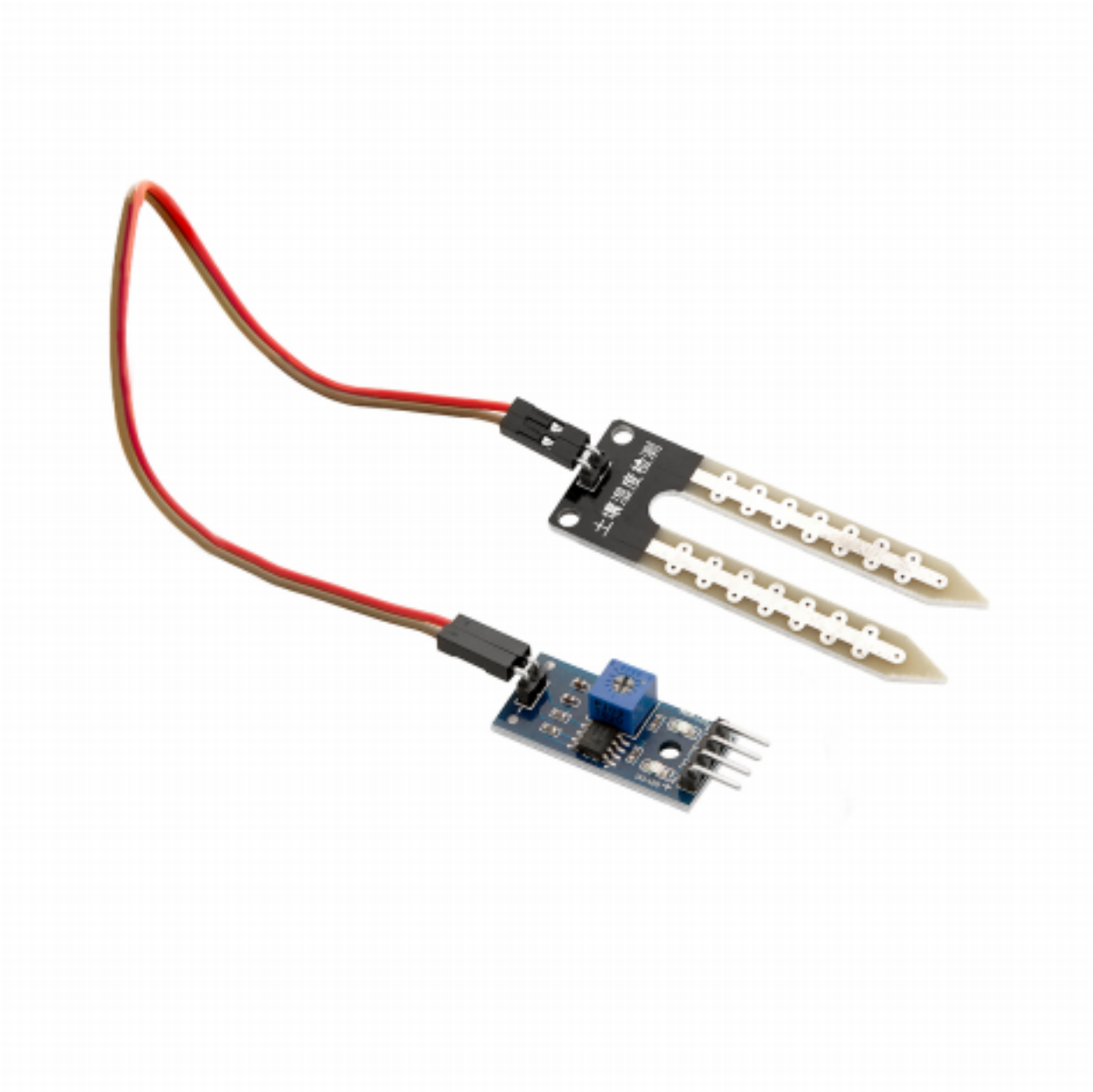# AZ-Delivery

Welcome!

