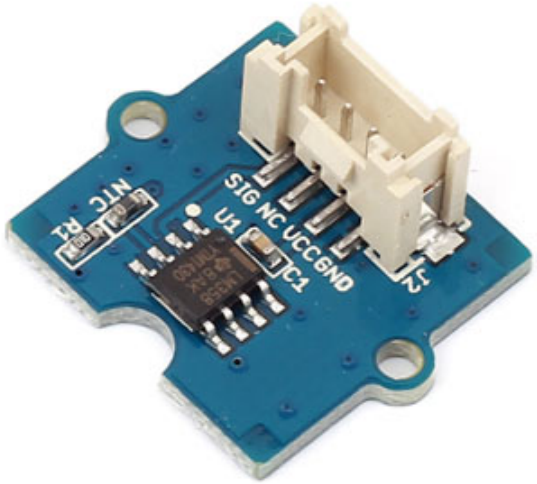
Grove - Temperature Sensor V1.2



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The Grove - Temperature Sensor uses a Thermistor to detect the ambient temperature. The resistance of a thermistor will increase when the ambient temperature decreases. It's this characteristic that we use to calculate the ambient temperature. The detectable range of this sensor is -40 - 125ºC, and the accuracy is ±1.5ºC

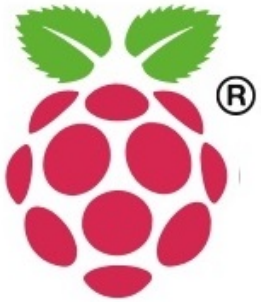
Note: This wiki works with Grove - Temperature sensor V1.1 as well, for V1.0 please refer to Grove - Temperature Sensor

Specifications

- Voltage: 3.3 ~ 5V
- Zero power resistance: 100 KΩ
- Resistance Tolerance: ±1%
- Operating temperature range: -40 ~ +125 ℃
- Nominal B-Constant： 4250 ~ 4299K

Tip
More details about Grove modules please refer to Grove System

Platforms Supported

Arduino	Raspberry	ArduPy
		

Caution
The platforms mentioned above as supported is/are an indication of the module's software or theoritical compatibility. We only provide software library or code examples for Arduino platform in most cases. It is not possible to provide software library / demo code for all possible MCU platforms. Hence, users have to write their own software library.

Getting Started

After this section, you can make Grove - Temperature Sensor V1.1/1.2 run with only few steps.

Note

If this is the first time you work with Arduino, we firmly recommend you to see Getting Started with Arduino before the start.

