AYWHP XDA116

AYHWP AS5600 12-bit High-Precision Magnetic Angle Sensor Module User Manual

Model: XDA116

1. Introduction

The AYHWP AS5600 Magnetic Angle Sensor Module is a non-contact angle detection module based on the high-performance AS5600 magnetic induction chip. It supports continuous angle measurement from 0 to 360 degrees with a resolution of up to 12 bits. This makes it suitable for applications requiring precise control, such as servo systems, motor control, robotic joint positioning, and rotary knobs.

The module supports analog voltage (0-5V) and PWM signal outputs. Communication with a main control device is established via the I2C bus, ensuring compatibility with various development platforms including Arduino, ESP32, STM32, and Raspberry Pi. Its non-contact magnetic measurement technology allows for high-resolution angle capture by simply placing a small magnet above or in front of the module, eliminating physical contact wear associated with traditional potentiometers.

2. What's in the Box

- 2 x AS5600 Magnetic Angle Sensor Modules
- 2 x Magnets
- 2 x Pin Headers

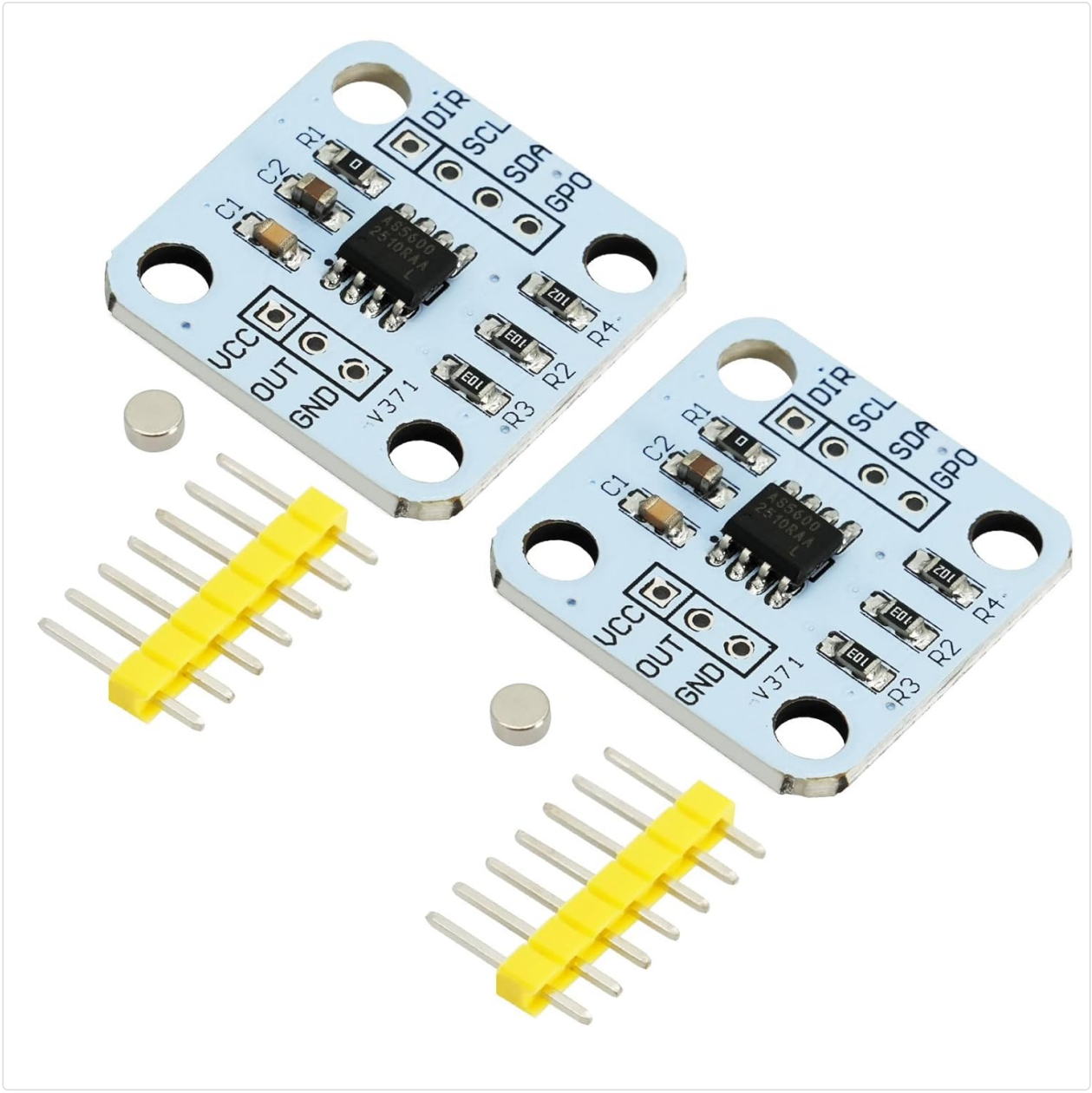

Image 2.1: Contents of the package, showing two AS5600 modules, pin headers, and magnets.

3. Specifications

Feature	Value
Chip	AS5600
Angle Measurement Range	0-360 degrees continuous
Resolution	12-bit
Output Modes	PWM, Analog Voltage (0-5V)
Communication Interface	I2C
Supply Voltage (VCC)	3.3V
Dimensions	23.2 mm x 23.2 mm (approx. 0.91 x 0.91 inches)
Model Number	XDA116

