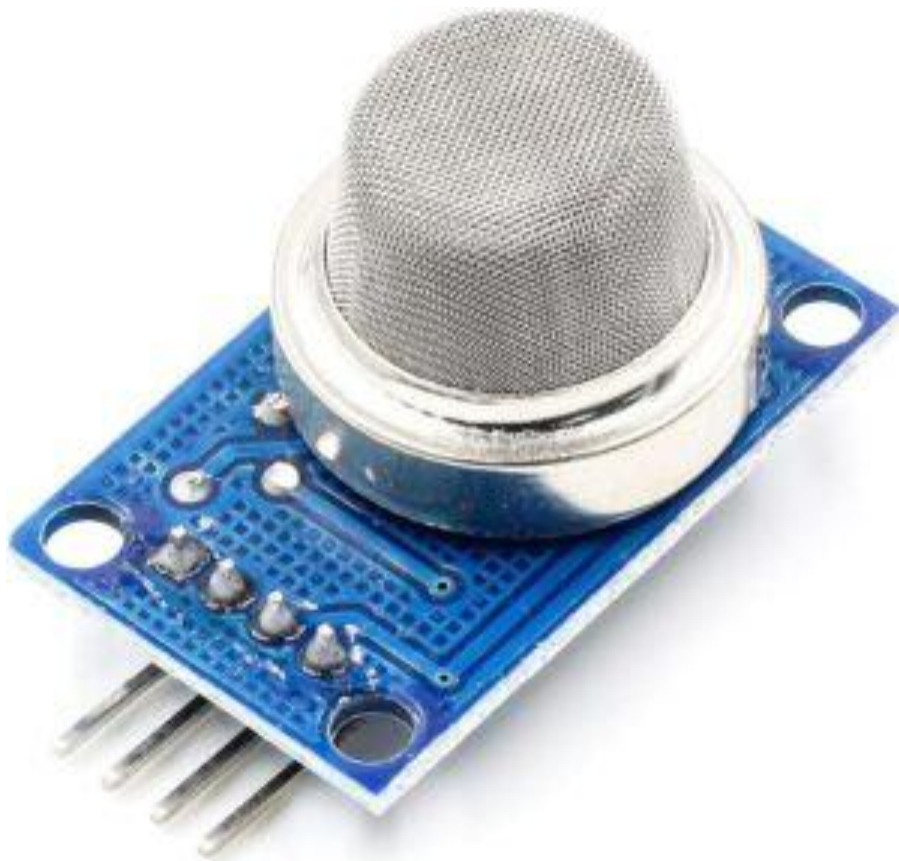


MQ-135 Air Quality Sensor – Hazardous Gas Detection Module for Arduino and Microcontrollers

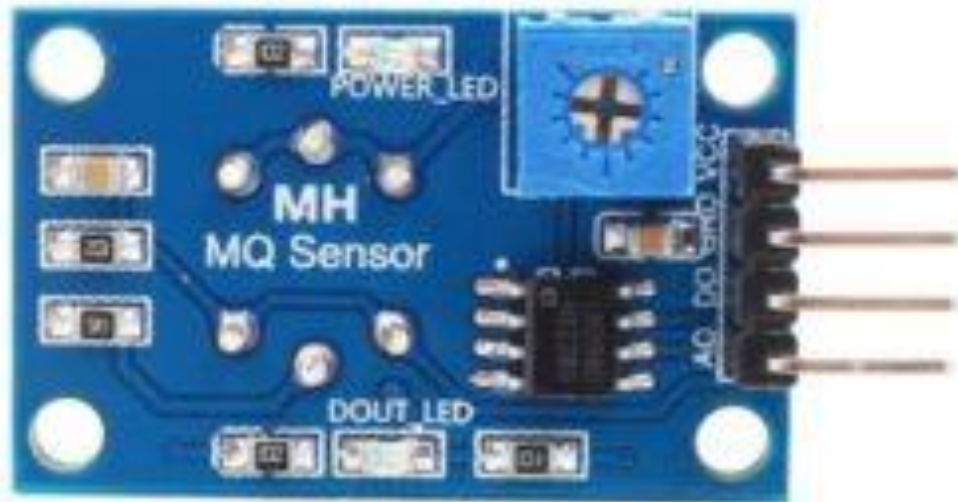
The **MQ-135 Air Quality Sensor Module** is a highly sensitive and versatile device designed to detect a wide range of hazardous gases and monitor air quality. Compatible with **Arduino, Raspberry Pi, ESP8266, ESP32, and other microcontrollers**, this sensor is ideal for both educational and professional projects requiring **air quality monitoring, environmental safety, and gas leak detection**.

The sensor can detect gases such as **NH₃ (Ammonia), NO_x (Nitrogen Oxides), alcohol, benzene, smoke, CO₂, and other harmful pollutants**, making it an essential tool for building smart home systems, industrial safety monitors, and environmental research devices. Its **compact design and dual output (analog and digital)** allow for easy integration into a wide variety of projects.



