

NEULOG INFRARED THERMOMETER LOGGER SENSOR GUIDE



NeuLog infrared thermometer logger sensor NUL-235

The NeuLog infrared thermometer sensor can be used for any science experiment which requires accurate temperature measurements such as in the fields of Physics, Chemistry, Biology, Environmental Science, etc.

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

Using the infrared thermometer sensor over the standard temperature sensor or the surface temperature sensor has several advantages:

- It can take measurements of hazardous materials safely from a distance.
- It has no probe which can react with chemicals.
- It has a more flexible use.
- It is very precise when measuring zones; this means you can reliably measure the temperature of a specific point instead of a large area.
- It is great for outdoor experiments.

Among hundreds of possible experimental subjects that can be studied with the NUL-235 sensor are: exothermic and endothermic chemical reactions, metabolism, heat and energy transfer, human temperature changes, effects of heat on enzyme function, weather studies, material thermal conductance properties, and many more.

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

Celsius: The SI (International System of Units) unit of temperature.

Fahrenheit: The temperature measurement unit of the English System commonly used in the United States.

Infrared light:

Infrared light (radiation) is emitted by moving molecules inside of bodies with a temperature above absolute zero (0 K). This phenomenon is called "black body radiation". When the temperature of an object increases the molecules inside move much more rapidly and more infrared radiation is released.

How the infrared thermometer sensor works:

At the top of the NeuLog infrared thermometer sensor is a metallic lens which focuses infrared light from an object onto an internal detector called a thermopile. The thermopile acts as a heat-sink as it collects infrared radiation. An electrical current runs through the thermopile and as more heat is absorbed more resistance is produced. The resistance is measured and easily converted into a temperature reading.

How to use the infrared thermometer sensor:

For instructions on connecting the sensor to computers, tablets, smartphones, or NeuLog Viewer please review the following sections.

After you have connected your NeuLog infrared sensor to the smart device of your choosing:

1. Locate the metallic lens on the top of the infrared sensor (this is where infrared radiation is detected).
2. Direct the metallic lens towards the target you want to measure, it can be either solid or liquid.
3. The sensor works over very long distances, however detecting small objects from far away can be tricky so you may need to measure from a closer distance.

Quick start procedure:

PC or Mac Computer

Materials needed:

- NUL-235 Infrared Thermometer Sensor
- USB-200 USB Module
- USB to mini USB cable (included with the USB-200 module)

Your infrared thermometer 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 infrared thermometer 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".

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Procedure:

1. Install the NeuLog application.
2. Connect the USB-200 module to the PC or Mac.
3. Connect the infrared thermometer sensor to the USB-200 module (they directly plug together). Please note that there is no calibration required for this sensor.
4. Open the NeuLog application by clicking on the shortcut on the screen.
5. Once the infrared thermometer 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 infrared thermometer sensor is not automatically identified, click the "Search for sensors" icon to find the sensor.
7. Select the "On-line experiment" icon; this will open a graph below.
8. Click on the "Module setup" button located in the infrared thermometer sensor module box to change the sensor's settings if need be.
9. Click on the "Experiment set up" icon to change the experiment settings if need be (experiment duration for example).
10. The infrared thermometer 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.

Tablet, smart phone device

Materials needed:

- NUL-235 Infrared Thermometer Sensor
- WIFI-201 WiFi Module
- BAT-200 Battery Module

Your infrared thermometer 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 infrared thermometer 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

4. module will run for 60-90 minutes (depending on the sensor) without being plugged in.
4. The WIFI-201 module 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 infrared thermometer sensor. In this box, real time data will be displayed.
14. Click on the "Module setup" button located in the infrared thermometer sensor module box to change the infrared thermometer 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 (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-235 Infrared Thermometer Sensor
- VIEW-101 Graphic Display Module
- BAT-200 Battery Module

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Procedure:

1. Connect the infrared thermometer 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-235 Infrared Thermometer 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. 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 infrared thermometer 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 infrared thermometer 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 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-235 infrared thermometer sensor).

Restoring sensor’s factory default settings:

Procedure:

1. Connect the USB-200 to a PC, Mac, tablet, or smart device.
2. Connect the infrared thermometer sensor to a USB-200 module (they directly plug together).
3. Open the NeuLog application.
4. Click the “Tools” icon.
5. Click “Restore sensor’s factory defaults” on the menu.

Included with the sensor:

- NeuLog NUL-235 Infrared Thermometer Sensor Guide (this document).

Sensor's specifications		
	Celsius	Fahrenheit
Range and operation modes	-30 to 382°C	-22 to 719°F
ADC resolution	13 bit	
Resolution	0.1°C	0.2°F
Max sample rate (S/sec)	100	

Experiment Duration: 1 second to 31 days.

Sensor's 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
 - Internal thermopile detector to gather infrared light
- Note:** NeuLog products are intended for educational use.

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Videos and experiment examples:

- Videos, literature and other probes can be found at www.NeuLog.com.
- In order to access the infrared thermometer sensor's page, choose "Products" on the main menu and then "Infrared thermometer logger sensor".
- 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".
- Biology Experiment:
 - Temperature Variations in the Human Body (B-42)

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 NeuLog infrared sensor is based on a phenomenon known as "black body radiation". As molecules are heated up, they move much more rapidly and in turn put off more infrared radiation.

Inside the infrared sensor is a detector called a thermopile, which collects infrared light directed from the external lens. As the thermopile heats up, an electrical current which flows through it encounters more resistance which scales with temperature changes. The resistance can easily be measured and then calculated back into a temperature value.

Maintenance and storage:

- Never submerge the NeuLog plastic body in any liquid.
- Do not allow liquid into the infrared thermometer sensor's body.
- After use, gently wipe away any foreign material from the infrared thermometer 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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V11042014