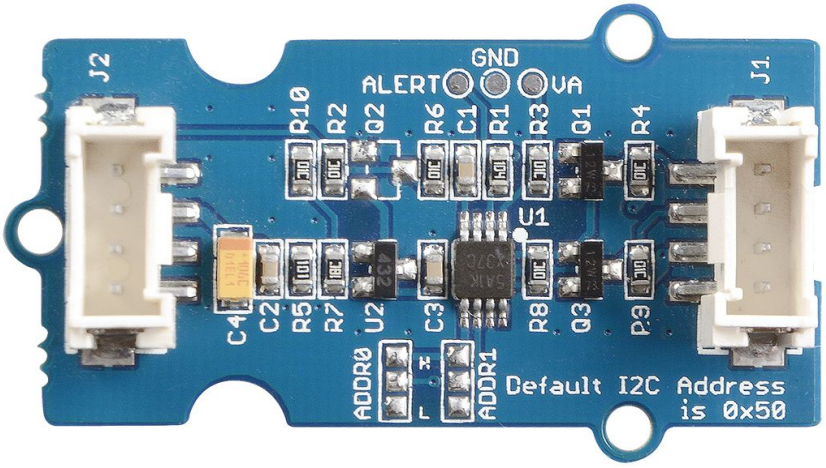
Grove - I2C ADC



Grove - I2C ADC is a 12-bit precision ADC module based on ADC121C021. It helps you increase the accuracy of value collected from analog sensor by providing a constant reference voltage. Because its address is changeable, you can use up to 9 I2C ADC at the same time at most. At the other hand, this module provides

auto sleep function which lowers the power consumption considerably.

Get One Now

[https://www.seeedstudio.com/depot/grove-i2c-adc-p-1580.html]

Version

Version	Default I2C Address
Grove - I2C ADC v1.0/v1.1	0x55
Grove - I2C ADC v1.2	0x50

Features

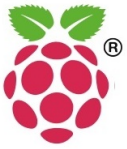
- Low power consumption
- High precision
- Automatic power-down mode
- Address changeable

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

Specifications

Item	Typical	Unit
Working Voltage	5.0	VDC
Resolution	12	Bit
Sample Rate	188.9	ksps
Dimension	40X20	mm

Platforms Supported

Arduino	Raspberry Pi		
			

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.

Hardware Overview

J1: used to connect Arduino IIC Interface as Grove - I2C ADC output interface.

J2: used to connect analog sensor as Grove - I2C ADC input interface.

U1: ADC121C021 IC,12-Bit Analog-to-Digital Converter

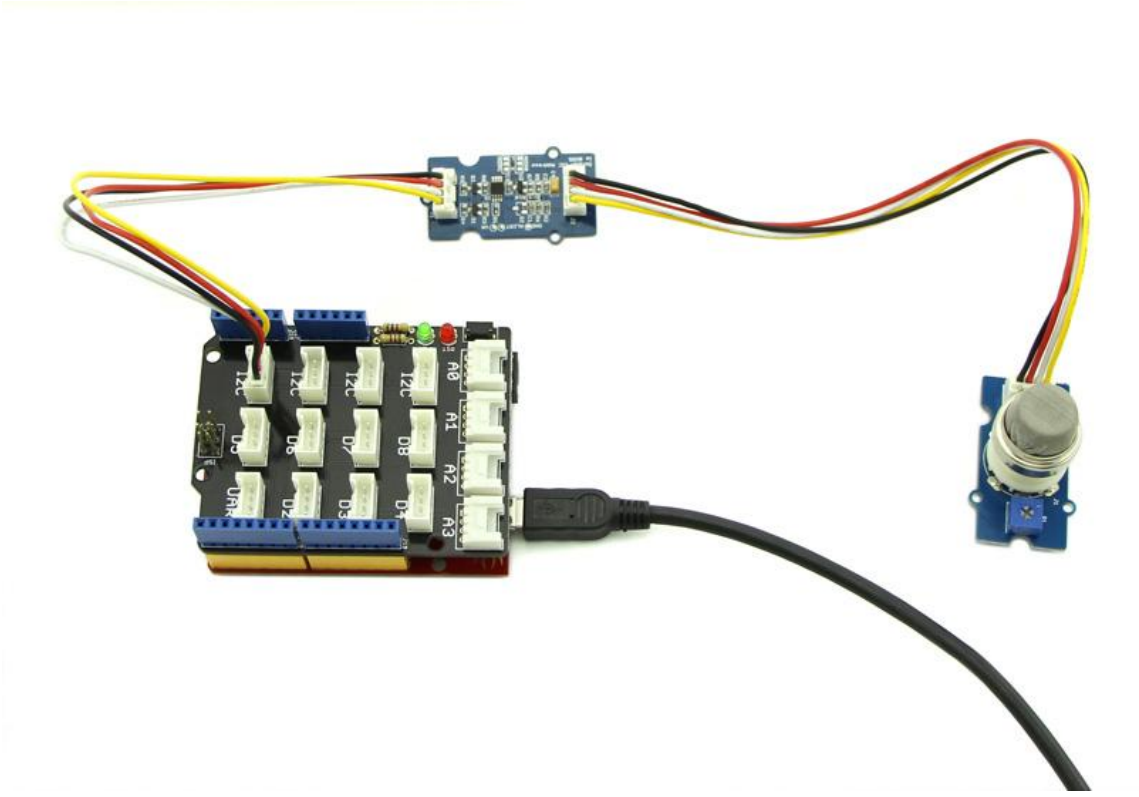
The black line area is used to set the IIC address. ADDR0 and ADDR1 are shipped connected to L. You can change them to "H" or floating by a little modification on the board(floating is neither connecting "H" nor connecting "L"). Find details in the Reference.

