

# Lesson 7 Relay

## Introduction

As we know relay is a device which is used to provide connection between two or more points or device in response to the input signal applied. In another words relay provide isolation between the controller and the device as we know devices may work on AC as well as on DC. However, they receive signals from microcontroller which works on DC hence we require a relay to bridge the gap. Relay is extremely useful when you need to control a large amount of current or voltage with small electrical signal.

## Components

- 1 \* Raspberry Pi
- 1 \* Breadboard
- 1 \* Relay
- 1 \* LED
- 1 \* Resistor (220Ω)
- 1 \* Resistor (1KΩ)
- 1 \* NPN Transistor
- 1 \* Diode (Rectifier)
- Several jumper wires
- 1 \* T-Extension Board
- 1 \* 40-Pin GPIO Cable

## Principle

### Relay

There are 5 parts in every relay:

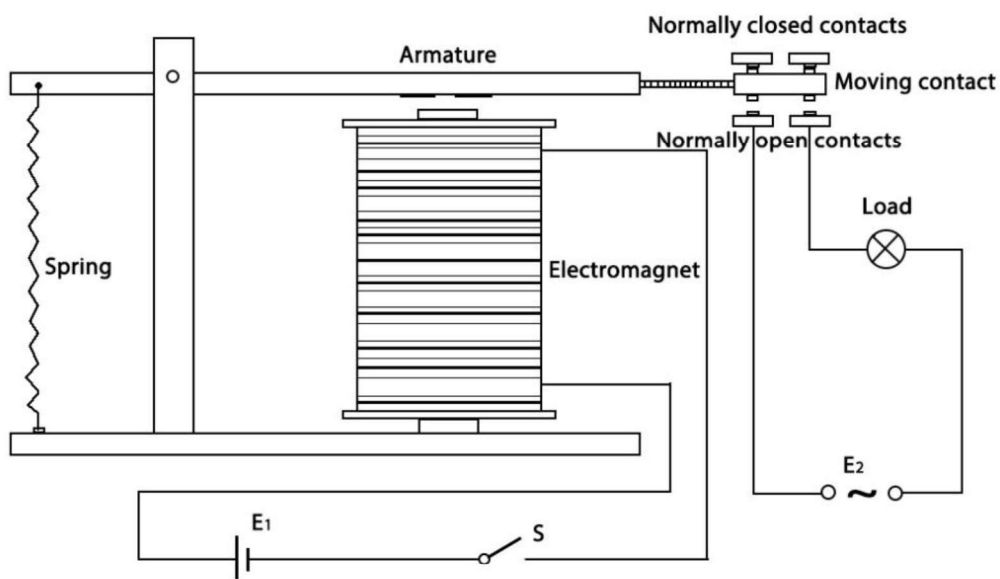
1. **Electromagnet** – It consists of an iron core wounded by coil of wires. When electricity is passed through, it becomes magnetic. Therefore, it is called electromagnet.
2. **Armature** – The movable magnetic strip is known as armature. When current flows through them, the coil is it energized thus producing a magnetic field which is used to make or break the normally open (N/O) or normally close (N/C) points. And the armature can be moved with direct current (DC) as well as alternating current (AC).
3. **Spring** – When no currents flow through the coil on the electromagnet, the spring pulls the armature away so the circuit cannot be completed.
4. Set of electrical **contacts** – There are two contact points:
  - Normally open - connected when the relay is activated, and disconnected when it is inactive.

- Normally close – not connected when the relay is activated, and connected when it is inactive.

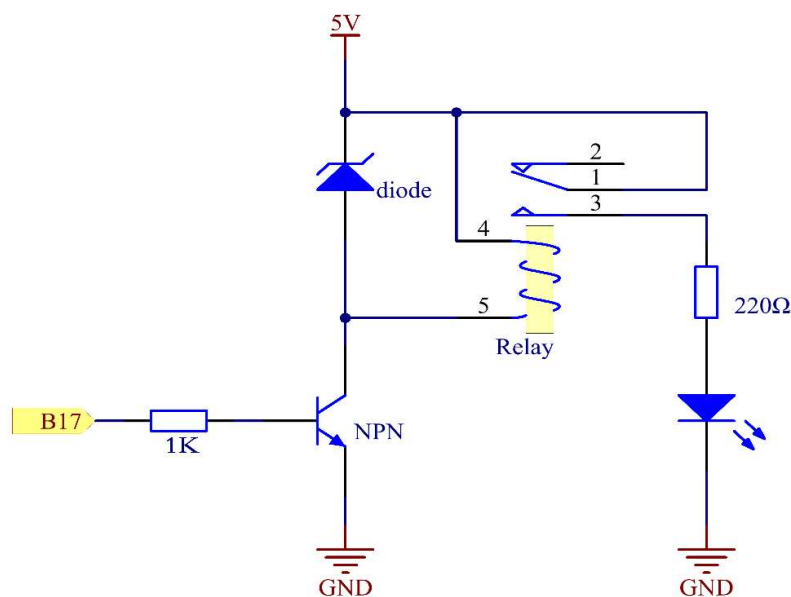
5. Molded frame – Relays are covered with plastic for protection.

