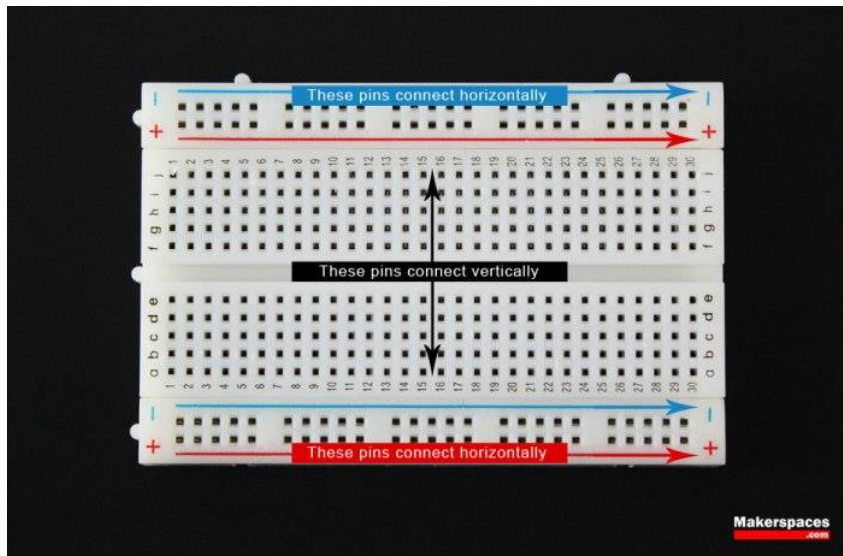


MODULE 1: INTRODUCTION TO BASIC ELECTRONICS

Breadboards

- Breadboards are an essential tool for prototyping and building temporary circuits. These boards contain holes for inserting wire and components. Because of their temporary nature, they allow you to create circuits without soldering. The holes in a breadboard are connected in rows both horizontally and vertically as shown below.