Image 3.1: Physical dimensions of the AS5600 module, measuring 23mm x 23mm.

4. Features

- **High-Precision AS5600 Encoder:** Utilizes the AS5600 encoder chip, supporting 12-bit high-resolution angle measurement, suitable for rotational angle detection, motor control, and robotics.
- **Multiple Output Modes:** Supports PWM and analog voltage outputs, compatible with the I2C interface, and suitable for various microcontroller platforms such as Arduino, ESP32, STM32, etc.
- **Non-Contact Operation:** Employs magnetic detection for angle measurement, which prevents mechanical wear, ensuring a longer lifespan and more stable performance compared to contact-based sensors.
- **Low Power Consumption:** Equipped with an intelligent power-saving mode that automatically reduces power consumption.
- **Configurable Rotation Direction:** The DIR pin allows selection of the output polarity's rotation direction. Grounding DIR results in increasing values clockwise; connecting DIR to VCC results in decreasing values clockwise.

5. Pinout and Interfaces

The AS5600 module features several pins for power, output, and communication:

- **VCC:** Power supply input (3.3V).
- **GND:** Power supply ground.
- **OUT:** PWM or Analog Voltage output.
- **DIR:** Rotation direction selection. Connect to GND for clockwise value increase; connect to VCC for clockwise value decrease.
- **SCL:** I2C communication clock line.
- **SDA:** I2C communication data line.
- **GPO:** Mode selection (internal pull-up, grounding enables programming mode B).