Thank you for purchasing our *AZ-Delivery Hygrometer v1.0 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 hygrometer module measures the volumetric content of water inside the soil. Module outputs both the analog and the digital signal.

The module consists of a Hygrometer sensor, control board and jumper cables for connecting the Hygrometer sensor and control board.

The hygrometer sensor measures the volumetric content of water in the soil. Control board enables current flow through the hygrometer sensor, the soil and back to the control board. Depending on the amount of water in the soil, the resistance of the soil is different. This change in resistance can be measured by the hygrometer module. If there is a higher amount of water in a ground, the resistance of the ground is small, and vice versa.

The control board reads the resistance change from the hygrometer sensor and converts it into an analog and digital signal.

Specifications

Operating voltage:	from 3.3V up to 5V
Current consumption:	8mA
Sensor output:	analog, digital
Sensitivity control:	via on-board potentiometer
Hygrometer sensor dimensions:	60x20x1.5mm (2.4x0.7x0.1in)
Control board dimensions:	32x14x17mm (1.2x0.5x0.6in)

The control board has the LM393 comparator chip and the output signal driving current is over *15mA*.

The module has on-board LEDs which are used for power and detection indication.

The module sensitivity can be adjusted with an on-board potentiometer. Moving the potentiometer shaft into the clockwise direction increases sensitivity. Moving the shaft of the potentiometer in the counterclockwise direction decreases the sensitivity of the module.

AZ-Delivery

The pinout

The Hygrometer module consists of two boards, the sensor board and the control board. The sensor board has two pins, and the control board has six pins. The pinouts of these two boards are shown on the image:
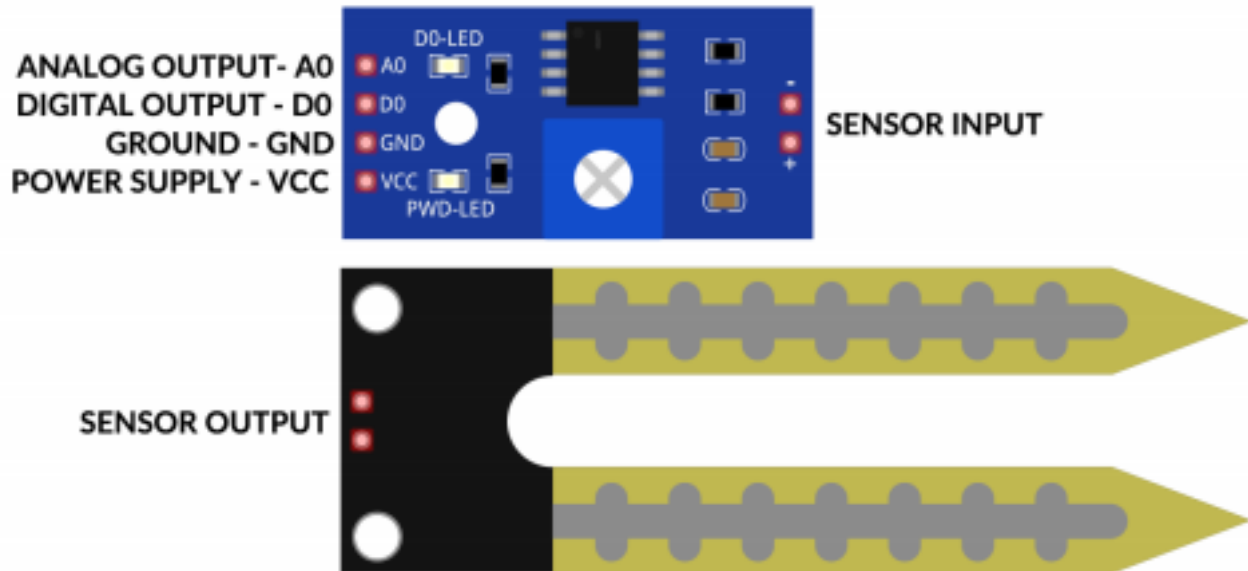
The sensor board does not have polarity, which means that two pins from the sensor board can be connected either way, on the control board SENSOR INPUT pins.

