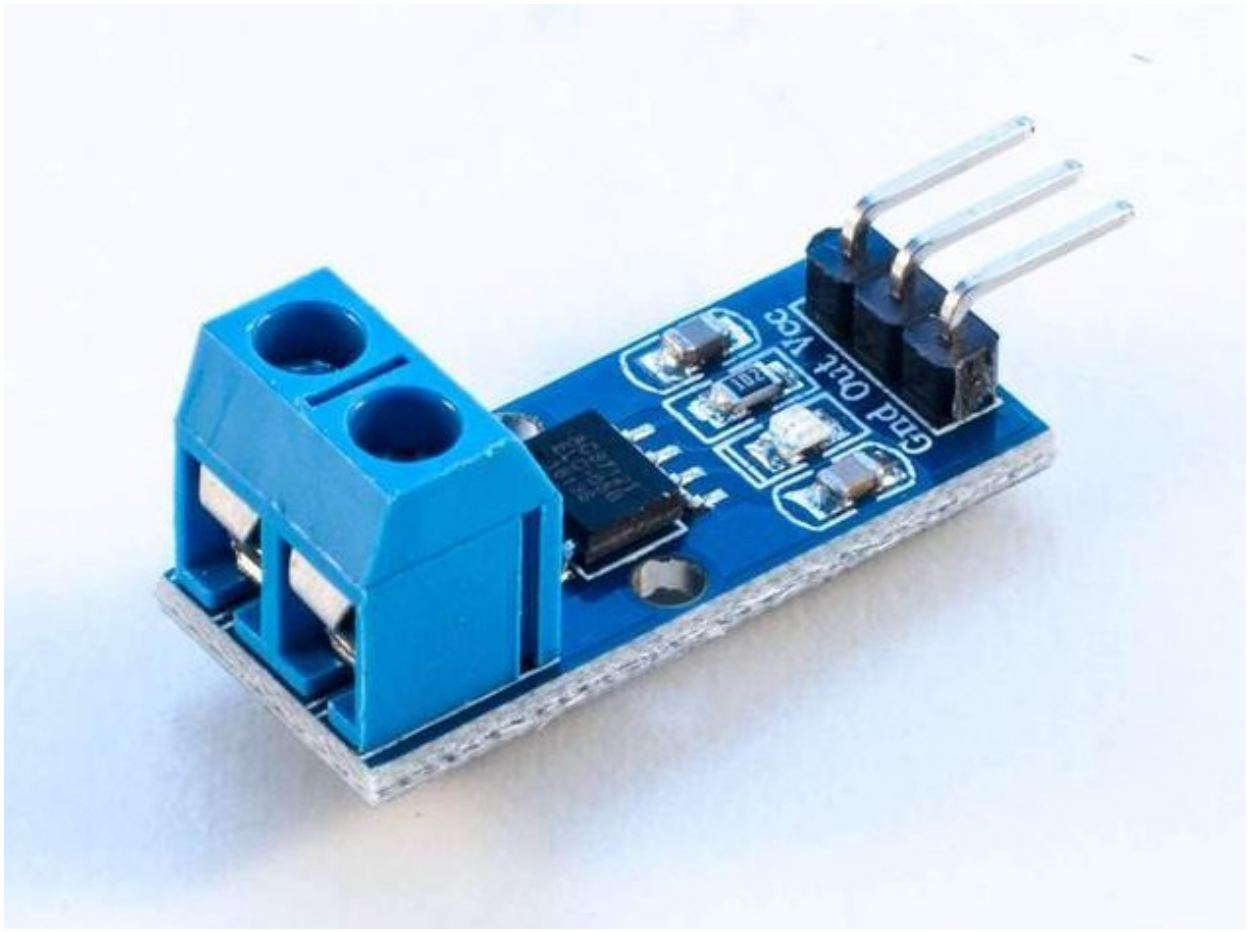
Welcome to our website!

Thank you thanks, that you yourself for our AZ-DeliveryACS712- 30A current sensor. On the following pages, we will show you how to use and set up this practical device.

Have fun!



Areas of application
Education and teaching: Use in schools, universities and training centres 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: Use by electronics enthusiasts and hobbyists for the development and realisation of DIY projects.