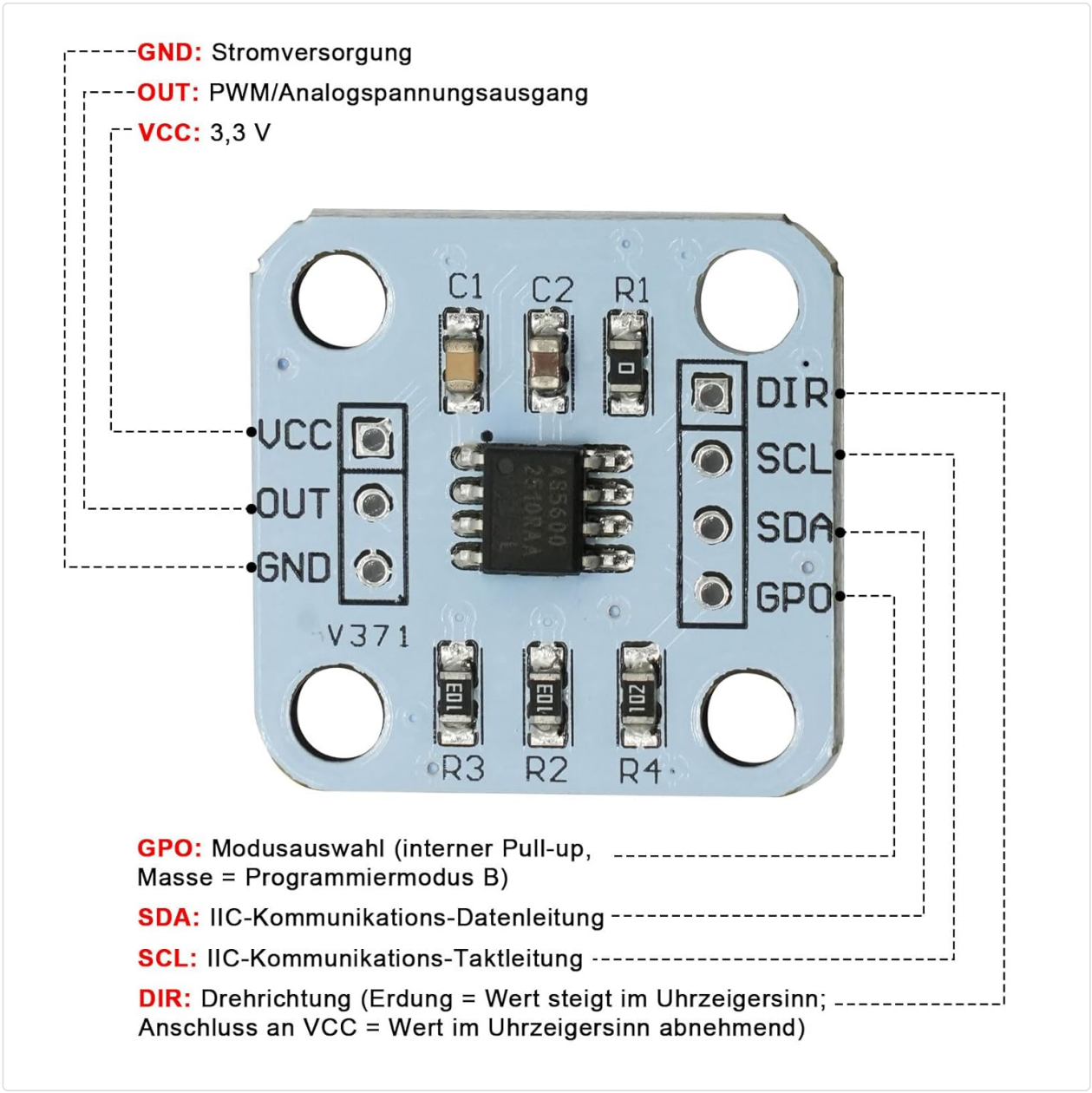

Image 5.1: Pinout diagram illustrating the function of each pin on the AS5600 module.

6. Setup and Installation

1. **Power Connection:** Connect the VCC pin to a 3.3V power source and the GND pin to the power ground.
2. **Magnet Placement:** Position a small magnet directly above the center of the AS5600 chip. The magnet should be axially magnetized and centered for optimal performance. The distance between the magnet and the sensor should be minimal, typically within 1-3mm, to ensure strong magnetic field detection.

3. **Output Mode Selection:**
    - For Analog Voltage or PWM output, connect the OUT pin to your microcontroller's analog input or PWM input pin, respectively.
    - For I2C communication, connect SCL to your microcontroller's SCL pin and SDA to your microcontroller's SDA pin.
4. **Rotation Direction:** Configure the DIR pin based on your desired rotation direction:
    - Connect DIR to GND for angle values to increase when rotating clockwise.
    - Connect DIR to VCC for angle values to decrease when rotating clockwise.
5. **Programming Mode (GPO):** The GPO pin is internally pulled up. Grounding GPO enables programming mode B, which is typically used for advanced configuration of the AS5600 chip. For standard operation, GPO can be left unconnected.

