to find the sensor.
8. Select the "On-line experiment" button; this will open a graph below.
9. Click on the "Module setup" button located on the spirometer sensor icon in the module window to change the sensor settings if need be.
10. Click on the experiment set up button to change the experiment settings if need be (experiment duration for example).
11. The spirometer sensor will give a live reading in the box to the left of the screen while plugged in.
12. To run an experiment and collect data click "Run experiment".
13. To end data collection early, click "Stop experiment".

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### Tablet, smart phone device

#### Materials needed:

- NUL-216 Spirometer Sensor
- Laminated Paper (included)
- WIFI-201 WIFI module
- BAT-200 Battery

Your spirometer 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. Prior to initial use, please review the “Using the spirometer sensor” section of the instructions starting on page 2.
2. Connect the spirometer sensor directly to the left side of a WIFI-201 module (no wires required).
3. Connect a BAT-200 module to the right side of the WIFI-201 module.
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 WIFI-201 module will run for 15-75 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](http://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 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)
8. Give your device 1-2 minutes to connect to the WIFI-201 network.
9. Once the device is connected go to your browser and type in the website [wifi201.com](http://wifi201.com) into the URL bar, 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 spirometer sensor. The icon will display data in real time.
14. To set the spirometer sensor’s settings click on “Module setup” button located on the spirometer sensor icon on the left side of your screen.
15. To change the experimental settings click the “Experiment setup” button (experiment duration for example).
16. To run an experiment and collect data click “Run experiment”.

### Operation with NeuLog viewer

#### Materials needed:

- NUL-216 Spirometer Sensor
- Laminated Paper (included)
- VIEW-101 Viewing Module
- BAT-200 Battery

#### Procedure:

1. Prior to initial use, please review the “Using the spirometer sensor” section of the instructions starting on page 2 of this document.
2. Connect the spirometer sensor to the left side of the viewer.
3. Connect the BAT-200 module 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. 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-216 Spirometer Sensor
- Laminated Paper (included)
- BAT-200 Battery

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### 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. Prior to initial use, please review the “Using the spirometer sensor” section of the instructions starting on page 2.
2. Connect the spirometer sensor directly to the left side of a charged BAT-200 module.
3. When ready to collect data press the “Start/Stop” button on the spirometer sensor, a red light will turn on for the duration of the experiment.
4. 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.)
5. 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)
6. Open NeuLog software.
7. Click the “Off-line experiment” button.
8. Click the “Load data from sensors” button.
9. Select which experimental data to upload. (5 experimental runs can be stored at one time on the NUL-216 spirometer sensor)

### Restoring sensor’s factory default settings:

### Procedure:

1. Connect the USB-200 to a PC, Mac, tablet, or smart device.
2. Connect the spirometer sensor to a USB-200 module (they directly plug together). Please note there is no calibration required for this sensor.
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-216 Spirometer Sensor Guide (this document).
- One package of laminated paper samples for testing.

### Sensor specifications

Range and operation modes	±10 L/s
ADC resolution	14 bit
Resolution	0.2 L/s
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).
- Pre-calibrated sensing equipment.
- Metal sensor tube attached by 2 durable rubber-coated wires.
- Two pressure sensors connected to the metal tube to accurately determine
- **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)
- <http://www.NeuLog.com/Products/SpirometerloggerSensor.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).

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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.

Inside of the NeuLog spirometer sensor's metal tube attachment there is a funnel which creates a difference in airflow speed as air passes through it. There are also two pressure sensors for detecting air flow rate before and after entering the funneling piece. Minor pressure differences before and after the funneling piece are measured and compared with each other to accurately calculate the flow of air in volume per second.

Using the NeuLog software, you can easily determine the area under the curve to calculate total lung capacity.

### Maintenance and storage:

- Never submerge the NeuLog plastic body in any liquid.
- Do not allow liquid into the spirometer sensor's body.
- After use, gently wipe away any foreign material from the spirometer 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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