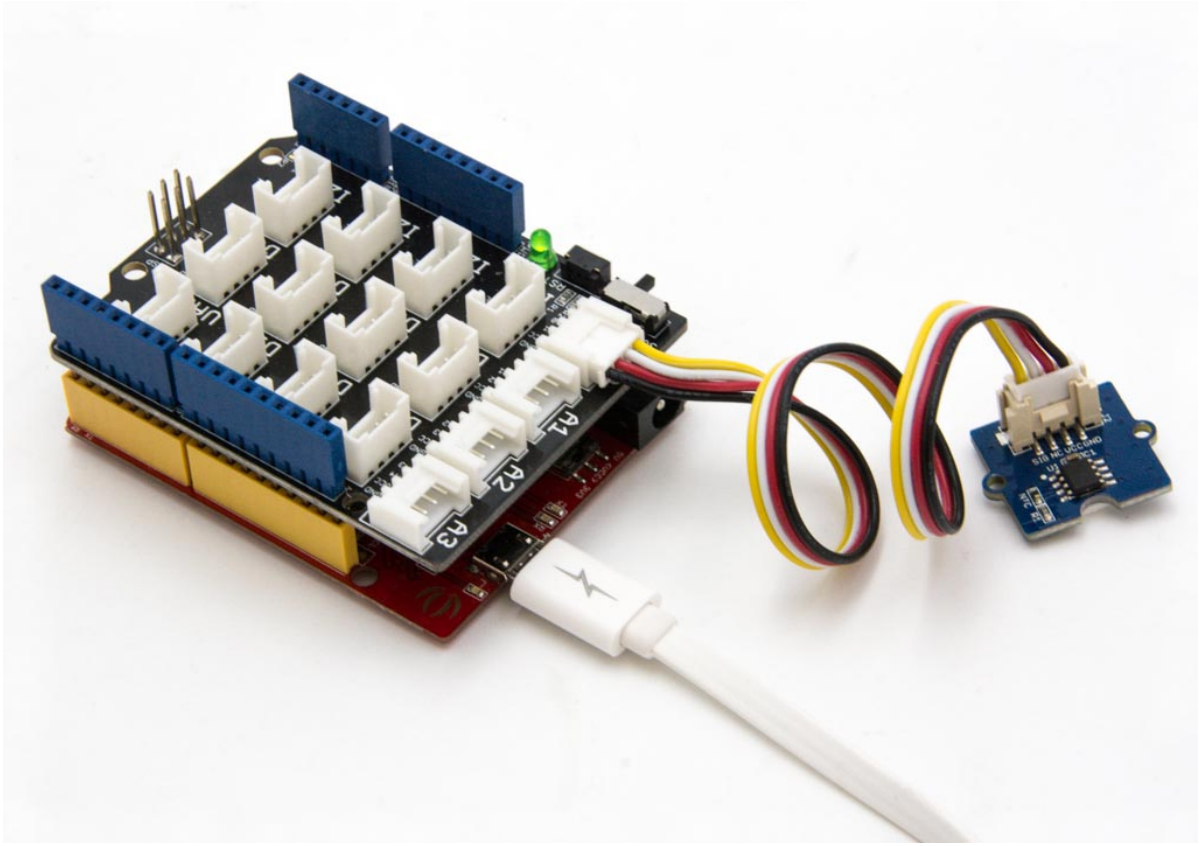
Play With Arduino

Hardware

- **Step 1.** Prepare the below stuffs:

Seeeduino V4.2	Base Shield	Grove - Temperature Sensor
		
Get One Now	Get One Now	Get One Now

- **Step 2.** Connect Grove - Temperature Sensor to port **A0** of Grove-Base Shield.
- **Step 3.** Plug Grove - Base Shield into Seeeduino.
- **Step 4.** Connect Seeeduino to PC via a USB cable.



Note
If we don't have Grove Base Shield, We also can directly connect Grove_Ultrasonic_Ranger to Seeeduino as below.

Seeeduino	Grove - Temperature Sensor
5V	Red
GND	Black
Not Conencted	White
A0	Yellow

Software

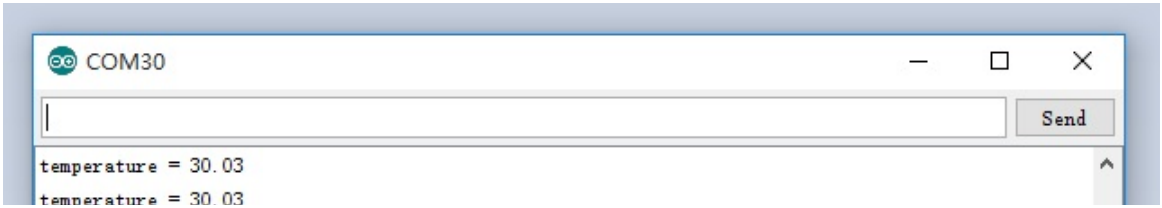
- **Step 1.** Launch Arduino IDE and click **File>New** to open a new page. Copy the following code into the new page and upload. If you do not know how to upload the code, please check How to upload code.