Key Features

- **Multi-Gas Detection:** Detects hazardous gases including NH₃, NO_x, CO₂, alcohol, benzene, and smoke.
- **Analog and Digital Outputs:** Analog output provides continuous air quality readings, while digital output signals when a threshold is exceeded.
- **Adjustable Sensitivity:** On-board potentiometer allows precise control of the detection threshold.
- **Compact Design:** Small and lightweight module for easy integration into projects.
- **Fast Response Time:** Quickly detects changes in air quality for timely alerts.
- **Wide Operating Voltage:** Operates on standard 5V DC power supply.
- **Compatible with Multiple Platforms:** Works with Arduino, Raspberry Pi, ESP32, ESP8266, and other microcontrollers.
- **Reliable Performance:** Durable sensor element ensures long-term stability.



Applications

The **MQ-135 Sensor Module** is suitable for a wide range of applications in home, industry, and education:

1. Air Quality Monitoring

- Indoor air quality sensors for homes and offices
- Smart ventilation and air purification systems
- Environmental monitoring stations

2. Gas Detection & Safety

- Detection of hazardous gases in industrial environments
- Gas leak alarms for laboratories or chemical plants
- IoT-based safety monitoring systems

3. Educational & DIY Projects

- STEM and robotics projects involving gas and air monitoring
- Arduino and Raspberry Pi experiments
- Student projects for environmental science and IoT learning

4. Smart Home & IoT Applications

- Home automation systems with air quality feedback
- Smart HVAC systems
- Connected IoT devices for remote air quality monitoring

Technical Specifications

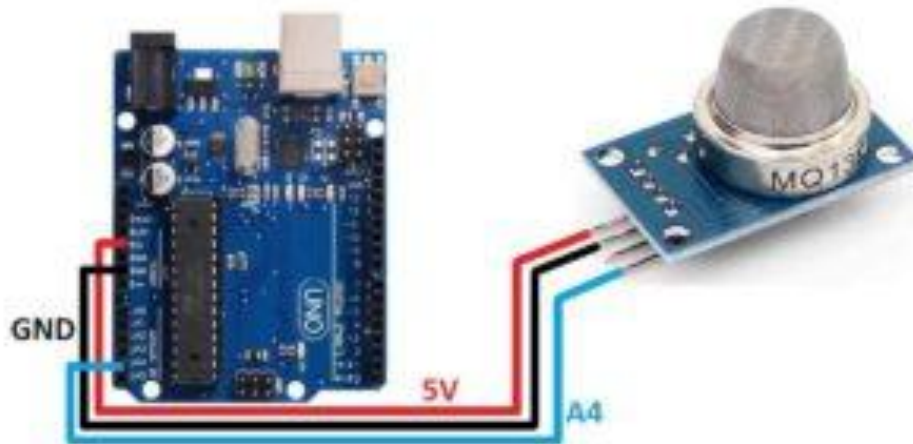
- **Model:** MQ-135 Air Quality Sensor Module
- **Detectable Gases:** NH₃, NO_x, alcohol, benzene, CO₂, smoke, and other harmful gases
- **Operating Voltage:** 5V DC
- **Outputs:**
 - **Analog Output (AO):** Continuous air quality levels
 - **Digital Output (DO):** HIGH/LOW signal when threshold exceeded
- **Sensitivity Adjustment:** On-board potentiometer for threshold tuning
- **Response Time:** Fast, suitable for real-time monitoring
- **Dimensions:** Compact module for breadboard and PCB integration
- **Operating Temperature:** -10°C to 50°C
- **Compatibility:** Arduino, ESP32, ESP8266, Raspberry Pi, STM32, and similar platforms

How It Works

The **MQ-135 sensor** uses a gas-sensitive material that changes resistance in the presence of specific gases. The sensor circuit converts these resistance changes into analog or digital signals:

- **Analog Mode (AO):** Provides a continuous voltage output proportional to the concentration of gases. Useful for air quality analysis and logging.
- **Digital Mode (DO):** Provides a HIGH or LOW signal when gas concentration exceeds a set threshold, ideal for alarms or automated actions.

The **potentiometer** allows users to adjust sensitivity, customizing the module to detect low or high concentrations based on the specific application.



Advantages

1. **Multi-Gas Detection:** Detects a wide range of harmful gases and pollutants.
2. **Dual Output Options:** Use analog for precise readings or digital for threshold-triggered actions.
3. **Adjustable Sensitivity:** Fine-tune detection levels for your project requirements.
4. **Fast and Reliable:** Quickly responds to changes in air quality.
5. **Easy Integration:** Compatible with popular microcontrollers and platforms.
6. **Cost-Effective Solution:** Affordable choice for both DIY projects and professional applications.

Example Use Case

Imagine creating a **smart indoor air quality monitor**. The **MQ-135 sensor module** can detect hazardous gases like CO₂ and ammonia, sending real-time data to an Arduino or ESP32. The system could automatically trigger fans, alert users via smartphone, or record data for analysis. This setup provides safer, healthier indoor environments, especially in homes, offices, or laboratories.

Conclusion

The **MQ-135 Air Quality Sensor / Hazardous Gas Detection Module** is an essential tool for anyone working on **air quality, environmental monitoring, or gas detection projects**. Its **analog and digital outputs, adjustable sensitivity, and broad gas detection capabilities** make it suitable for DIY, educational, and professional applications.

Whether you are building **home automation systems, IoT safety monitors, or research projects**, this module offers **reliable performance, fast response, and easy integration**, making it a top choice for developers and hobbyists alike.