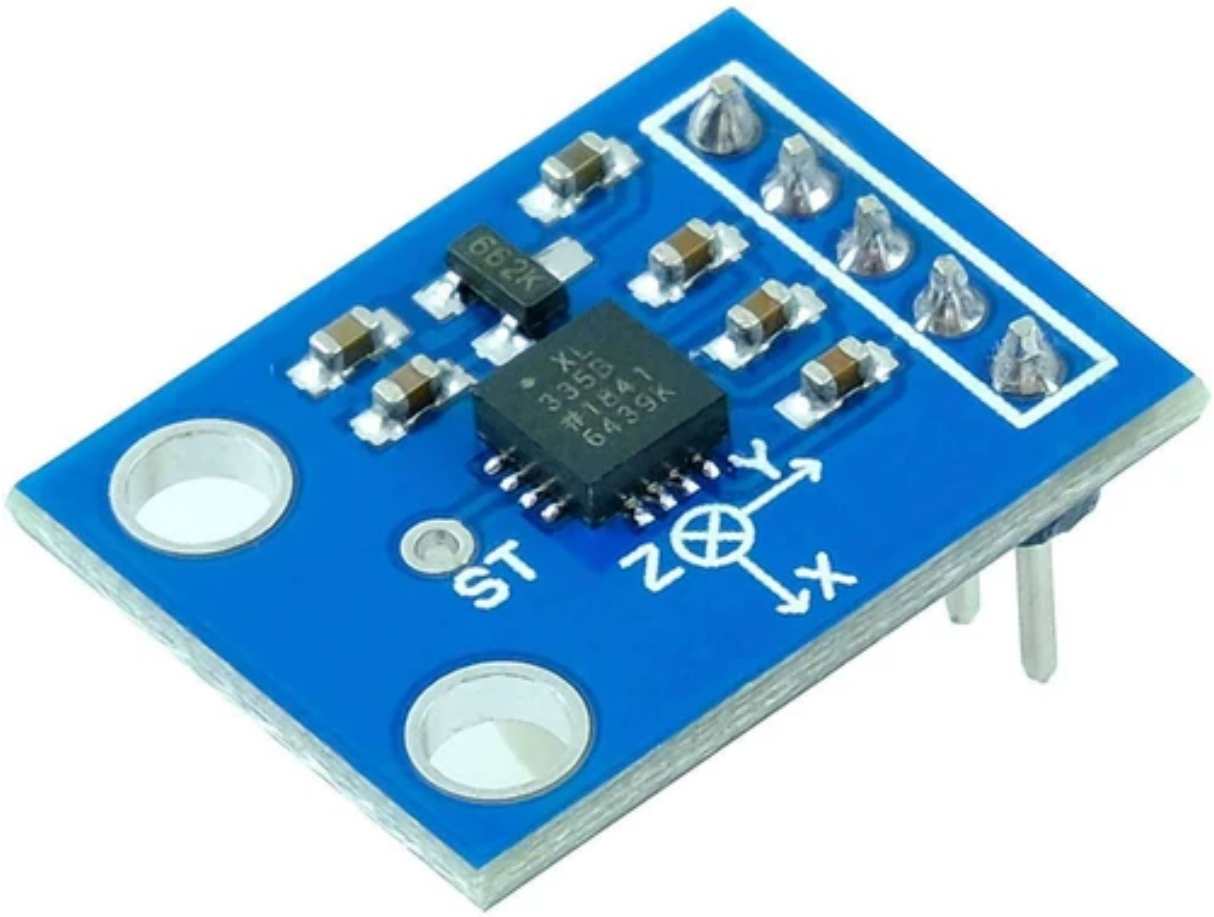
Welcome!

Thank you for purchasing our *AZ-Delivery GY-61 Accelerometer Sensor Module*. On the following pages, you will be introduced to how to use and set-up this handy device.

Have fun!



Areas of application
Education and teaching: Use in schools, universities and training institutions to teach the basics of electronics, programming and embedded systems. Research and development: Use in research and development projects to create prototypes and experiments in the fields of electronics and computer science. Prototype development: Use in the development and testing of new electronic circuits and devices. Hobby and Maker Projects: Used by electronics enthusiasts and hobbyists to develop and implement DIY projects.

Required knowledge and skills
Basic understanding of electronics and electrical engineering. Knowledge of programming, especially in the C/C++ programming language. Ability to read schematics and design simple circuits. Experience working with electronic components and soldering.

Operating conditions
The product may only be operated with the voltages specified in the data sheet to avoid damage. A stabilized DC power source is required for operation. When connecting to other electronic components and circuits, the maximum current and voltage limits must be observed to avoid overloads and damage.

Environmental conditions
The product should be used in a clean, dry environment to avoid damage caused by moisture or dust. Protect the product from direct sunlight (UV)

Intended Use
The product is designed for use in educational, research and development environments. It is used to develop, program and prototype electronic projects and applications. The Sensor product is not intended as a finished consumer product, but rather as a tool for technically savvy users, including engineers, developers, researchers and students.

Improper foreseeable use
The product is not suitable for industrial use or safety-relevant applications. Use of the product in medical devices or for aviation and space travel purposes is not permitted

disposal
Do not discard with household waste! Your product is according to the European one Directive on waste electrical and electronic equipment to be disposed of in an environmentally friendly manner. The valuable raw materials contained therein can be recycled become. The application of this directive contributes to environmental and health protection. Use the collection point set up by your municipality to return and Recycling of old electrical and electronic devices. WEEE Reg. No.: DE 62624346

electrostatic discharge
Attention: Electrostatic discharges can damage the product. Note: Ground yourself before touching the product, such as by wearing an anti-static wrist strap or touching a grounded metal surface.

safety instructions
Although our product complies with the requirements of the RoHS Directive (2011/65/EU) and does not contain any hazardous substances in quantities above the permitted limits, residues may still be present. Observe the following safety instructions to avoid chemical hazards: Caution: Soldering can produce fumes that can be harmful to health. Note: Use a solder fume extractor or work in a well-ventilated area. If necessary, wear a respirator mask. Caution: Some people may be sensitive to certain materials or chemicals contained in the product. Note: If skin irritation or allergic reactions occur, stop use and, if necessary, consult a doctor. Caution: Keep the product out of the reach of children and pets to avoid accidental contact and swallowing of small parts. Note: Store the product in a safe, closed container when not in use. Attention: Avoid contact of the product with food and drinks. Note: Do not store or use the product near food to prevent contamination. Although our product complies with the requirements of the RoHS Directive (2011/65/EU) and does not contain any hazardous substances in quantities above the permitted limits, residues may still be present. Observe the following safety instructions to avoid chemical hazards: Caution: Soldering can produce fumes that can be harmful to health. Note: Use a solder fume extractor or work in a well-ventilated area. If necessary, wear a respirator mask. Caution: Some people may be sensitive to certain materials or chemicals contained in the product. Note: If skin irritation or allergic reactions occur, stop use and, if necessary,

