NEULOG INFRARED TEMPERATURE LOGGER SENSOR GUIDE

NeuLog wide range t NeuLog infrared temperature logger sensor
NUL-235

The NeuLog infrared temperature sensor can be used for any science experiment or activity 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 any of the following guides.

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

- Can safely take measurements of hazardous materials from a distance.
- Has no probe which can react with chemicals.
- Greater flexibility of use.
- Very precise measuring zone means you can reliably measure the temperature of a specific point instead of a larger area.
- Great for outdoor experiments.

Just a few of the thousands of possible experimental subjects that can be done with the NUL-235 sensors 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.

The infrared temperature sensor uses the following units of measure:

- 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 from 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 temperature sensor works:

On the top of the NeuLog infrared temperature 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 temperature sensor:

For instructions on connecting the sensor to computers, tablets, smartphones, or the 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 a 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 Temperature Sensor
- USB-200 USB Module
- A USB to mini USB cable (which comes with the USB-200)

Your infrared temperature 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 temperature sensor directly into the computer.

Resident PC software and browser based software can be downloaded for free at www.NeuLog.com/dowload 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.

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Procedure:

1. Install the NeuLog software
2. Connect the USB-200 module to the PC or Mac
3. Connect the infrared 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 the infrared 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 infrared temperature 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 infrared temperature 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 infrared temperature 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-235 Infrared Temperature Sensor
- WIFI-201 WIFI module
- BAT-200 Battery

Your infrared 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 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 temperature 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.
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 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 infrared temperature sensor. The icon will display data in real time.
13. To set the infrared temperature sensor’s settings click on “Module setup” button located on the infrared temperature 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”.

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Operation with NeuLog viewer

Materials needed:

- NUL-235 Infrared Temperature Sensor
- VIEW-101 Viewing Module
- BAT-200 Battery

Procedure:

1. Connect the infrared temperature 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-235 Infrared Temperature Sensor
- 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 infrared 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 infrared temperature 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-235 infrared temperature 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 temperature 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-235 Infrared Temperature Sensor Guide (this document).

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Sensor specifications		
	Celsius	Fahrenheit
Range and operation modes	-30 to 382°C	-22 to 719°F
ADC resolution	13 bit	
Resolution	0.1°C	0.1°F
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.
- Internal thermopile detector to gather infrared 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/Products/InfraredTemperatureloggerSensor.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 (^{o}C, ^{o}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 works on the 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 temperature sensor's body.
- After use, gently wipe away any foreign material from the infrared temperature 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 proves 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!

NeuLog

Flexible, simple, fast, forward thinking.
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