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

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

Environmental conditions
The product should be used in a clean, dry environment to avoid damage from 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 for the development, programming and prototyping of electronic projects and applications. The sensor product is not intended as a finished consumer product, but as a tool for technically skilled users, including engineers, developers, researchers and students.

Non-intended foreseeable use
The product is not suitable for industrial use or safety-relevant applications. The product is not authorised for use in medical devices or for the purposes of air and space technology

Waste disposal
Do not dispose of with household waste! Your product must be disposed of in an environmentally friendly manner in accordance with the European directive on waste electrical and electronic equipment. The valuable raw materials it contains can then be reused.
are supplied. The application of this directive contributes to environmental and health protection. Use the collection centre set up by your local authority for the return and recycling of old electrical and electronic equipment. WEEE-Reg. No.: DE 62624346

Electrostatic discharge
Caution: Electrostatic discharges can damage the product. Note: Earth yourself before touching the product, for example by wearing an antistatic wristband or touching an earthed 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 exceeding the permitted limits, residues may still be present. Observe the following safety instructions to avoid chemical hazards: Caution: Soldering can produce vapours that can be harmful to health. Note: Use a soldering fume extractor or work in a well-ventilated room.
area. Wear a respirator if necessary. Caution: Some people may be sensitive to certain materials or chemicals contained in the product. Note: If skin irritation or allergic reactions occur, discontinue use and consult a doctor if necessary. Caution: Keep the product out of the reach of children and pets to avoid accidental contact and ingestion of small parts. Note: Store the product in a secure, closed container when not in use. Caution: Avoid contact of the product with food and drink. Note: Do not store or use the product near food to prevent contamination. Although our product fulfils the

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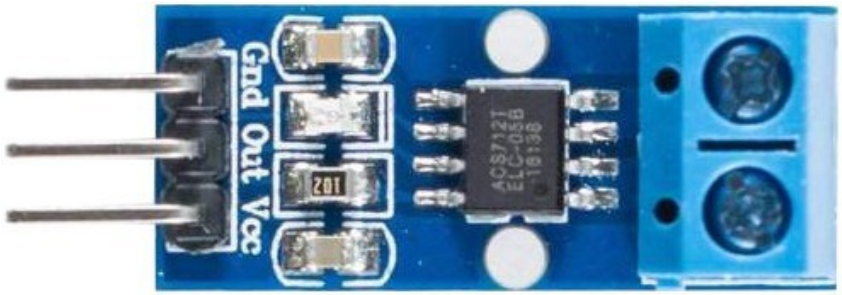
Store the product in a secure, closed container when not in use. Caution: Avoid contact of the product with food and drink. Note: Do not store or use the product near food to prevent contamination. The product contains sensitive electronic components and sharp edges. Improper handling or installation can lead to injury or damage. Observe the following safety instructions to avoid mechanical hazards: Caution: The circuit board and the connections of the product may have sharp edges. Proceed with caution to avoid cutting injuries. Note: Wear suitable protective gloves when handling and installing the product. Caution: Avoid excessive pressure or mechanical stress on the circuit board and components. Note: Only mount the product on stable and level surfaces. Use suitable spacers and housings to minimise mechanical stress. Caution: Ensure that the product is securely fastened to prevent it from accidentally slipping or falling. Note: Use a suitable base or secure fastening in housings or on mounting plates. Caution: Ensure that all cable connections are securely and correctly connected to prevent tensile loads and accidental disconnection. Note: Route cables so that they are not live and do not pose a tripping hazard. The product works with electrical voltages and currents that can lead to electric shocks, short circuits or other hazards if used improperly. Observe the following safety instructions to avoid electrical hazards: Caution: Only use the product with the specified voltages. Note: The power limits of the product can be found in the corresponding data sheet Caution: Avoid short circuits between the connections and components of the product Note: Ensure that no conductive objects touch or bridge the circuit board. Use insulated tools and observe the arrangement of the connections.
Caution: Do not carry out any work on the product when it is connected to a power source. Note: Disconnect the product from the power supply before making any changes to the circuit or connecting or disconnecting components. Caution: Do not exceed the specified current levels for the inputs and outputs of the product. Note: The power limits of the product can be found in the technical specifications or in the data sheet Caution: Ensure that the power sources used are stable and correctly dimensioned. Note: Only use tested and suitable power supply units to avoid voltage fluctuations and overloads. Caution: Maintain sufficient distance from live parts to avoid unintentional 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 housing to prevent accidental contact and short circuits. The product and the components on it can heat up during operation. Improper handling or overloading of the product can lead to burns, damage or fire. Observe the following safety instructions to avoid thermal hazards: Caution: Ensure that the product is used within the 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. Caution: 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. Caution: Ensure that the product is well ventilated to prevent overheating. Note: Use fans or heat sinks if the product is operated in a closed housing or in an environment with limited air circulation. Caution: Mount the product
on heat-resistant surfaces and in heat-resistant housings. Note: Use materials for enclosures that can withstand high temperatures to avoid damage or fire hazards. Caution: Implement temperature monitoring when using an enclosure and, if necessary, protective mechanisms that switch off the product if it overheats. Note: Use temperature sensors and appropriate software to monitor the temperature of the product and switch off the system if necessary. Caution: Avoid overloading, which can lead to excessive heating of the components. Note: Do not exceed the specified limit values.
The current and voltage are regulated to prevent overheating. Caution: Short circuits can generate considerable heat and cause fires. Note: Ensure that all connections are correct and secure and that no conductive objects can inadvertently cause short circuits.