Getting Started

With Arduino [/Arduino]

Grove - I2C ADC has two interfaces: input socket(J2) and output socket(J1). Connect an analog sensor to its input socket and connect the I2C ADC to Arduino/Seeeduino also via Grove cables.

Take Grove - Gas Sensor as an example, and now we learn how to read sensor data using Grove - I2C ADC. The hardware installation should be like this:



Now you can read the gas sensor value using the code below.

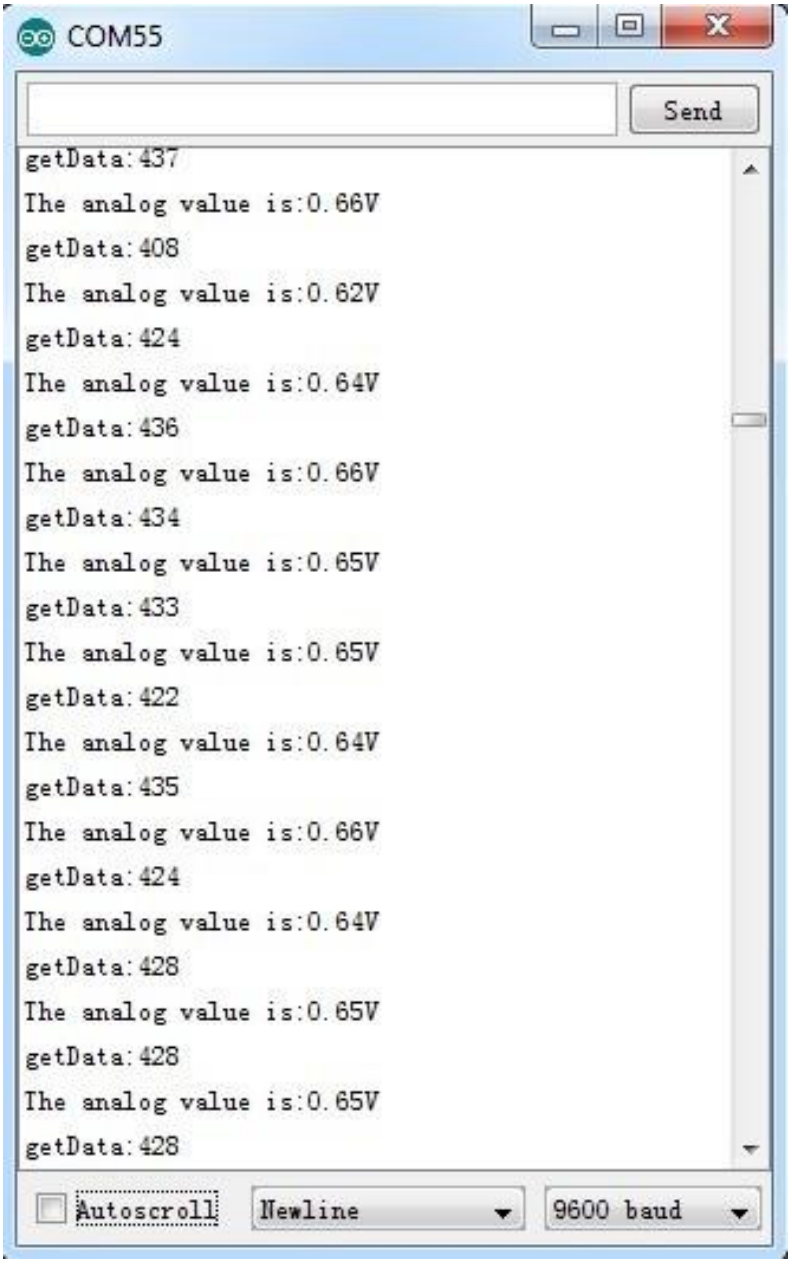
```
#include <Wire.h>

#define ADDR_ADC121                 0x50 // For v1.0 & v1.1,

#define V_REF 3.00

#define REG_ADDR_RESULT             0x00
#define REG_ADDR_ALERT              0x01
#define REG_ADDR_CONFIG             0x02
#define REG_ADDR_LIMITL             0x03
#define REG_ADDR_LIMITH             0x04
#define REG_ADDR_HYST               0x05
#define REG_ADDR_CONVL              0x06
#define REG_ADDR_CONVH              0x07

unsigned int getData;
float analogVal=0;          // convert
void init_adc()
{
```

```
  Wire.beginTransmission(ADDR_ADC121);        // transmi
  Wire.write(REG_ADDR_CONFIG);                // Configu
  Wire.write(0x20);
  Wire.endTransmission();
}

void read_adc()     //unsigned int *data
{


    Wire.beginTransmission(ADDR_ADC121);        // transi
    Wire.write(REG_ADDR_RESULT);                // get r
    Wire.endTransmission();

    Wire.requestFrom(ADDR_ADC121, 2);           // reque
    delay(1);
    if(Wire.available()<=2)
    {
      getData = (Wire.read()&0x0f)<<8;
      getData |= Wire.read();
    }
    Serial.print("getData:");
    Serial.println(getData);
    delay(5);
    Serial.print("The analog value is:");
    Serial.print(getData*V_REF*2/4096);
    Serial.println("V");
}
void setup()
{
  Serial.begin(9600);
  Wire.begin();
  init_adc();
}

void loop()
{  read_adc();//adcRead);
   delay(50);
}
```