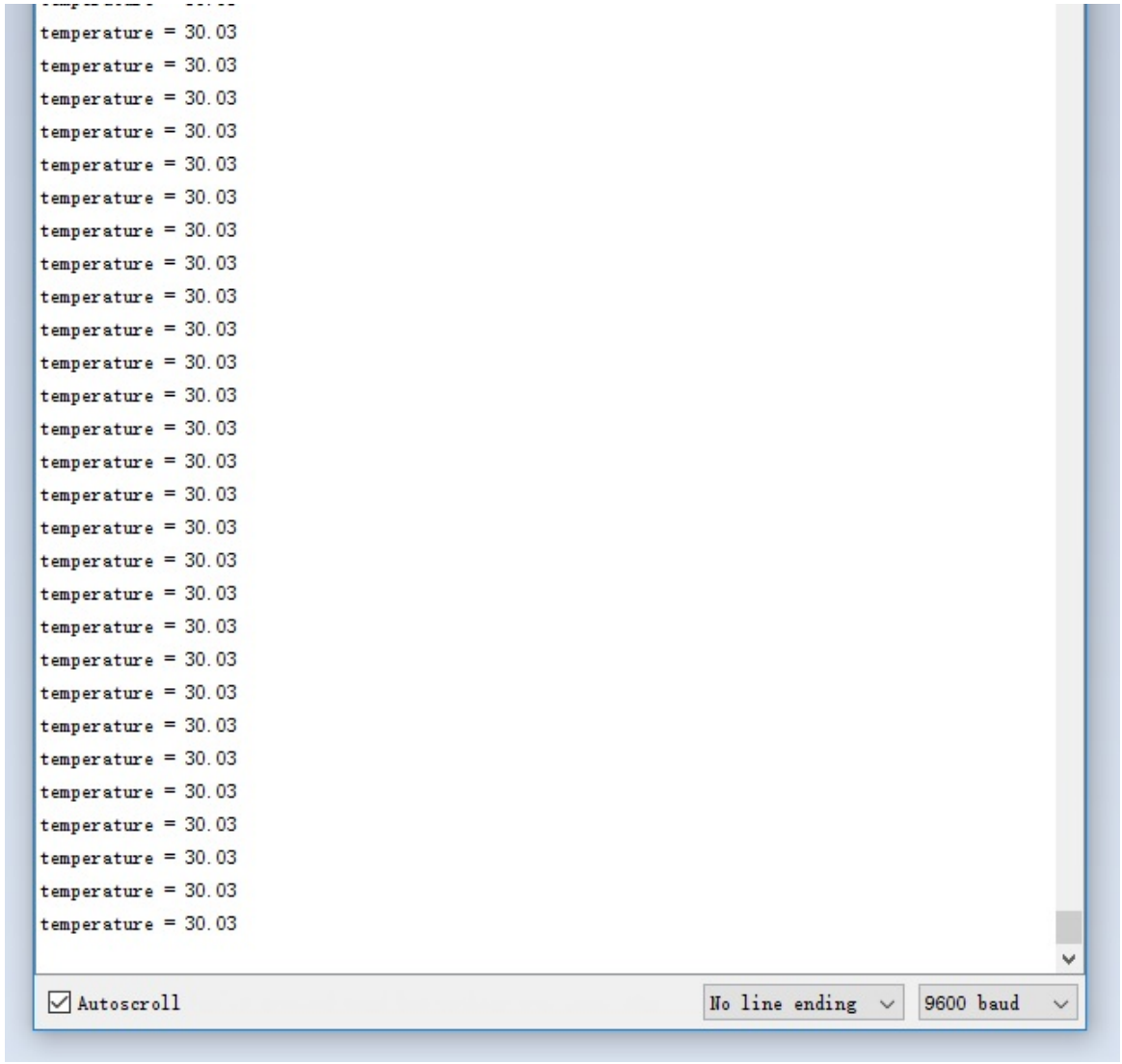
```
// Demo code for Grove - Temperature Sensor V1.1/1.2
// Loovee @ 2015-8-26

#include <math.h>

const int B = 4275;               // B value of the thermistor
const int R0 = 100000;            // R0 = 100k
const int pinTempSensor = A0;     // Grove - Temperature Sensor connect t

#if defined(ARDUINO_ARCH_AVR)
#define debug  Serial
#elif defined(ARDUINO_ARCH_SAMD) ||  defined(ARDUINO_ARCH_SAM)
#define debug  SerialUSB
#else
```

```
#define debug  Serial
#endif

void setup()
{
    Serial.begin(9600);
}

void loop()
{
    int a = analogRead(pinTempSensor);

    float R = 1023.0/a-1.0;
    R = R0*R;

    float temperature = 1.0/(log(R/R0)/B+1/298.15)-273.15; // convert to

    Serial.print("temperature = ");
    Serial.println(temperature);

    delay(100);
}
```

Step 2. Open the **Serial Monitor** of Arduino IDE by click **Tool-> Serial Monitor**. Or tap the `Ctrl` + `Shift` + `M` key at the same time. if every thing goes well, you will get the temperature.