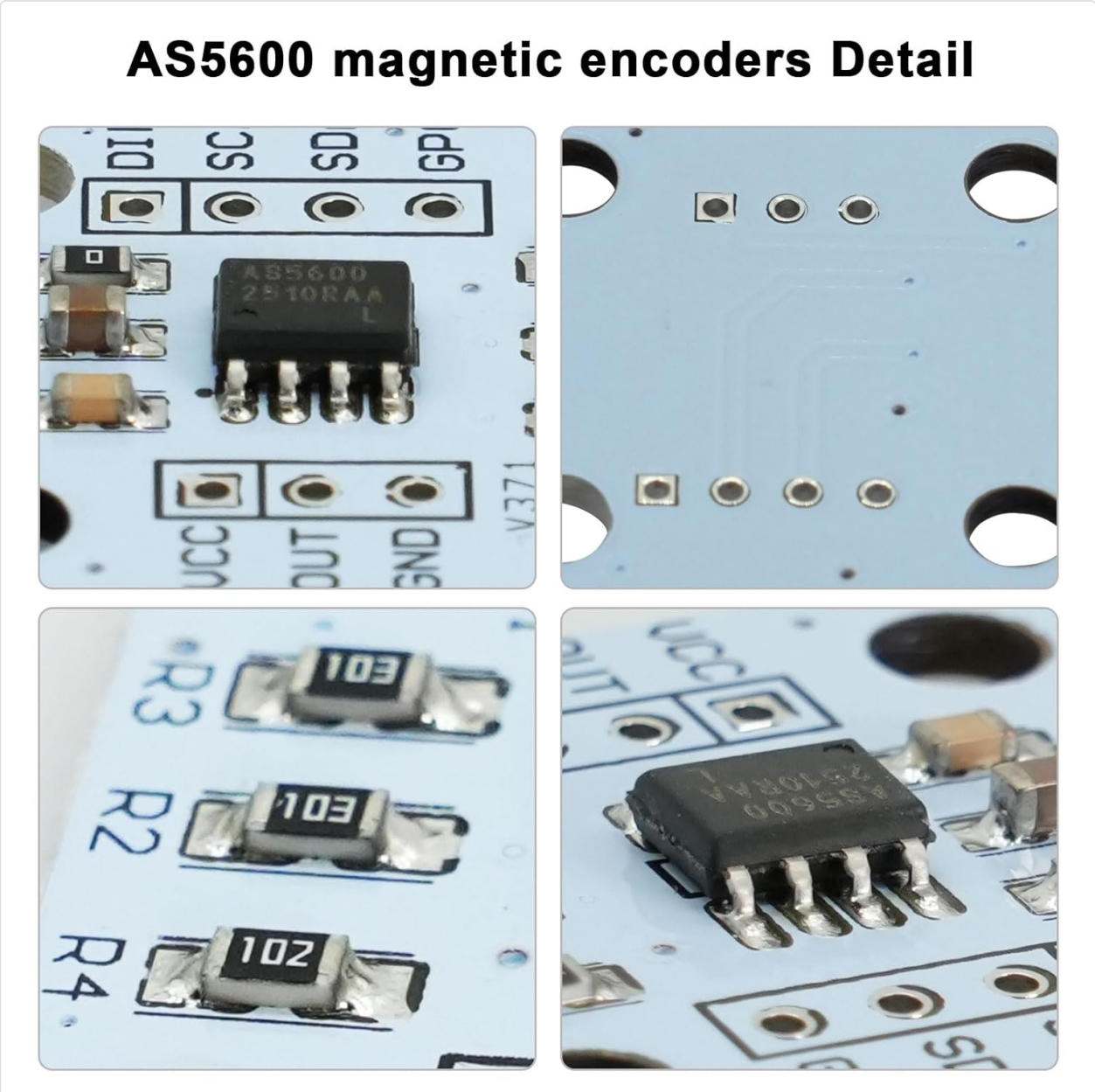

Image 6.1: Detailed view of the AS5600 module components, useful for identifying connection points.