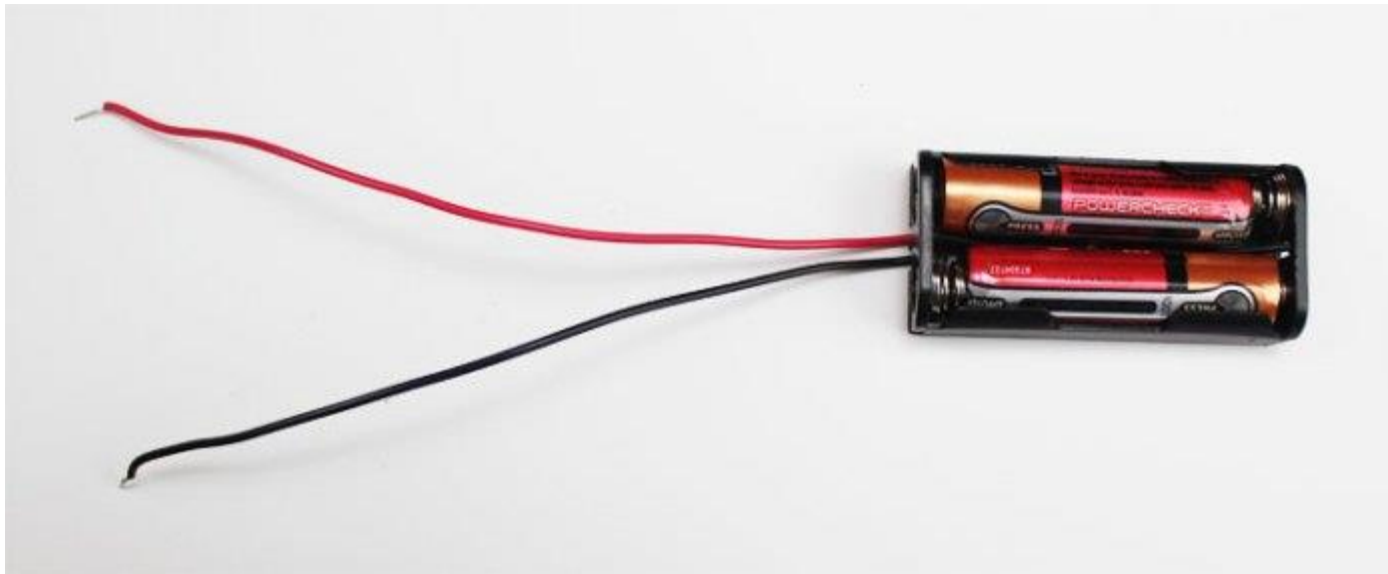
Digital Multimeter

- A multimeter is a device that's used to measure electric current (amps), voltage (volts) and resistance (ohms). It's a great for troubleshooting circuits and is capable of measuring both AC and DC voltage.



Battery holder

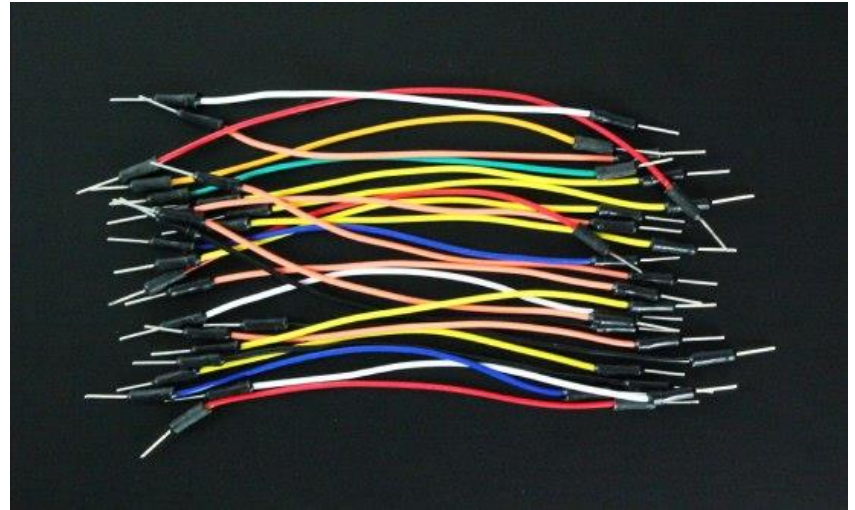
- A battery holder is a plastic case that holds batteries from 9V to AA. Some holders are enclosed and may have an on/off switch built in.



