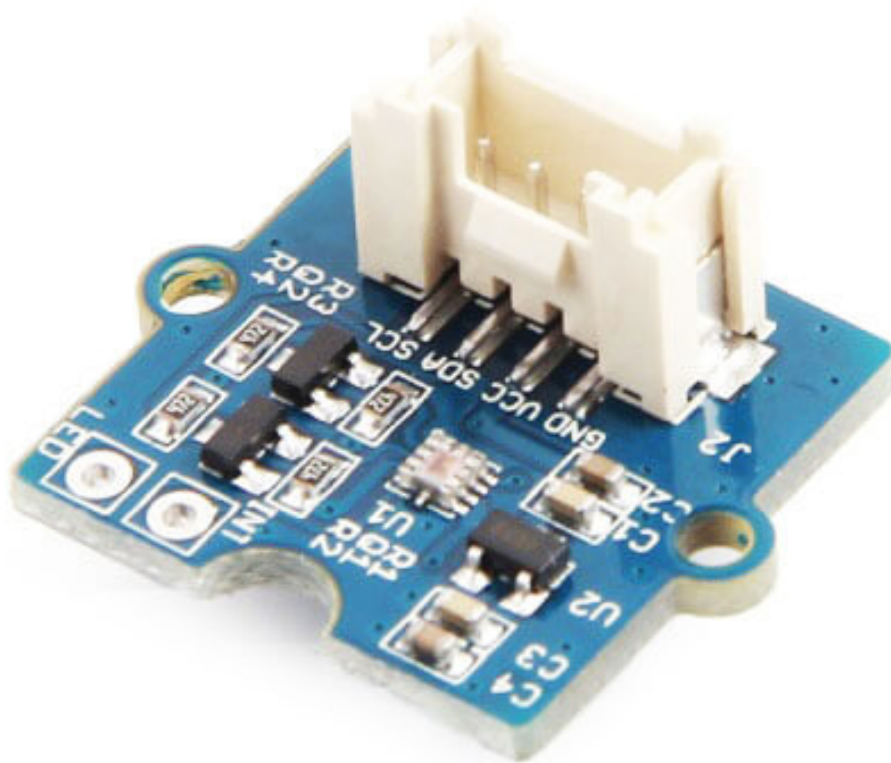


Grove - Sunlight Sensor



[Get One Now](https://www.seeedstudio.com/Grove-Sunlight-Sensor-p-2530.html) 

[<https://www.seeedstudio.com/Grove-Sunlight-Sensor-p-2530.html>]

Grove - Sunlight Sensor is a multi-channel digital light sensor, which has the ability to detect UV-light, visible light and infrared light.

This device is based on SI1151, a new sensor from SiLabs. The SI1151 is a low-power, reflectance-based, infrared proximity, UV index and ambient light sensor with I2C digital interface and programmable-event interrupt output. This device offers excellent performance under a wide dynamic range and a variety of light sources including direct sunlight.

Grove - Sunlight Sensor include an on-board Grove connector, which help you to connect it your Arduino easily. You can use this device for making some project which need to detect the light, such as a simple UV detector.

The main chip of the device has been updated to SI1151, the tutorial to SI1145 still remain.

Version

Product Version	Changes	Released Date
Grove - Sunlight Sensor v1.0	Initial	Feb 12 2020
Grove - Sunlight Sensor v2.0	replace Si1145 with Si1151-AB00-GMR	Jul 27 2021

Features

- Digital light sensor
- Wide spectrum detection range to improve accuracy.
- Programmable configuration which make it versatile for various applications.
- Detect sunlight directly
- Grove compatible
- I2C Interface(7-bit)

