

## NEULOG TEMPERATURE LOGGER SENSOR GUIDE



### NeuLog temperature logger sensor NUL-203

The NeuLog temperature sensor can be used to take temperature measurements in solids, liquids, or gases for any science experiment where a thermometer is required. It is used in the fields of Chemistry, Physics, Biology, Earth Science, Environmental 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 experiments that can be performed with the NUL-203 sensor are: Monitoring of ecological systems, study of photosynthesis, effect of temperature on enzymes, endothermic and exothermic reactions, heat and energy transfer, weather studies, insulation studies and ideal gas law studies.

This sensor is capable of measuring both in Celsius and Fahrenheit.

- Celsius ( $^{\circ}\text{C}$ ): The SI (International System of Units) unit of temperature.
- Fahrenheit ( $^{\circ}\text{F}$ ): The temperature measurement unit of the English System commonly used in the United States.

### Quick start procedure:

#### PC or Mac Computer

##### Materials needed:

- NUL-203 Temperature Sensor
- USB-200 USB Module
- USB to mini USB cable (included with the USB-200 module)

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

Resident PC software and browser based application can be downloaded for free at [www.neulog.com/Download/SoftwareandApplication.aspx](http://www.neulog.com/Download/SoftwareandApplication.aspx) 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 temperature 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 temperature sensor logo appears on the left side of the screen, the probe has been automatically identified and you can begin experimentation.
6. If the temperature sensor is not automatically identified, 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 temperature sensor icon in the module window to change the temperature probe settings if need be (Celsius or Fahrenheit for example).
9. Click on the experiment set up button to change the experiment settings if need be (Experiment duration for example).
10. The temperature sensor will give a live reading in the box to the left of the screen when running.
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-203 Temperature Sensor
- WiFi-201 WiFi Module
- BAT-200 Battery Module

Your Temperature 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 Temperature Sensor directly to the left side WiFi-201 (no wires required).
2. Connect a BAT-200 module to the right side of the WiFi-201 module.

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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 15-75 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 units 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/Download/SoftwareandApplication.aspx](http://www.neulog.com/Download/SoftwareandApplication.aspx)  
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.
6. Take your tablet or smart phone, 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 about 20 seconds to connect to the WiFi-201.
8. Once the device is connected, go to your browser and type 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 sensor(s); this can take a minute. (You can stop the search when the sensor is found.)
11. If the browser does not auto detect the sensor(s), select "Search for sensors".
12. If the browser does not auto detect the sensor(s), select "Search for sensors".
13. Once the sensor is found you will see an icon on the left side of the screen for the temperature sensor. The icon will display real time data.
14. To set experiment settings click on the temperature sensor icon on the left side of your screen (experiment duration for example).
15. To change the units of the data, select the temperature sensor icon and then click "Range" (Celsius or Fahrenheit for example).
16. To do an experiment and collect data, select "On-Line" experiment, then select run.
17. If you have a newer generation WiFi-201 (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 key. Repeating this operation will return the unit to WiFi mode.

### Operation with NeuLog viewer

#### **Materials needed:**

- NUL-203 Temperature Sensor

- VIEW-101 Graphic Display Module
- BAT-200 Battery Module

#### **Procedure:**

1. Connect the temperature sensor to the left side of the viewer.
2. Connect the BAT-200 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 when you do not have a sensor connected directly to a computer, tablet, smartphone, or NeuLog viewer).

#### **Materials needed:**

- NUL-203 Temperature Sensor
- BAT-200 Battery Module

#### **Materials needed to configure your offline experiment:**

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

#### **Procedure:**

1. Connect the temperature 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 temperature sensor; a red light will turn on for the duration of the experiment.
3. To change the experiment's 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 experiment settings view the 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 (you can find full instructions in each device's quick start procedure section).

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5. Open the 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-203 temperature sensor).

### Restoring sensor's factory default settings:

#### Procedure:

1. Connect the USB-200 module to a PC, Mac, tablet, or smart device
2. Connect the temperature sensor to the USB-200 module (they directly plug together). Please note no calibration is required for this sensor.
3. Open the NeuLog software.
4. Click the "Tools" icon.
5. Click the "Restore sensor's factory defaults" icon.
6. If prompted to clear the graph, click either the "Off-line experiment" or "On-line experiment" button (whichever you are using).
7. Click "Clear experiment results".
8. Resume from step 4.

### Included with sensor:

- Stainless steel temperature sensor connected permanently to the NeuLog connection block.
- NeuLog NUL-203 Temperature Sensor Guide (this document).

Sensor specifications	
Range (Celsius)	-40 to +140°C
Range (Fahrenheit)	-40 to +284°F
Resolution	12 Bits
Accuracy (Celsius)	± 0.1°C
Accuracy (Fahrenheit)	± 0.2°F
Resolution (Celsius)	0.1°C
Resolution (Fahrenheit)	0.1°F
Maximum sampling rate	100 samples/second

Experiment duration	1 sec to 31 days depending on set up parameters
Probe dimensions	180 mm long, 3.2mm in diameter

### 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)
  - Stainless Steel tube
- Note:** NeuLog products are intended for educational use.

### Videos and experiment examples:

- Videos, literature and other probes can be found at <http://www.neulog.com/http://www.neulog.com/Products/TemperatureloggerSensor.aspx>
- **Chemistry – Distillation – part 1**  
<http://www.neulog.com/Portals/3/Users/Experiment%20C-15%20Distillation%20part%20I%20Ver%203.2.3.pdf>
- **Chemistry – Distillation – part 2**  
<http://www.neulog.com/Portals/3/Users/Experiment%20C-16%20Distillation%20part%20II%20Ver%203.2.3.pdf>
- **Evaporation**  
<http://www.neulog.com/Portals/3/Users/Experiment%20C-17%20Evaporation%20Ver%203.2.6.pdf>
- **Endothermic and Exothermic reactions – part 1**  
<http://www.neulog.com/Portals/3/Users/Experiment%20C-18%20%20Endothermic%20and%20Exothermic%20reactions%20I%20Ver%203.2.4.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 (°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 at any time using software.

Inside of the stainless steel probe is a thermistor which is a variable resistor that varies significantly with temperature. The resistance increases nonlinearly with a decreasing temperature. During calibration, the sensor's internal controller creates the conversion formula from resistance to temperature.

No calibration is needed ever for this sensor because the probe is permanently connected to the controller and there is no need to change the conversion formula.

The stainless steel rod contains a 10K $\Omega$  NTC thermistor (Negative Temperature Coefficient variable resistor) glued in its bottom by temperature conductor special glue.

### Maintenance and storage:

- Never submerge the NeuLog plastic body in any liquid
- Do not allow liquid into the NeuLog plastic body where the temperature tether enters the body.
- After using the probe, wipe off all excess material, liquid or residue from the temperature probe.
- Store in a box at room temperature out of direct sunlight.
- Do not put the plastic case or cord of the temperature probe in an acid or base.

### 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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