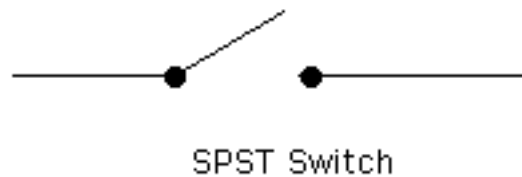


# 4. Switches

Switches open and close circuits and play an important role in an electronic device by (among other things) turning the device on or off.

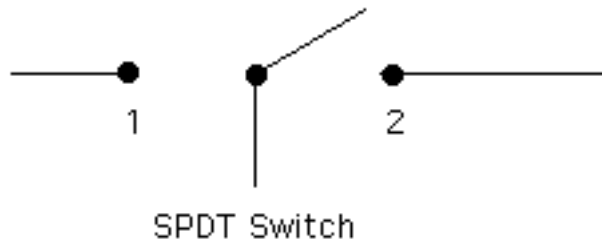
## *Kinds of Switches*

1. SPST or Single Pole, Single Throw switches are represented schematically as



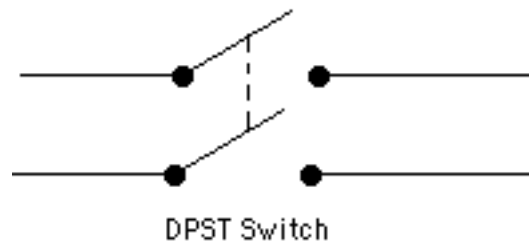
SPST switches are useful in turning on or turning off devices.

2. SPDT or Single Pole, Double throw switches are represented as



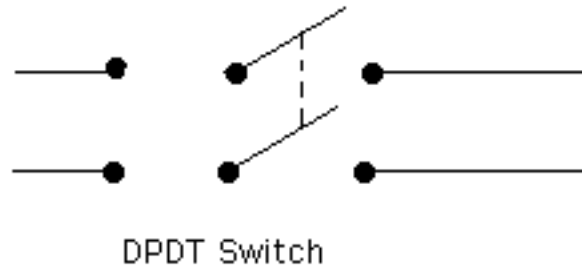
SPDT switches can turn on two loads (e.g. two lights) separately one or the other.

3. DPST or Double Pole, Single Throw switches are represented as



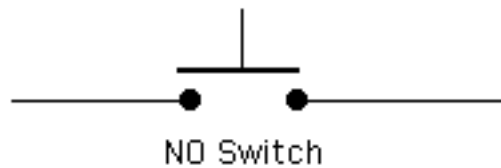
DPST switches can turn off or on two loads simultaneously.

4. DPDT or Double Pole, Double Throw switches are represented as



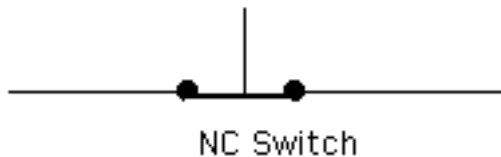
Both poles control two circuits (loads) so that there are four circuits total.

#### 5. Push Button switch NO or Normally Open



Unless this switch is pushed, the circuit remains open.

#### 6. Push Button switch NC or Normally Closed



Unless this switch is pushed, the circuit remains closed.

Both the NO and NC push button switches are sometimes called "dead man" switches since if the person stops performing the act of pushing the switch (because the man is dead) then the switch automatically reverts to the normal state of open or closed.

There are also **solenoid** or electromagnetic switches that are controlled indirectly. This kind of switch is used in the starter circuit of a car since the switch circuit (having low current) is used to turn on the starter which has a larger current.

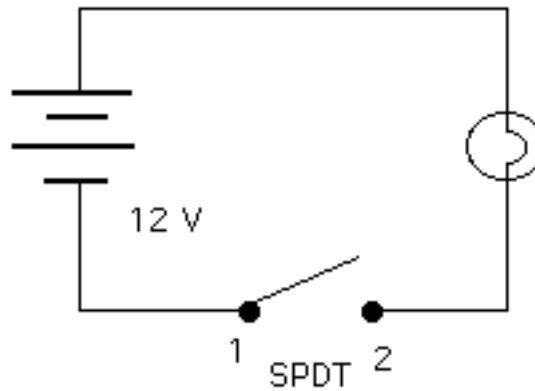
There are also **rotary** and **slide** switches founds in older meters.