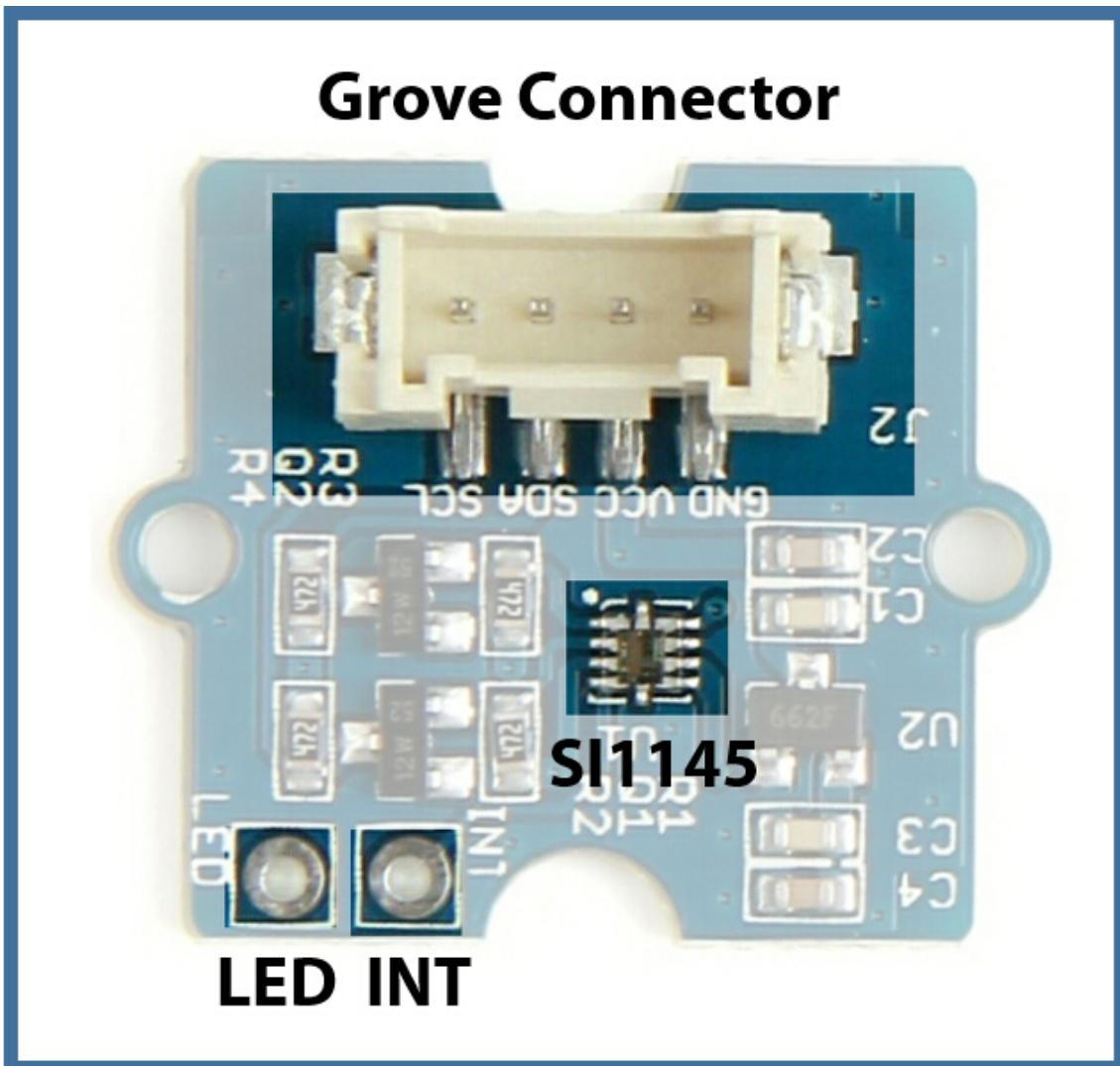
**Tip**

More details about Grove modules please refer to [Grove System](https://wiki.seeedstudio.com/Grove_System/)
[https://wiki.seeedstudio.com/Grove_System/]

Specification

Operating Voltage	3.0-5.5V
Working current	3.5mA
Wave length	280-950nm
Default I2C Address	0x60
Operating Temperature	-45-85°C

Hardware Overview





- Grove Connector - a 4pin interface, contain VCC, GND, SDA and SCL
- LED - LED Driver pin
- INT - a programmable interrupt output
- SI1151 - IC

Getting Started

After this section, you can make Grove - Sunlight Sensor run with only few steps.

Play with Arduino

Materials required

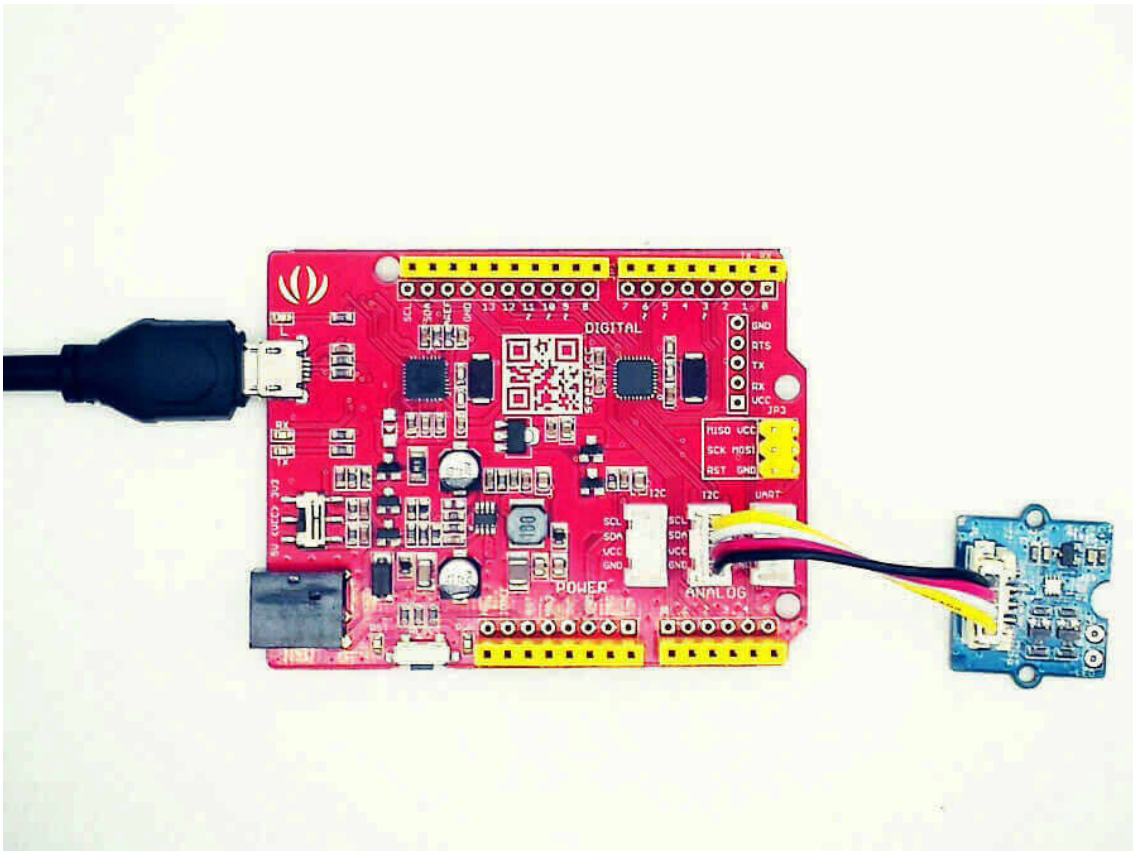
Seeeduino V4.2	Grove - Sunlight Sensor
	
<p>Get One Now [https://www.seeedstudio.com/Seeeduino-V4.2-p-2517.html]</p>	<p>Get One Now [https://www.seeedstudio.com/Grove-Sunlight-Sensor.html]</p>



Attention

If this is your first time using Arduino, Please put hand on [here](https://wiki.seeedstudio.com/Getting_Started_with_Seeeduino) [https://wiki.seeedstudio.com/Getting_Started_with_Seeeduino] to start your Arduino journey.

Connecting hardware



Note

If you need a plug more modules on main control board, you may need a [Grove base shield](https://wiki.seeedstudio.com/Base_Shield_V2/) [https://wiki.seeedstudio.com/Base_Shield_V2/] which will make your work easy.

Download

Click [here](https://github.com/Seeed-Studio/Grove_Sunlight_Sensor/tree/SI1151) [https://github.com/Seeed-Studio/Grove_Sunlight_Sensor/tree/SI1151] to download the library and then [add](https://wiki.seeedstudio.com/How_to_install_Arduino_Library/) [https://wiki.seeedstudio.com/How_to_install_Arduino_Library/] it to the Arduino.