The result should be like:




temperature = 30.03
temperature = 30.03
temperature = 30.03
temperature = 30.03
temperature = 30.03
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temperature = 30.03
temperature = 30.03
temperature = 30.03
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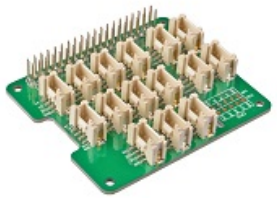
temperature = 30.03
temperature = 30.03
temperature = 30.03
temperature = 30.03
temperature = 30.03
temperature = 30.03
temperature = 30.03
Autoscroll
No line ending
9600 baud

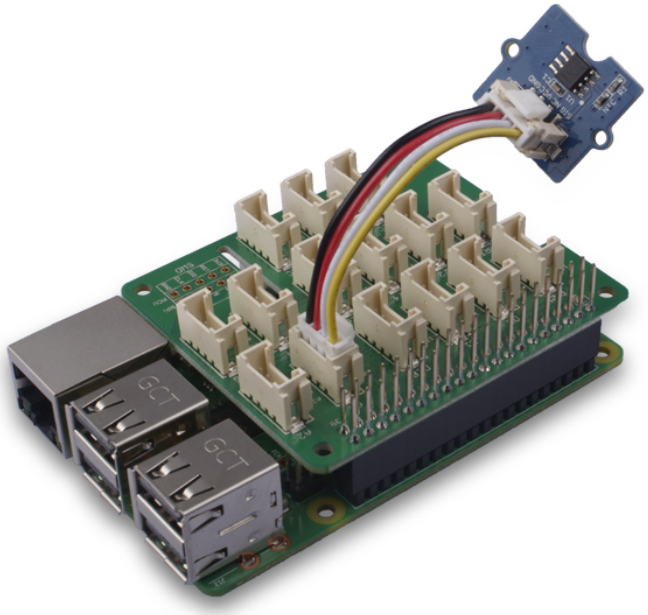
Play With Raspberry Pi (With Grove Base Hat for Raspberry Pi)

Hardware

- **Step 1**. Things used in this project:

Raspberry pi	Grove Base Hat for RasPi	Grove - Temperature Sensor
		
Get ONE Now	Get ONE Now	Get ONE Now

- **Step 2**. Plug the Grove Base Hat into Raspberry.
- **Step 3**. Connect the temperature sensor to port A0 of the Base Hat.
- **Step 4**. Connect the Raspberry Pi to PC through USB cable.



Note
For step 3 you are able to connect the temperature sensor to **any analog Port** but make sure you change the command with the corresponding port number.

Software

- **Step 1**. Follow Setting Software to configure the development environment.
- **Step 2**. Download the source file by cloning the grove.py library.

```
cd ~
git clone https://github.com/Seeed-Studio/grove.py
```

- **Step 3**. Excute below commands to run the code.

```
cd grove.py/grove
python grove_temperature_sensor.py 0
```

Following is the grove_temperature_sensor.py code.

```
import sys
import time
from grove.factory import Factory


def main():
    from grove.helper import SlotHelper
    sh = SlotHelper(SlotHelper.ADC)
    pin = sh.argv2pin()

    sensor = Factory.getTemper("NTC-ADC", pin)

    print('Detecting temperature...')
    while True:
        print('{} Celsius'.format(sensor.temperature))
        time.sleep(1)
```

```
17
18
19 if __name__ == '__main__':
20     main()
```