These sensors are based on the *Allegro ACS712ELC* chip. The current sensor is used to measure AC or DC currents in the range of ±30A with an error of 1.5% at
T = 25°C. The sensor consists of two parts, a connection for the sensor chip, and the other part with two screw terminal connections for current measurement.



The sensor utilises the Hall effect to measure the current flowing through it. The current flowing through the sensor generates a magnetic field, which is detected by the sensor and converted into a proportional analogue voltage.

SAFETY WARNING!

When you are making projects that are connected to mains voltage, you really need to know what you are doing otherwise you may shock yourself. This is as serious topic and we want you to be safe. If you are not 100% sure what you are doing, do yourself a favor and don't touch anything. Ask someone who knows!

This sensor delivers:

" Isolation from the load

"easy to integrate with microcontrollers

"Scaling factor":

Module:	5A - Module	20A - Module	30A - Module
Scale Fact:	185 mV/Amp	100 mV/Amp	66 mV/Amp

You need to choose the right range for your project as you will have to accept the accuracy for higher range modules.

Typical applications include motor control, load detection and management, switching power supplies and overcurrent protection.

The device is not intended for use in vehicles!

This module outputs an **analogue** voltage (0 ÷ 5V) based on the current flowing through the wire (in which we measure the current flow), so it is very easy to connect this module to any microcontroller. So if you are looking for a module to measure current with a microcontroller for your project, this module could be the right choice for you.

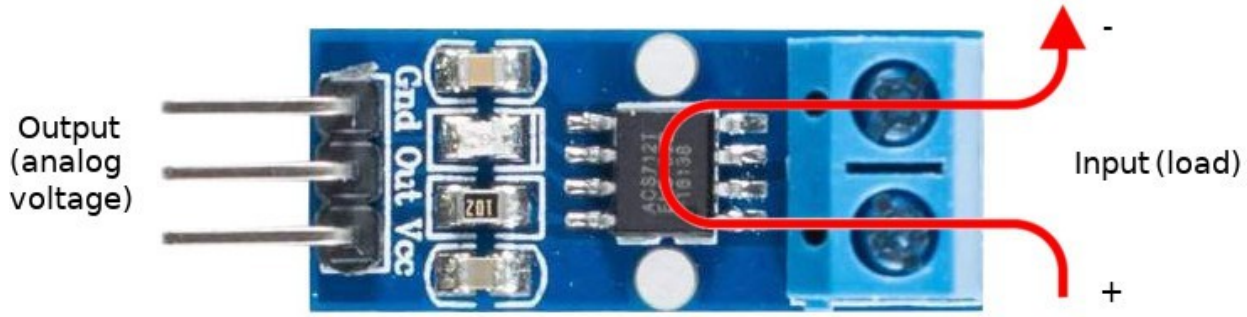
The ACS712 device eliminates the risk of damage to the current monitoring circuit due to the high voltage on the measurement side. The galvanic isolation between the measured current and the sensor circuit also minimises safety concerns when dealing with high voltage systems.

