



ELECTRONIC WORKSHOP # 06

Switches and Relays

Roll. No:	Date:
Checked by:	Grade:

Object: To become familiar with various type of switches and Relays

Apparatus:

- 1). A Digital Multimeter (DMM)
- 2). Few hard wires (Gauge Number 22)
- 3). A Few switches
- 4). A Few Relays
- 5). 2 Lamps
- 6). A 5V, 12V DC Power Supply

Theory:

A switch is an electromechanical component that can be used to electrically connect or disconnect two points in a circuit. Switches are of many kinds, some have a mechanical actuating mechanism (manual switches), some work using a magnetic field (relays) while some even get turned on using light or temperature etc. Switches can be classified according to a number of criteria. In terms of the number of contacts, switches can be classified in to 3 types:

- a) Single Pole Single Throw Switch (SPST)
- b) Single Pole Double Throw Switch (SPDT)
- c) Double Pole Double Throw Switch (DPDT)

Poles and Throws are the two sets of contacts on any switch, by virtue of its actuating mechanism, a switch connects poles and throws to each other and is said to be *Closed* , when the poles and throws are not connected to each other, the switch is said to be *Open*.

a) Single Pole Single Throw Switch (SPST):

A Single Pole Single Throw switch is the simplest type of switch available in that it consists of only two terminals which are connected together whenever the switch is actuated. Such types of switches are used for home appliances. Figure-1 shows the symbol of an SPST switch:



Figure-1: Symbol of an SPST Switch



Figure-2: Connecting an SPST switch to a Lamp

b) Single Pole Double Throw Switch (SPDT):

A Single Pole Double Throw switch consists of three terminals of which one is a pole and the other two are throws. At any time the pole can only be connected to one of the throws. Such switches are used in changeovers for home mains supply. Figure-3 shows the symbol of an SPDT switch.

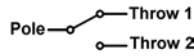


Figure-3: Symbol of a SPDT Switch

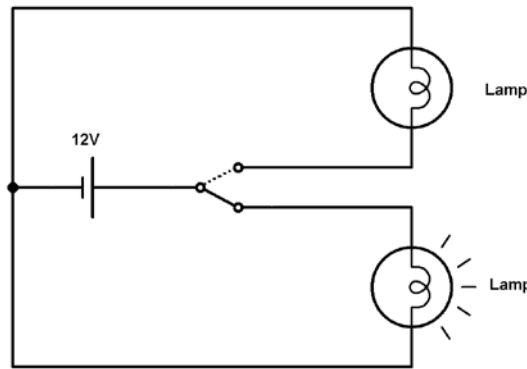


Figure -4: Connecting an SPDT switch to two Lamps

c) Double Pole Double Throw Switch (DPDT):

A Double Pole Double Throw switch consists of six terminals of which two are poles and the rest are throws. It is just like two parallel SPDT switches combined into a single component with a single control. Both poles cannot be connected to a +ve throw. Such types of switches are used whenever a device is needed to be connected to a power supply with reversible polarity. DPDT switches often have a neutral position in which neither poles are not connected to their throws. Figure-5 below shows the symbol of a DPDT switch.

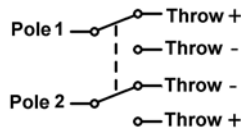


Figure-5: Symbol of a DPDT Switch

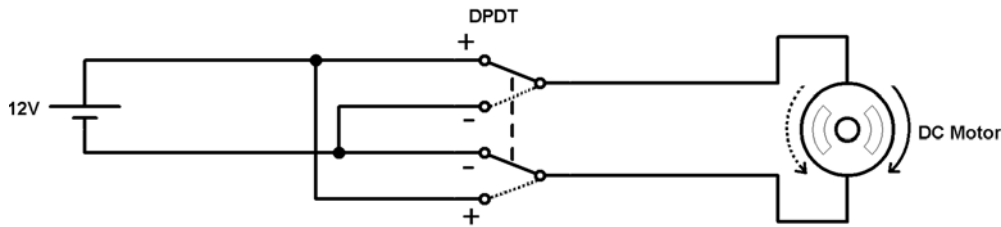


Figure-6: Connecting a DPDT Switch with a Motor

The most commonly used switches are manual switches (operated by hand). The other category, discussed later, is called Relay. Switches can also be classified according to their switching mechanism, the way in which they are turned ON (Closed) or OFF (Opened):

- i. Push ON- Push OFF- Need to be pushed once to turn ON and pushed again to turn OFF (Bistable)
- ii. Push ON- Release OFF- Need to be pressed to turn ON and released to turn OFF (Stable OFF)
- iii. Push OFF- Release ON- Need to be pressed to turn OFF and released to turn ON (Stable ON)

i. Toggle Switches/Rocker Switches:

These switches come in the category of Push ON- Push OFF. Toggle switches have a lever which can be brought in to two positions, one connects the pole to the throw and the other disconnects them. Rocker switches have a button that can move like a seesaw to open or close the switch. They come as SPST, SPDT as well as DPDT switches.



