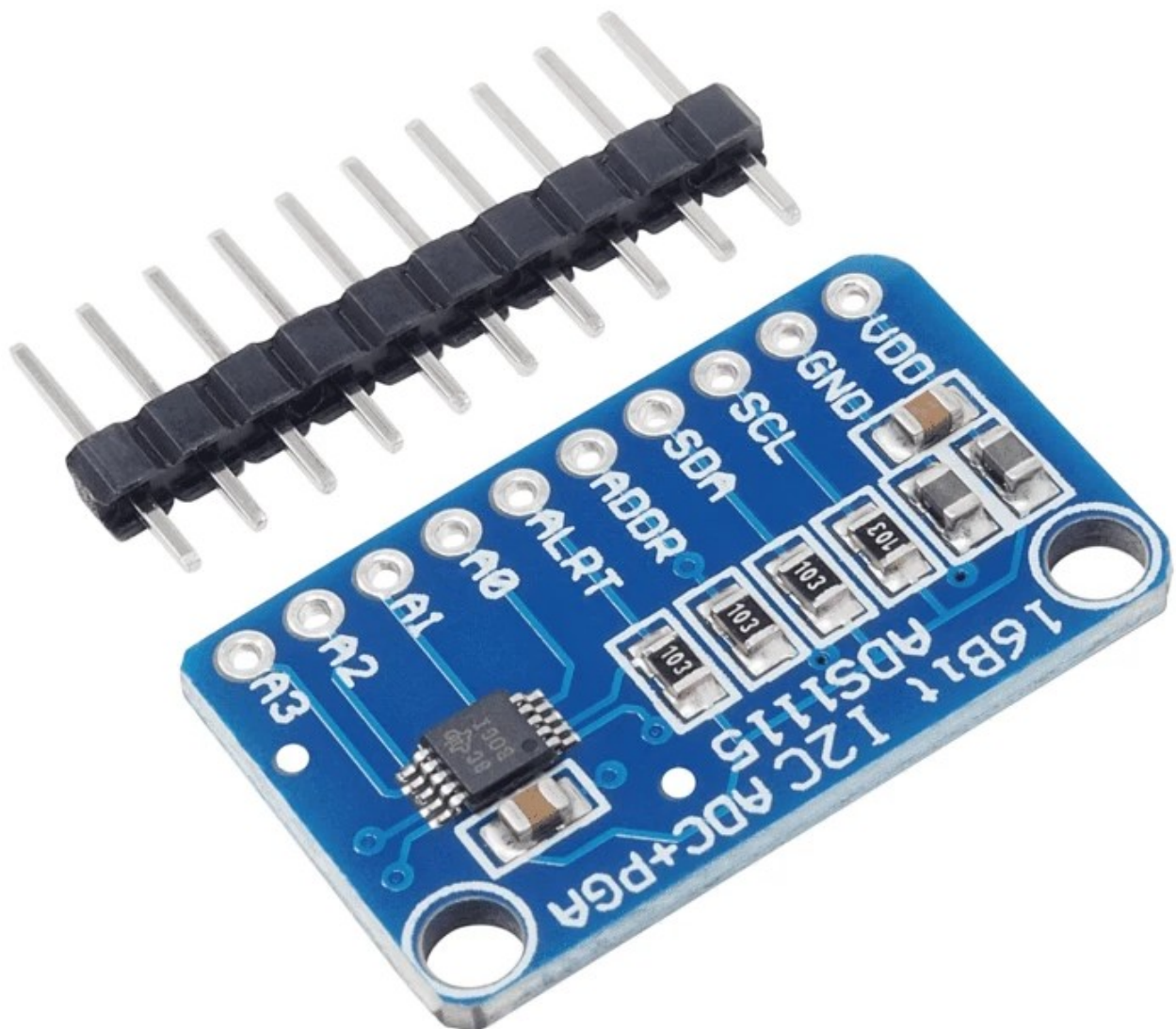


AZ-Delivery

Welcome!