consult a doctor. Caution: Keep the product out of the reach of children and pets to avoid accidental contact and swallowing of small parts. Note: Store the product in a safe, closed container when not in use. Attention: Avoid contact of the product with food and drinks. Note: Do not store or use the product near food to prevent contamination. The product contains sensitive electronic components and sharp edges. Improper handling or assembly can result in injury or damage. Observe the following safety instructions to avoid mechanical hazards: Attention: The product's circuit board and connectors may have sharp edges. Use caution to avoid cuts. Note: Wear appropriate protective gloves when handling and assembling the product. Caution: Avoid excessive pressure or mechanical stress on the board and components. Note: Only mount the product on stable and flat surfaces. Use appropriate spacers and housings to minimize mechanical stress. Attention: Make sure the product is securely fastened to prevent accidental slipping or falling. Note: Use appropriate support or secure mounting in enclosures or on mounting plates. Caution: Make sure all cable connections are connected securely and correctly to avoid strain and accidental unplugging. Note: Route cables so that they are not under tension and do not pose a tripping hazard. The product operates with electrical voltages and currents that, if used improperly, can result in electric shocks, short circuits or other hazards. Observe the following safety instructions to avoid electrical hazards: Attention: Use the product only with the specified voltages. Note: The performance limits of the product can be found in the associated data sheet Caution: Avoid short circuits between the connectors and components of the product Note: Make sure that no conductive objects touch or bridge the circuit board. Use insulated tools and pay attention to the arrangement of connections. Caution: Do not perform any work on the product when it is connected to a power source. Note: Disconnect the product from power before making any circuit changes or connecting or removing components. Caution: Do not exceed the specified current ratings for the product's inputs and outputs. Note: The performance limits of the product can be found in the technical specifications or in the data sheet Attention: Make sure that the power sources used are stable and correctly sized. Note: Only use tested and suitable power supplies to avoid voltage fluctuations and overloads. Attention: Maintain sufficient distance from live parts to avoid accidental contact. Note: Ensure that the cabling is arranged safely and clearly according to the voltage used. Caution: Use insulating housings or protective covers to protect the product from direct contact. Note: Place the product in a non-conductive case to avoid accidental touching and short circuits. The product and the components on it may become warm during operation. Improper handling or overloading the product can result in burns, damage or fire. Observe the following safety instructions to avoid thermal hazards: Caution: Make sure the product is used within recommended operating temperatures. Note: The recommended operating temperature range is typically between-40°C and +85°C. Check the specific information in the product data sheet. Attention: Do not place the product near external heat sources such as radiators or direct sunlight. Note: Ensure that the product is operated in a cool and well-ventilated area. Attention: Make sure the product is well ventilated to avoid overheating. Note: Use fans or heat sinks when operating the product in a closed enclosure or in an environment with limited air circulation. Attention: Mount the product on heat-resistant surfaces and in heat-resistant housings. Note: Use enclosure materials that can withstand high temperatures to avoid damage or fire hazard. Caution: Implement temperature monitoring when using an enclosure and, if necessary, protection mechanisms that shut down the product if it overheats. Note: Note: Use temperature sensors and appropriate software to monitor the temperature of the product and shut down the system if necessary. Caution: Avoid overloads that can cause excessive heating of components. Note: To prevent overheating, do not exceed the specified current and voltage limits. Caution: Short circuits can generate significant heat and cause fires. Note: Make sure that all connections are correct and secure and that no conductive objects can accidentally cause short circuits.

Table of Contents

Introduction

The GY-61 accelerometer module is a three axis accelerometer sensor module based on the ADXL335 integrated circuit which reads *X*, *Y* and *Z* axis acceleration and converts them in analog voltages.

By measuring the amount of acceleration due to gravity, an accelerometer can figure out the angle it is tilted at with respect to the earth. By sensing the amount of dynamic acceleration, the accelerometer can find out how fast and in what direction the device is moving.

The ADXL335 chip has low noise and power consumption. The sensor has a full sensing range of ±*3g*. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock or vibration.

The module is used in many applications such as mobile devices, gaming systems, disk drive protection, image stabilization, sports and health devices etc.

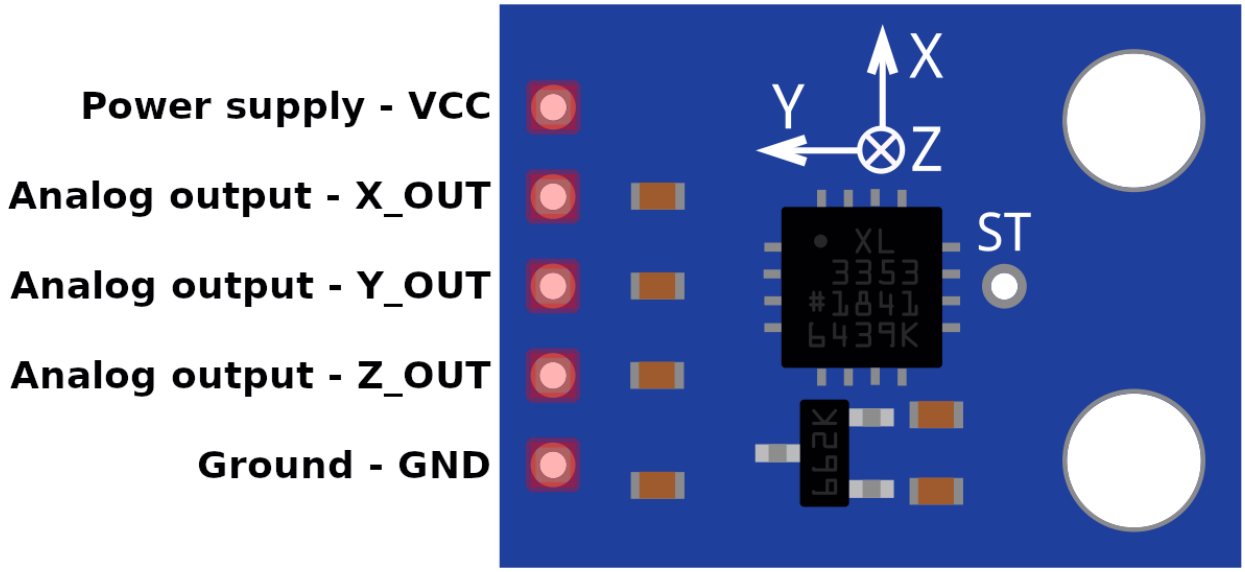
The module has an on-board *3.3V* voltage regulator to power the ADXL335, so power provided should be between *+3.3V* and *+5V* DC.