In the code above, we defined the Vref as 3.0V which is decided by the I2C ADC module. This reference voltage is more accurate than one generated by microcontroller. And you can make that more accurate by measuring the voltage between VA and GND and use that value to replace 3.00 in the code above.

Now you can upload the code.

Afterwards, open the serial monitor and read the values:



Note
The address of Grove - I2C ADC is changeable which means you can redefine its address. That requires some hardware modification on the board. If you are thinking about using more than one I2C ADCs at the same time, follow the instructions in the Reference part below to do so. The maximum number of I2C ADCs that can be used simultaneously is 9, but there are only 4 I2C sockets on Grove - Base Shield V1.2 [/Base_Shield_V2], so if you want to use more than 4 I2C ADC, take a Grove - I2C Hub [/Grove-I2C_Hub] to create more I2C sockets.

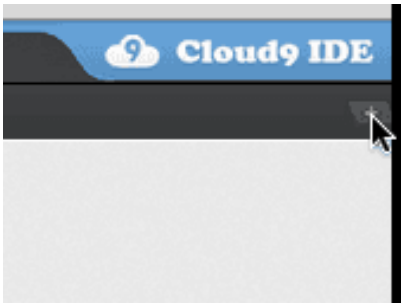
With Beaglebone Green

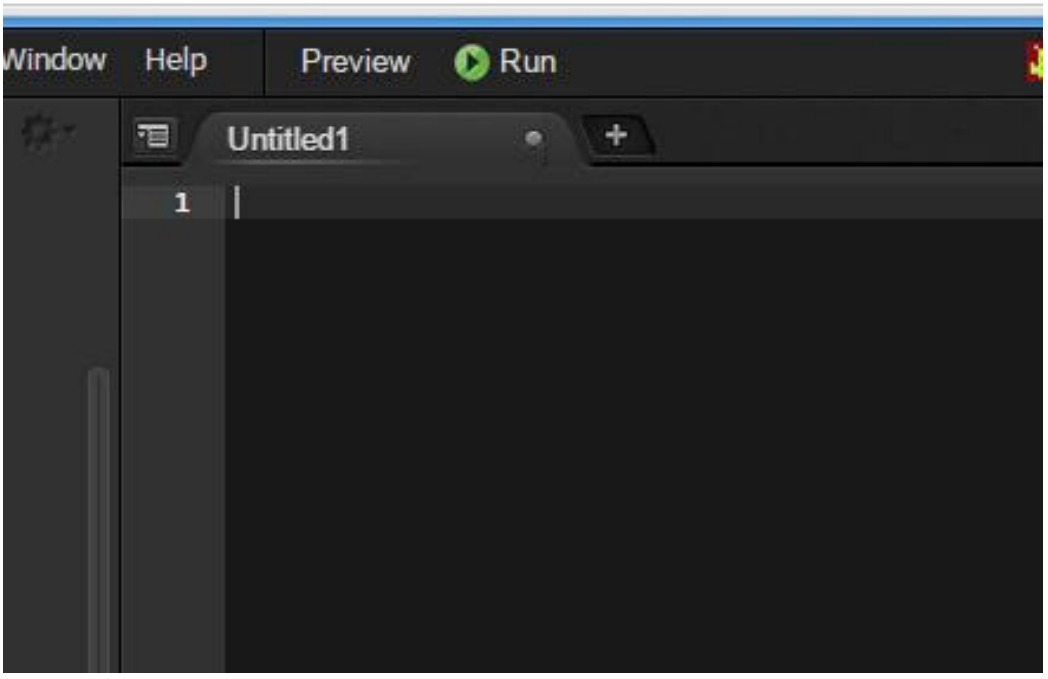
To begin editing programs that live on BBG, you can use the Cloud9 IDE. As a simple exercise to become familiar with Cloud9 IDE, creating a simple application to blink one of the 4 user programmable LEDs on the BeagleBone is a good start.

If this is your first time to use Cloud9 IDE, please follow this **link** [/BeagleBone_Green].

Step1: Set the Grove - UART socket as a Grove - GPIO Socket, just follow this **link** [https://www.seeedstudio.com/recipe/362-how-to-use-the-grove-uart-port-as-a-gpio-on-bbg.html].

Step2: Click the "+" in the top-right to create a new file.





Step3: Copy and paste the following code into the new tab

```
from Adafruit_I2C import Adafruit_I2C
import time

ADDR_ADC121 = 0x50

REG_ADDR_RESULT = 0x00
REG_ADDR_ALERT = 0x01
REG_ADDR_CONFIG = 0x02
REG_ADDR_LIMITL = 0x03
REG_ADDR_LIMITH = 0x04
REG_ADDR_HYST = 0x05
REG_ADDR_CONVL = 0x06
REG_ADDR_CONVH = 0x07

i2c = Adafruit_I2C(ADDR_ADC121)

class I2cAdc:
    def __init__(self):
        i2c.write8(REG_ADDR_CONFIG, 0x20)

```

```
    def read_adc(self):
        "Read ADC data 0-4095."
        data_list = i2c.readList(REG_ADDR_RESULT, 2)
        #print 'data list', data_list
        data = ((data_list[0] & 0x0f) << 8 | data_list[1
        return data

if __name__ == '__main__':
    # Connect the Grove - I2C ADC to I2C Grove port of B
    adc = I2cAdc()
    while True:
        print 'sensor value ', adc.read_adc()
        time.sleep(.2)
```

Step4: Save the file by clicking the disk icon and giving the file a name with the .py extension.

