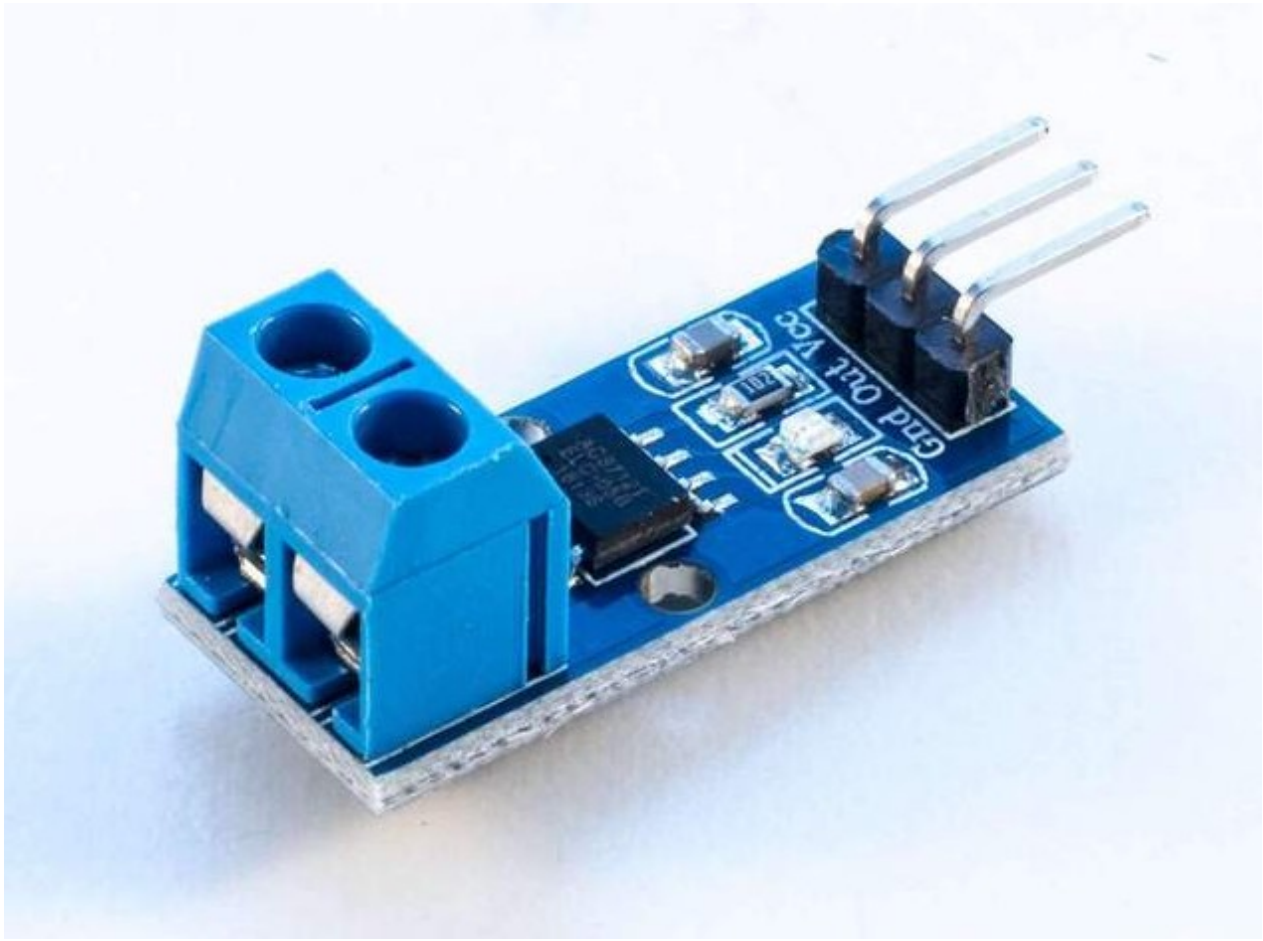
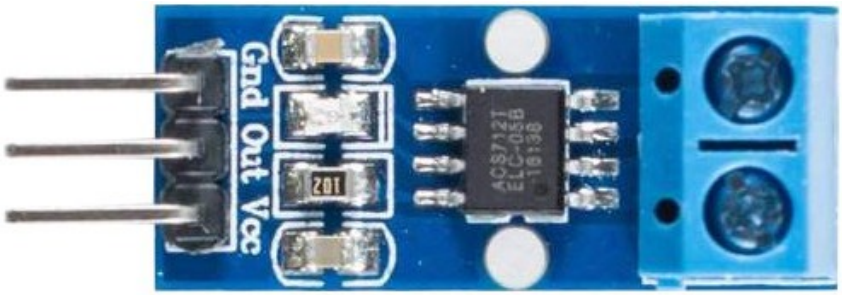
Welcome!