Launch Arduino IDE and click

File>Examples>Grove_Sunlight_Sensor>SI1151 to open the test code.

```
1  #include "Si115X.h"
2
3  Si115X si1151;
4
5  /**
6   * Setup for configuration
7   */
8  void setup()
9  {
10     uint8_t conf[4];
11
12     Wire.begin();
13     Serial.begin(115200);
14     if (!si1151.Begin())
15         Serial.println("Si1151 is not ready!");
16     else
17         Serial.println("Si1151 is ready!");
18
19 }
20
21 /**
22  * Loops and reads data from registers
23  */
24 void loop()
25 {
26     Serial.print("IR: ");
27     Serial.println(si1151.ReadHalfWord());
28     Serial.print("VISIBLE: ");
29     Serial.println(si1151.ReadHalfWord_VISIBLE());
30     Serial.print("UV: ");
31     Serial.println(si1151.ReadHalfWord_UV());
32     delay(100);
33 }
```

Click Tools>Board to choose Arduino UNO and select respective serial port.

Now click Upload(CTRL+U) to burn testing code. Please refer to [here](https://wiki.seeedstudio.com/Arduino_Common_Error) [https://wiki.seeedstudio.com/Arduino_Common_Error] for any

error prompt .

Review Results

After upload completed, Open Serial Monitor of your Arduino IDE, you can get the data:



The screenshot shows a Serial Monitor window with the title bar "/dev/cu.usbmodem113201". The window contains the following text output:

```
IR: 16  
VISIBLE: 6  
UV: 0.01  
IR: 17  
VISIBLE: 6  
UV: 0.01  
IR: 18  
VISIBLE: 6  
UV: 0.01  
IR: 19  
VISIBLE: 6  
UV: 0.01  
IR: 19  
VISIBLE: 6  
UV: 0.01  
IR: 14  
VISIBLE: 5  
UV: 0.01  
IR: 19  
VISIBLE: 6
```



Note

Vis - visible light, unit in lm IR - infrared light, unit in lm UV - UN index

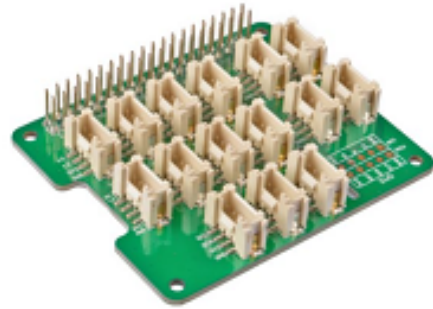
Now, put Grove - Sunlight Sensor under the sun to see if it's a nice day.

SI1145 - Play with Raspberry Pi

Materials required

Raspberry Pi 4 Model B

Grove - Base Hat for Raspberry Pi



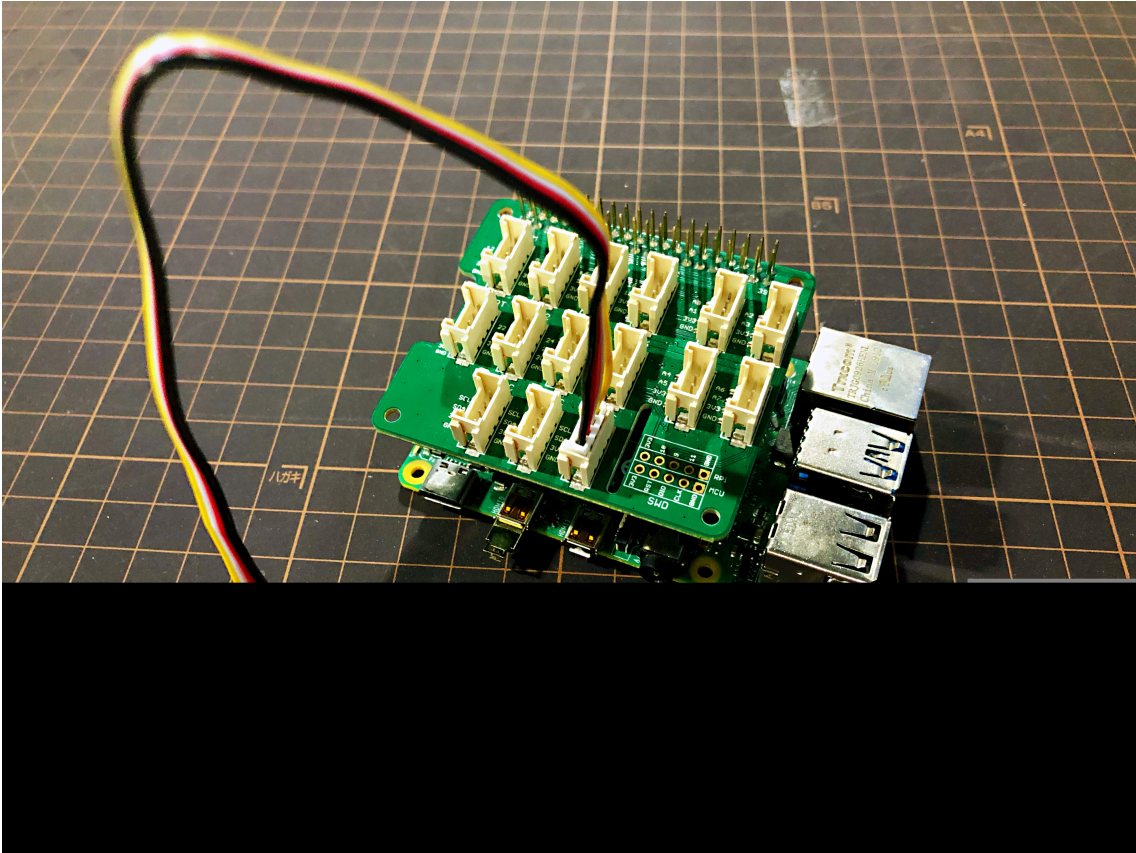
[Get One Now](#)

[<https://www.seeedstudio.com/Raspberry-Pi-4-Computer-Model-B-8GB-p-4595.html>]

[Get One Now](#)

[<https://www.seeedstudio.com/Grove-Base-Hat-for-Raspberry-Pi.html>]

Connecting hardware



Step 1. Connect Grove - Sunlight Sensor to port **I2C** of Grove - Base Hat for Raspberry Pi, Plugged into Raspberry Pi 4 Model B. And then connect the Raspberry Pi 4 Model B with a PC.