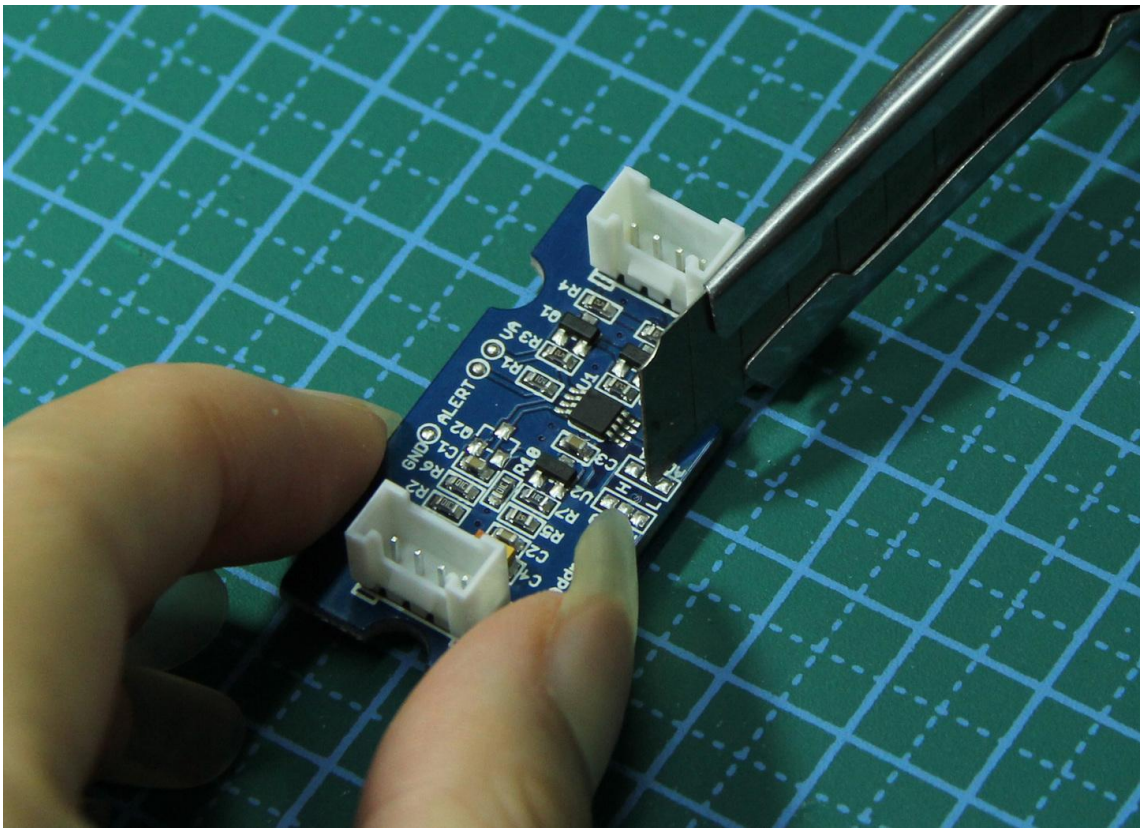
Step5: Connect Grove I2C ADC to Grove I2C socket on BBG.

Step6: Run the code. You'll find that the terminal outputs AD value every 2 seconds.

Reference

I2C Address Setting

The ADC I2C has a seven-bit hardware address which is decided by ADR0 and ADR1. ADR0 and ADR1 are connected to L inside the board as default. But you can change it. For example, use a knife to cut off the connection between L and ADR0(as the picture shown below), then you make the state of ADR0 into Floating(connected to nothing). And if you solder up ADR0 and H this time, then you make the value of ADR0 H.