Thank you very much for purchasing our AZ-Delivery ACS712 - 5A current sensor. On the following pages, we will introduce you to how to use and setup this handy device.

Have fun!



These sensors are based on the *Allegro ACS712ELC* chip. Current sensor is used for measuring AC or DC currents in range ±5A with error of 1.5% at T = 25℃. The sensor consists of two parts, one connections for the sensor chip, and other part with two screw terminal block connectors for current measurement.



Sensor uses Hall effect to sense current flowing through it. Current flowing through sensor generates a magnetic field which is sensed by sensor and converted into a proportional analog 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 provides:

» isolation from the load

» easy to integratable with microcontrollers

» scale factor:

module:	5A - Module	20A - Module	30A - Module
scale fact.:	185 mV/Amp	100 mV/Amp	66 mV/Amp

You have to select the right range for your project since you have to trade off accuracy for higher range modules.

Typical applications include motor control, load detection and management, switched-mode power supplies, and overcurrent fault protection.

The device is not intended for automotive applications!

This modules outputs **analog** voltage (0 ÷ 5V) based on the current flowing through the wire (in which we measure current flow), hence it is very easy to interface this module with any microcontroller. So if you are looking for a module to measure current using a microcontroller for your project, then this module might be the right choice for you.

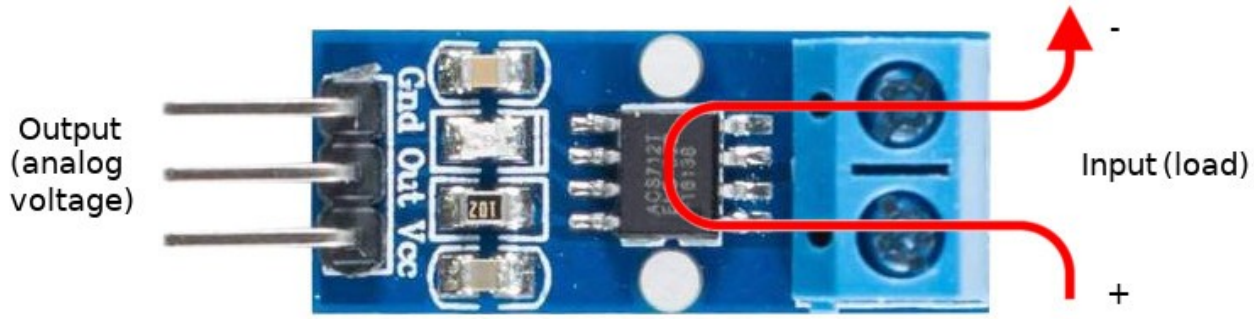
The ACS712 device eliminates the risk of damaging the current monitoring circuit due to the high voltage on the measuring side. The electrical isolation between the current that is measured and the sensor circuit also minimizes the safety concerns while dealing with high voltage systems.

The ACS712-05B can measure current up to ±5A and provides output sensitivity of 185mV per A (at +5V power supply), which means for every 1A increase in the current through the conduction terminals in positive direction, the output voltage also rises by 185mV.

The sensitivities of 20A and 30A versions are 100mV/A and 66mV/A, respectively.

Connecting the module

The ACS712 module has two block terminal connectors (green blocks on board) with mounting screws as shown above. These are the terminals through which the wire has to be connected. In our case we are measuring the current drawn by the motor so the wires that is going to the load (motor) is passed through the ACS712 Module.



Make sure the module is connected in series with the load and be extra cautious to avoid short circuits!

At zero current, the output voltage is half of the supply voltage (In our case that is 2.5V because Vcc = 5V). The ACS712 provides ratiometric output, which means the zero current output and the device sensitivity are both proportional to the supply voltage. This feature is particularly useful when using the ACS712 with an analog to digital converter (ADC). The precision of any A-D conversion depends upon the stability of the reference voltage (Vref) used in the ADC operation. In most microcontroller circuits, the reference voltage for A-D conversion is the supply voltage itself.

So, if the supply voltage is not stable, the ADC measurements may not be precise and accurate. However, if the reference voltage of ADC is same as the supply voltage for ACS712, then the ratiometric output of ACS712 will compensate for any error in the A-D conversion due to the fluctuation in the reference voltage.

