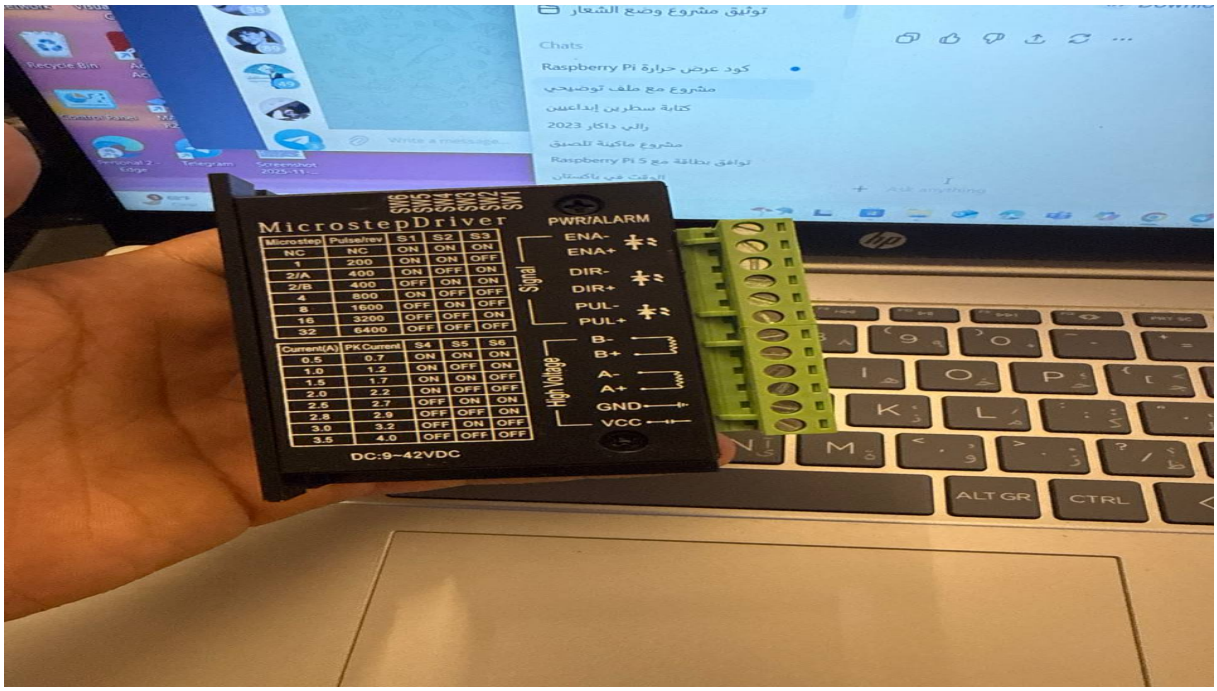
System Components Detailed Description – Raspberry Pi Automation Project