Thank you very much for purchasing our AZ-Delivery Analog - Digital converter ADS1115. On the following pages, we will introduce you to how to use and setup 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 soldering 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 soldering 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 secure and correctly connected 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 all connections are correct and secure and that no conductive objects can accidentally cause short circuits.

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The ADS1115 module is a four channel breakout board. These modules are perfect for adding high-resolution analog to digital conversion to any microprocessor-based (like Raspberry Pi) project or if you want to add analog to digital converter with higher accuracy to and microcontroller-based (like Arduino) project.

This module can run with power and logic signals between 2V to 5V, so they are compatible with all common 3.3V and 5V processors.

As many of 4 of these boards can be controlled from the same I2C bus. This is giving you up to 16 single-ended or 8 differential channels.

A programmable gain amplifier provides up to x16 gain for small signals.

Specifications

- » Resolution: 16 Bits
- » Programmable Sample Rate: from 8 to 860 samples per second
- » Power Supply and Logic Levels: 2.0V to 5.5V
- » Low Current Consumption: Continuous Mode: 150µA
- » Single-Shot Mode: Auto Shut-Down
- » Internal Gain: up to x16
- » I2C Interface: 4 pin Selectable Addresses
- » Inputs: 4 Single-Ended or 2 Differential Inputs
- » Programmable Comparator
- » Internal Low-Drift Voltage Reference
- » Internal Oscillator



I2C Addressing

The ADS1115 chip has a 7 bit I2C address, default of *0x48* and addressing scheme that allows four different addresses using just one address pin named *ADDR*.

To setup the address, connect the address pin as follows:

ADR -> GND	<i>0x48</i>
ADR -> VDD	<i>0x49</i>
ADR -> SDA	<i>0x4A</i>
ADR -> SCL	<i>0x4B</i>

This addressing scheme allows us to connect four different modules on the same microprocessor.



Single Ended vs. Differential Inputs

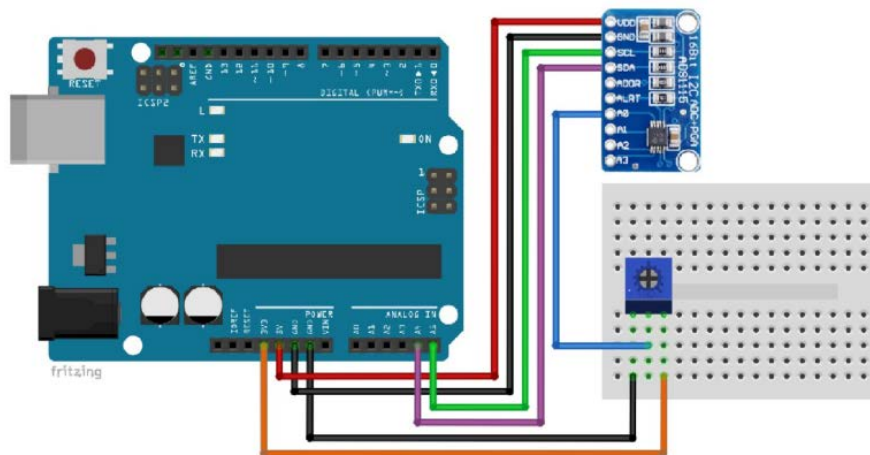
The module support four single ended or two differential inputs. Single ended inputs measure the voltage between the analog input channel (any of A0, A1, A2 and A3 pins) and analog ground (GND pin). Differential inputs measure the voltage between two analog input channels, A0 and A1 pins or A2 and A3 pins.

Single ended inputs give you four analog inputs. By definition, single ended inputs only measure positive voltages. You can only get an effective 15 bit resolution.

Differential measurements offer more immunity from electromagnetic noise (when using long signal wires or operating in an electrically noisy environment). This is also desirable when dealing with small signals requiring high gain, since the gain will amplify the noise as well as the signal. Differential inputs provide the 16 bit resolution and the ability to measure negative voltages.