Precision screwdrivers



Jumper Wire



Test leads

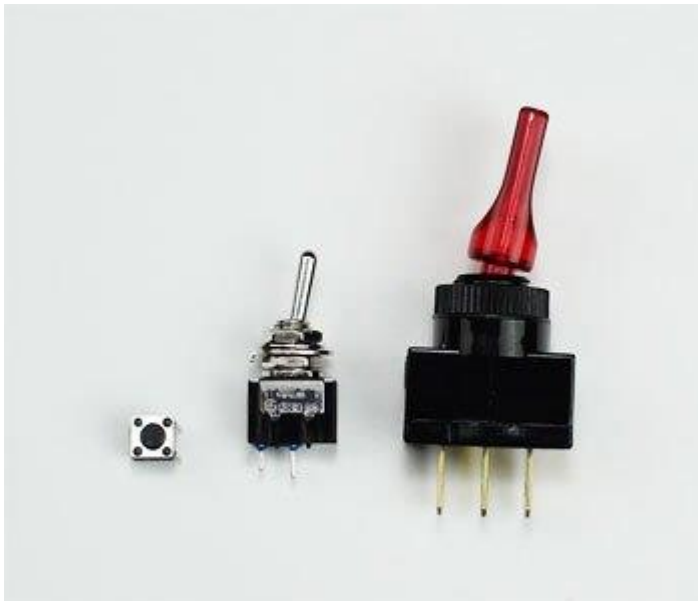


Wire cutters

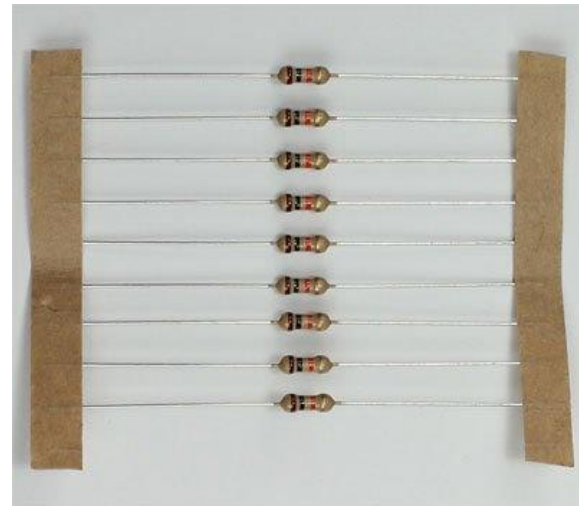


Electronic Components

- **Switches** can come in many forms such as pushbutton, rocker, momentary and others. Their basic function is to interrupt electric current by turning a circuit on or off.



- **Resistors** are used to resist the flow of current or to control the voltage in a circuit. The amount of resistance that a resistor offers is measured in Ohms. Most resistors have colored stripes on the outside and this code will tell you it's value of resistance.



Electronic Components

- A **variable resistor** is also known as a potentiometer. These components can be found in devices such as a light dimmer or volume control for a radio. When you turn the shaft of a potentiometer the resistance changes in the circuit.



- A **light-dependent resistor** is also a variable resistor but is controlled by the light versus turning a knob. The resistance in the circuit changes with the intensity of the light.



Electronic Components

- A **capacitor** is like a rechargeable battery and can be charged and then discharged. The value is measured in F (Farad), nano Farad (nF) or pico Farad (pF) range.



- A **diode** allows electricity to flow in one direction and blocks it from flowing the opposite way. The diode's primary role is to route electricity from taking an unwanted path within the circuit.



Electronic Components

- A **light-emitting diode (LED)** is like a standard diode in the fact that electrical current only flows in one direction.
- The main difference is an LED will emit light when electricity flows through it. Inside an LED there is an anode and cathode.
- Current always flows from the anode (+) to the cathode (-) and never in the opposite direction. The longer leg of the LED is the positive (anode) side.

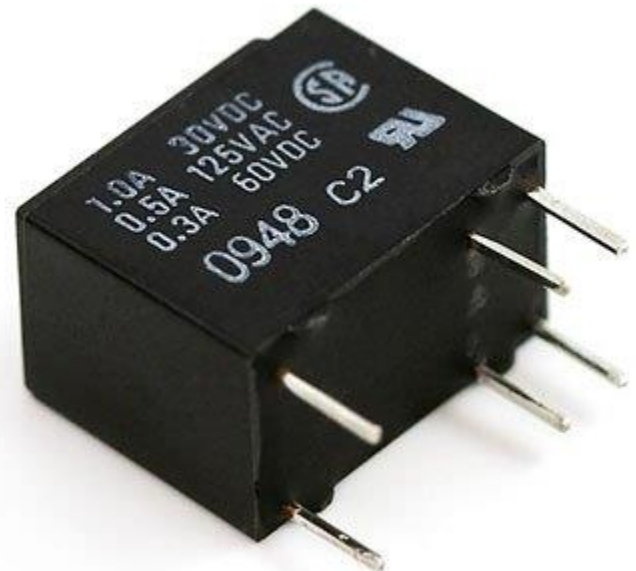


Electronic Components

- **Transistor** are tiny switches that turn a current on or off when triggered by an electric signal. In addition to being a switch, it can also be used to amplify electronic signals. A transistor is similar to a relay except with no moving parts.



- A relay is an electrically operated switch that opens or closes when power is applied. Inside a relay is an electromagnet which controls a mechanical switch.