Step 2. After accessing the system of Raspberry Pi, git clone [Seeed_Python_SI114X](https://github.com/Seeed-Studio/Seeed_Python_SI114X) [https://github.com/Seeed-Studio/Seeed_Python_SI114X] and install **grove.py** by inserting the following command:

```
pip3 install Seeed-grove.py
```



Or on supported GNU/Linux systems like the Raspberry Pi, you can install the driver locally from PyPI:

```
pip3 install seeed-python-si114x
```



Step 3. To install system-wide (this may be required in some cases):

```
sudo pip3 install seeed-python-si114x
```

And you can insert the following command to upgrade the driver locally from PyPI:

```
pip3 install --upgrade seeed-python-si114x
```

Software

```
1 import seeed_si114x
2 import time
3 import signal
4 def handler(signalnum, handler):
5     print("Please use Ctrl C to quit")
6 def main():
7     SI1145 = seeed_si114x.grove_si114x()
8     print("Please use Ctrl C to quit")
9     signal.signal(signal.SIGTSTP, handler) # Ctrl-z
10    signal.signal(signal.SIGQUIT, handler) # Ctrl-\
11    while True:
12        print('Visible %03d UV %.2f IR %03d' % (SI1145.R
13        print('\r', end='')
14        time.sleep(0.5)
15 if __name__ == '__main__':
16    main()
```

Before running the demo code, you must check the corresponding i2c number of the board:

```
ls /dev/i2c*
```

If the i2c device works properly, there will be:

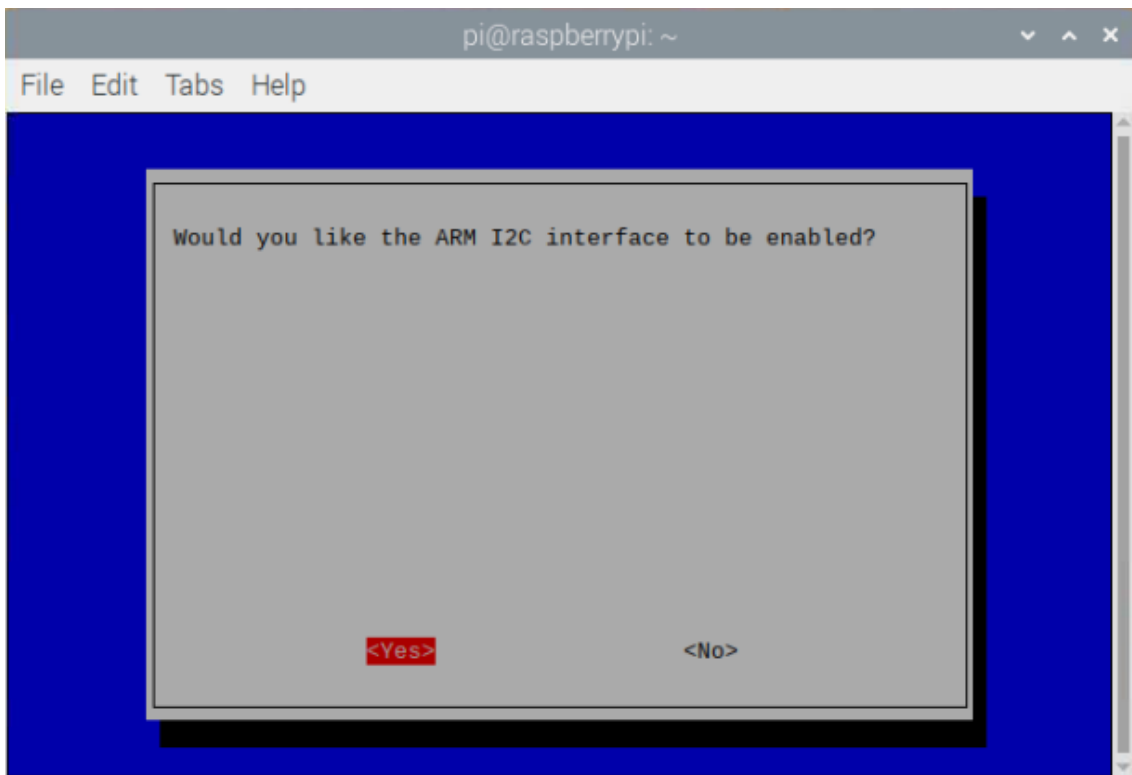
```
/dev/i2c-1
```



If NOT, use the command **sudo raspi-config** and reboot to enable the i2c device:

```
pi@raspberrypi: ~  
File Edit Tabs Help  
Raspberry Pi 4 Model B Rev 1.1  
Raspberry Pi Software Configuration Tool (raspi-config)  
1 Change User Password Change password for the 'pi' user  
2 Network Options Configure network settings  
3 Boot Options Configure options for start-up  
4 Localisation Options Set up language and regional settings to match your  
5 Interfacing Options Configure connections to peripherals  
6 Overclock Configure overclocking for your Pi  
7 Advanced Options Configure advanced settings  
8 Update Update this tool to the latest version  
9 About raspi-config Information about this configuration tool  
  
<Select> <Finish>
```

```
pi@raspberrypi: ~  
File Edit Tabs Help  
Raspberry Pi Software Configuration Tool (raspi-config)  
P1 Camera Enable/Disable connection to the Raspberry Pi Camera  
P2 SSH Enable/Disable remote command line access to your Pi using  
P3 VNC Enable/Disable graphical remote access to your Pi using Rea  
P4 SPI Enable/Disable automatic loading of SPI kernel module  
P5 I2C Enable/Disable automatic loading of I2C kernel module  
P6 Serial Enable/Disable shell and kernel messages on the serial conn  
P7 1-Wire Enable/Disable one-wire interface  
P8 Remote GPIO Enable/Disable remote access to GPIO pins  
  
<Select> <Back>
```



Step 4. Run the demo by the following command:

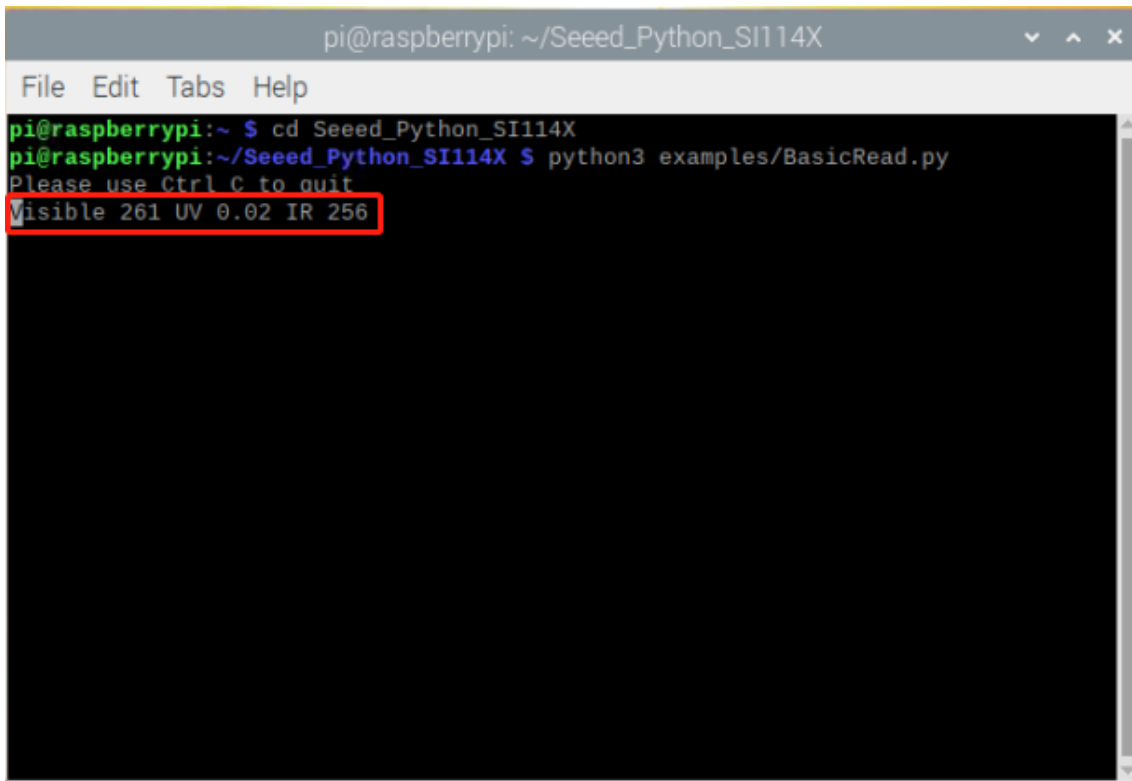
```
cd Seeed_Python_SI114X-Si115x
```

```
python3 examples/BasicRead.py
```



Success

The outcome will display as following if everything goes well:



```
pi@raspberrypi: ~/Seed_Python_SI114X
File Edit Tabs Help
pi@raspberrypi:~ $ cd Seed_Python_SI114X
pi@raspberrypi:~/Seed_Python_SI114X $ python3 examples/BasicRead.py
Please use Ctrl C to quit
Visible 261 UV 0.02 IR 256
```

**Note**

Visible refers to **visible light of Ambient** and **UV** refers to **Ultraviolet (UV) Index** while **IR** means **infrared light of Ambient**.

SI1151 - Play with Raspberry Pi

Materials required

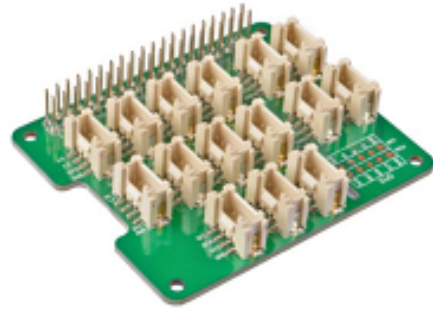
Raspberry Pi 4 Model B



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[<https://www.seeedstudio.com/Raspberry-Pi-4-Computer-Model-B-8GB-p-4595.html>]

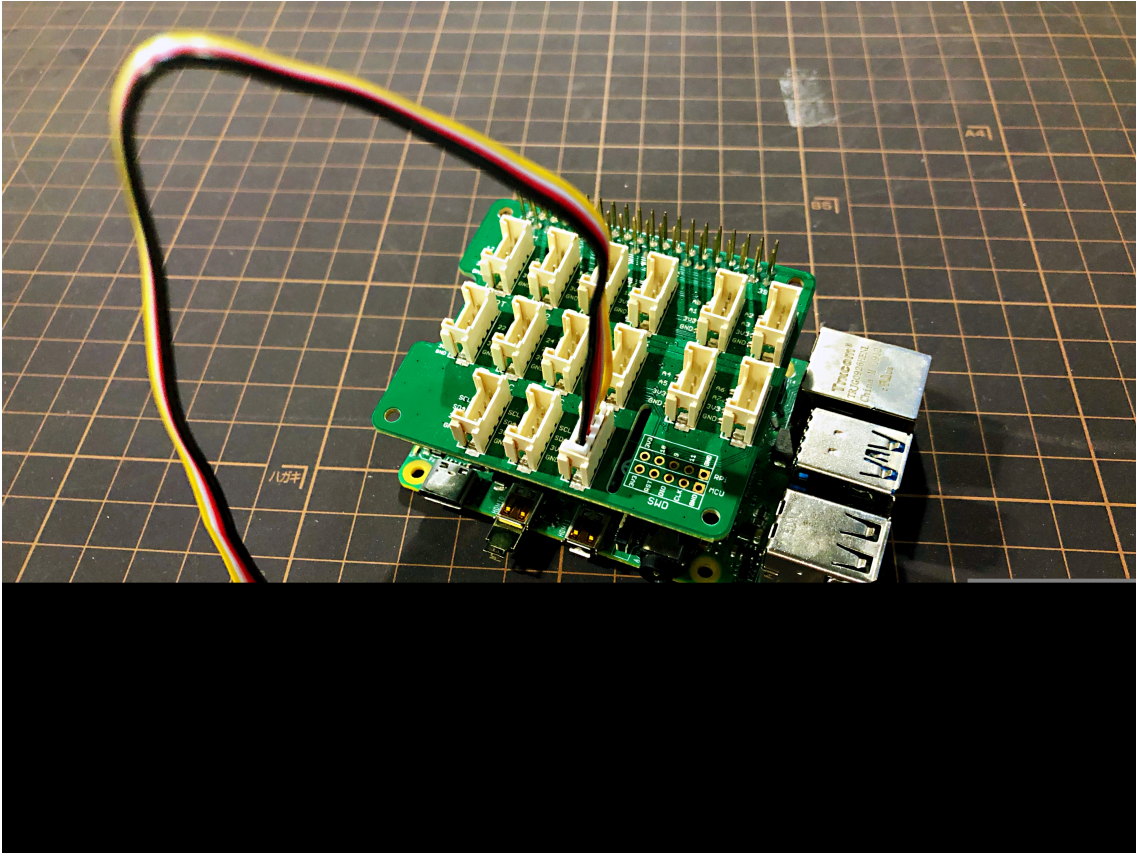
Grove - Base Hat for Raspberry Pi



[Get One Now](#)