The ACS712-30B can measure currents up to ±30A and offers an output sensitivity of 66mV per A (at a supply voltage of +5V). This means that for every 1A increase in current through the line connections in the positive direction, the output voltage also increases by 66mV.

The sensitivity of the 5A and 20A versions is 185mV/A and 100mV/A.

Connecting the module

The ACS712 module has two block terminal connections (green blocks on the board) with mounting screws, as shown above. These are the terminals to which the wire must be connected. In our case, we are measuring the current drawn by the motor. Therefore, the wires going to the load (motor) are routed through the ACS712 module.



Make sure that the module is connected in series with the load and be particularly careful to avoid short circuits!

At zero current, the output voltage is half the supply voltage (in our case this is 2.5 V, as Vcc = 5 V). The ACS712 offers a ratiometric output, i.e. the zero current output and the sensitivity of the device are both proportional to the supply voltage. This feature is particularly useful when using the ACS712 with an analogue-to-digital converter (ADC). The precision of any A-D conversion depends on the stability of the reference voltage (Vref) used in ADC operation. In most microcontroller circuits, the reference voltage for the A-D-

conversion the supply voltage itself.

Therefore, if the supply voltage is not stable, the ADC measurements may not be precise and accurate. However, if the reference voltage of the ADC matches the supply voltage of the ACS712, then the ratiometric output of the ACS712 compensates for any error in the A-D conversion caused by the fluctuation of the reference voltage.

The microcontroller on the microcontroller board has a 10-bit ADC and works with a reference voltage (Vref) of 5 V for the A-D conversion. In this case, the microcontroller reads the values from the ADC in the range from 0 to 1023. We can use the following equation to calculate the output voltage in *mV* from the raw ADC data:
Vout = (AdcRawData / 1023.0) * 5000.0

We then use the next equation to calculate the current in *A* from Vout:
Current = (Vout - 2500) / ScaleFactor

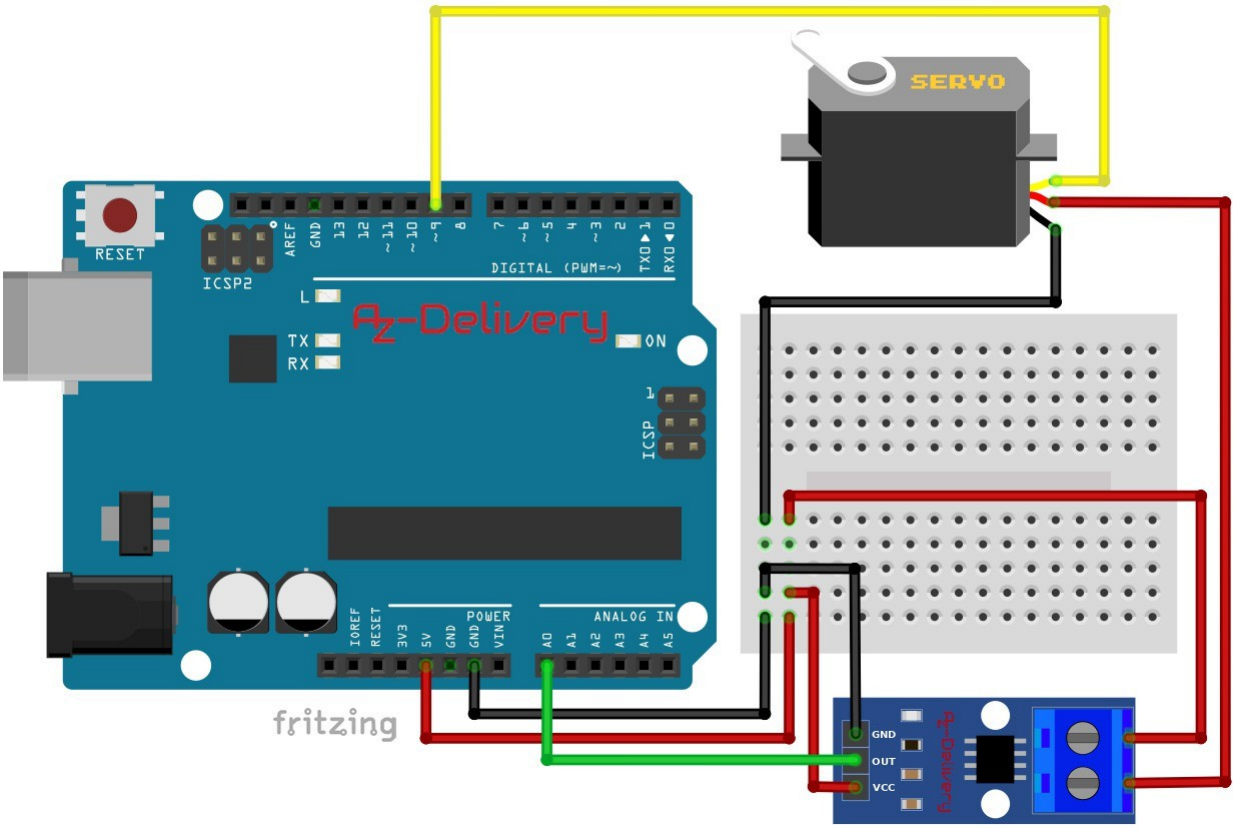
Note that the value of the scaling factor for each module changes depending on its range. The scaling factor values for all three modules are given in the specifications above.