Figure-7: Symbol of a Toggle/Rocker Switch

ii. Push Buttons:

These switches come in all three switching mechanisms i-e Push ON- Push OFF, Push ON- Release OFF and Push OFF- Release ON. They come with two states only (SPST) and consist of a flat round top which is pressed to either connect or disconnect the pole with the throw. The circuit symbol of a pushbutton is shown in figure 6.8:



Figure-8: Symbol of a Push Button

iii. Selector Switch:

This type of switch can be used to connect a single pole to multiple throws (two or more). It consists of a rotary knob which can elect one or more positions. This type of switch is used in a multimeter for selecting the range of the measured quantity.

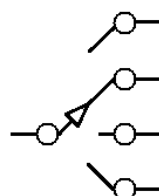


Figure-9: Symbol of a Selector Switch

Relays:

An Electromechanical relay is a switch that uses an electromagnet to make or break contacts. Relays are mostly Single Pole Double Throw switches. As shown in figure, a relay consists of a coil, a spring, an armature and 5 contacts, two of which are for the coil supply and 3 contacts form the SPDT switch. Like before, the pole is connected to one of the throws, whenever current is made to flow through the coil, it attracts the armature and connects the pole to the other throw 2, as soon as the current flow is stopped, the armature returns back to its original position because of the spring and connects the pole to throw 1 again. The coil can work with a DC as well as an AC supply.

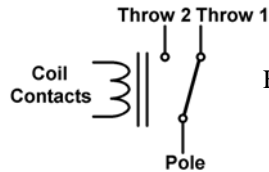


Figure-10: Symbol of a SPDT Relay

One notable use of a relay is that it is used to switch a high voltage load with low voltages such as those coming from a computer. There are several types of relays such as Reed Relays, Solid State Relays and Latching Relay. The figure below shows some physical switches.

Type of Switch	SPST	SPDT	DPDT
Toggle Switch			
Rocker Switch			
Slider Switch			
Push Button			
Relays			

Figure-.11
Some real Switches

Procedure:

1. Take a Multimeter and set it on the buzzer function.
2. Take two pieces of wire and wrap them around the probe tips.
3. Perform the following tests and write down your answer in the table:
 - i. Take an SPST, SPDT and a DPDT switch and name the terminals as A, B, C and so on.
 - ii. Check connections among their contacts.
4. Take two SPDT Switches, a lamp and connectors for the mains power supply. Make connections as shown in the figure:

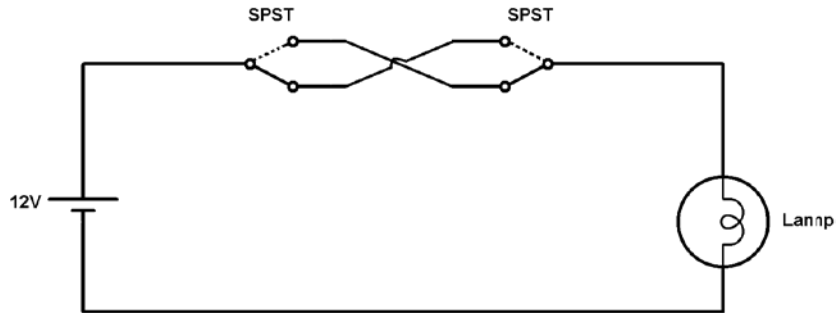


Figure-12: A Two Way Switch

Observations:

List the switches that you tested:

S N.o	Type of Switch	No of Stable states	Implication (Working or not)
1.			
2.			
3.			
4.			
5.			

Table-1: Checking a Switch

Review Questions

1. Write down the working of the following types of switches:

i. Limit switch ii. Proximity Switch iii. Joystick Switch

2. What is switch bounce?

3. In what conditions does the lamp turn On for the two way switch?
