

## NEULOG COLORIMETER LOGGER SENSOR GUIDE



### NeuLog colorimeter logger sensor NUL-219

The colorimeter sensor can be used for any science experiment or activity where liquid samples of different colors and concentrations are utilized such as in the fields of Chemistry, Biology, Pharmacology, Biochemistry, Environmental Science, Physics, or even just to study the behavior of light waves.

Colorimeters are used to determine absorbance of given wavelengths (generally red, green, and blue) in a liquid solution. Absorbance is directly related to the concentration of known solutes in the solution which is calculated using the Beer-Lambert law.

The sensor comes pre-calibrated and never needs to be recalibrated.

Just a few of the thousands of possible experiments that can be done with the NUL-219 sensor are: Monitoring of ecological systems, study of photosynthesis, analyzing chemical reactions, water quality testing, studying light waves, studying Beer's Law, and can take the place of a spectrophotometer in many experiments.

The NeuLog colorimeter sensor can collect data using the following units of measurement:

- %Transmittance: The amount of light that passes through a sample.
- Absorbance: The amount of light which is absorbed by a sample.

### Cuvette usage and handling:

It is important to maintain a standard for cuvette usage as their quality will directly impact the results of your experiments. If the cuvette has fingerprints, smudges, or cracks the sensor will detect them and give off an improper colorimeter reading. Smudges left from handling can easily be wiped off with tissue paper.

### Proper usage:

1. Carefully remove the cuvettes from their packaging.
2. Load your liquid sample into the cuvette before placing it into the sensor to prevent spilling and damaging the sensor.

3. Plug the cap into the cuvette and gently invert a few times. Shaking will create air bubbles which will be detected by the sensor and give an incorrect reading.
4. Before placing the cuvette in the sensor; hold the cuvette as far toward the top as you can and wipe the bottom portion of the cuvette off with a tissue. Do not touch the bottom portion of the cuvette again as this will leave a residue which will affect the results of the experiment.
5. To load the cuvette into the colorimeter sensor;
  - a. Determine which sides of the cuvette are clear and which sides have an opaque finish.
  - b. The clear opposing sides must be positioned facing the front and back of the sensor (they won't fit the other way) while the glossy sides face either side.
  - c. If the cuvette does not fit with a gentle push, rotate 90° in either direction and try again.
6. After experimentation, empty your samples and gently rinse out the cuvettes with distilled water and then let the cuvettes air-dry.

### Selecting a wavelength:

Selecting the correct wavelength is important to get the best data and can easily be determined using one of two different methods. There is no incorrect wavelength, just some which are more informative than others. Lab experiments often come with a predetermined wavelength to use. If it doesn't, follow one of these methods for the best results:

- Knowing that the color we see solutions as is based on the color which is reflected from it (and not absorbed): Choose a color you know will be absorbed. For example, if the solution is red try the blue LED option.
- Once the sensor is connected and the NeuLog software is open (follow one of the guides below for more instruction) click the "Module setup" button and try the different LED color options to determine which has the highest absorbance (which will read out in real time on the sensor's icon). Select the color which has the highest absorbance reading.

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### Quick start procedure:

#### PC or Mac Computer

##### Materials needed:

- NUL-219 Colorimeter Sensor
- Cuvettes + Cuvette Lids
- USB-200 USB Module
- A USB to mini USB cable (which comes with the USB-200)

Your colorimeter 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 colorimeter 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. Install the NeuLog software
2. Connect the USB-200 module to the PC or Mac
3. Connect the colorimeter sensor to the USB-200 module (they directly plug together). Please note there is no calibration required for this sensor.
4. Open the NeuLog software.
5. Once a colorimeter sensor logo appears on the left side of the screen the probe has been automatically identified and you can begin experimentation.
6. If the colorimeter 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 colorimeter 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 colorimeter 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-219 Colorimeter Sensor
- Cuvettes + Cuvette Lids
- WIFI-201 WIFI module
- BAT-200 Battery

Your colorimeter 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 colorimeter 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.
4. For further WIFI-201 instructions or the WIFI-201 quick start guide please visit [www.NeuLog.com/download](http://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](http://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 colorimeter sensor. The icon will display data in real time.

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13. To set the colorimeter sensor's settings click on "Module setup" button located on the colorimeter 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-219 Colorimeter Sensor
- Cuvettes + Cuvette Lids
- VIEW-101 Viewing Module
- BAT-200 Battery

#### Procedure:

1. Connect the colorimeter 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-219 Colorimeter Sensor
- Cuvettes + Cuvette Lids
- 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. Connect the colorimeter 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 colorimeter 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.
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-219 colorimeter sensor)

### Restoring sensor's factory default settings:

#### Procedure:

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

- Three plastic cuvettes with three lids.
- NeuLog NUL-219 Colorimeter sensor Guide (This Document)

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Sensor specifications		
	Transmittance	Absorbance
Range and operation modes	R.G.B.	0-4 absorbance
ADC resolution	10 bit	
Resolution	0.01%	0.01 abs.
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.
- Red, green, blue, and orange LED's for four different wavelength tests.
- Testing in both transmittance and absorbance.
- Internal photodiode for detecting light.
- **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/ColorimeterloggerSensor.aspx>
- **Beer-Lambert Law** - <http://www.neulog.com/Portals/3/Users/Experiment C-28 Beer%E2%80%93Lambert law Ver 3.0.4.pdf>
- **Color Absorption** - <http://www.neulog.com/Portals/3/Users/Experiment C-31 Color Absorption Ver 3.0.5.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 is pre-calibrated at the factory. The built-in software in the logger can be upgraded at any time using software available on the NeuLog website. Inside the

sensor's plastic body there are four LED lights (red, green, blue, orange) to test various wavelengths.

Light is transmitted from four different colored LED's inside of the sensor body, passed through the cuvette containing solution and then detected at the other end to determine the absorbance or transmittance of light at a specific wavelength. The sensor works off of Beer's Law which is explained in the above section "Beer's Law".

### Beer's Law:

Beer's Law is an extremely useful concept in solution concentration testing in the fields of Chemistry and Biology. Standard curves are created by using solutions of known concentrations which analyzed in a colorimeter to determine the absorbance then graphed. The absorption for unknown samples can easily be tested and plotted on the standard curve to determine their concentration.

### Maintenance and storage:

- Never submerge the Neulog plastic body in any liquid
- Never place anything in the colorimeter sensor's opening on the faceplate except the approved cuvettes.
- Do not allow liquid into the Neulog plastic body.
- After using the probe wipe off all excess material, liquid or residue from the colorimeter probe.
- Store in a box at room temperature out of direct sunlight.
- The cuvette handling and storage guide can be found at the beginning of this document

### 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.

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Thank you for using NeuLog!



Flexible, simple, fast, forward thinking.

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