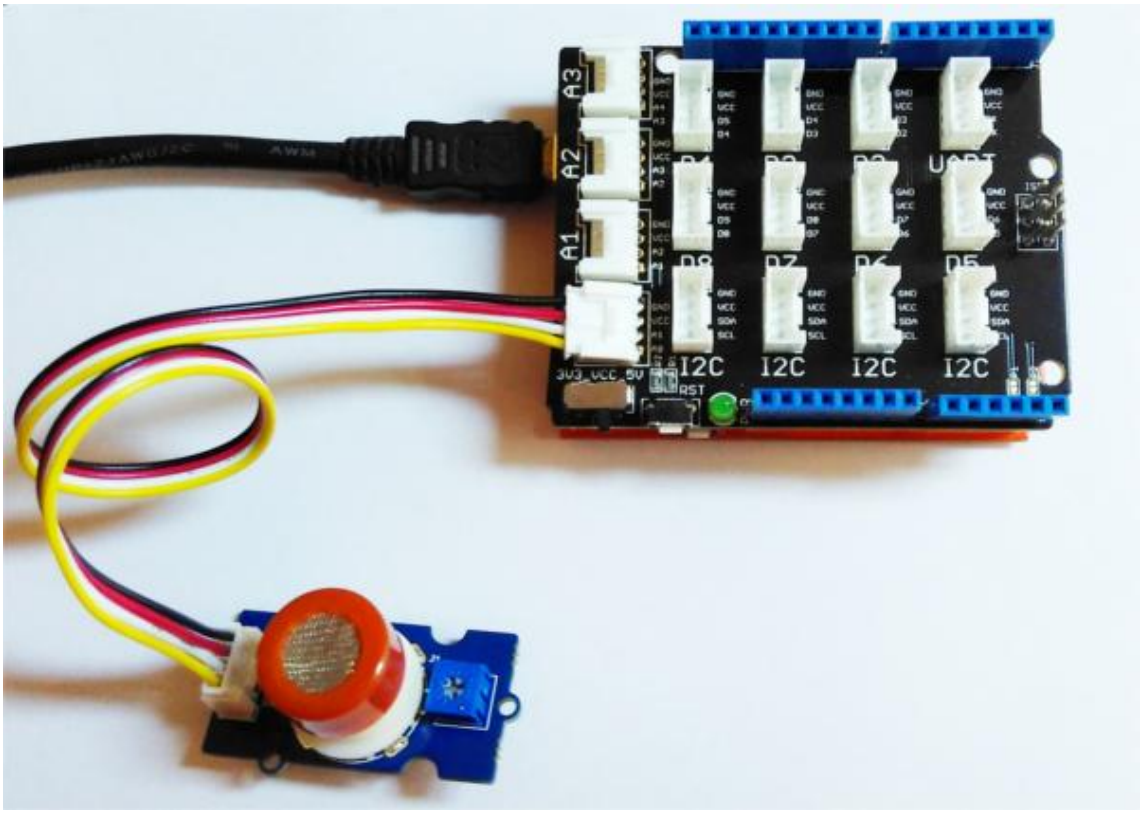


You can find the relationship of hardware I2C address and the values of ADR0 and ADR1 in the following table.

Slave Address[A6 - A0]	ADR0 and ADR1 inputs state	
	ADR1	ADR0
1010000(0x50)	Floating	Floating
1010001(0x51)	Floating	L
1010010(0x52)	Floating	H
1010100(0x54)	L	Floating
1010101(default 0x55)	L	L
1010110(0x56)	L	H
1011000(0x58)	H	Floating
1011001(0x59)	H	L
1011010(0x5A)	H	H

How much does the I2C ADC increase the accuracy?

Here is an experiment we make to give you a sense about how much the I2C ADC increase the accuracy of an analog sensor. First, let's check the values collected directly through analog port on Arduino/Seeeduino from an Grove - Gas Sensor(MQ5)