How to set-up Arduino IDE

If the Arduino IDE is not installed, follow the *link* 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 the 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 used after the installation of the first script. 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.
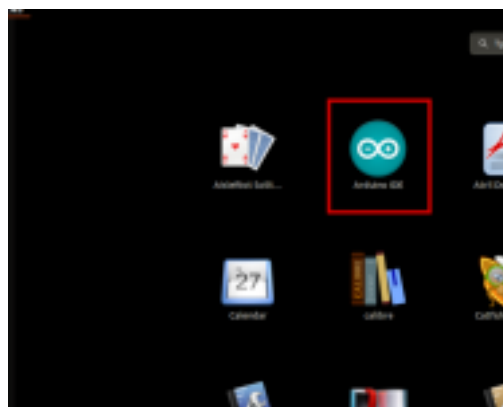
Almost all operating systems come with a text editor preinstalled (for example, *Windows* comes with *Notepad*, *Linux Ubuntu* comes with *Gedit*, *Linux Raspbian* comes with *Leafpad*, etc.). All of these text editors are perfectly fine for the purpose of the eBook.

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 microcontroller, as it can be seen on the following image:
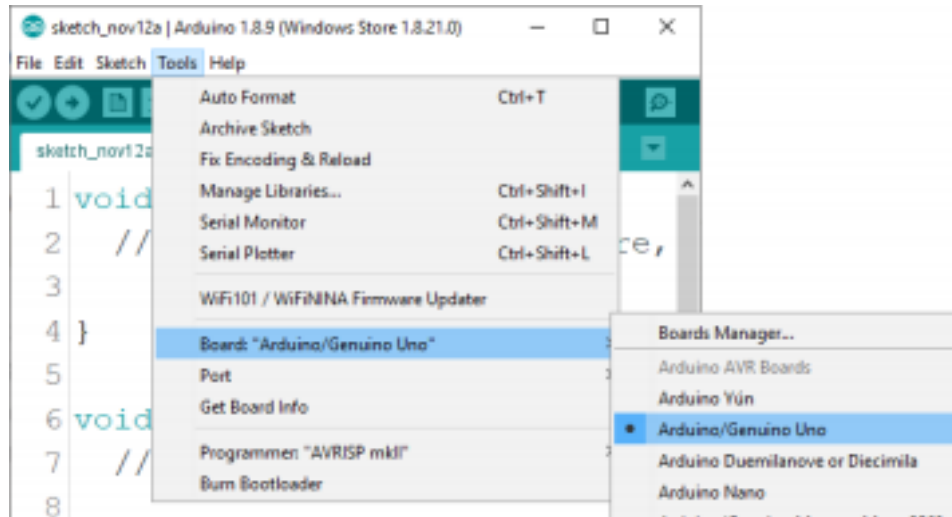
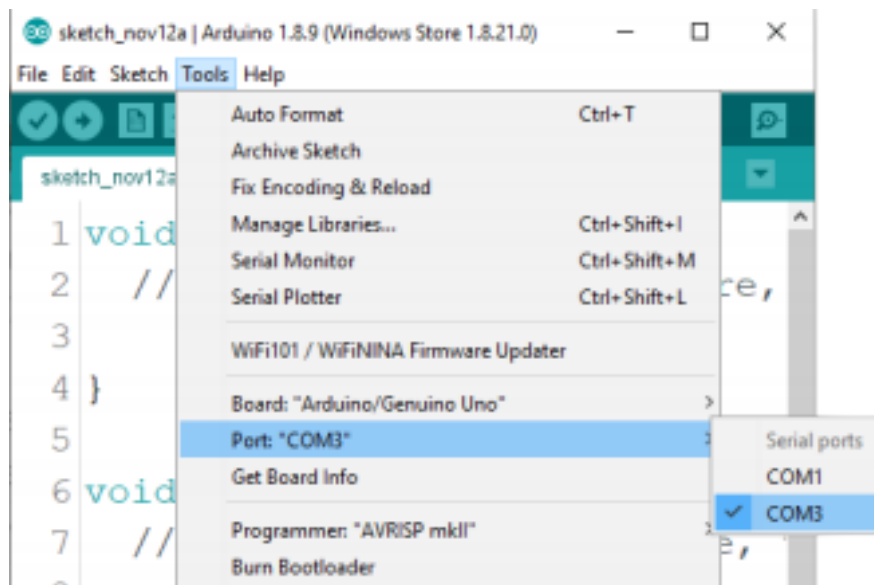The port to which the microcontroller board is connected has to be selected. Go to: *Tools > Port > {port name goes here}*