Success
If everything goes well, you will be able to see the following result

```
1  pi@raspberrypi:~/grove.py/grove $ python grove_temperature_sensor.py 0
2  Hat Name = 'Grove Base Hat RPi'
3  Detecting temperature...
4  24.7473402633 Celsius
5  24.7473402633 Celsius
6  24.7473402633 Celsius
7  24.7112751977 Celsius
8  24.7112751977 Celsius
9  ^CTraceback (most recent call last):
10   File "grove_temperature_sensor.py", line 53, in <module>
11     main()
12   File "grove_temperature_sensor.py", line 49, in main
13     time.sleep(1)
14 KeyboardInterrupt
```

You can quit this program by simply press `Ctrl`+`C`.

Notice
You may have noticed that for the analog port, the silkscreen pin number is something like **A1, A0**, however in the command we use parameter **0** and **1**, just the same as digital port. So please make sure you plug the module into the correct port, otherwise there may be pin conflicts.

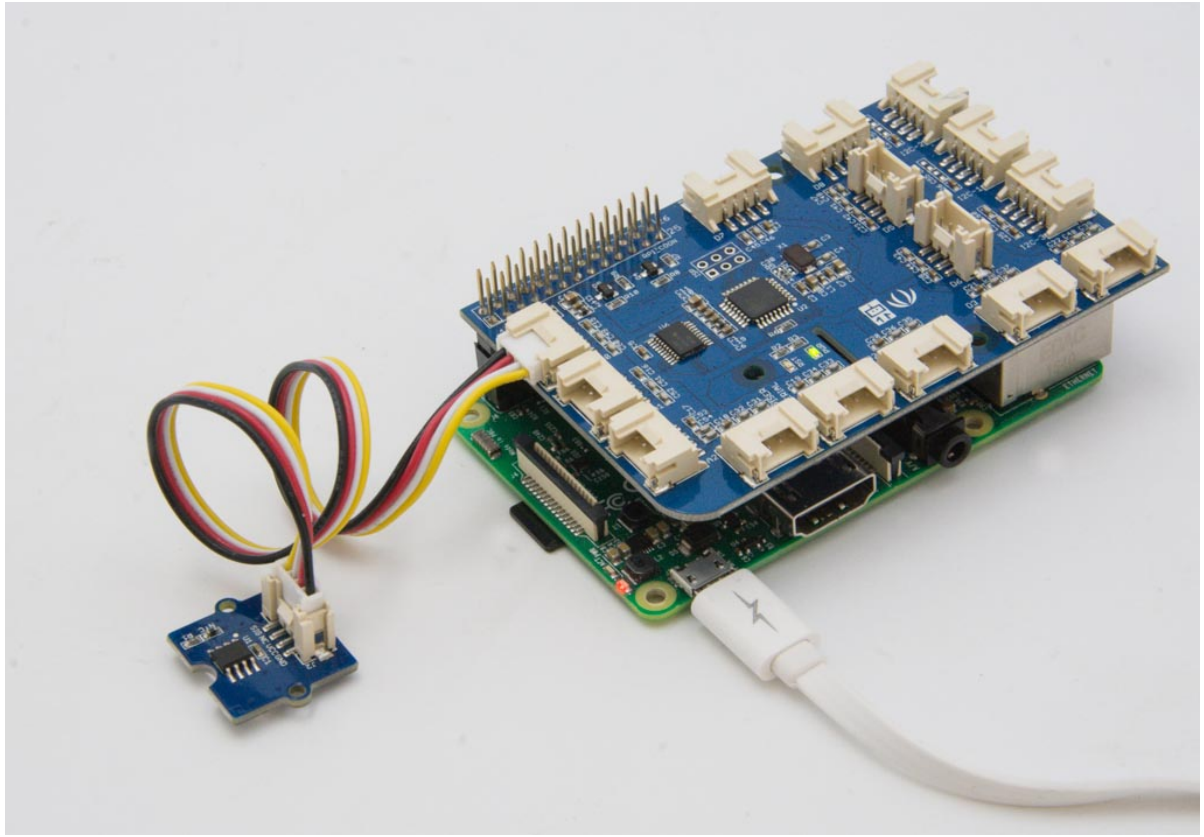
Play With Raspberry Pi (with GrovePi_Plus)

Hardware

- **Step 1.** Prepare the below stuffs:

Raspberry pi	GrovePi_Plus	Grove - Temperature Sensor
		
Get One Now	Get One Now	Get One Now

- **Step 2.** Plug the GrovePi_Plus into Raspberry.
- **Step 3.** Connect Grove - Temperature Sensor ranger to **A0** port of GrovePi_Plus.
- **Step 4.** Connect the Raspberry to PC via USB cable.