## *Laboratory Exercises*

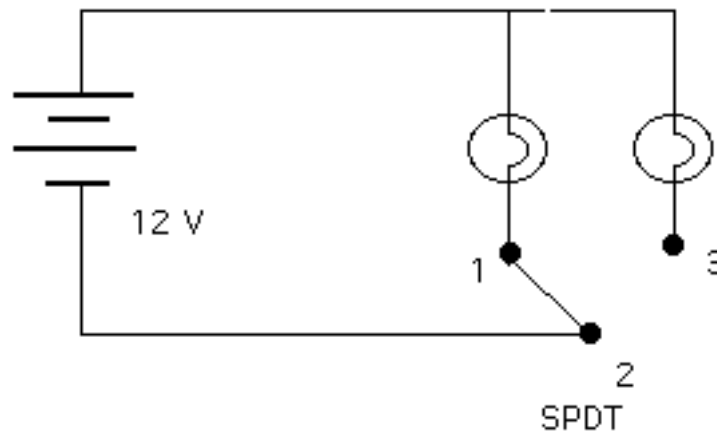
1. Find your switches in the parts box and use an ohmmeter to determine how they function. When two poles are **closed** or make contact, the switch is effectively a short circuit between the poles and the

resistance between the poles is almost zero. When two poles are **open**, the resistance between the poles is infinite. You can use a DPDT switch as a simpler SPST etc. switch by just using part of the DPDT switch.

2. Construct the circuit below using a power supply, light blub and SPDT switch. First construct the circuit without the switch and make the light blub. Then break the circuit and insert a switch with the proper terminals wired.



3. Construct the circuit below using a power supply and two light bulbs and SPDT switch. Make sure each light bulb turns when the other light is off.

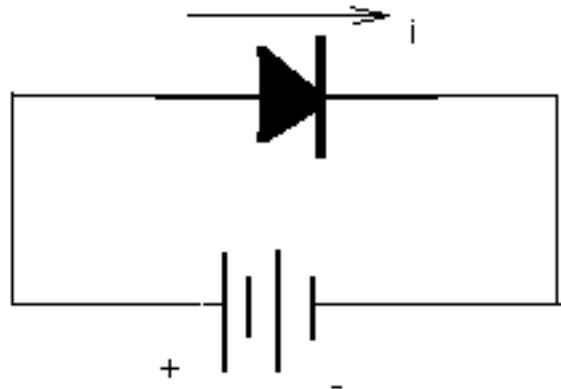


4. Locate a solid state diode in your parts box. It looks a lot like a resistor but it has only one band (and it is usually black) with an arrow. There might be a symbol like below:

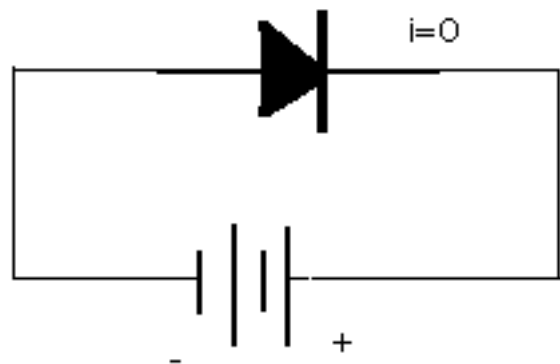


Diodes conduct and have zero resistance when a battery is connect in one direction (the "forward"

direction).