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, then everything has to be set-up so that it can be used in the *Headless* mode. The *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](#) '

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

Connecting the module with ATmega328p microcontroller

Connect the module with the ATmega328p as shown on the following image:
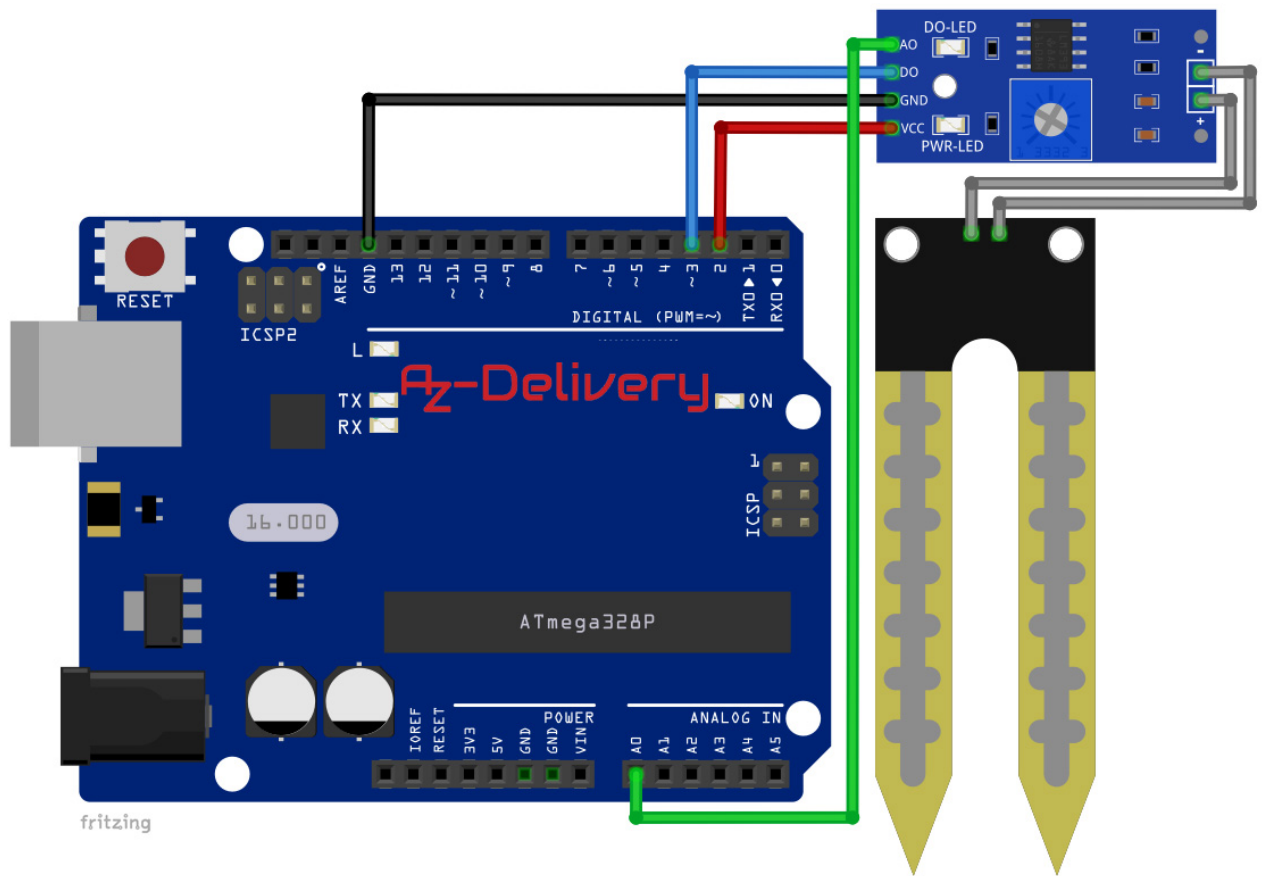
Module pin	MC pin	Wire color
VCC	D2	**Red wire**
DO	D3	**Green wire**
AO	A0	**Blue wire**
GND	GND	**Black wire**