The microcontroller on Arduino Uno board has a 10-bit ADC and operates at 5V with a reference voltage (Vref) of 5V for A-D conversion in that case the microcontroller will read the values from ADC in range from 0 to 1023. We can use the equation below to calculate the output voltage in *mV* from ADC raw data:

Vout = (AdcRawData / 1023.0) * 5000.0

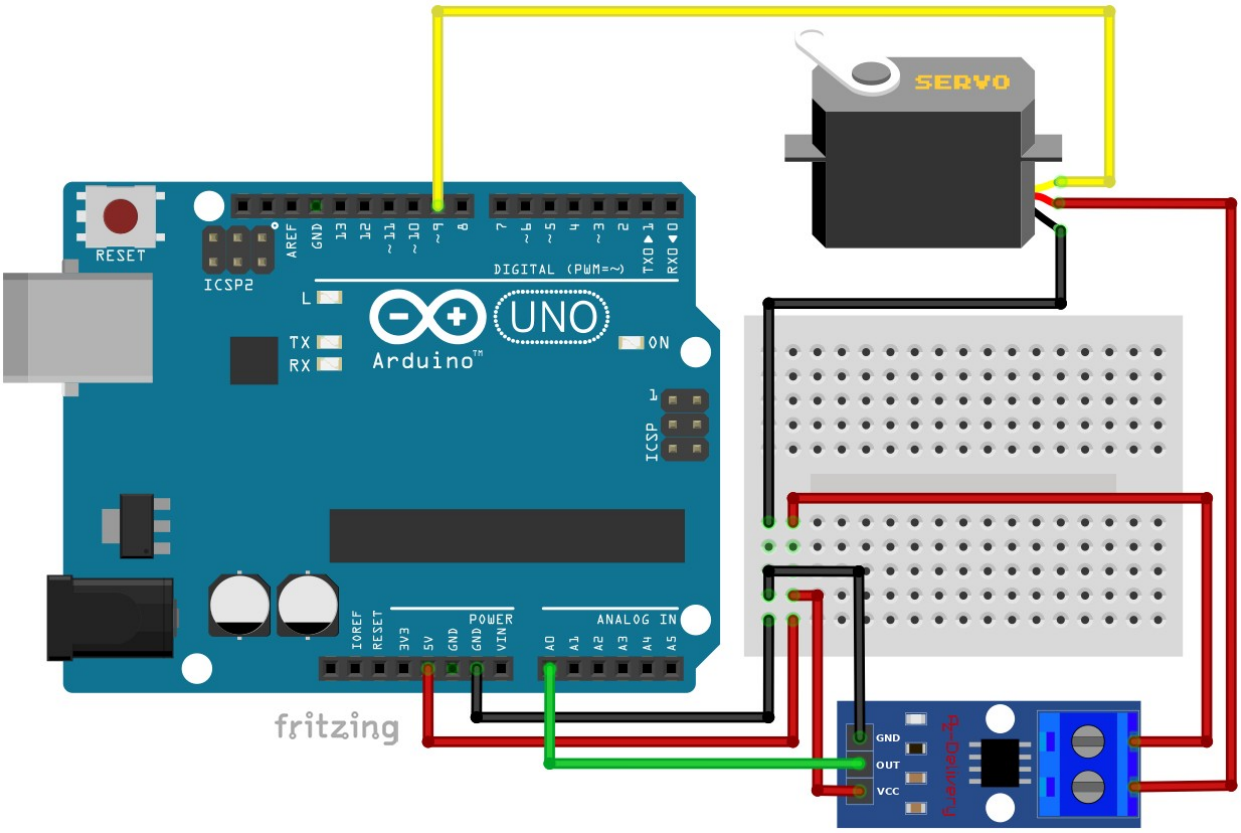
After this we use next equation to calculate current in *A* from Vout:

Current = (Vout - 2500) / ScaleFactor

Note that the value of scale factor changes for every module based on its range. The values of scale factor for all three modules are given in the specifications above.

At zero input current, the ACS712 output should be ideally Vcc divided by 2, which is equivalent to value of 512 when we do analog to digital conversion by Arduino. (for Vref = 5.0V, resolution of Arduino 10-bit ADC is 5V/1024 = 4.9mV). A one bit is equivalent to 26mA of current for ACS712-05B. The ACS712 output for zero input current is fluctuating around 512 ±1. If it is 513, the measured current would be 0.02A. So it is always better to take multiple ADC measurements and then take their average.

Application example



In this example we use servo motor to measure current that servo draws from an Arduino. When servo is connected to power supply but control wire (**yellow wire** on the image) is not connected, it draws 0A current. But when we set PWM output on Arduino (digital pin 9) and connect servo control wire to it, servo also draws 0A current form Arduino. Only when we try to shift the shaft of the servo, the servo will draw more current, and we can see current change output in Serial Monitor (image after sketch example).

Output from the sensor (**green wire**) we connect to the analog input pin 0.