Software

- **Step 1.** Follow Setting Software to configure the development environment.
- **Step 2.** Follow Updating the Firmware to update the newest firmware of GrovePi.

Tip

In this wiki we use the path **~/GrovePi/** instead of **/home/pi/Desktop/GrovePi**, you need to make sure Step 2 and Step 3 use the same path.

Note
We firmly suggest you to update the firmware, or for some sensors you may get errors.

- **Step 3.** Git clone the Github repository.

```
cd ~
git clone https://github.com/DexterInd/GrovePi.git
```

- **Step 4.** Excute below commands to use the Grove - Temperature Sensor to meansure the temperature.

```
cd ~/GrovePi/Software/Python
sudo python grove_temperature_sensor.py
```

Here is the grove_temperature_sensor.py code.

```
# NOTE:
#   The sensor uses a thermistor to detect ambient temperature.
#   The resistance of a thermistor will increase when the ambient temperat
#
#   There are 3 revisions 1.0, 1.1 and 1.2, each using a different model t
#   Each thermistor datasheet specifies a unique Nominal B-Constant which
#
#   The second argument in the grovepi.temp() method defines which board v
#   Defaults to '1.0'. eg.
```

```
#       temp = grovepi.temp(sensor)         # B value = 3975
#       temp = grovepi.temp(sensor,'1.1')   # B value = 4250
#       temp = grovepi.temp(sensor,'1.2')   # B value = 4250

import time
import grovepi

# Connect the Grove Temperature Sensor to analog port A0
# SIG,NC,VCC,GND
sensor = 0

while True:
    try:
        temp = grovepi.temp(sensor,'1.2')
        print("temp =", temp)
        time.sleep(.5)

    except KeyboardInterrupt:
        break
    except IOError:
        print ("Error")
```

The result should be like:

```
pi@raspberrypi:~/GrovePi/Software/Python $ sudo python grove_temperature

('temp =', 25.28652137917777)
('temp =', 25.28652137917777)
('temp =', 25.28652137917777)
('temp =', 25.28652137917777)
('temp =', 25.368489566400115)
('temp =', 25.61468397498203)
('temp =', 27.43501590142614)
```

```
10  ('temp =', 27.85285590636829)
11  ('temp =', 27.18509952680688)
12  ('temp =', 26.852756540240193)
```

Play With Wio Terminal (ArduPy)

Hardware

- **Step 1.** Prepare the below stuffs:

Wio Terminal	Grove - Temperature Sensor
	
Get One Now	Get One Now

- **Step 2.** Connect Grove - Temperature Sensor to **A0** port of Wio Terminal.
- **Step 3.** Connect the Wio Terminal to PC through USB Type-C cable.

Software

- **Step 1.** Follow **ArduPy Getting Started** to configure the ArduPy development environment on Wio Terminal.
- **Step 2.** Make sure that the ArduPy firmware is flashed into Wio Terminal. For more information, please follow **here**.

```
aip build
aip flash
```

