

NEULOG HEART RATE AND PULSE LOGGER SENSOR GUIDE



NeuLog heart rate and pulse logger sensor NUL-208

The NeuLog pulse sensor can be used for any science experiment which requires a human heart rate or pulse measurement such as in the fields of Biology, Health Sciences, Physiology, Exercise Science, Psychophysiology, etc.

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

With this sensor, the heart rate can be measured in two ways, beats per minute or analog arbitrary values to demonstrate the wave signal of a heartbeat showing the blood volume in the finger or earlobe.

Among hundreds of possible experiments that can be performed with the NUL-208 sensor are: physiological experimentation, relationship between heart rate and oxygen flow, blood volume, psychological experiments which utilize heart rates, lie detection, exercise experiments, VO_2 max experiments and metabolism.

The heart rate and pulse sensor has two possible units of measurement:

Beats Per Minute (BPM): The amount of heart beats per minute.

Arbitrary analog units (Arb): An arbitrary unit meant to show wave functions.

Probe usage:

The sensor consists of an infrared LED transmitter and a matched infrared phototransistor receiver (light detector).

For best results:

- Wash hands before use.
- Clip the sensor to the little finger (pinky) or earlobe.
- For better results, place the light detector side of the clip (with a white transparent cover) on the pad of your finger, not the nail.
- Remain as still as possible until testing is complete.
- Nail polish can skew the results.
- Let the signal stabilize before reading.

Quick start procedure:

PC or Mac Computer

Materials needed:

- NUL-208 Heart Rate and Pulse Sensor
- USB-200 USB Module
- USB to mini USB cable (included with the USB-200 module)

Your heart rate and pulse 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 heart rate and pulse sensor directly into the computer.

The browser based application can be downloaded for free at www.NeuLog.com as well as a full application user guide.

Choose "Downloads" on the main menu and then choose "Software and Application".

Procedure:

1. Install the NeuLog application.
2. Connect the USB-200 module to the PC or Mac.
3. Connect the heart rate and pulse sensor to the USB-200 module (they directly plug together). Please note that no calibration is required for this sensor.
4. Open the NeuLog application by clicking on the shortcut on the screen.
5. Once a heart rate and pulse sensor module box appears on the left side of the screen the probe has been automatically identified and you can begin experimentation.
6. If the heart rate and pulse sensor is not automatically identified, click the "Search for sensors" icon to find the sensor.
7. Click on the "On-line experiment" icon; this will open a graph below.
8. Click on the "Module setup" button located in the heart rate and pulse sensor module box to change the sensor's settings if need be.
9. Click on the "Experiment setup" icon to change the experiment settings if need be (experiment duration for example).
10. The heart rate and pulse sensor will give a live reading in its module box to the left of the screen while plugged in.
11. To run an experiment and collect data click the "Run experiment" icon.
12. To end data collection early, click the "Stop experiment" icon.

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Tablet, smart phone device

Materials needed:

- NUL-208 Heart Rate and Pulse Sensor
- WIFI-201 WiFi Module
- BAT-200 Battery Module

Your heart rate and pulse 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 the 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 heart rate and pulse 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 mini USB charger (such as a typical cell phone charger). The WIFI-201 module will run for 60-90 minutes (depending on the sensor) without being plugged in.
4. The WIFI-201 can be powered directly using a mini to USB cord and plugging it into your computer or a wall charger. Please note this function is only available on WIFI-201 modules with the USB icon on the cover.
5. For further WIFI-201 instructions or the WIFI-201 quick start guide please visit: www.NeuLog.com; Choose "Products" on the main menu, then choose "WiFi Communication module".
6. The WIFI-201 indicator lights will flash; take no action until the LED to the far left turns blue; this can take up to one minute.
7. Take your tablet or smart phone, go to the WiFi settings and select the NeuLog network (NeuLog0184 for example) which matches the ID found on the back of the WIFI-201 module (0184 for example).
8. Give your device about 20 seconds to connect to the WIFI-201 module.
9. Once the device is connected, go to your browser and type the website **wifi201.com** into the URL bar, then wait for 30-60 seconds.
10. You will see a "Control mode" icon in the application, click on it.
11. The application will then load a new screen and begin to auto detect the sensor(s); this can take a minute. (You can stop the search when the sensor is found.)
12. If the application does not auto detect the sensor(s), select "Search for sensors".
13. Once the sensor is found, you will see a module box on the left side of the screen for the heart rate and pulse sensor. In this box, real time data will be displayed.

