

This lesson covered sensors and actuators. Research and describe one sensor and one actuator that can be used with an IoT dev kit, including:

- What it does
- The electronics/hardware used inside
- Is it analog or digital
- What the units and range of inputs or measurements is

### **Answer**

#### **\*Describe a sensor**

- I choose: MQ2 Gas sensors

#### What it does?

- The MQ2 Gas Sensor is a versatile sensor used to detect a variety of combustible gases, including Liquefied Petroleum Gas (LPG), propane, methane, smoke, and alcohol. It's commonly used in gas leak detection systems, fire alarms, and air quality monitoring applications.

#### The electronics/hardware used inside

- Sensing Element:
  - + A tin dioxide (SnO<sub>2</sub>) semiconductor material that changes its resistance based on the concentration of the target gas.
- Heating Element:
  - + A small heating coil that maintains the sensor's operating temperature for optimal sensitivity.
- Electrode Contacts:
  - + Connect the sensing element to external circuitry.
- Resistor (RL):
  - + A load resistor used in a voltage divider configuration to convert the resistance change of the sensing element into a voltage signal.
- Pin: the MQ2 has 6 pins
  - + VCC: Power supply
  - + GND: Ground
  - + Analog Output (AO): Provides a digital HIGH or LOW signal indicating the presence of gas above a certain threshold.
  - + Digital Output (DO): Provides an analog voltage proportional to the gas concentration.
  - + H: Heating element pins (connect to VCC and GND).

#### Is it analog or digital?

- The MQ2 provides both analog and digital outputs.
  - + Analog Output (AO): Provides a continuous voltage that changes with gas concentration.
  - + Digital Output (DO): Provides a simple HIGH/LOW signal based on a preset threshold.

What the units and range of inputs or measurements is?

- Gas Concentration:
  - + The MQ2 is typically used to detect gas concentrations in parts per million (ppm).
- Sensitivity Range:
  - + The sensor can detect a range of gas concentrations, typically from 200 ppm to 10000 ppm for various gases.
- Output Voltage (Analog):
  - + The output voltage changes inversely with gas concentration. The exact range depends on the load resistor (RL) and the specific gas.
- Digital Output Threshold:
  - + The threshold for the digital output is adjustable using a potentiometer on the sensor module.

**\*Describe an actuator**

- I choose: Pneumatic Actuator

What it does?

- A pneumatic actuator is a device that converts energy typically in the form of compressed air into mechanical motion. Within the industry, pneumatic actuators are recognized by several different names including pneumatic cylinders, air cylinders, and air actuators; all of which are one and the same.

The electronics/hardware used inside

- Pneumatic Cylinder: The mechanical part that converts air pressure into linear motion.
- Solenoid Valve: An electrically controlled valve that directs compressed air to the cylinder. This is the key interface for IoT control.
- Air Compressor (or Source of Compressed Air): Provides the pressurized air.
- Pressure Regulator: Maintains a consistent air pressure.
- Air Hoses and Fittings: Connect the components.
- Microcontroller (e.g., Arduino, ESP32): To control the solenoid valve.
- Relay or Transistor: To switch the higher voltage/current needed for the solenoid valve.
- Wiring and Power Supply: To connect the electronic components.

Is it analog or digital?

- Control:

- + The control is typically digital. The microcontroller sends a digital signal to the relay/transistor, which then switches the solenoid valve on or off.
- Position:
  - + The position of the cylinder rod can be made analog if you add a position sensor to the cylinder. However, basic pneumatic actuators without these sensors are digitally controlled.

What the units and range of inputs or measurements is?

- Stroke Length:
  - + The distance the cylinder rod extends.
- Bore Diameter:
  - + The diameter of the cylinder, which affects the force output.
- Air Pressure:
  - + Measured in psi (pounds per square inch) or bar. This determines the force exerted by the cylinder.
- Control Signal:
  - + Typically, a digital signal to switch the solenoid valve. (5V or 24V)