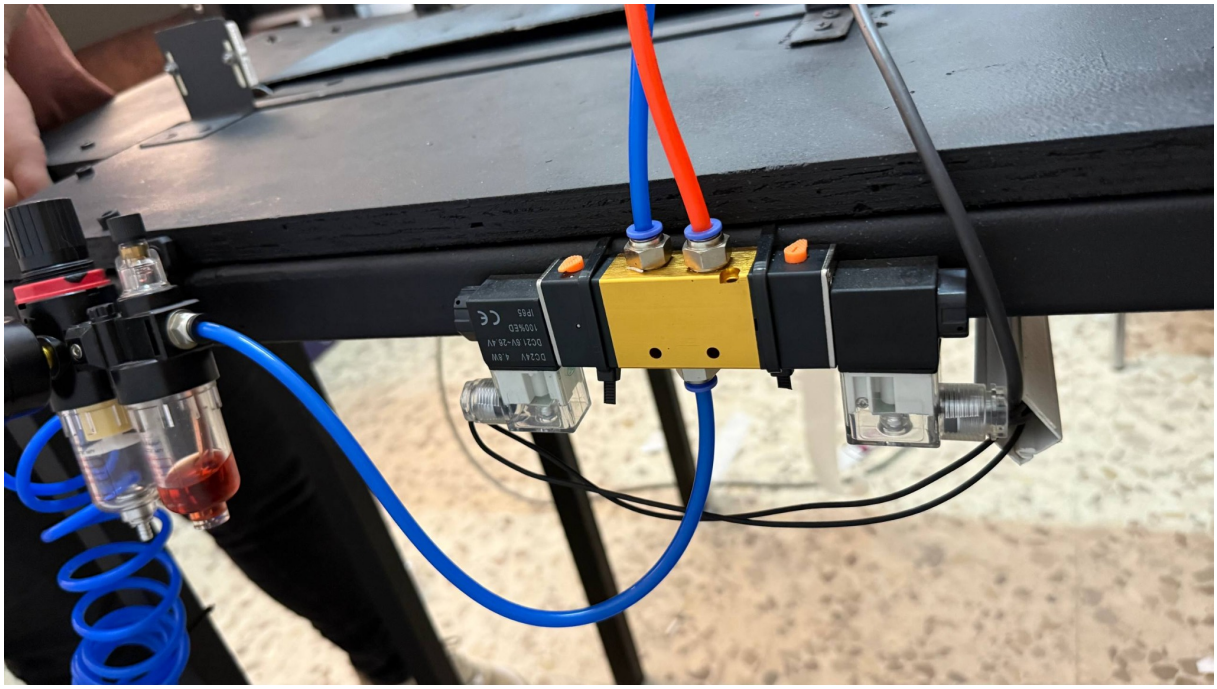


Microstep Driver

The microstep driver is used to control bipolar stepper motors. It enables precise and smooth motor motion by dividing full steps into smaller microsteps. It receives signals for pulse (PUL), direction (DIR), and enable (ENA) from the controller such as a Raspberry Pi or PLC.

Specifications:

• Model: Microstep Driver DM542 or equivalent • Input voltage: DC 9–42V • Output current: 0.5A – 4.2A adjustable • Input signals: PUL, DIR, ENA (5V TTL) • Microstep settings: Up to 1/128 step resolution • Protection: Over-voltage, over-current, short-circuit