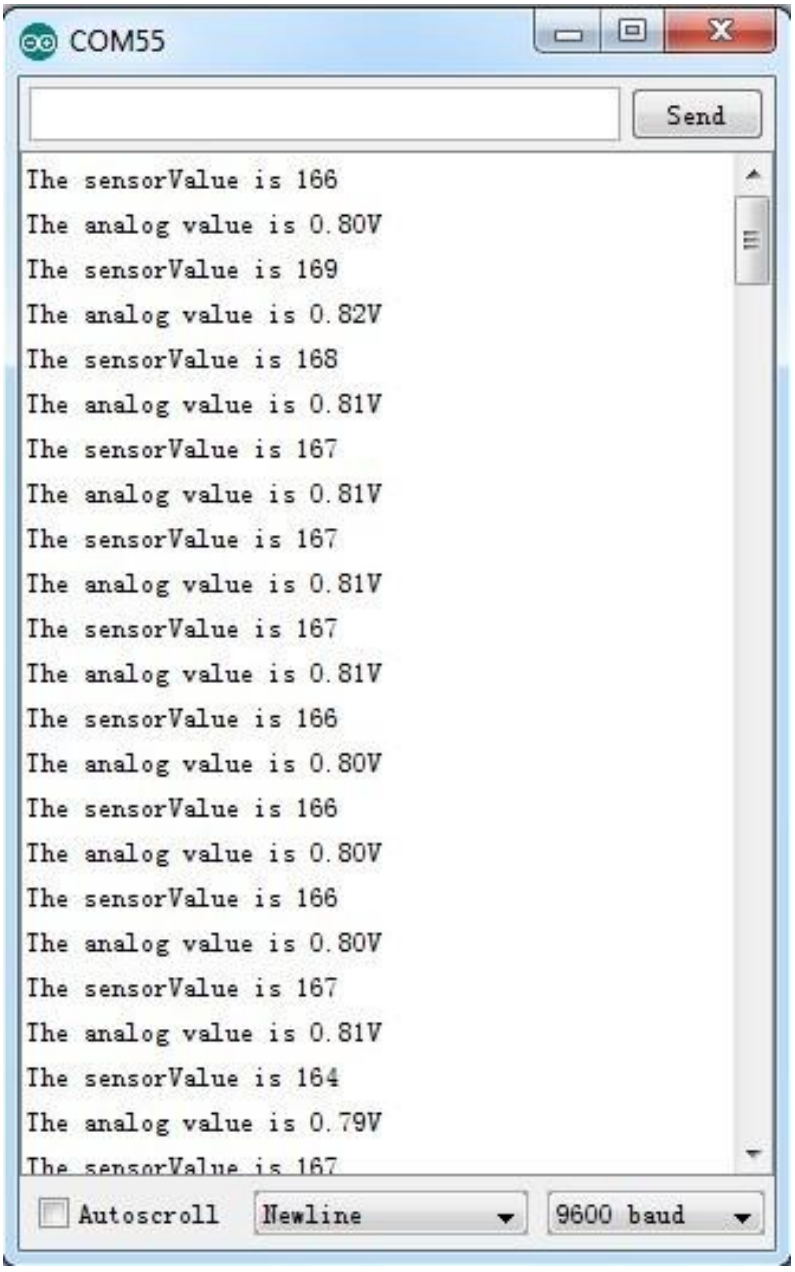


We upload the code below to get the data.

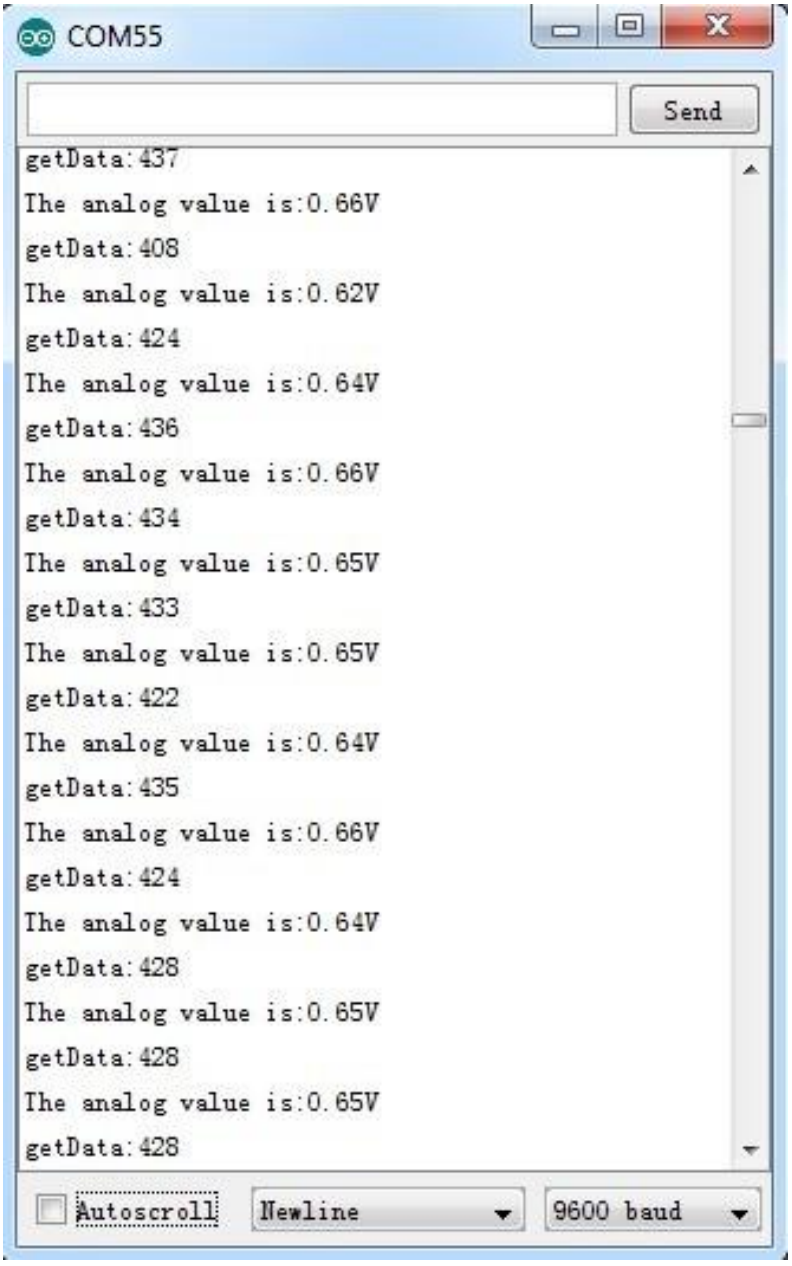
```
/*
 * Grove - Gas Sensor(MQ5)
 *
 * The Gas Sensor detect the related Gas density,
 * Arduino get the result by analogread. the gas Den
 * 0~1, larger the output is, the denser the gas.
 * Connect the Sensor to A0 in this demo;
 *
 *  By: https://www.seeedstudio.com
*/
#define Vref 4.95
void setup() {
  Serial.begin(9600);
}

void loop() {
  float vol;
  int sensorValue = analogRead(A0);
  vol=(float)sensorValue/1023*Vref;
```

```
20        Serial.print("The sensorValue is ");
21        Serial.println(sensorValue);
22        Serial.print("The analog value is ");
23        Serial.print(vol);
24        Serial.println("V");
25        delay(100);
26      }
```