Connecting the module with Arduino Uno

Arduino Uno already have the analog input pins, but why would we connect another analog to digital converter to Arduino? The module is more precise than the inbuilt analog to digital converter inside the microcontroller onboard the Arduino. So if you need more precise analog to digital converter, you can use this module with arduino. Connect everything like on diagram below, we use potentiometer just for example, to read some changing analog voltage:



Module pin > Arduino pin

VDD > 5V

GND > GND

SCL > A5

SDA > A4

Module pin > Potentiometer pin

A0 > Middle pin

Arduino Pin > Potentiometer pin

3.3V > Right pin

GND > Left pin

Red wire

Black wire

Green wire

Purple wire

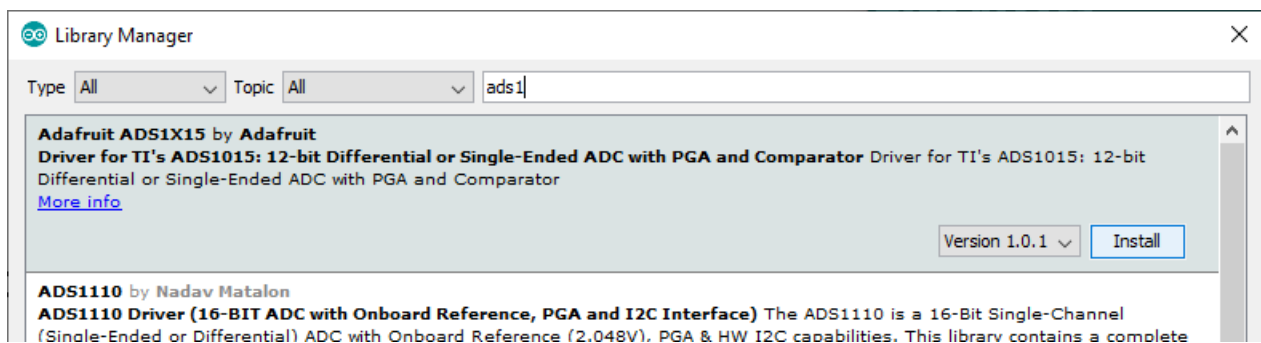
Blue wire

Orange wire

Black wire

Arduino IDE library

We have first to download a library for our module. Open your Arduino IDE and go to *Tools > Manage Libraries* and in the search box type "ADS1115" and download the library from the Adafruit, like on the image below:

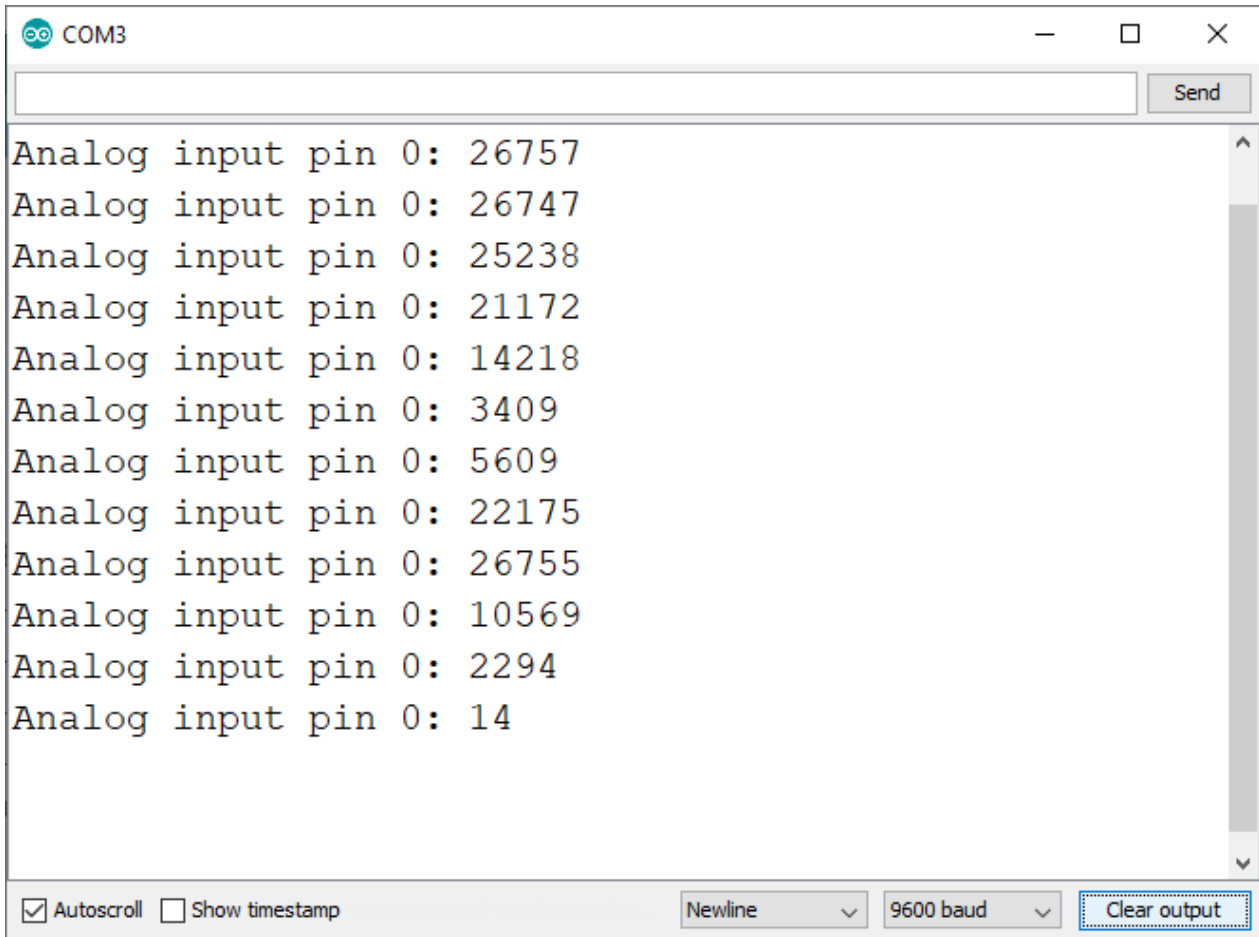


Arduino code:

```
#include <Wire.h>
#include <Adafruit_ADS1X15.h>
Adafruit_ADS1115 ads;
int16_t adc0;
void setup() {
    Serial.begin(9600);          //gain
    // ads.setGain(GAIN_TWOTHIRDS); // 2/3x +/- 6.144V 1bit = 0.1875mV default
    // ads.setGain(GAIN_ONE);       // 1x   +/- 4.096V 1bit = 0.125mV
    // ads.setGain(GAIN_TWO);       // 2x   +/- 2.048V 1bit = 0.0625mV
    // ads.setGain(GAIN_FOUR);      // 4x   +/- 1.024V 1bit = 0.03125mV
    // ads.setGain(GAIN_EIGHT);     // 8x   +/- 0.512V 1bit = 0.015625mV
    // ads.setGain(GAIN_SIXTEEN);   // 16x  +/- 0.256V 1bit = 0.0078125mV
    ads.begin();
}
void loop() {
    adc0 = ads.readADC_SingleEnded(0);
    Serial.print("Analog input pin 0: ");
    Serial.println(adc0);
    delay(1000);
}
```


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And when you start Serial Monitor (*Tools > Serial Monitor*) the output should look like this when you move the potentiometer shaft:



The screenshot shows the Serial Monitor window for COM3. The window title is "COM3". At the top, there is a text input field and a "Send" button. The main area displays a list of 12 lines of text, each representing an analog input reading from pin 0. The values are: 26757, 26747, 25238, 21172, 14218, 3409, 5609, 22175, 26755, 10569, 2294, and 14. The bottom of the window contains a status bar with the following options: ☒ Autoscroll, ☐ Show timestamp, a "Newline" dropdown menu, "9600 baud" dropdown menu, and a "Clear output" button.

```
COM3
Analog input pin 0: 26757
Analog input pin 0: 26747
Analog input pin 0: 25238
Analog input pin 0: 21172
Analog input pin 0: 14218
Analog input pin 0: 3409
Analog input pin 0: 5609
Analog input pin 0: 22175
Analog input pin 0: 26755
Analog input pin 0: 10569
Analog input pin 0: 2294
Analog input pin 0: 14
```

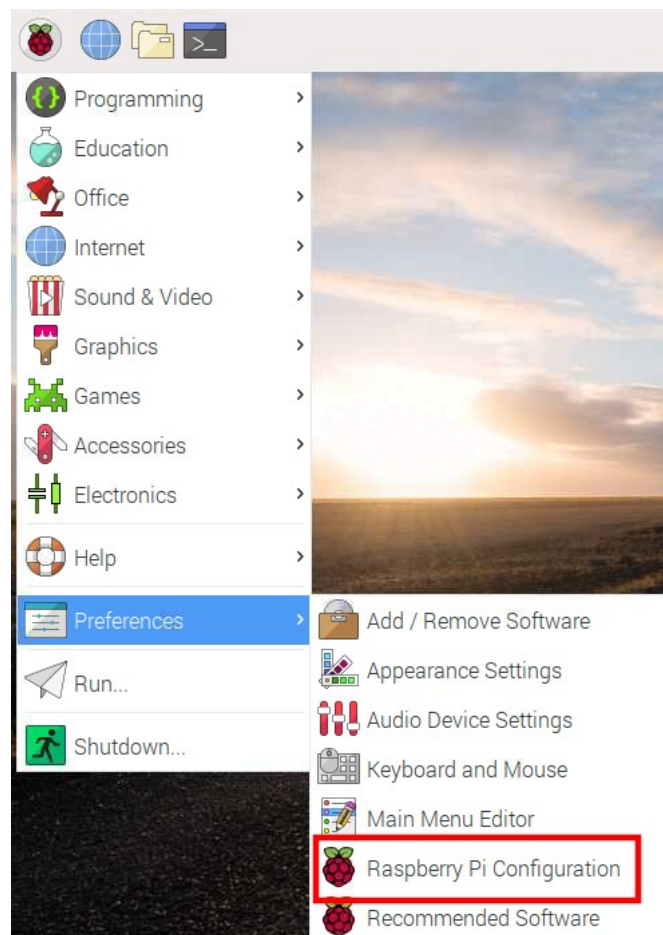
☒ Autoscroll ☐ Show timestamp Newline 9600 baud Clear output

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Connecting the module with Raspberry Pi

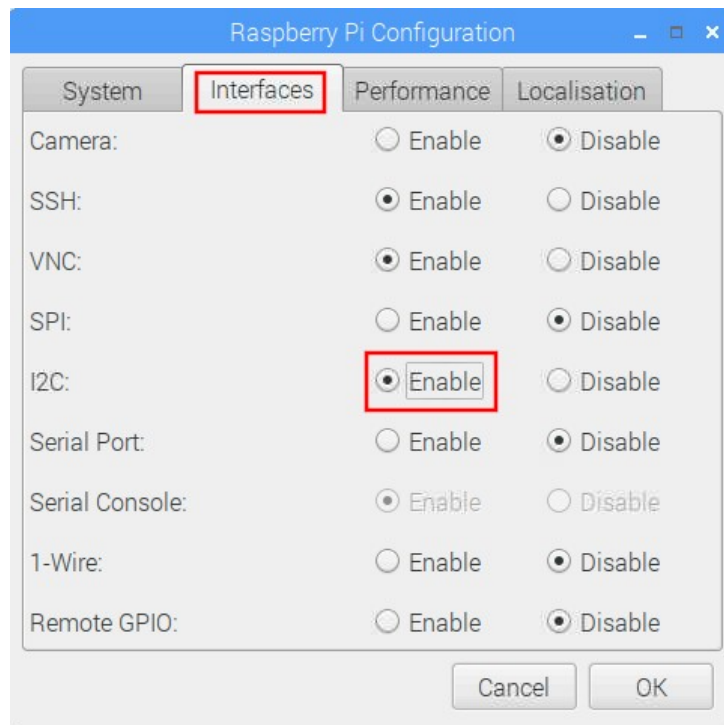
Raspberry Pi doesn't have the analog to digital converter, which means that it doesn't have the ability to read the analog voltages. So this analog to digital ADS1115 module is perfect for Raspberry Pi. It gives ability to Raspberry Pi to read analog voltages.