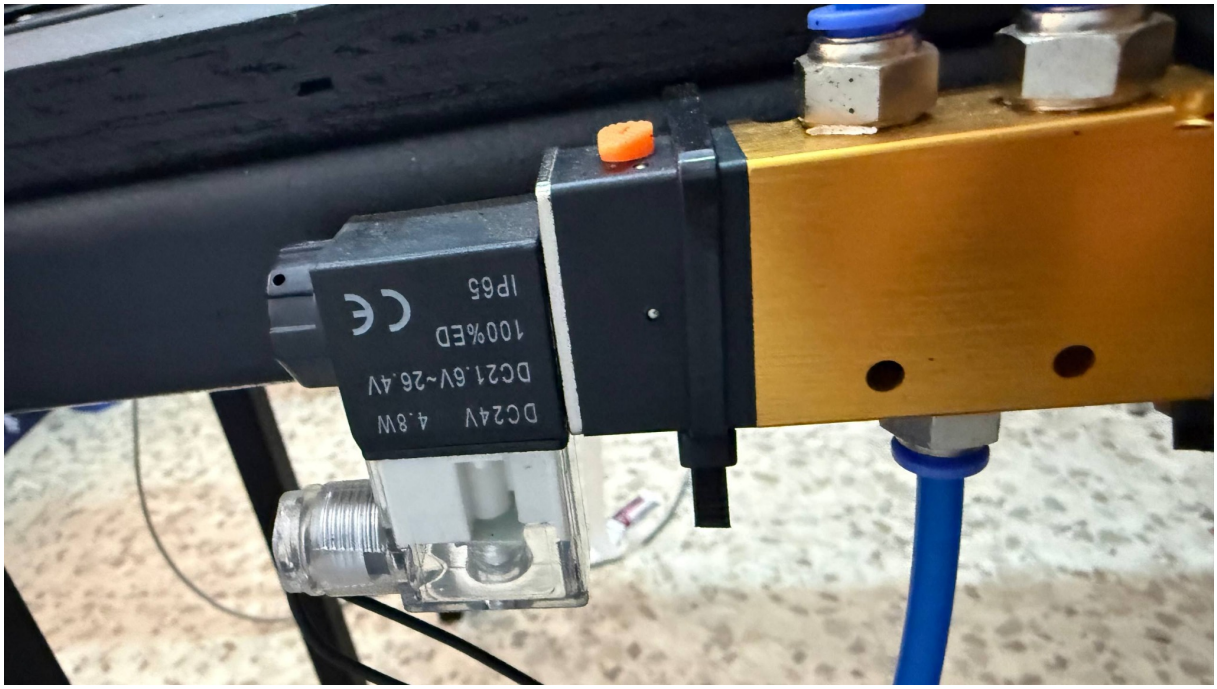


Pneumatic Solenoid Valve with FRL Unit

This system consists of a pneumatic solenoid valve combined with an FRL (Filter-Regulator-Lubricator) unit. The valve controls the airflow to pneumatic actuators, while the FRL unit ensures clean and properly regulated air for system reliability.

Specifications:

• Solenoid coil voltage: 24V DC • Valve type: 5/2 double-acting • FRL function: Air filtration, pressure regulation, and lubrication • Pressure range: 0.15 – 0.8 MPa • Material: Aluminum body with plastic housing • Ports: Standard 1/4 inch pneumatic fittings



5/2 Pneumatic Solenoid Valve

A dual-coil 5/2 solenoid valve used to control the extension and retraction of double-acting pneumatic cylinders. It switches the airflow path when either coil is energized.

Specifications:

• Type: 5/2 double solenoid valve • Coil voltage: 24V DC • Working pressure: 0.15 – 0.8 MPa • Response time: ≤ 40 ms • Operating temperature: -5°C to +50°C • Port size: 1/8 inch (PT1/8)

Omron General Purpose Relay

The Omron relay is used to switch electrical loads and isolate low-voltage control circuits from higher-voltage field devices. It is typically used as an interface between the Raspberry Pi and industrial equipment.

Specifications:

• Model: Omron MY2N / MY2J • Coil voltage: 24V DC • Contact form: DPDT (Double Pole Double Throw) • Contact rating: 5A at 250V AC or 30V DC • Base type: PYF08A socket mount • LED indicator: Available for coil status

CHINT NXC-12 Contactor

This contactor is used to control the connection and disconnection of power circuits. It handles high current and is often used to switch AC motors or VFDs on and off.

Specifications:

• Model: NXC-12 • Rated current: 12A • Coil voltage: 220V AC or 24V DC (depending on type) • Rated insulation voltage: 690V • Number of poles: 3 main + 1 auxiliary (optional) • Mechanical life: 10 million operations

Delta VFD (Variable Frequency Drive)

The Delta VFD controls the speed and direction of AC motors by adjusting the frequency and voltage supplied to the motor. It supports analog or digital control signals for precise automation.

Specifications:

• Model: VFD015EL21A (Delta VFD-EL Series) • Input: 1-phase 220V AC • Output: 3-phase 0–240V AC, 1.5 kW (2 HP) • Frequency range: 0.1 – 600 Hz • Control method: V/f or Sensorless Vector • Communication: RS-485 (Modbus RTU)

24V DC Power Supply Unit

A switching power supply that converts 220V AC mains power to 24V DC for sensors, solenoids, relays, and control circuits. It ensures stable operation of all 24V components in the automation system.

Specifications:

• Input voltage: 220V AC ±15% • Output voltage: 24V DC • Output current: 5A (typical model) • Efficiency: ≥ 85% • Protection: Overload, short-circuit, over-voltage • Cooling: Natural air convection

Photoelectric Sensor (CNTD CGY18-D30PA)

This sensor detects the presence of objects using light reflection. It sends a light beam and detects the reflected signal from a nearby object to determine its presence or position.

Specifications:

• Model: CGY18-D30PA • Type: Diffuse reflective photoelectric sensor • Detection range: Up to 30 cm • Power supply: 10–30V DC • Output type: PNP, normally open (NO) • Response time: ≤ 2 ms • Material: Plastic housing (M18 threaded) • Indicator: LED output signal

Inductive Proximity Sensor (Bentong BR Series)

An inductive proximity sensor detects metal objects without physical contact. It operates using an electromagnetic field and detects changes when metal enters its sensing area.

Specifications:

• Model: BR Series (e.g., BR18 or BR30) • Sensing type: Inductive (metal only) • Sensing distance: 4–8 mm • Power supply: 10–30V DC • Output type: NPN or PNP, normally open (NO) • Protection: IP67 • Housing: Nickel-plated brass • Operating temperature: -25°C to +70°C