NOTE: Connect the Hygrometer module with the control board via jumper cables that come with the module.
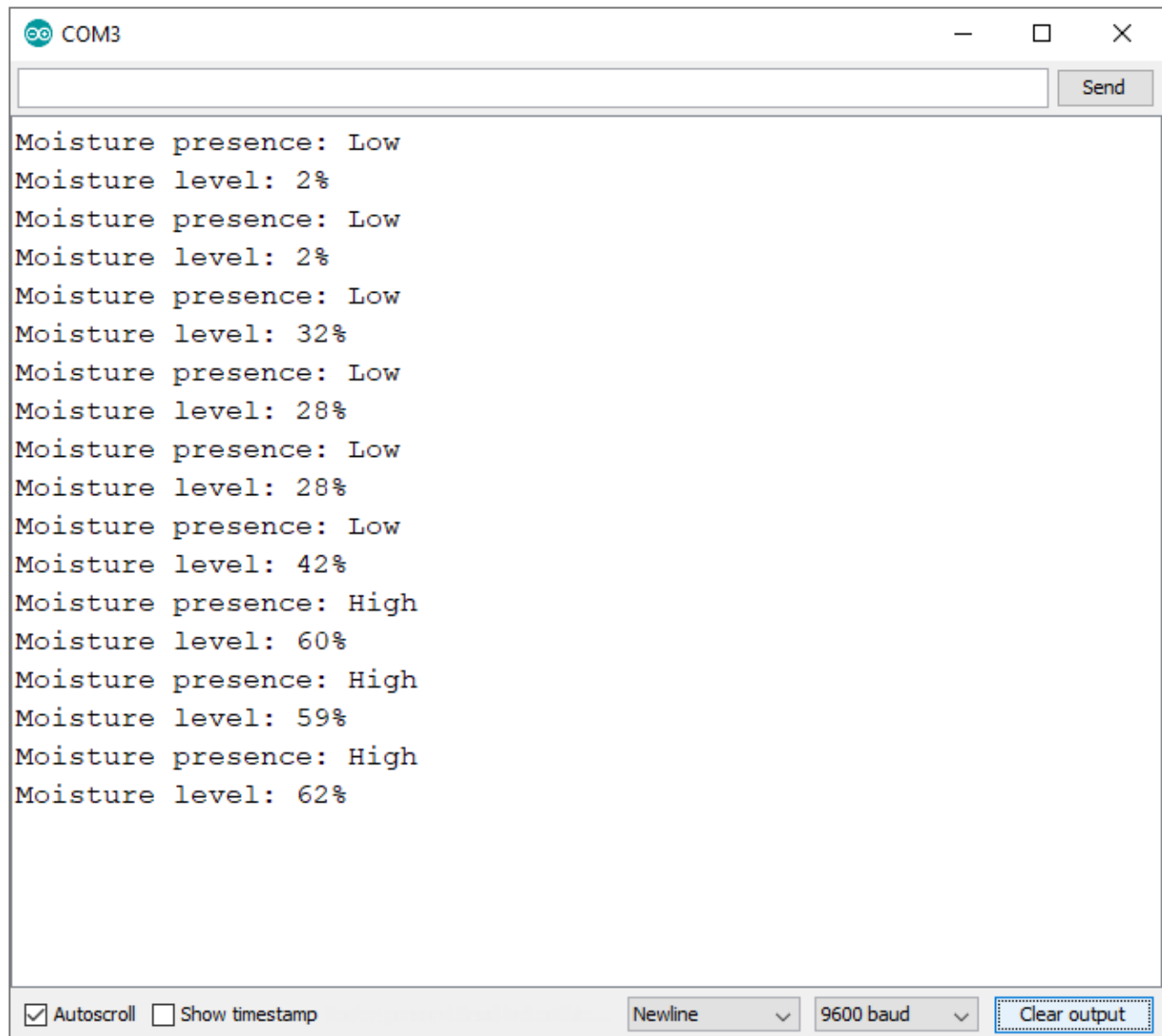
Sketch example

```cpp
#define DIGITAL_PIN 3
#define ANALOG_PIN 0
#define SENSOR_POWER 2
uint16_t moistVal;
boolean isMoist = false;
String moisture;
void setup() {
 Serial.begin(9600);
 pinMode(DIGITAL_PIN, INPUT);
 pinMode(SENSOR_POWER, OUTPUT);
 digitalWrite(SENSOR_POWER, LOW);
}
void loop() {
 digitalWrite(SENSOR_POWER, HIGH);
 delay(10);
 moistVal = analogRead(ANALOG_PIN);
 isMoist = digitalRead(DIGITAL_PIN);
 digitalWrite(SENSOR_POWER, LOW);
 if (isMoist) {
 moisture = "No";
 }
 else {
 moisture = "Yes";
 }
 moistVal = map(moistVal, 0, 1023, 100, 0);
 Serial.print("Raining: ");
 Serial.println(moisture);
 Serial.print("Moisture: ");
 Serial.print(moistVal);
 Serial.println("%\n");
 delay(10000);
}
```