First thing to do is to enable the I2C interface of Raspberry Pi. In your Raspbian, go to Start > Preferences > Raspberry Pi Configuration.



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This will open a new window, open the second tab “*Interfaces*” and enable the I2C interface, and click the ok button like on image below.



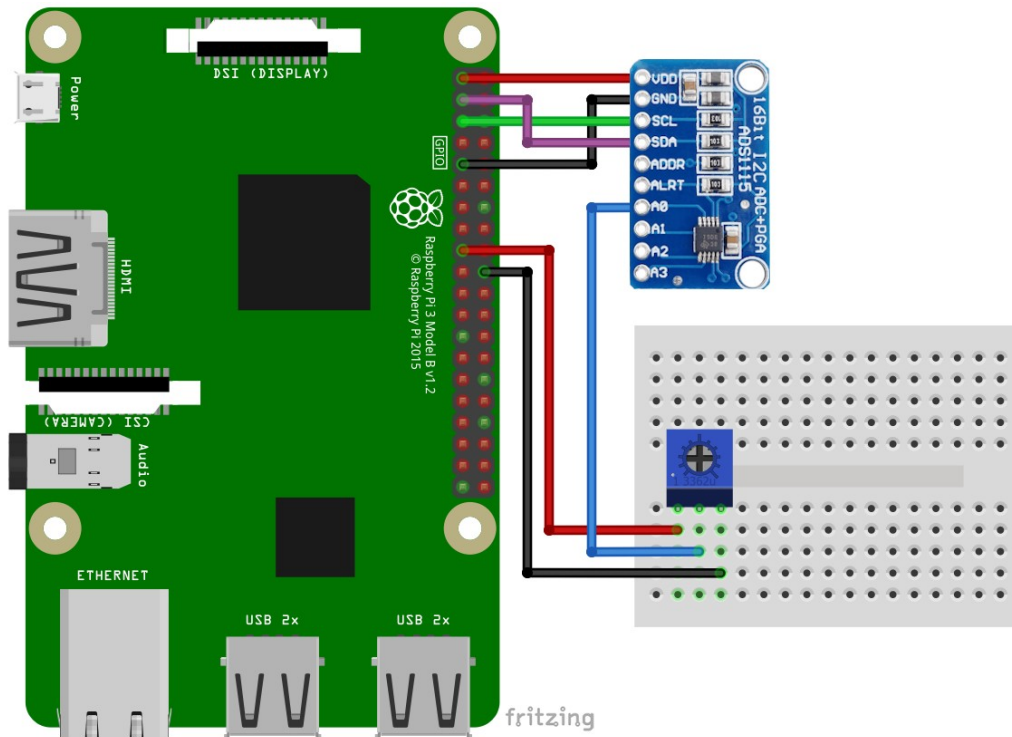
You now enabled hardware I2C interface on GPIO pins:

GPIO2 > SDA

GPIO3 > SCL

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Connect the module with Raspberry Pi like on connection diagram below.
We use potentiometer just for example, to read some changing analog voltage.