[<https://www.seeedstudio.com/Grove-Base-Hat-for-Raspberry-Pi.html>]

Connecting hardware



Step 1. Connect Grove - Sunlight Sensor to port **I2C** of Grove - Base Hat for Raspberry Pi, Plugged into Raspberry Pi 4 Model B. And then connect the Raspberry Pi 4 Model B with a PC.

Step 2. After accessing the system of Raspberry Pi, git clone [Seeed_Python_SI114X](https://github.com/Seeed-Studio/Seeed_Python_SI114X) [https://github.com/Seeed-Studio/Seeed_Python_SI114X]

```
git clone https://github.com/Seeed-Studio/Seeed_Python_SI114X
```

Before running the demo code, you must check the corresponding i2c number of the board:

```
ls /dev/i2c*
```

If the i2c device works properly, there will be:

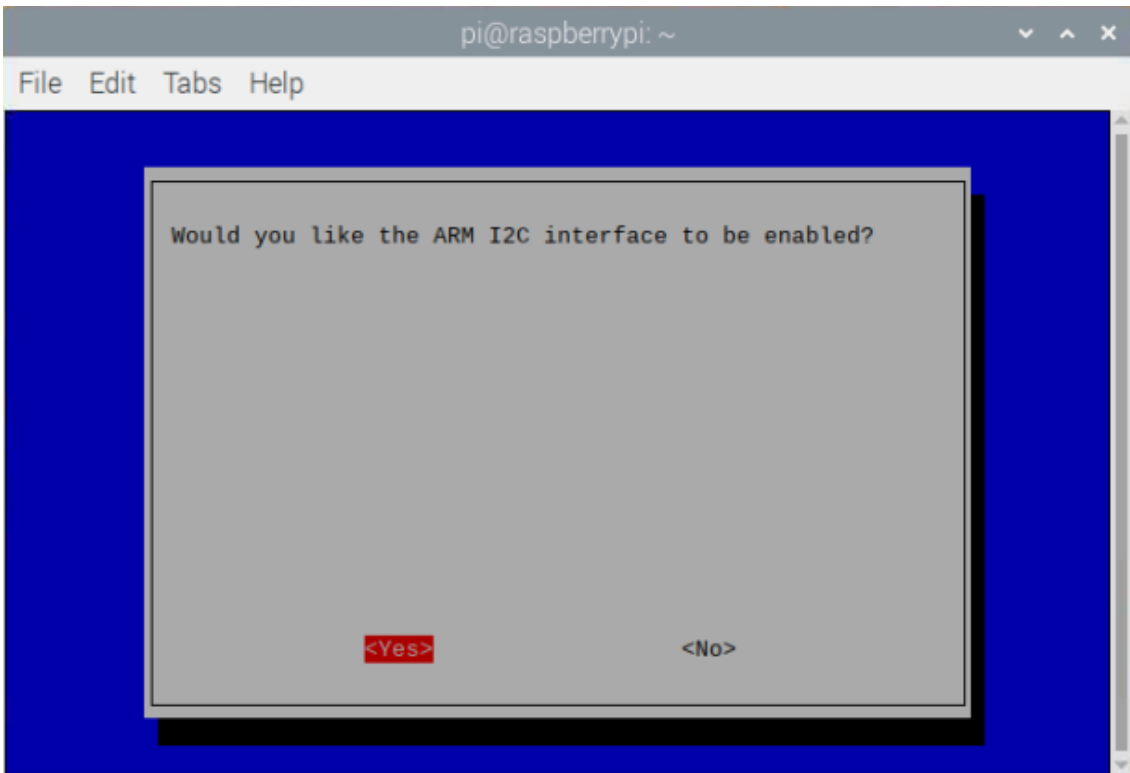
```
/dev/i2c-1
```



If **NOT**, use the command **sudo raspi-config** and reboot to enable the i2c device:

```
pi@raspberrypi: ~  
File Edit Tabs Help  
Raspberry Pi 4 Model B Rev 1.1  
Raspberry Pi Software Configuration Tool (raspi-config)  
1 Change User Password Change password for the 'pi' user  
2 Network Options Configure network settings  
3 Boot Options Configure options for start-up  
4 Localisation Options Set up language and regional settings to match your  
5 Interfacing Options Configure connections to peripherals  
6 Overclock Configure overclocking for your Pi  
7 Advanced Options Configure advanced settings  
8 Update Update this tool to the latest version  
9 About raspi-config Information about this configuration tool  
  
<Select> <Finish>
```

```
pi@raspberrypi: ~  
File Edit Tabs Help  
Raspberry Pi Software Configuration Tool (raspi-config)  
P1 Camera Enable/Disable connection to the Raspberry Pi Camera  
P2 SSH Enable/Disable remote command line access to your Pi using  
P3 VNC Enable/Disable graphical remote access to your Pi using Rea  
P4 SPI Enable/Disable automatic loading of SPI kernel module  
P5 I2C Enable/Disable automatic loading of I2C kernel module  
P6 Serial Enable/Disable shell and kernel messages on the serial conn  
P7 1-Wire Enable/Disable one-wire interface  
P8 Remote GPIO Enable/Disable remote access to GPIO pins  
  
<Select> <Back>
```



Step 3. Run the demo by the following command:

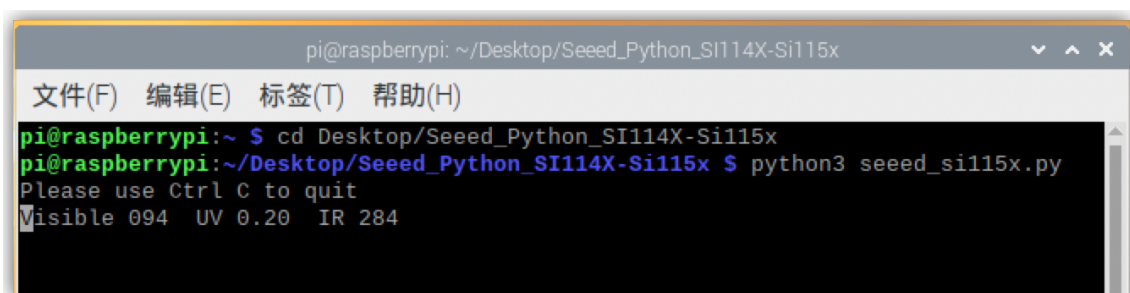
```
cd Seeed_Python_SI114X-Si115x
```

```
python3 seeed_si115x.py
```



Success

The outcome will display as following if everything goes well:



**Note**

Visible refers to **visible light of Ambient** and **UV** refers to **Ultraviolet (UV) Index** while **IR** means **infrared light of Ambient**.

References

Spectrum

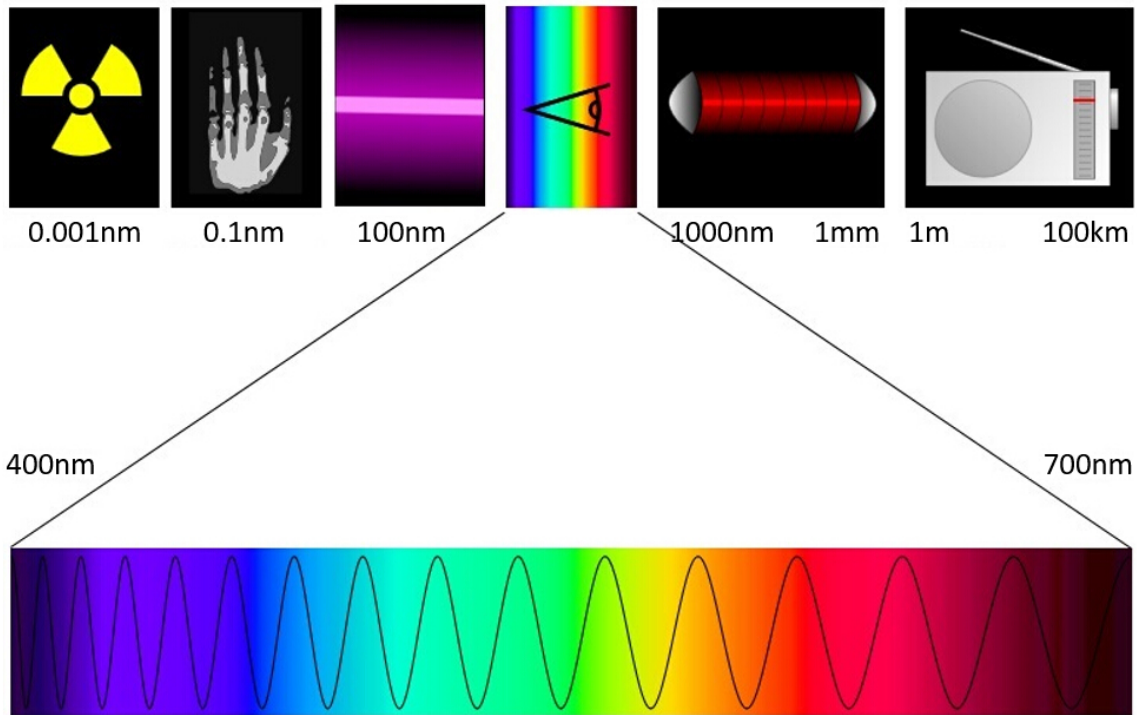
The content of this chapter is got from [Wikipedia - Spectrum](https://en.wikipedia.org/wiki/Spectrum) [https://en.wikipedia.org/wiki/Spectrum], click to view the original page.

A spectrum (plural spectra or spectrums[1]) is a condition that is not limited to a specific set of values but can vary infinitely within a continuum. The word was first used scientifically within the field of optics to describe the rainbow of colors in visible light when separated using a prism. As scientific understanding of light advanced, it came to apply to the entire electromagnetic spectrum.

Spectrum has since been applied by analogy to topics outside of optics. Thus, one might talk about the spectrum of political opinion, or the spectrum of activity of a drug, or the autism spectrum. In these uses, values within a spectrum may not be associated with precisely quantifiable numbers or definitions. Such uses imply a broad range of conditions or behaviors grouped together and studied under a single title for ease of discussion.

In most modern usages of spectrum there is a unifying theme between extremes at either end. Some older usages of the word did not have a unifying theme, but they led to modern ones through a sequence of events set out below. Modern usages in mathematics

did evolve from a unifying theme, but this may be difficult to recognize.



Lumen

The content of this chapter is got from [Wikipedia - Lumen \(unit\)](https://en.wikipedia.org/wiki/Lumen_(unit)) [https://en.wikipedia.org/wiki/Lumen_(unit)], click to view the original page.

The lumen (symbol: lm) is the SI derived unit of luminous flux, a measure of the total "amount" of visible light emitted by a source. Luminous flux differs from power (radiant flux) in that luminous flux measurements reflect the varying sensitivity of the human eye to different wavelengths of light, while radiant flux measurements indicate the total power of all electromagnetic waves emitted, independent of the eye's ability to perceive it. Lumens are related to lux in that one lux is one lumen per square meter.

Ultraviolet index

The content of this chapter is got from [Wikipedia - Ultraviolet index](https://en.wikipedia.org/wiki/Ultraviolet_index) [https://en.wikipedia.org/wiki/Ultraviolet_index], click to view the original page.

The ultraviolet index or UV Index is an international standard measurement of the strength of sunburn-producing ultraviolet (UV) radiation at a particular place and time. The scale was developed by Canadian scientists in 1992, then adopted and standardized by the UN's World Health Organization and World Meteorological Organization in 1994. It is primarily used in daily forecasts aimed at the general public, and is increasingly available as an hourly forecast as well.