7. Operating Instructions

7.1. I2C Communication

The AS5600 module communicates via the I2C protocol. The default I2C address for the AS5600 is 0x36. You will need to use an I2C library compatible with your microcontroller (e.g., Wire library for Arduino) to read angle data from the sensor. The AS5600 provides registers for reading raw angle data, filtered angle data, and for configuring various parameters.

7.2. Analog Voltage Output

When configured for analog output, the OUT pin provides a voltage proportional to the measured angle. The output range is typically 0-5V, corresponding to 0-360 degrees. This output can be read directly by an analog-to-digital converter (ADC) pin on your microcontroller.

7.3. PWM Output

In PWM output mode, the OUT pin generates a pulse-width modulated signal where the duty cycle is proportional to the measured angle. The frequency and duty cycle range can be configured via I2C. This output can be read by a digital input pin capable of measuring pulse width on your microcontroller.

7.4. Calibration

The AS5600 chip has internal registers for setting zero position and maximum angle. Refer to the AS5600 datasheet for detailed instructions on calibrating the sensor for specific applications. This typically involves writing values to specific I2C registers to define the start and end points of your desired measurement range.

8. Applications

The AS5600 magnetic angle sensor module is versatile and can be integrated into various projects and systems:

- **Robotics:** Joint position sensing for robotic arms and manipulators.
- **Motor Control:** Feedback for brushless DC (BLDC) motors and servo motors.
- **Industrial Equipment:** Position sensing in machinery, automation, and control systems.
- **Automotive:** Steering angle sensors, pedal position sensors.
- **DIY Projects:** Rotary encoders for user interfaces, precise angle measurement in custom devices.