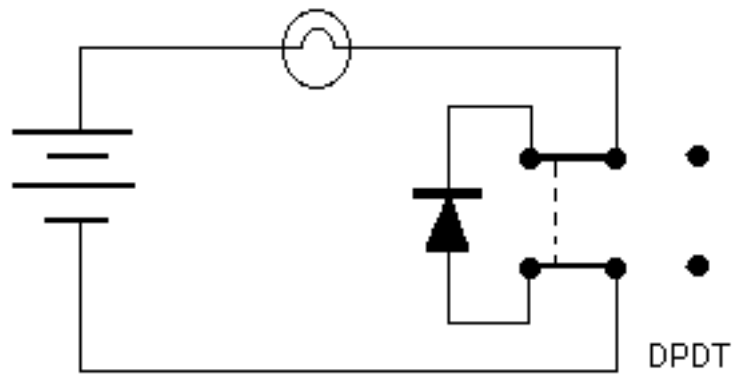


The diode should not be left in such a circuit (by itself) except momentarily as the battery is short circuited and the current is large so the diode will burn out and the battery die. IN FACT DO **NOT** USE THE ABOVE CIRCUIT AS IT IS MEANT ONLY TO MAKE A POINT. There is a DIODE TESTING POSITION on the Digital Multimeter (look in the resistance range near zero ohms). Diodes do NOT conduct and have INFINITE resistance when a battery is connect in the opposite direction (the "reverse" direction).

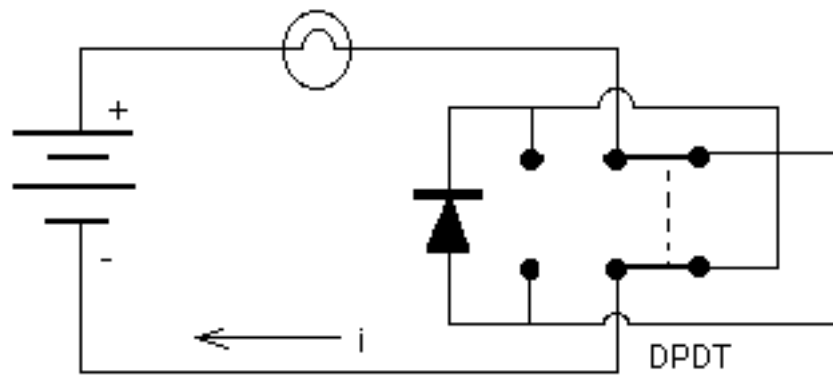


DO **NOT** USE THE ABOVE CIRCUIT AS IT IS MEANT ONLY TO MAKE A POINT. Determine the forward and reverse directions of your diode using the symbol and the multimeter in DIODE position.

5. Connect your diode, light and battery to the DPDT switch as indicated below.



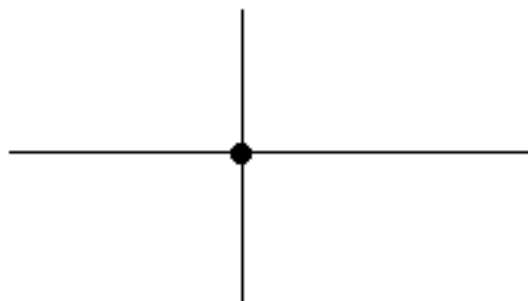
The bulb will NOT light when the switch is in the left position. Do you understand why? Add two more wires thus



Now when the switch is the right, current flows since the direction the battery is in the circuit (relative the diode) is reversed.

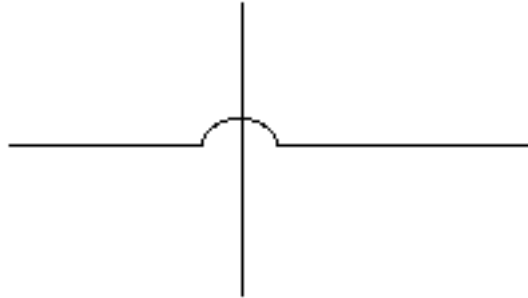
### *Wire Crossing Symbols*

When two wires cross and the wires are connected, the symbol used is



and sometimes the dot is not included.

If two wires physically cross and the wires are NOT connect electrically (the wires are insulated) then the symbol used is



so the horizontal wire goes over the vertical wire.

© Rodney L. Varley (2008).