The result is:

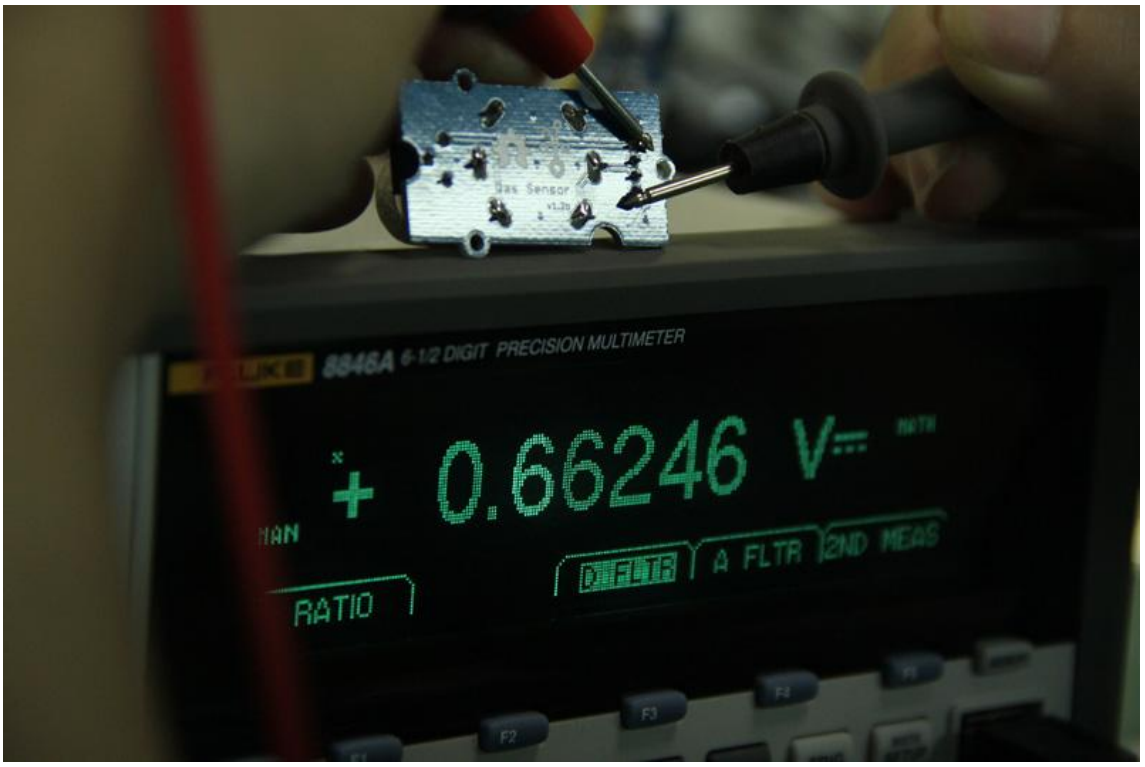


As default, Vref is generated by Arduino which is theoretically 5V. But actually that is a value afloat which results the deviation of the final data. This kind of inaccuracy is avoided when using Grove - I2C ADC, because it provides a strict 3.0V as Vref. To contrast, in the same condition, sensor values collected by the circuit with Grove - I2C ADC in the scope is shown below:



In order to find out which result is more close to the actual condition, here we use a multimeter to measure the voltage

between the pin SIG and pin GND of the sensor.



Schematic Online Viewer

Resources

- I2C ADC Eagle File [https://files.seeedstudio.com/wiki/Grove-I2C_ADC/res/I2C_ADC_Eagle_File.zip]
- ADC121C021 Datasheet [https://files.seeedstudio.com/wiki/Grove-I2C_ADC/res/ADC121C021_Datasheet.pdf]

Project

BeagleBone Green Temperature Monitor on Artik Cloud Publish Grove Temperature Sensor values collected by a BeagleBone Green to Artik Cloud.

(https://www.hackster.io/LaurenceHR/be
green-temperature-monitor-on-artik-
cloud-08ca3b)

Tech Support

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

[https://www.seeedstudio.com/act-4.html?utm_source=wiki&utm_medium=wikibanner&utm_campaign=newproducts]