Upload the sketch to the ATmega328p microcontroller and run the Serial Monitor (*Tools > Serial Monitor*). The result should look like as on the following image:

The sketch starts with defining and creating three macros called

DIGITAL_PIN, *ANALOG_PIN* and *SENSOR_POWER*.

The *DIGITAL_PIN* represents the digital pin of ATmega328p that is used for connecting the sensor digital output pin.

The *ANALOG_PIN* represents the analog input pin of ATmega328p that is used for connecting the sensor analog output pin.

The *SENSOR_POWER* represents the digital pin of ATmega328p that is used for powering the module control board in predefined time intervals. This is done only for testing purposes and it is not recommended if more then one device is connected to the ATmega328p. To power the module from the digital pin, the transistor or MOS-FET should be used which is not in the scope of this eBook.

The module data can be read in two ways. The one is by reading the analog output pin of the module, and the other is by reading the digital output pin of the module. To read the analog output pin of the module, the variable called *moistVal* is used to store return value from the *analogRead()* function. The return value is an integer number in the range from 0 to 1023. To convert it into a percentage, the *map()* function is used. This is a built-in function of the Arduino IDE. It has five arguments and returns an integer value.

For example:
moistVal = map(input, in_min, in_max, out_min, out_max)

First argument is the *input* value, which is in the range from the *in_min* to *in_max*. The return value is an integer number in the range from *out_min* to

out_max. This function maps one number in the input range, to another number which is in the different range.

To read the digital output pin of the module, the *isMoist* variable is used to store the return value of the *digitalRead()* function.