The UV Index is designed as an open-ended linear scale, directly proportional to the intensity of UV radiation that causes sunburn on human skin. For example, if a light-skinned individual (without sunscreen or a suntan) begins to sunburn in 30 minutes at UV Index 6, then that individual should expect to sunburn in about 15 minutes at UV Index 12 – twice the UV, twice as fast.

The purpose of the UV Index is to help people effectively protect themselves from UV radiation, which has health benefits in moderation but in excess causes sunburn, skin aging, DNA damage, skin cancer, immunosuppression,[1] and eye damage such as cataracts (see the section Human health-related effects of ultraviolet radiation). Public health organizations recommend that people protect themselves (for example, by applying sunscreen to the skin and wearing a hat and sunglasses) if they spend substantial time outdoors when the UV Index is 3 or higher; see the table below for more-detailed recommendations.

When the day's predicted UV Index is within various numerical ranges, the recommendations for protection are as follows:

UV Index	Media graphic color	Risk of harm from unprotected sun exposure, for the average adult	Recommended protection
0–2.9	Green	"Low"	Wear sunglasses on bright days; use sunscreen if there is snow on the ground, which reflects UV radiation, or if you have particularly fair skin.
3–5.9	Yellow	"Moderate"	Take precautions, such as covering up, if you will be outside. Stay in shade near midday when the sun is strongest.
6–7.9	Orange	"High"	SPF 30+ sunscreen, wear a hat, reduce time in the sun within three hours of solar noon, and wear sunglasses. (Australian slogan: Slip-Slop-Slap-Seek-Slide.)
8–10.9	Red	"Very high"	Wear SPF 30+ sunscreen, a shirt, sunglasses, and a wide-brimmed hat. Do not stay in the sun for too long.
11+	Violet	"Extreme"	Take all precautions: Wear SPF 30+ sunscreen, a long-sleeved shirt and trousers, sunglasses, and a very broad hat. Avoid the sun within three hours of solar noon.

Cautionary notes

When interpreting the UV Index and recommendations, be aware that:

- The intensity of UV radiation reaching the surface of the earth depends on the angle of the sun in the sky. Each day, the sun achieves its highest angle (highest intensity, shortest shadows) at solar noon, which only approximately corresponds to 12:00 on clocks. This is because of the differences between solar time and local time in a given time zone. In general, UV risk is high when the sun is directly enough overhead that people's shadows are shorter than their height.
- Likewise, UV intensity can be higher or lower for surfaces at different angles to the horizontal. For example, if people are walking or standing outdoors, UV exposure to the eyes and vertical surfaces of skin, such as the face, can actually be more severe when the sun is lower, such as the end of a summer's day, or winter afternoons on a ski trail. This is partly a consequence of the fact that the measurement equipment upon which the index is based is a flat horizontal surface. UV intensity can nearly double with reflection from snow or other bright surfaces like water, sand, or concrete.

- The recommendations given are for average adults with lightly tan skin. Those with darker skin are more likely to withstand greater sun exposure, while extra precautions are needed for children, seniors, particularly fair-skinned adults, and those who have greater sun sensitivity for medical reasons or from UV exposure in previous days. (The skin's recovery from UV radiation generally takes two days or more to run its course.)
- Because of the way the UV Index is calculated, it technically expresses the risk of developing sunburn, which is caused mostly by UVB radiation. However, UVA radiation also causes damage (photoaging, melanoma). Under some conditions, including most tanning beds, the UVA level may be disproportionately higher than described by the UV Index. The use of broad-spectrum (UVA/UVB) sunscreen can help address this concern.

Schematic Online Viewer



Resources

- [Schematic in PDF](https://files.seeedstudio.com/wiki/Grove-Sunlight_Sensor/res/Grove_-_Sunlight_Sensor_v1.0.pdf) [https://files.seeedstudio.com/wiki/Grove-Sunlight_Sensor/res/Grove_-_Sunlight_Sensor_v1.0.pdf]
- [Schematic in Eagle File](https://files.seeedstudio.com/wiki/Grove-Sunlight_Sensor/res/Grove_-_Sunlight_Sensor_v1.0_SCH%26PCB%26PDF.zip) [https://files.seeedstudio.com/wiki/Grove-Sunlight_Sensor/res/Grove_-_Sunlight_Sensor_v1.0_SCH%26PCB%26PDF.zip]

- [Si1145 datasheet](https://files.seeedstudio.com/wiki/Grove-Sunlight_Sensor/res/Si1145-46-47.pdf) [https://files.seeedstudio.com/wiki/Grove-Sunlight_Sensor/res/Si1145-46-47.pdf]
- [Github Repository for Grove - Sunlight Sensor](https://github.com/Seeed-Studio/Grove_Sunlight_Sensor) [https://github.com/Seeed-Studio/Grove_Sunlight_Sensor]
- [Spectrum](https://en.wikipedia.org/wiki/Spectrum) [https://en.wikipedia.org/wiki/Spectrum]
- [Lumen \(unit\)](https://en.wikipedia.org/wiki/Lumen_(unit)) [https://en.wikipedia.org/wiki/Lumen_(unit)]
- [Ultraviolet index](https://en.wikipedia.org/wiki/Ultraviolet_index) [https://en.wikipedia.org/wiki/Ultraviolet_index]
- [Grove - Sunlight Sensor v2.0](https://files.seeedstudio.com/wiki/Grove-Sunlight_Sensor/res/v2.0/Grove-SunlightSensorv2.0.zip) [https://files.seeedstudio.com/wiki/Grove-Sunlight_Sensor/res/v2.0/Grove-SunlightSensorv2.0.zip]
- [SI1151-AB00-GMR Datasheet](https://files.seeedstudio.com/wiki/Grove-Sunlight_Sensor/res/v2.0/SI1151-AB00-GMR.pdf) [https://files.seeedstudio.com/wiki/Grove-Sunlight_Sensor/res/v2.0/SI1151-AB00-GMR.pdf]

Project

The Environment Cube! Know the Land Beneath You! A cube with all the necessary sensors, suitable for a wide range of applications like agriculture. Know the land beneath you!



(<https://www.hackster.io/dhairya-parikh/the-environment-cube-know-the-land-beneath-you-h3c2dd>)

Tech Support

Please submit any technical issue into our [forum](https://forum.seeedstudio.com/) [<https://forum.seeedstudio.com/>].



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