Specifications

» Operating voltage:	from 3V to 5V
» Current consumption:	40µA (0.1µA idle)
» Full scale range:	±3g
» Sensitivity:	300mV/g (Type)
» Sensor ouput:	Analog
» Voltage output:	centered at 1.65V
» Dimensions:	21 x 16 x 3mm [0.8 x 0.6 x 0.1in]

The pinout

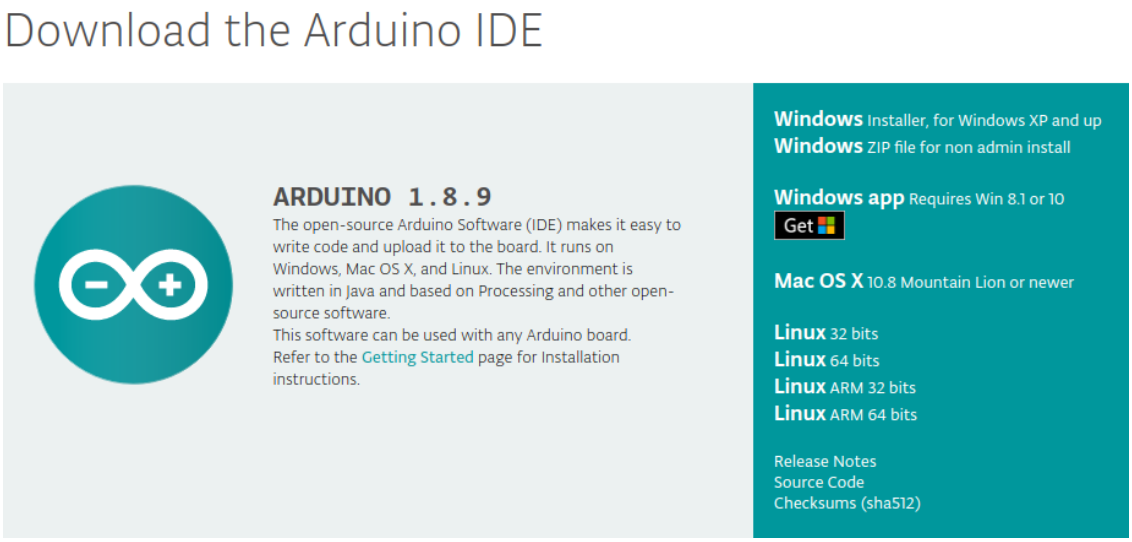
The GY-61 accelerometer sensor module has five pins. The pinout diagram is shown on the following image:



NOTE: Raspberry Pi can not read analog voltages, so the external analog to digital converter has to be used.

How to set-up Arduino IDE

If the Arduino IDE is not installed, follow the link:
https://www.arduino.cc/en/Main/Software
and download the installation file for the operating system of choice.



For *Windows* users, double click on the downloaded *.exe* file and follow the instructions in the installation window.

For *Linux* users, download a file with the extension *.tar.xz*, which has to be extracted. When it is extracted, go to the extracted directory and open the terminal in that directory. Two *.sh* scripts have to be executed, the first called *arduino-linux-setup.sh* and the second called *install.sh*.

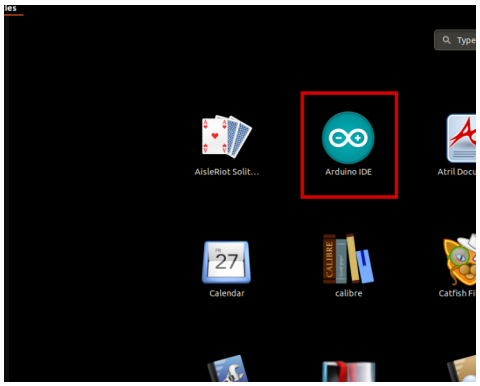
To run the first script in the terminal, open the terminal in the extracted directory and run the following command:

sh arduino-linux-setup.sh user_name

user_name - is the name of a superuser in Linux operating system. A password for the superuser has to be entered when the command is started. Wait for a few minutes for the script to complete everything.

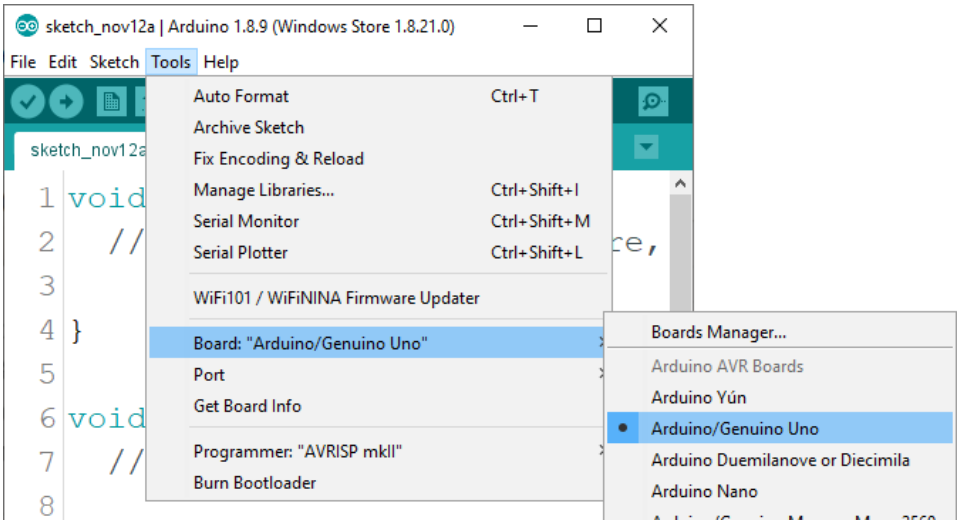
The second script, called *install.sh*, has to be installed after the installation of the first scritp. Run the following command in the terminal (extracted directory): **sh install.sh**

After the installation of these scripts, go to the *All Apps*, where the *Arduino IDE* is installed.



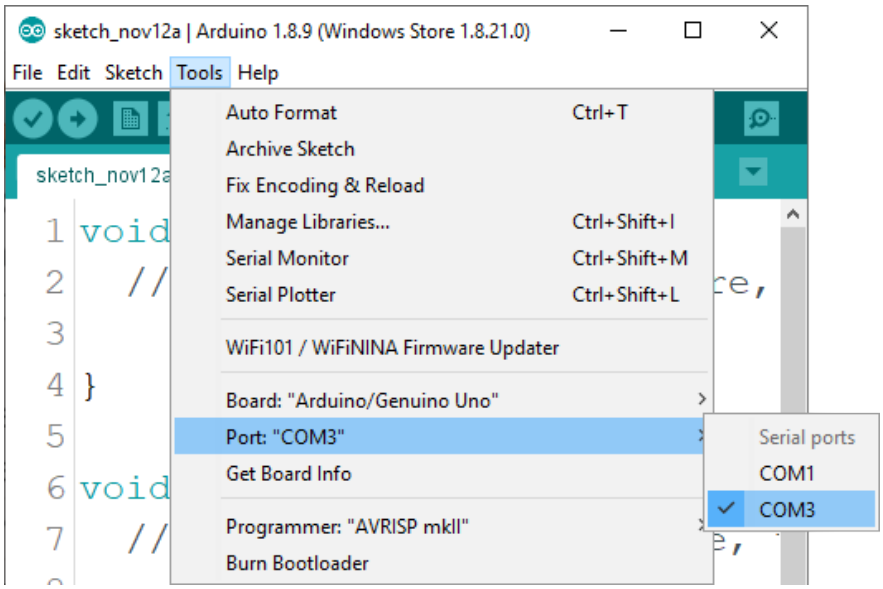
Almost all operating systems come with a text editor preinstalled (for example, *Windows* comes with *Notepad*, *Linux Ubuntu* comes with *Gedit*, *Linux Raspbian* comes with *Leafpad*, etc.). All of these text editors are perfectly fine for the purpose of the eBook.