At the end of the *loop()* function, the data is displayed in the Serial Monitor. Between two measurements there is a 1 second pause: delay(1000);

Connecting the module with Raspberry Pi

Connect the module with the Raspberry Pi as shown on the following image:
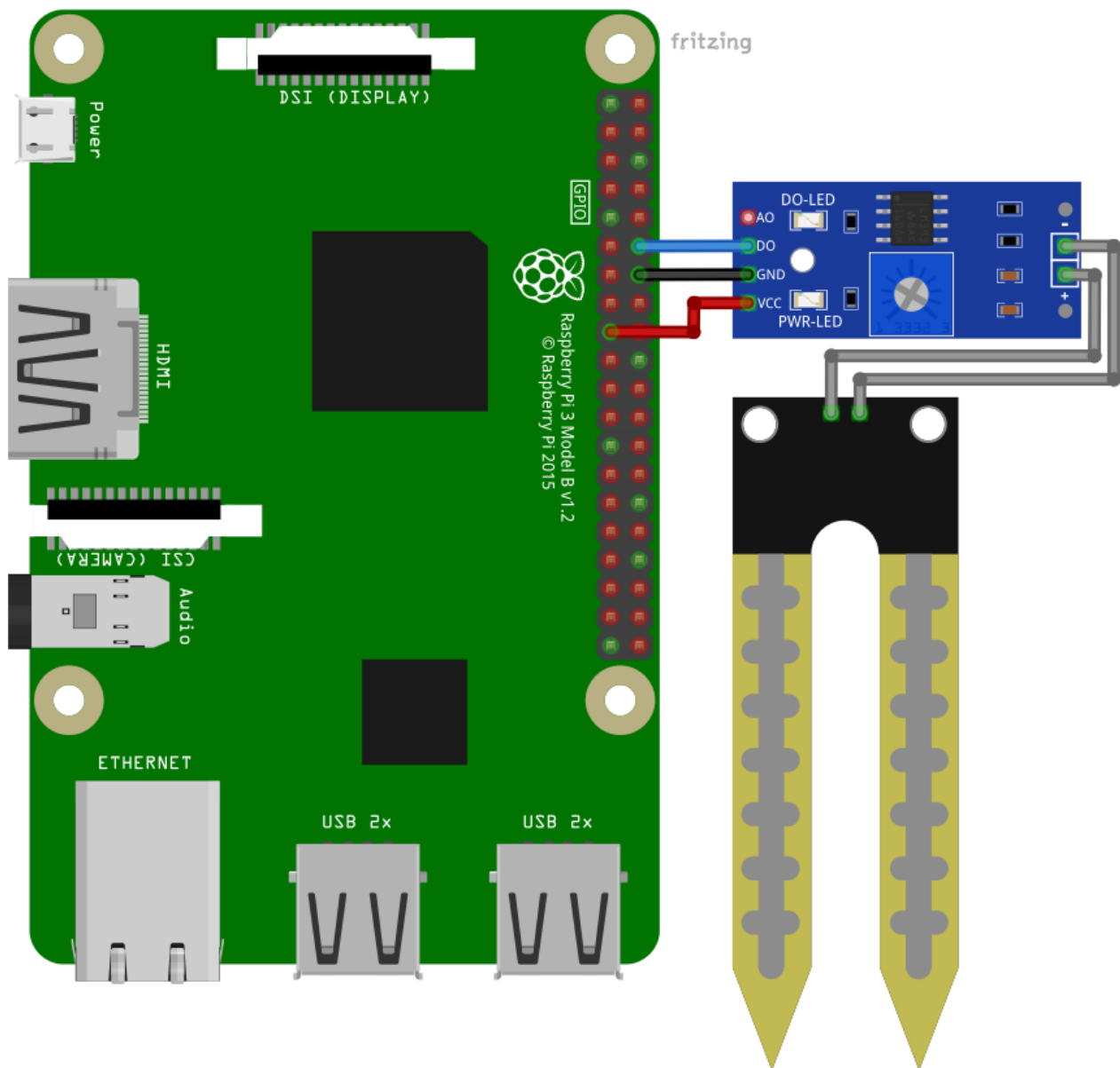
Module pin	Raspberry Pi pin	Physical pin	
D0	GPIO18	12	**Blue wire**
GND	GND	14	**Black wire**
VCC	3V3	17	**Red wire**

NOTE: Connect the sensor module with the control board via jumper cables that come with the module.

