

## ACS712 Current Sensor with Arduino

The ACS712 is a popular Hall-effect-based current sensor that provides accurate current measurements in both AC and DC circuits. It is widely used in electronic projects and industrial applications to measure current flowing through a load.

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### Features and Specifications of the ACS712

#### 1. Model Variants:

- **ACS712-05B:** Measures  $\pm 5\text{A}$  with a sensitivity of 185 mV/A.
- **ACS712-20B:** Measures  $\pm 20\text{A}$  with a sensitivity of 100 mV/A.
- **ACS712-30B:** Measures  $\pm 30\text{A}$  with a sensitivity of 66 mV/A.

#### 2. Key Specifications:

- **Input Voltage Range:** Up to 5V.
- **Output Voltage:** Proportional to the current sensed.
- **Operating Voltage:** 4.5V to 5.5V (typically powered by 5V from Arduino).
- **Accuracy:**  $\pm 1.5\%$  at 25°C.
- **Bandwidth:** 80 kHz (can be reduced with an external capacitor).
- **Operating Temperature:** -40°C to 85°C.
- **Low Noise:** Provides stable and low-noise output.

#### 3. Hall-Effect Technology:

- The sensor uses the Hall-effect principle to measure the magnetic field generated by the current passing through the conductor. This magnetic field is converted into a voltage signal proportional to the current.
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### Applications of ACS712 Current Sensor

#### 1. Energy Monitoring:

- Used in power meters and energy monitoring systems to measure load currents.

## 2. Motor Control:

- Monitors motor currents in robotics, industrial machines, and automation systems.

## 3. Battery Management Systems:

- Measures charge and discharge currents in batteries.

## 4. Overcurrent Protection:

- Detects current overloads in circuits to protect components from damage.

## 5. Solar and Renewable Energy Systems:

- Measures current in solar panels and inverters.
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## Working Principle of ACS712 Current Sensor with Arduino

The ACS712 sensor operates on the Hall-effect principle. When current flows through the input terminals (IP+ and IP-), it generates a magnetic field proportional to the current. The integrated Hall sensor detects this magnetic field and produces a corresponding voltage at the VOUT pin.

### 1. Output Voltage:

- At **zero current**, the output voltage is approximately 2.5V (midpoint of the supply voltage).
- For **positive currents**, the voltage increases above 2.5V.
- For **negative currents**, the voltage decreases below 2.5V.

### 2. Measuring Current:

- Using the Arduino's ADC (Analog-to-Digital Converter), the output voltage of the ACS712 is read and converted to a digital value. The current is then calculated using the formula:

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- Where: 
$$I = \frac{V_{OUT} - V_{OFFSET}}{\text{Sensitivity}}$$

$V_{OUT}$  Output voltage from the ACS712.

$V_{OFFSET} = 2.5V$  (for zero current).

- Sensitivity = Depending on the ACS712 variant (e.g., 185 mV/A for ACS712-05B).

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### Pin Description of ACS712

Pin Name	Description
VCC	Power input pin (4.5V to 5.5V). Connect to Arduino 5V.
GND	Ground pin. Connect to Arduino GND.
OUT	Analog voltage output pin proportional to the current. Connect to an analog pin of Arduino.
IP+	Current input terminal (positive).
IP-	Current input terminal (negative).

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### Connecting ACS712 to Arduino

#### 1. Connections:

- **VCC:** Connect to the Arduino 5V pin.
- **GND:** Connect to the Arduino GND pin.
- **OUT:** Connect to an analog input pin of the Arduino (e.g., A0).
- **IP+ and IP-:** Connect in series with the load to measure current.

#### 2. Wiring Example:

- Place the ACS712 between the power source and the load, ensuring the current flows through the IP+ and IP- terminals.
- Use appropriate connectors for secure wiring.

### Tips for Accurate Measurement

#### 1. Calibrate:

- Measure and adjust the offset voltage to improve accuracy.

#### 2. Add a Capacitor:

- Use an external capacitor on the filter pin to reduce noise (e.g., 0.1  $\mu$ F).

### 3. **Avoid Overcurrent:**

- Ensure the current does not exceed the sensor's maximum rating.

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This guide covers all aspects of the ACS712 current sensor, including its working, applications, and integration with Arduino, to help you achieve precise current measurements in your projects.