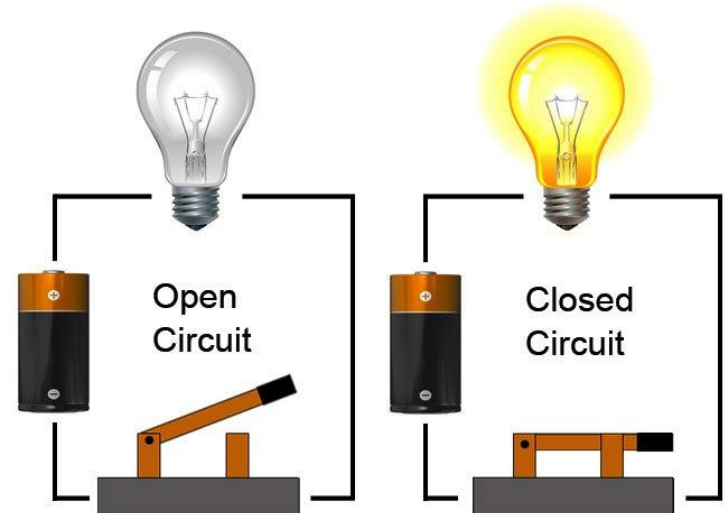


Electronic Components

- An **integrated circuit** is a circuit that's been reduced in size to fit inside a tiny chip. This circuit contains electronic components like resistors and capacitors but on a much smaller scale.



- An **electronic circuit** is a circular path of conductors by which electric current can flow. A closed circuit allows electricity to flow from the (+) power to the (-) ground uninterrupted.



Schematic Diagram

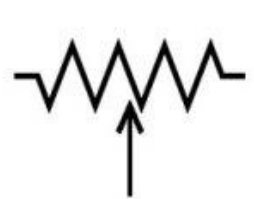
- There are many types of electronic symbols and they vary slightly between countries.
- Here are a few of the most commonly used electronic symbols in the US:



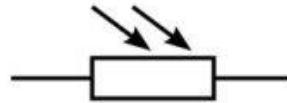
Resistor



Variable Resistor



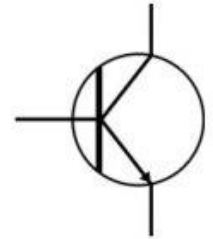
Potentiometer



Light-Dependent Resistor



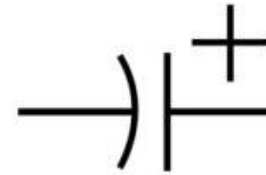
Switch



Transistor



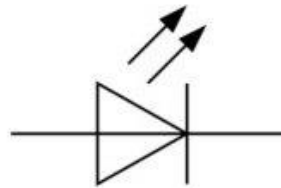
Relay



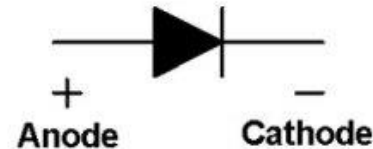
Polarized Capacitor



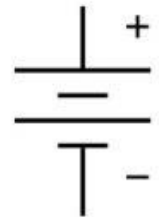
Non-Polarized Capacitor



Light-Emitting Diode



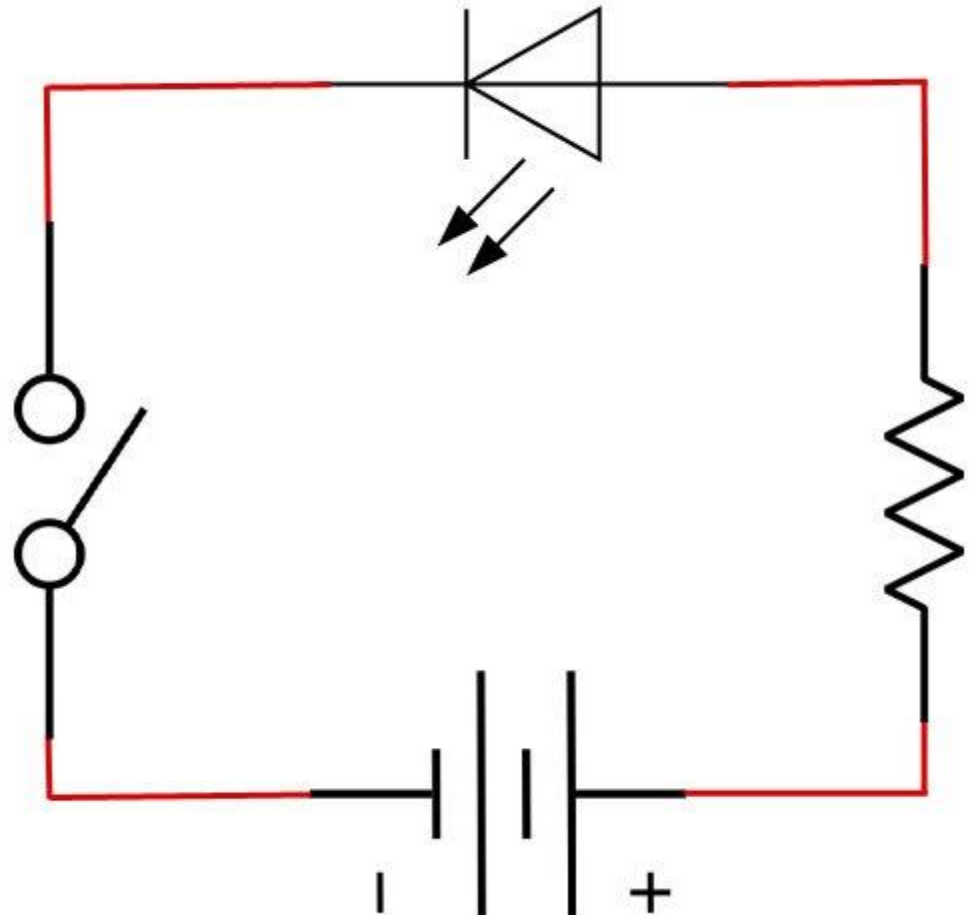
Diode



Battery

Schematic Diagram (...con)

- When working with circuits, you will often find something called a schematic diagram.
- These diagrams use symbols to illustrate what electronic components are used and where they're placed in the circuit.
- These symbols are graphic representations of the actual electronic components.



Schematic Diagram For LED Circuit

Scheming schematic

- Each electronic component has a schematic symbol which is a simplified drawing of the part.

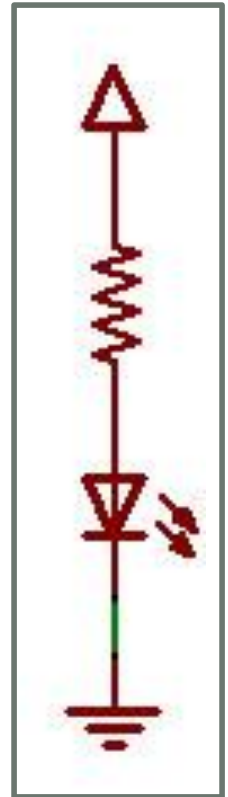
- *Resistor symbol*



- *LED symbol, positive pin on the left, negative pin on the right*



- *Power and Ground symbols*



A barebones schematic

How To Determine A Resistor Size

- Resistors are commonly used in electronics projects and it's important to know which size to use.
- To find the resistor value, you need to know the voltage and the amps for your LED and battery.

Ohm's Law – Resistance (R) = Voltage (V) / Current (I)

- Resistance is measured in Ohms (Ω)
- Voltage is measured in volts (V)
- Current is measured in amps (A)

How To Determine A Resistor Size

- A standard LED generally needs a voltage of around 2V and a current of 20mA or .02A to operate correctly.
- Next, you need to find out what voltage your battery is.
- In this example, we will be using a 9V battery:

This will give you a voltage of 7 which needs to be divided by .02 amps from the LED. This formula shows that you will need a 350 Ω resistor.

Note - standard resistors don't come in 350 Ω but are available in 330 Ω which will work fine.

$$R = \frac{V_{\text{Bat}} - V_{\text{LED}}}{I_{\text{LED}}}$$

$$350 = \frac{9V - 2V}{.02A}$$

The End

Thanks!

Introduction to Electronics:

Hands-on Project #1

Hands-on Project #2