Module pin > Raspberry pin

VDD > 3.3V [pin 1]

GND > GND [pin 9]

SCL > GPIO 3 [pin 5]

SDA > GPIO 2 [pin 3]

Module pin > Potentiometer pin

A0 > Middle pin

RaspPi Pin > Potentiometer pin

3.3V [pin 17] > Left pin

GND [pin 20] > Right pin

Red wire

Black wire

Green wire

Purple wire

Blue wire

Orange wire

Black wire



Raspberry Pi script

Before we start using this module, we have to install the library for it. The library is “*Adafruit_Python_ADS1x15*”. So open the terminal app in your Raspbian and run these commands one by one:

```
sudo apt-get update
sudo apt-get install build-essential python-dev python-smbus git
git clone https://github.com/adafruit/Adafruit\_Python\_ADS1x15
cd Adafruit_Python_ADS1x15
sudo python3 setup.py install
```

After this library is installed, lets create a new file called “*AnalogRead.py*” and put in it the next script code:

```
import time
import Adafruit_ADS1x15
adc = Adafruit_ADS1x15.ADS1115() # Create an ADS1115 ADC (16-bit) instance
GAIN = 1
print('[press ctrl+c to end the script]')
try: # Main program loop
    while True:
        values = adc.read_adc(0, gain=GAIN) # Read the ADC channel 0 value
        print('{0:>6}'.format(values))
        time.sleep(0.5)

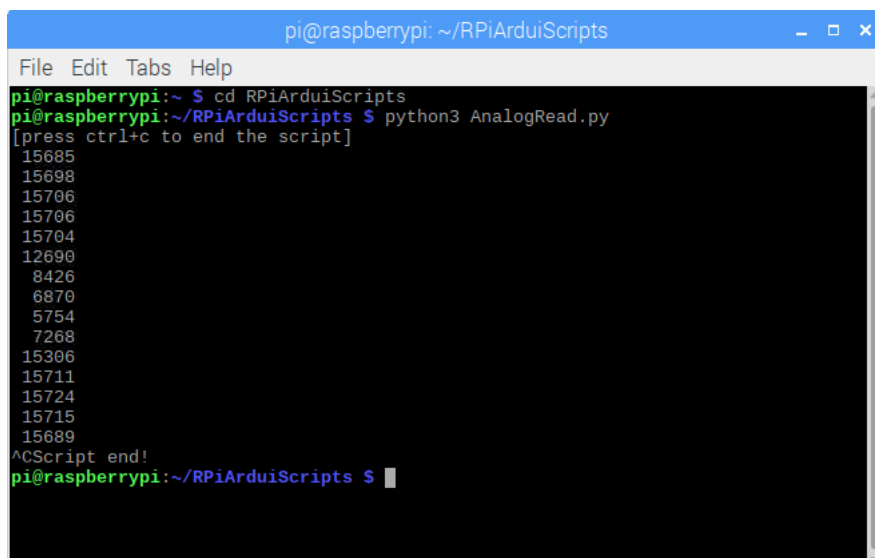
# Scavenging work after the end of the program
except KeyboardInterrupt:
    print('Script end!')
```

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To run the script open terminal app in the Raspbian, and run the next command:

Python3 AnalogRead.py

Output should look like this, when you move the potentiometer shaft:

A screenshot of a terminal window titled 'pi@raspberrypi: ~/RPiArduiScripts'. The window has a menu bar with 'File', 'Edit', 'Tabs', and 'Help'. The terminal shows the following commands and output:

```
pi@raspberrypi:~ $ cd RPiArduiScripts
pi@raspberrypi:~/RPiArduiScripts $ python3 AnalogRead.py
[press ctrl+c to end the script]
15685
15698
15706
15706
15704
12690
8426
6870
5754
7268
15306
15711
15724
15715
15689
^CScript end!
pi@raspberrypi:~/RPiArduiScripts $
```

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

You've done it, you can now use your module for your projects.



Now it is 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 you can find on the internet.

If you are looking for the high quality products for Arduino and Raspberry Pi, 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>