### Working of Relay

The working principle of relay is simple. When power is supplied to the relay, currents start flowing through the control coil; as a result, the electromagnet starts energizing. Then the armature is attracted to the coil, pulling down the moving contact together thus connecting with the normally open contacts. So the circuit with the load is energized. Then breaking the circuit would a similar case, as the moving contact will be pulled up to the normally closed contacts under the force of the spring. In this way, the switching on and off of the relay can control the state of a load circuit.

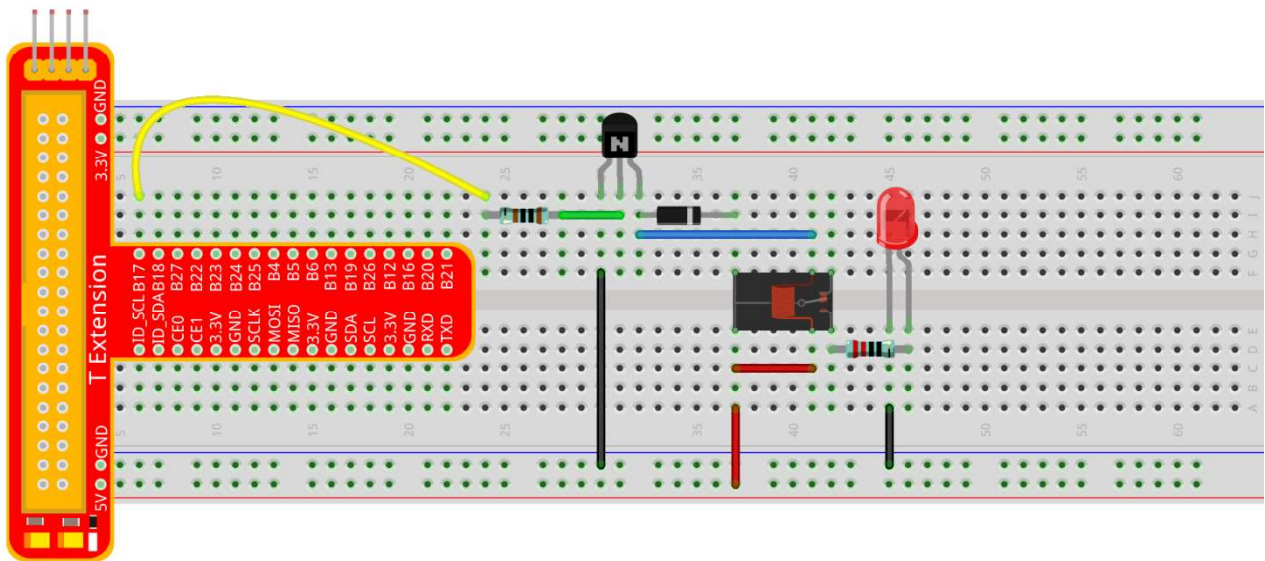


Schematic diagram:



## Experimental Procedures

### Step 1: Build the circuit



### For C language users:

#### Step 2: Open the code file

```
cd /home/pi/SunFounder_Super_Kit_V3.0_for_Raspberry_Pi/C
```

#### Step 3: Compile the Code

```
make 07_relay
```

#### Step 4: Run the executable file above

```
sudo ./07_relay
```

### Code Explanation

```
digitalWrite(relayPin, LOW); // set the I/O port as low level (0V) to energize the  
transistor. The coil of the relay is powered and generate electromagnetic force, and the  
relay closes.
```

```
digitalWrite(relayPin, HIGH); // Set the I/O port as high level (5V), thus the  
transistor is not energized and the coil is not powered. There is no electromagnetic  
force, so the relay opens.
```

### For Python users:

#### Step 2: Open the code file

```
cd /home/pi/SunFounder_Super_Kit_V3.0_for_Raspberry_Pi/Python
```

#### Step 3: Run

```
sudo python 07_relay.py
```

### Code Explanation

```
GPIO.output(relayPin, GPIO.LOW) # Set the pins of transistor as low level to actuate  
the relay.
```

```
time.sleep(1)    # wait for 1 second. Change the switching frequency of the relay by
                 # changing this parameter. Note: Relay is a kind of metal dome formed in mechanical
                 # structure. So its lifespan will be shortened under high-frequency using.
GPIO.output(relayPin, GPIO.HIGH)    # Set the pins of the transistor as low level to
let the relay open.
time.sleep(1)
```

Now, connect a device of high voltage, and the relay will close and the LED will light up; connect one of low voltage, and it will open and the LED will go out. In addition, you can hear a ticktock caused by breaking normally close contact and closing normally open contact.