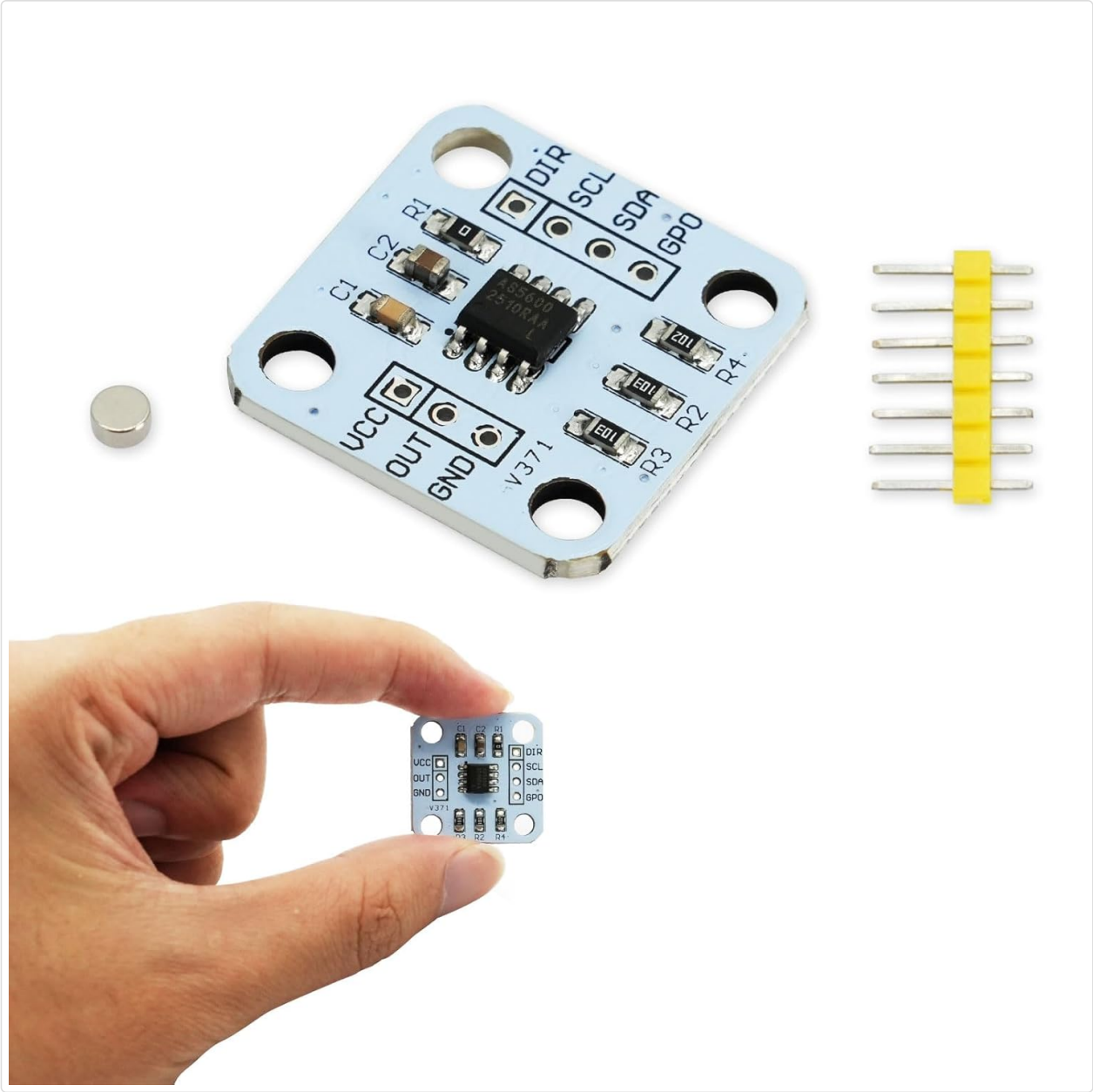

Image 8.1: Illustrative examples of common applications for the AS5600 magnetic angle sensor module.

9. Maintenance

- **Cleanliness:** Keep the module free from dust, dirt, and moisture. Use a soft, dry cloth for cleaning.
- **Magnet Placement:** Ensure the magnet remains securely positioned relative to the sensor. Any movement or misalignment can affect accuracy.
- **Environmental Conditions:** Operate the module within its specified temperature and humidity ranges to prevent damage and ensure reliable performance.
- **Avoid Strong Magnetic Fields:** Keep the module away from other strong magnetic fields that could interfere with its operation.

10. Troubleshooting

- **No Output/Incorrect Readings:**
  - Verify power connections (VCC to 3.3V, GND to ground).
  - Check magnet positioning and distance from the sensor. Ensure the magnet is axially magnetized and centered.

- Confirm correct wiring for I2C, analog, or PWM output.
- Ensure the correct I2C address (0x36) is used in your code.
- Check for short circuits or loose connections.

- **Inconsistent Readings:**
  - Ensure the magnet is stable and not wobbling.
  - Minimize electrical noise in the environment.
  - Recalibrate the sensor if necessary, especially after initial setup or if the magnet position changes.

- **I2C Communication Failure:**
  - Check SCL and SDA connections.
  - Ensure pull-up resistors are present on SCL and SDA lines if not provided by the microcontroller or module.
  - Verify the I2C address.

11. Warranty and Support

Information regarding specific warranty terms for the AYHWP AS5600 Magnetic Angle Sensor Module is not available in this document. For warranty claims or technical support, please refer to the retailer or manufacturer's official support channels.

General support for the AS5600 chip and its integration can often be found through online communities, forums, and documentation provided by the chip manufacturer (AMS) or various microcontroller platform communities (e.g., Arduino forums, ESP32 documentation).

Documents - AYWHP – XDA116
no relevant documents