14. Click on the "Module setup" button located in the pulse sensor module box to change the pulse probe settings if need be.
15. Click on the "Experiment setup" icon to change the experiment settings if need be (Experiment duration for example).
16. To run an experiment and collect data, click on the "On-Line experiment" icon, then click the "Run experiment" icon.
17. If you have a newer generation WIFI-201 module (with the USB icon on the cover) this can be used as a USB-200, meaning you can tether the probes directly to the computer using the WIFI-201. To engage operation in this fashion, press 3 times on the panel button. Repeating this operation will return the module to WiFi mode.

Operation with NeuLog Graphic Display Module (viewer)

Materials needed:

- NUL-208 Heart Rate and Pulse Sensor
- VIEW-101 Graphic Display Module
- BAT-200 Battery Module

Procedure:

1. Connect the heart rate and pulse 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 press the run icon (little green person).

Off-line experiments

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

Materials needed:

- NUL-208 Heart Rate and Pulse Sensor
- BAT-200 Battery Module

Materials needed to configure your offline experiment:

- USB-200 Module or WIFI-201 module or VIEW-101 Module
- USB to mini USB cable (included with the USB-200)

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Procedure:

1. To determine the experiment settings, first connect to your chosen device (PC, Mac, tablet, smart device) and click on the "Off-line experiment" icon after the sensor search has ended. (For more information on how to change the experiment settings, view the quick start procedure section for your chosen device in this document.)
2. Connect the heart rate and pulse 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 heart rate and pulse sensor, a red light will turn on for the duration of the experiment.
4. After the experiment has concluded (the "Start/Stop" button is pressed again or the data collection period ends) connect the sensor to your chosen device (you can find full instructions in each device's quick start procedure section).
5. Open the NeuLog application.
6. Click the "Off-line experiment" icon.
7. Click the "Load data from sensors" icon.
8. Select which experimental data to upload (5 experimental runs can be stored at one time on the NUL-208 heart rate and pulse sensor).

Restoring sensor's factory default settings:

Procedure:

1. Connect the USB-200 to a PC, Mac, tablet, or smart device.
2. Connect the heart rate and pulse sensor to a USB-200 module (they directly plug together).
3. Open the NeuLog application.
4. Click the "Tools" icon.
5. Click the "Restore sensor's factory defaults" on the menu.

Included with the sensor:

- NeuLog NUL-208 Heart Rate and Pulse Sensor Guide (this document)
- Fingertip/earlobe clip with IR receiver transmitter

| Sensor specifications | | |
|---------------------------|------------------|--|
| | Beats per minute | Arbitrary analog units (wave function) |
| Range and operation modes | 0 to 240 | 0-1023 Analog values |
| ADC resolution | 10 bit | |
| Accuracy | | 1 |
| Resolution | 1 | 1 |
| Max sample rate (S/sec) | 100 | 100 |

Experiment Duration: 1 second to 31 days.

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
- Pulse sensing electrodes located in the probe clips attached directly to the sensor's plastic body

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 heart rate and pulse sensor's page, choose "Products" on the main menu and then "Heart rate and pulse".
- In order to find the science experiments, choose "Experiments" on the main menu of the NeuLog website, then choose "Physics", "Chemistry", "Biology" or "Environmental Science".

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- Biology Experiments:
 - Heart Rate and Coughing (B-18)
 - Heart Rate and Physical Activity (B-19)

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.

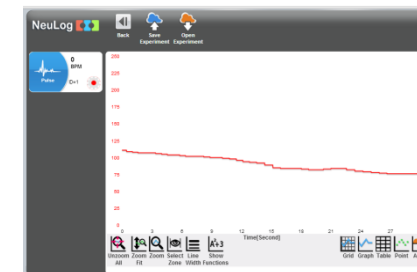
The pulse sensor's probe consists of a fingertip/earlobe clip which houses an infrared light source and an infrared light detector on opposite sides.

The blood in the finger flows forward (oxygenated) and backward (deoxygenated with CO₂). The IR light absorbed by the deoxygenated blood and the detected light intensity changes are according to the heart pulses.

Arbitrary analog units (wave function):



Beats per minute:



The light average intensity changes according to the skin color and/or thickness, the probe's pressure, etc. The sensor's electronics offsets the average intensity, amplifies and passes the pulses only to the internal controller, which calculates the pulses' rate.

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Maintenance and storage:

- Never submerge the NeuLog 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 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. The warranty is for a period of 3 years from the date of purchase and 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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