Libraries and tools for Python

To use the module with the Raspberry Pi, the library RPi.GPIO has to be installed. If the library is already installed, running the installation command only updates the library to a newer version.

To install the library, open the terminal and run the following commands, one by one:

sudo apt-get update && sudo apt-get upgrade sudo apt-get install python3-rpi.gpio

Python script

```python
import time
import RPi.GPIO as GPIO

GPIO.setmode(GPIO.BCM)
GPIO.setwarnings(False)

DIGIOUT = 18
GPIO.setup(DIGIOUT, GPIO.IN)
time.sleep(2)

print('[Press CTRL + C to end the script!]') try: # Main
program loop
    while True:
    if GPIO.input(DIGIOUT)==0:
    print('Soil moisture level: HIGH')  time.sleep(2)
    else:
    print('Soil moisture level: LOW')
    time.sleep(2)

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

finally:
        GPIO.cleanup()
```
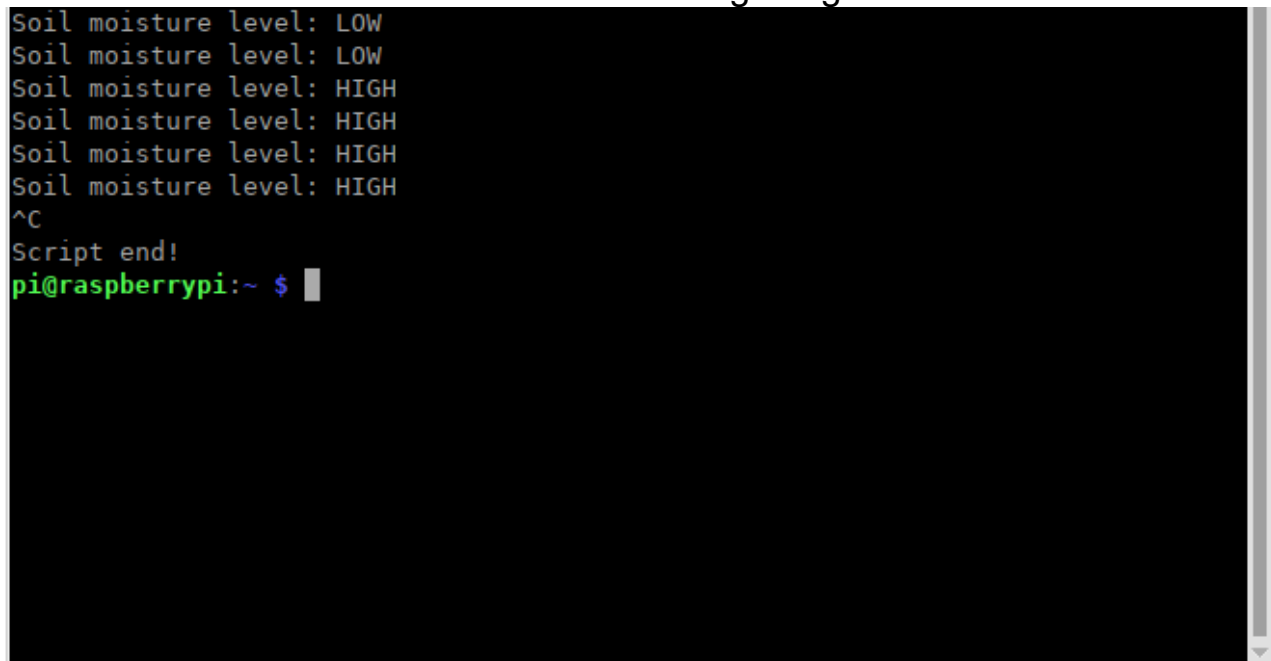
Save the script by the name *hygrometer.py*. To run the script, open the terminal in the directory where the script is saved and run the following command:

python3 hygrometer.py

The result should look like as on the following image:

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

Now it is the time to learn and make your own projects. 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 microelectronic products 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

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