With an input current of zero, the output of the ACS712 should ideally be Vcc divided by 2, which corresponds to the value of 512 if we perform an analogue-to-digital conversion with the microcontroller board. (at Vref = 5.0V, the resolution of the 10-bit ADC of the microcontroller board is 5V/1024 = 4.9mV). One bit corresponds to a current of 26mA for ACS712-30B. The ACS712 output fluctuates around 512 ±1 with an input current of zero. If it is 513, the measured current would be

current is 0.02A. It is therefore

It is always better to take several ADC measurements and then calculate their average.

Application example



In this example, we use a servo motor to measure the current that the servo motor draws from a microcontroller board. If the servo motor is connected to the power supply but the control wire (**yellow wire** in the picture) is not connected, it will draw 0A current. However, if we set the PWM output on the microcontroller board (digital pin 9) and connect the servo control wire to it, the servo will also draw 0A current from the Atmega328P Borad. Only when we try to move the shaft of the servo, the servo draws more current and we can see the current change in the serial monitor (picture after the example sketch).

We connect the output of the sensor (**green wire**) to the analogue input pin 0.

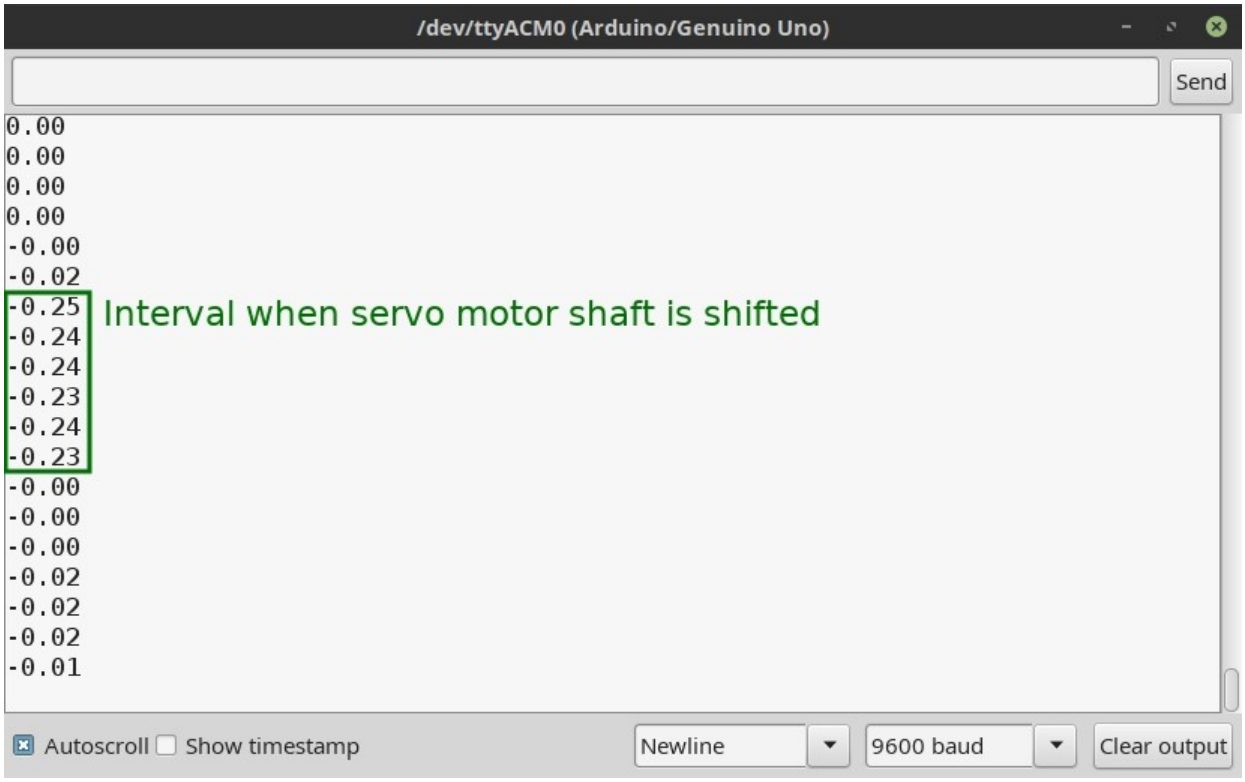
Example of a sketch:

```
// Current measurement with ACS712 - 5A, 20A and 30A modules
int rawData;              // Analogue data read from the
sensor int servo = 9;     // The PWM pin to which the servo
is connected double average = 0;
double scaleFactor = 185.0;     // for 20A module = 100.0
                                // for 30A module = 66.0
double Voltage = 0.0;
double Current = 0.0;

void setup() {
  Serial.begin(9600);
  pinMode(servo, OUTPUT);
}
void loop() { average =
  0;
  analogWrite(servo, 200); // the servo must be in a position

  // for a stable measurement, we take 100 measurements
  // and the average for(int i =
  0; i < 100; i++) {
    average += analogRead(0);
    delay(1);
  }
  Average /= 100;
  Voltage = (average / 1023.0) * 5000.0; // in mV
  // for calibration to determine the number 2494 at 0A current