- **Step 3.** Copy the following code and save it as `ArduPy-temp.py`:

```
from machine import Pin, ADC
from machine import LCD
from machine import Sprite
import time, math

raw = ADC(Pin(13))
lcd = LCD()
spr = Sprite(lcd) # Create a buff
B = 4275 # B value of the thermistor
R0 = 100000 # R0 = 100k

def temp(reading):
    R = 1023.0 / reading - 1.0
    R = R0*R
    temperature = 1.0/(math.log(R/R0)/B+1/298.15)-273.15 # Convert to te
    return temperature

def main():
    spr.createSprite(320, 240)
    while True:
        spr.setTextSize(2)
        spr.fillSprite(spr.color.BLACK)
        spr.setTextColor(lcd.color.ORANGE)
        spr.drawString("Temperature Reading", 45, 10)
        spr.drawFastHLine(40, 35, 240, lcd.color.DARKGREY)
        spr.setTextColor(lcd.color.WHITE)
        spr.drawString("- ", 20, 50)
        spr.drawFloat(temp(raw.read()), 3, 40,50)
        spr.drawString("C", 120, 50)
        spr.pushSprite(0,0)
        time.sleep_ms(500)

```

```
        print("Temperature: ", temp(raw.read()), "C")

if __name__ == "__main__":
    main()
```

- **Step 4.** Save the `ArduPy-temp.py` in a location that you know. Run the following command and **replace** `<YourPythonFilePath>` with your `ArduPy-temp.py` location.

```
aip shell -n -c "runfile <YourPythonFilePath>"
# Example:
# aip shell -n -c "runfile /Users/ansonhe/Desktop/ArduPy-temp.py"
```

- **Step 5.** We will see the temperature value display on terminal as below, and displaying on the Wio Terminal LCD screen.

```
ansonhe@Ansons-Macbook-Pro ~:aip shell -n -c "runfile /Users/ansonhe/Des
Positional argument (/dev/cu.usbmodem141101) takes precedence over --ope
Connected to ardupy
Temperature:  28.08603 C
Temperature:  28.50415 C
Temperature:  28.16953 C
Temperature:  28.25308 C
Temperature:  28.08603 C
Temperature:  28.16953 C
Temperature:  28.08603 C
Temperature:  28.16953 C
Temperature:  28.33671 C
Temperature:  28.16953 C
Temperature:  28.25308 C
```

Reference

If you want to know how the algorithm of temperature coming, please refer to the below image:

1. Zero-power Resistance of Thermistor: R

$R=R_0 \exp B (1/T-1/T_0)$ ·····(1)

R: Resistance in ambient temperature T (K)

(K: absolute temperature)

R_0: Resistance in ambient temperature T_0 (K)

B: B-Constant of Thermistor

2. B-Constant

as (1) formula

$B= \ell n (R/R_0) / (1/T-1/T_0)$ ·····(2)

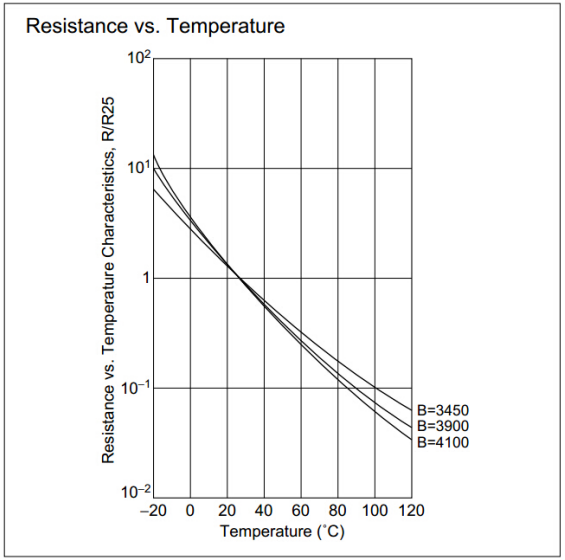
3. Thermal Dissipation Constant

When electric power P (mW) is spent in ambient temperature T_1 and thermistor temperature rises T_2, there is a formula as follows

$P=C (T_2-T_1)$ ·····(3)

C: Thermal dissipation constant (mW/°C)

Thermal dissipation constant is varied with dimensions, measurement conditions, etc.



Schematic Online Viewer

Resources

- **[Zip]** Grove - Temperature Sensor v1.1 Eagle File

- **[PDF]** Grove - Temperature Sensor v1.1.PDF
- **[PDF]** Temperature Sensor datasheet

Tech Support

Please submit any technical issue into our forum.