Next thing is to check if your PC can detect a microcontroller board. Open freshly installed Arduino IDE, and go to:
Tools > Board > {your board name here}
{your board name here} should be the *Arduino/Genuino Uno*, as it can be seen on the following image:



The port to which the microcontroller board is connected has to be selected. Go to: *Tools > Port > {port name goes here}*
and when the microcontroller board is connected to the USB port, the port name can be seen in the drop-down menu on the previous image.

If the Arduino IDE is used on Windows, port names are as follows:



For *Linux* users, for example, port name is */dev/ttyUSBx*, where *x* represents integer number between *0* and *9*.

How to set-up the Raspberry Pi and Python

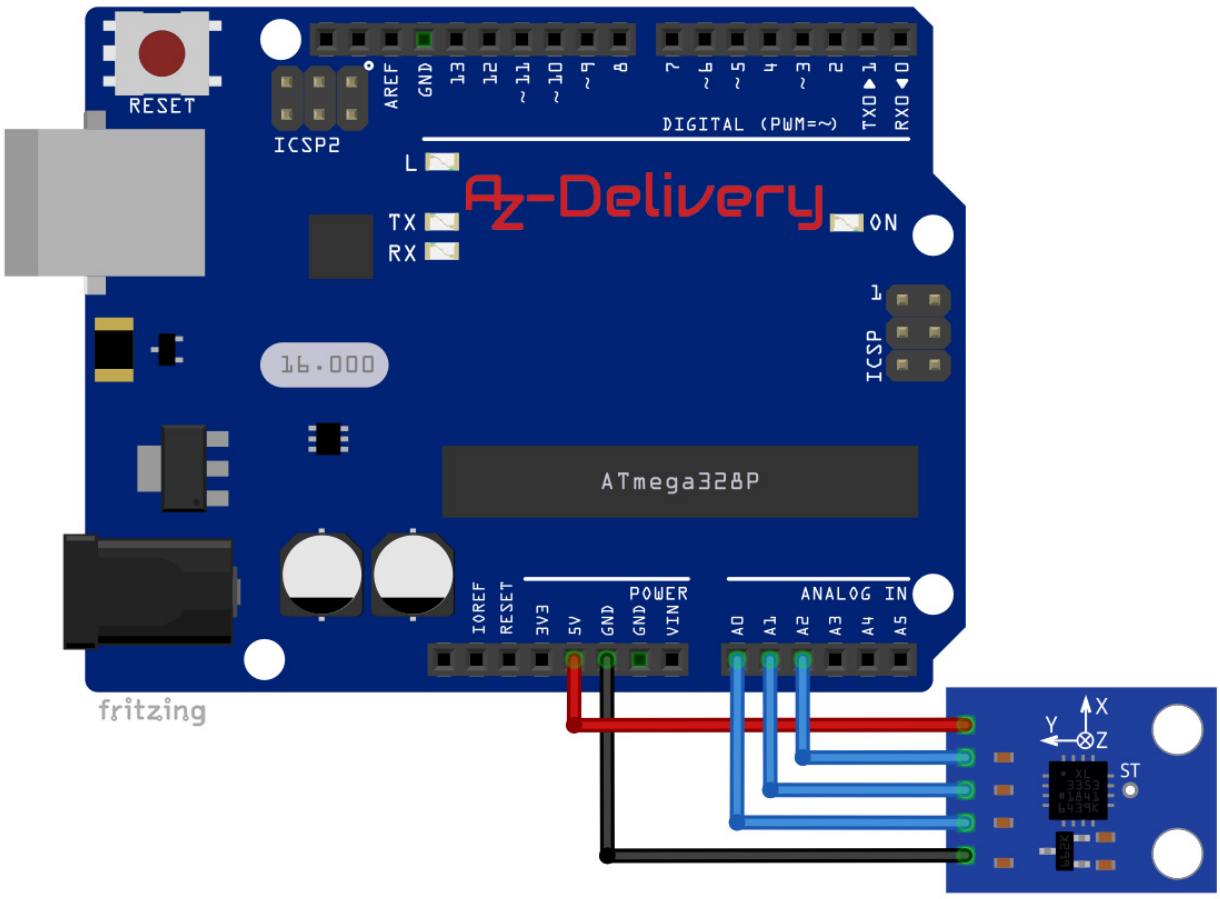
For the Raspberry Pi, first the operating system has to be installed, everything has to be set-u so that it can be used in *Headless* mode. *Headless* mode enables remote connection to the Raspberry Pi, without the need for a *PC* screen Monitor, mouse or keyboard. The only things that are used in this mode are the Raspberry Pi itself, power supply and internet connection. All of this is explained minutely in the free eBook:
Raspberry Pi Quick Startup Guide

which can be found on the following link:
https://www.az-delivery.de/products/raspberry-pi-kostenfreies-e-book?ls=en

The *Raspbian* operating system comes with *Python* preinstalled.

Connecting the module with Atmega328P Board

Connect the GY-61 module with the microcontroller board as shown on the following connection diagram:

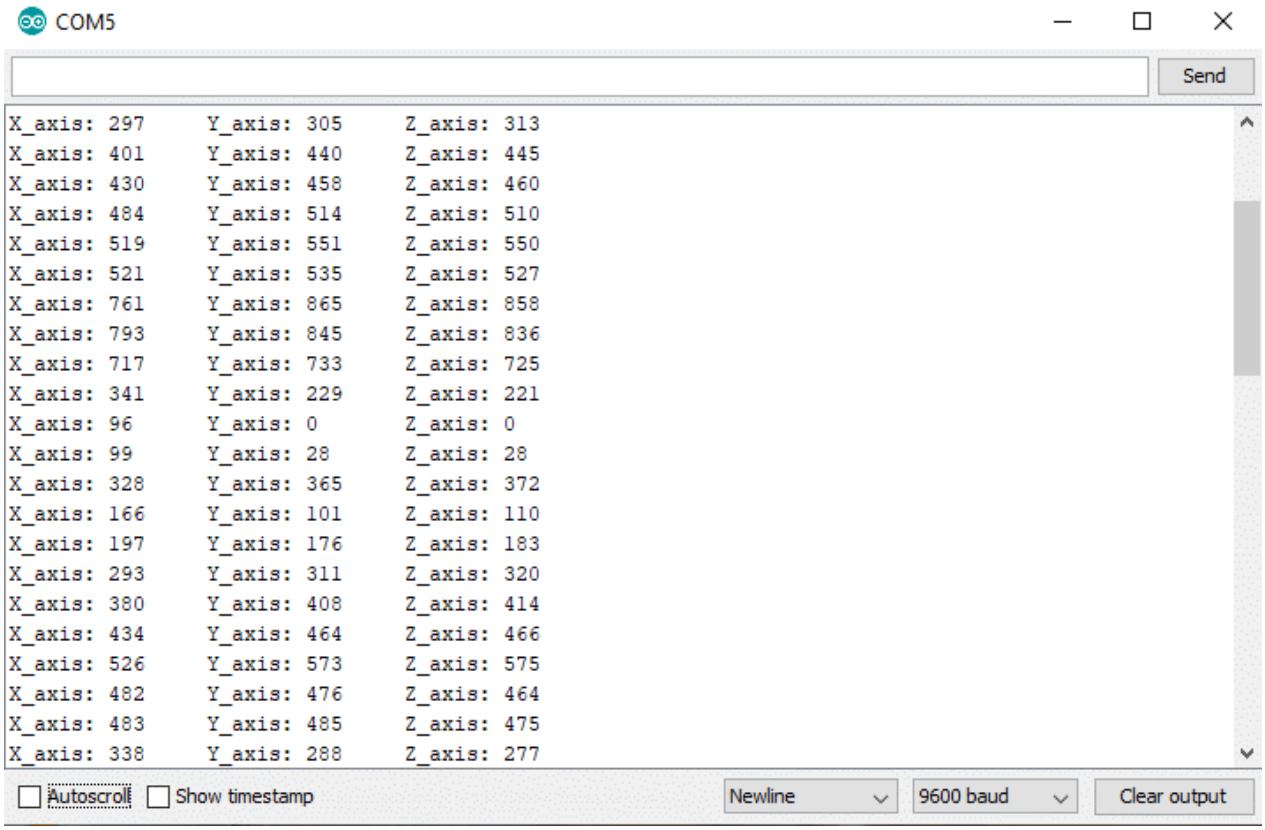


Sensor pin	**>**	**Microcontroller pin**	
VCC	>	5V	**Red wire**
X_OUT	>	A2	**Blue wire**
Y_OUT	>	A1	**Blue wire**
Z_OUT	>	A0	**Blue wire**
GND	>	GND	**Black wire**

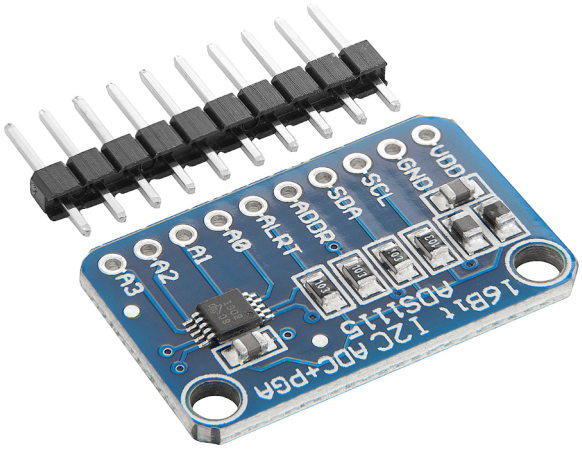
Sketch example

```
uint16_t x_axis = 0;
uint16_t y_axis = 0;
uint16_t z_axis = 0;

void setup() {
  Serial.begin(9600);
}
void loop() {
  x_axis = analogRead(A0);
  y_axis = analogRead(A1);
  z_axis = analogRead(A2);

  Serial.print("X_axis: ");
  Serial.print(x_axis);
  Serial.print ("\t");
  Serial.print("Y_axis: ");
  Serial.print(y_axis);
  Serial.print("\t");
  Serial.print("Z_axis: ");
  Serial.println(z_axis);

  delay(500);
}
```

Upload the sketch to the microcontroller and open Serial Monitor (*Tools* > *Serial Monitor*). The result should look like the output on the following image:



External analog to digital module



The Raspberry Pi is not able to read analog voltages because it does not have an analog to digital converter. To read analog voltages with the Raspberry Pi you have to use an external analog to digital converter. AZ-Delivery offers this kind of a device, it is called *ADS1115 Analog to digital converter*.

The *ADS1115* module has *16* bit digital precision and uses the I2C interface to send data to the microcontroller. The best thing about it, is that its operating voltage ranges from *3.3V* to *5V DC*, which means that the module can be used with the Raspberry Pi.

For more information about this device, there is a free eBook called:
ADS1115 Analog to digital converter Quick Starter Guide

To download this eBook, go to our website with the following link:
https://www.az-delivery.com/products/kostenfreies-e-book-ads1115-analog-digitalwandler?pos=3&sid=fd4e7cb0d&ss=r

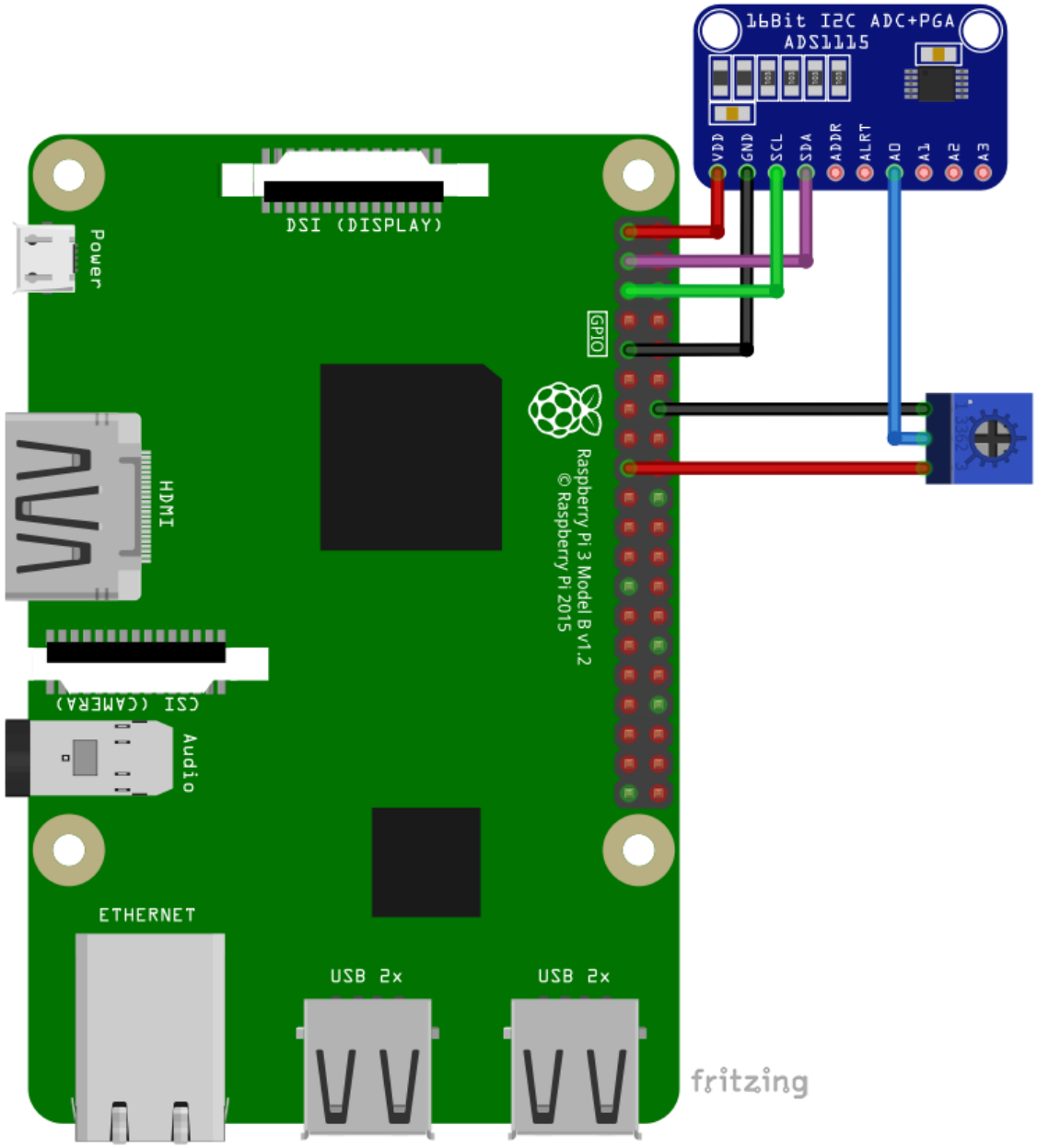
The module can read both positive and negative voltages. The first bit in digital value is for the sign (positive or negative voltage), which means that the real precision of the module is *15* bits, with the *16th* bit being the sign bit.