  // Serial.println(Voltage);
  Current = (voltage - 2494) / scaleFactor; // in A
  // prints the current in A
  Serial.println(current);
```

```
  delay(500);
}
```

The number 2494 can vary from sensor to sensor, so we have to determine it by calibration. This number represents the sensor output at 0A current. It is the analogue voltage output of the sensor at 0A current.

Decomment the code line *Serial.println(voltage) and load the* sketch onto the microcontroller board, start the serial monitor and you will get this value. Then change 2494 to your new value and comment *out* the line *Serial.println(voltage)*. Upload the sketch again and start the serial monitor. Try to move the shaft of the servo motor a little. The output should look something like this:



This concludes the discussion about the ACS712 current sensor. However, one problem has not yet been addressed. How would you measure an AC current with the ACS712 sensor? Remember that the ACS712 sensor provides an instantaneous output signal that corresponds to the current flowing through the block terminals. When the current flows in the positive direction, the sensitivity of the device is positive and the ACS712 output voltage rises above 2.5V. However, if the current changes direction, the sensitivity is negative and the output voltage of the ACS712 drops below 2.5V. This means that with an alternating current, the 10-bit ADC output measured by the microcontroller oscillates around the value 512. Therefore, the microcontroller must sample the sensor output fast enough so that the actual value of the current can be calculated from it.

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

Now it's time to learn and create the projects yourself. You can do this with the help of many example scripts and other instructions that you can find on the Internet.

If you are looking for high-quality microelectronics and accessories, AZ-Delivery Vertriebs GmbH is the right address for you. You will receive numerous application examples, complete installation instructions, eBooks, libraries and support from our technical experts.

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fun!

Imprint

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