Sketch example:

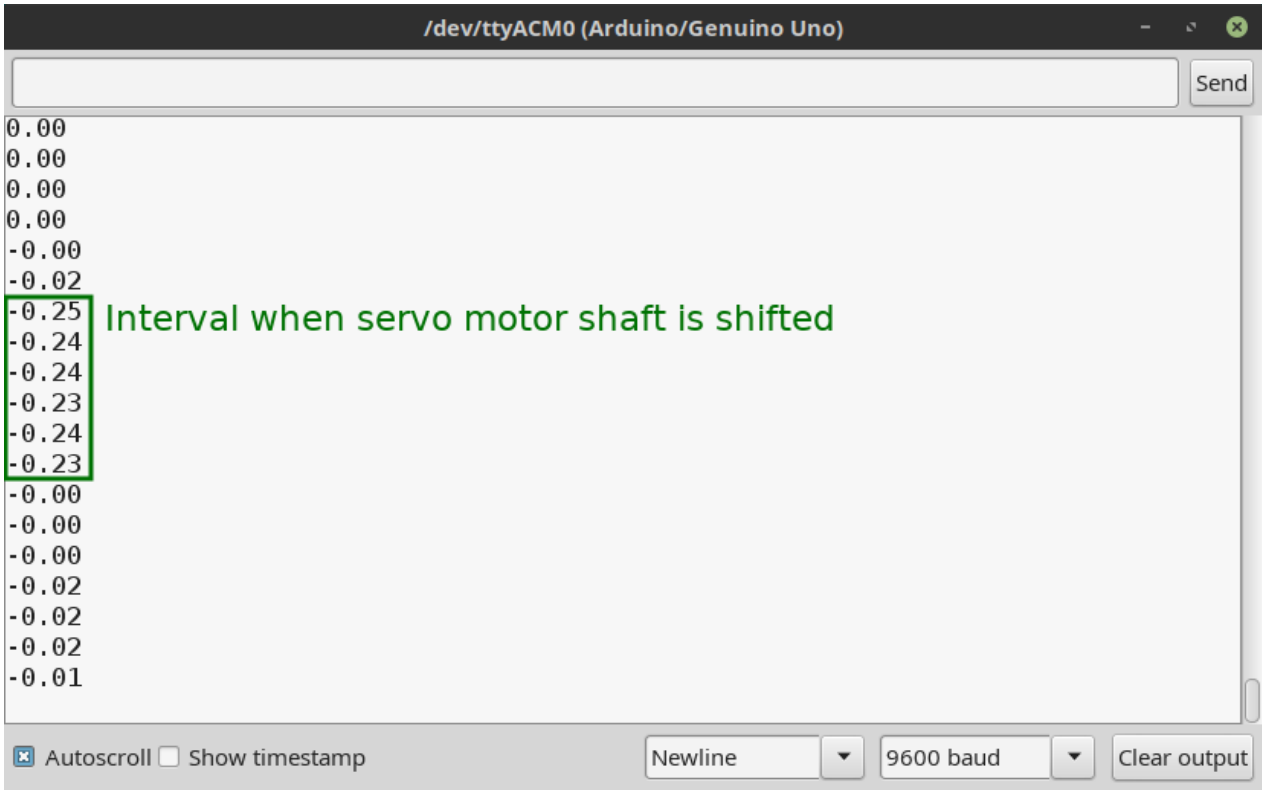
```
//  Measuring current using ACS712 - 5A, 20A and 30A modules
int rawData;             //  analog data read from sensor
int servo = 9;           //  the PWM pin the servo is attached to
double average = 0;
double scaleFactor = 185.0;     //  for 20A module = 100.0
                                //  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 has to be in one position

  //  for stable measurement we take 100 measurements
  //  and average it
  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 number 2494 at 0A current
  //  Serial.println(voltage);
  current = (voltage - 2494) / scaleFactor; //  in A
  //  prints current in A
  Serial.println(current);
  delay(500);
}
```

The number 2494 may vary from sensor to sensor, so we have to use calibration to determine it. This number represents sensor output at 0A current, it is analog voltage output from sensor at 0A current.

Uncomment code line *Serial.println(voltage)* upload sketch to Arduino, start Serial monitor and you will get this value. After that, change 2494 to your new value and comment back *Serial.println(voltage)* line. Upload that sketch again, and start Serial monitor. Try to shift servo motor shaft a little bit. The output should look something like this:



This concludes the discussion on the ACS712 current sensor. However, one concern is still not addressed. How would you measure an AC current with the ACS712 sensor? Keep in mind that the ACS712 sensor provides an instantaneous output corresponding to the current flowing through the block terminals. If the current flow is in positive direction, the sensitivity of the device is positive, and the ACS712 output voltage rises above 2.5V. But if the current changes its direction, the sensitivity will be negative and the output of the ACS712 decreases below 2.5V. This means, for an AC current, the 10-bit ADC output measured by the microcontroller oscillates around value 512. Therefore, the microcontroller needs to sample the sensor output fast enough so that the real value of the current can be computed from it.

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.

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Have Fun!

Impressum

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