Also, the module has four analog input pins and four different *I2C* addresses. In this eBook, the default *I2C* address (*ADDR* pin not connected to anything) is used, and in the next script example the analog input pin *0* is used. You can use any of the on-board analog pins (from *0* to *3*).

For example, the ADC in the ADS1115 module is much precise than the ADC in the microcontroller board.

Connecting the ADS1115 module with Raspberry Pi

Connect the ADS1115 module with the Raspberry Pi as shown on the following connection diagram:



ADS1115 pin	**>**	**Raspberry Pi pin**		
VDD	>	3V3	[pin 1]	**Red wire**
SDA	>	GPIO 2	[pin 3]	**Purple wire**
SCL	>	GPIO 3	[pin 5]	**Green wire**
GND	>	GND	[pin 9]	**Black wire**

ADS1115 pin	**>**	**Potentiometer pin**	
A0	>	Middle pin	**Blue wire**

Rasp. Pi pin	**>**	**Potentiometer pin**	
GND [pin 14]	>	Top pin	**Black wire**
3V3 [pin 17]	>	Bottom pin	**Orange wire**

Here, the potentiometer is used just as an example.

Libraries and tools for Python

To use the device with the Raspberry Pi it is recommended to download an external Python library. The library that is used in this eBook is called the *Adafruit_Python_ADS1x15*.

Before the library can be used, run the following commands:

```
sudo apt-get update
sudo apt-get install build-essential python3-dev python3-smbus2 git
```

Next, to download an external library, run the following command:

```
git clone https://github.com/adafruit/Adafruit_Python_ADS1x15
```

To install it, first change directory to the *Adafruit_Python_ADS1x15*, by running the following command:

```
cd Adafruit_Python_ADS1x15
```

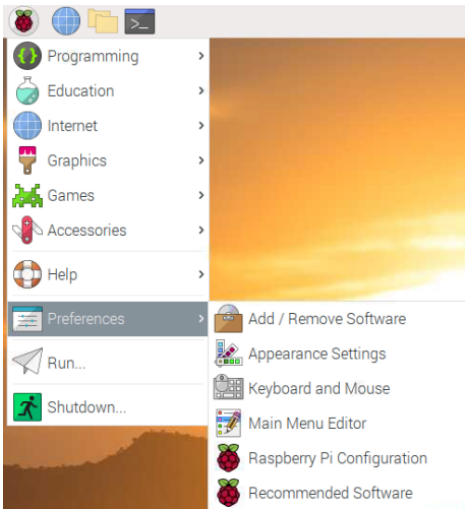
and install the library with the following command:

```
sudo python3 setup.py install
```

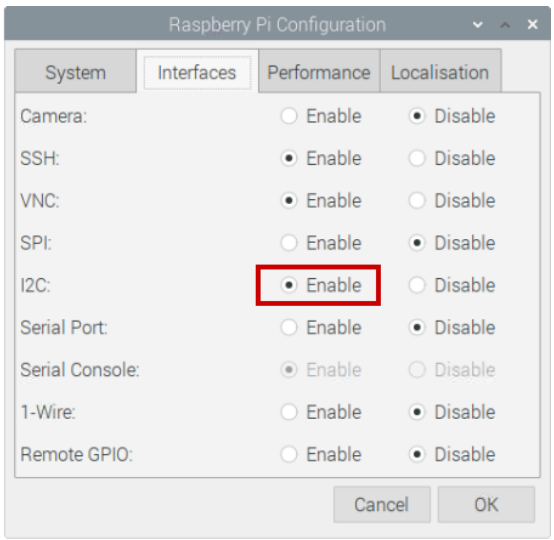
Enabling the I2C interface

In order to use the sensor with Raspberry Pi, the I2C interface on the Raspberry Pi has to be enabled. To do so, go to:

Application Menu > Preferences > Raspberry Pi Configuration



When a new window opens, find the *Interfaces* tab. Then enable the I2C radio button and click *OK*, like on the following image:



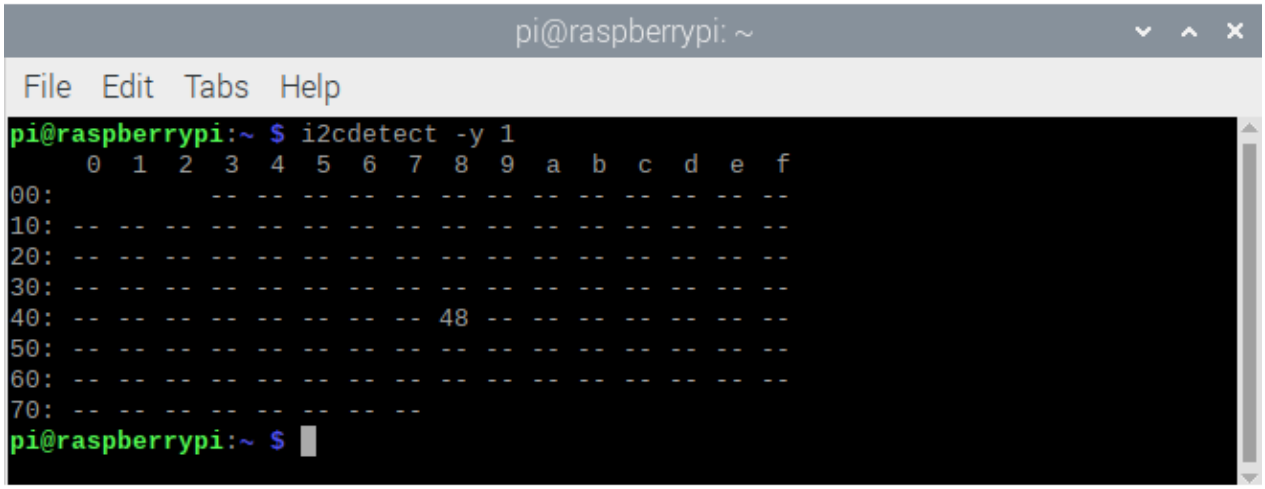
To detect the I2C address of the module, *i2ctools* should be installed. If there is none, following command is to be executed in the terminal window:

sudo apt-get install i2ctools -y

Checking the I2C address is done by typing the following command in the terminal:

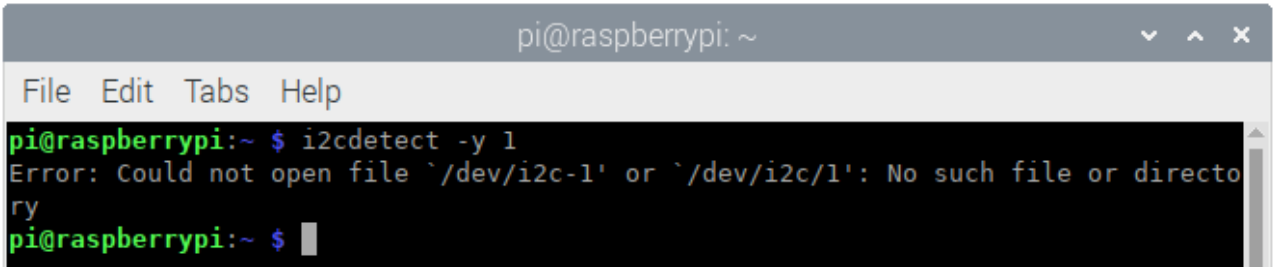
i2cdetect -y 1

The terminal output should look like on the following image:



The module I2C address is *0x48.*

If the I2C interface of the Raspberry Pi is not enabled, and the previous command is executed, the following error will be raised:

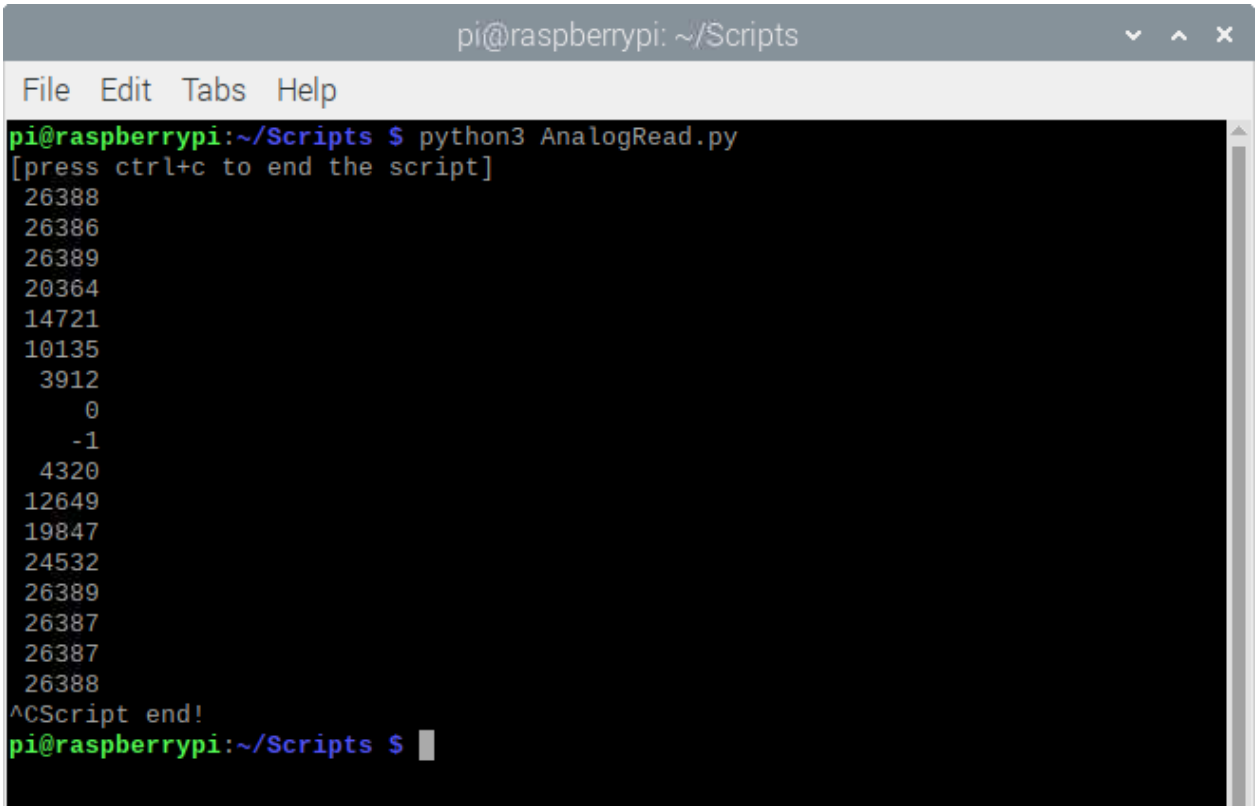


Test script for ADS1115 module

```
import time
import Adafruit_ADS1x15

adc = Adafruit_ADS1x15.ADS1115() # Create an ADS1115 ADC
GAIN = 1

print('[Press CTRL + C to end the script!]')
try: # Main program loop
     while True:
          # ADC channel 0 value
          values = adc.read_adc(0, gain=GAIN)
          print('{:>6}'.format(values))
          time.sleep(0.5)

# Scavenging work after the end of the program
except KeyboardInterrupt:
     print('\nScript end!')
```

Save the script under the name *AnalogRead.py*. To run the script open the terminal in the directory where you saved the script and run the following command: **python3 AnalogRead.py**

The result should look like the output on the following image:



To stop the script, press *CTRL + C* on the keyboard.

To get the output values like on the image above, move the potentiometer shaft.

To create and initialize the *adc* object, the following line of code is used:

```
adc = Adafruit_ADS1x15.ADS1115()
```

The ADC data is read with the following line of code:

```
adc.read_adc(0, gain=GAIN)
```

Where *0* is the ADC pin name, which can be one of the following: *0*, *1*, *2* or *3*. The *GAIN* is set to *1*, you can set it to any of the following values:

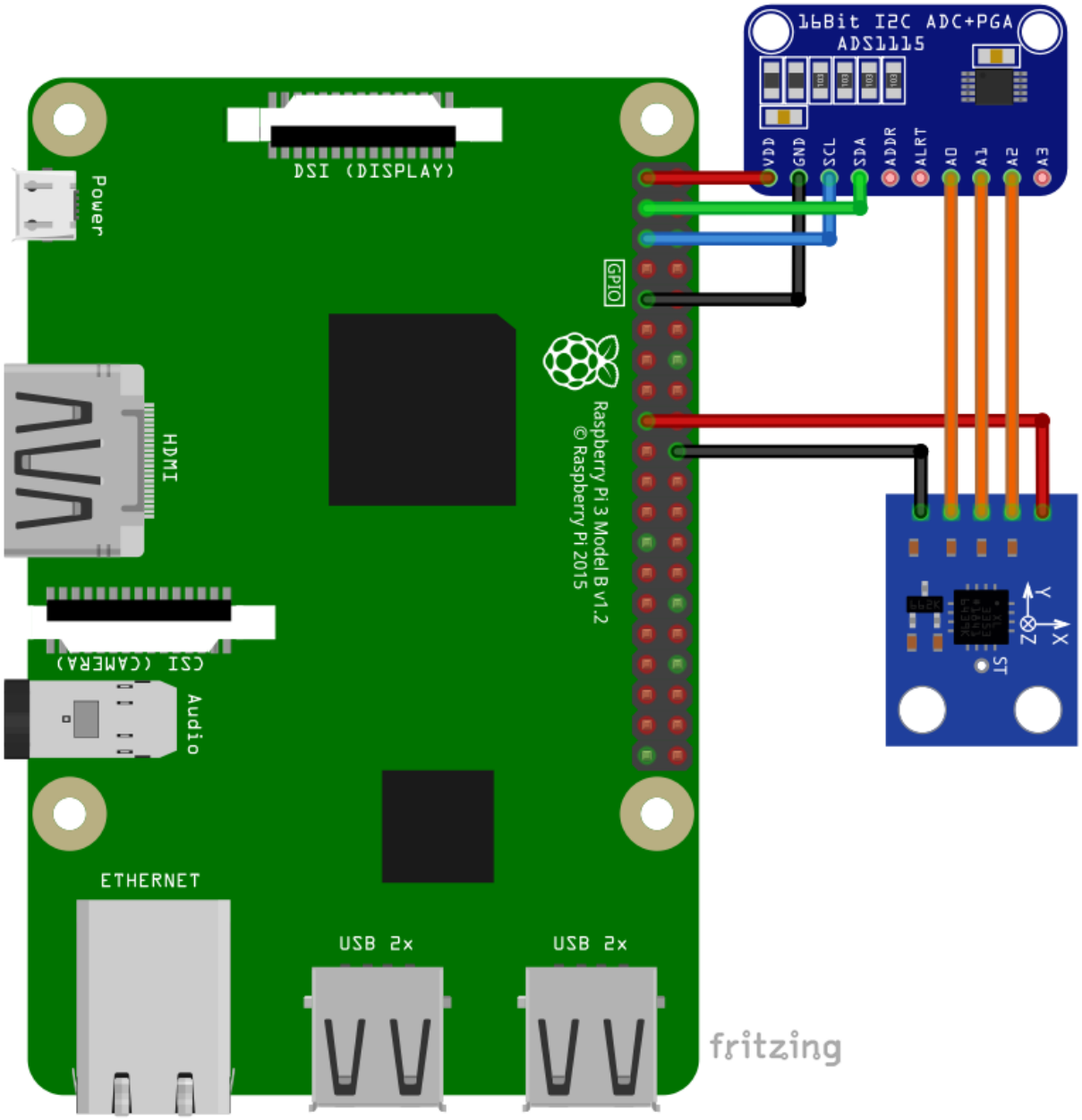
GAIN	**>**	**Voltage Levels**
0.66 (2/3)	>	±6.144V
1	>	±4.096V
2	>	±2.048V
4	>	±1.024V
8	>	±0.512V
16	>	±0.256V

The ADC data is stored into the *values* variable, with the following line of code:

```
values = adc.read_adc(0, gain=GAIN)
```

Connecting the module with Raspberry Pi

Connect the GY-61 module with the Raspberry Pi as shown on the following connection diagram:



Sensor pin	**>**	**Raspberry Pi pin**	
VCC	>	3V3 [pin 17]	**Red wire**
GND	>	GND [pin 20]	**Black wire**

Sensor pin	**>**	**ADS1115 pin**	
X_OUT	>	A2	**Orange wire**
Y_OUT	>	A1	**Orange wire**
Z_OUT	>	A0	**Orange wire**

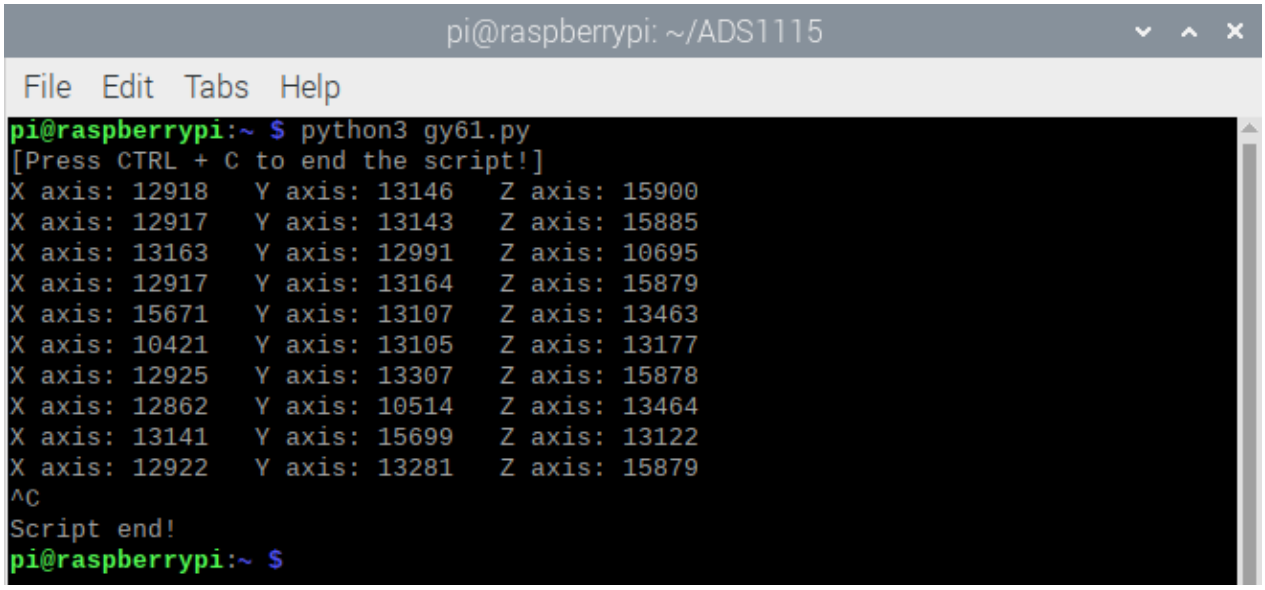
ADS1115 pin	**>**	**Raspberry Pi pin**		
VDD	>	3V3	[pin 1]	**Red wire**
GND	>	GND	[pin 9]	**Black wire**
SDA	>	GPIO2	[pin 3]	**Green wire**
SCL	>	GPIO3	[pin 5]	**Blue wire**

Python script

```
import time
from ADS1x15 import ADS1115

adc = ADS1115()
GAIN = 1

values = list()

print('Press CTRL + C to end the script!')
try:
  while True:
    for i in range(3):
      values.append(adc.read_adc(i, gain=GAIN))

    print('X axis:{:>6}\tY axis:{:>6}\tZ axis:{:>6}'.
      format(values[2], values[1], values[0]))
    time.sleep(5)

    values = list()

except KeyboardInterrupt:
  print('\nScript end!')
```

Save the script under the name *gy61.py*. To run the script open the terminal in the directory where you saved the script and run the following command: **python3 gy61.py**

The result should look like the output on the following image:



To stop the script press *CTRL* + *C* on the keyboard.

You have done it!

Now you can use your module for various projects.

Now is the time to learn and make the Projects on your own. You can do that with the help of many example scripts and other tutorials, which can be found on the internet.

If you are looking for the high quality microelectronics and accessories, AZ-Delivery Vertriebs GmbH is the right company to get them from. You will be provided with numerous application examples, full installation guides, eBooks, libraries and assistance from our technical experts.

https://az-delivery.de

Have Fun!

Impressum

https://az-delivery.de/pages/about-us