

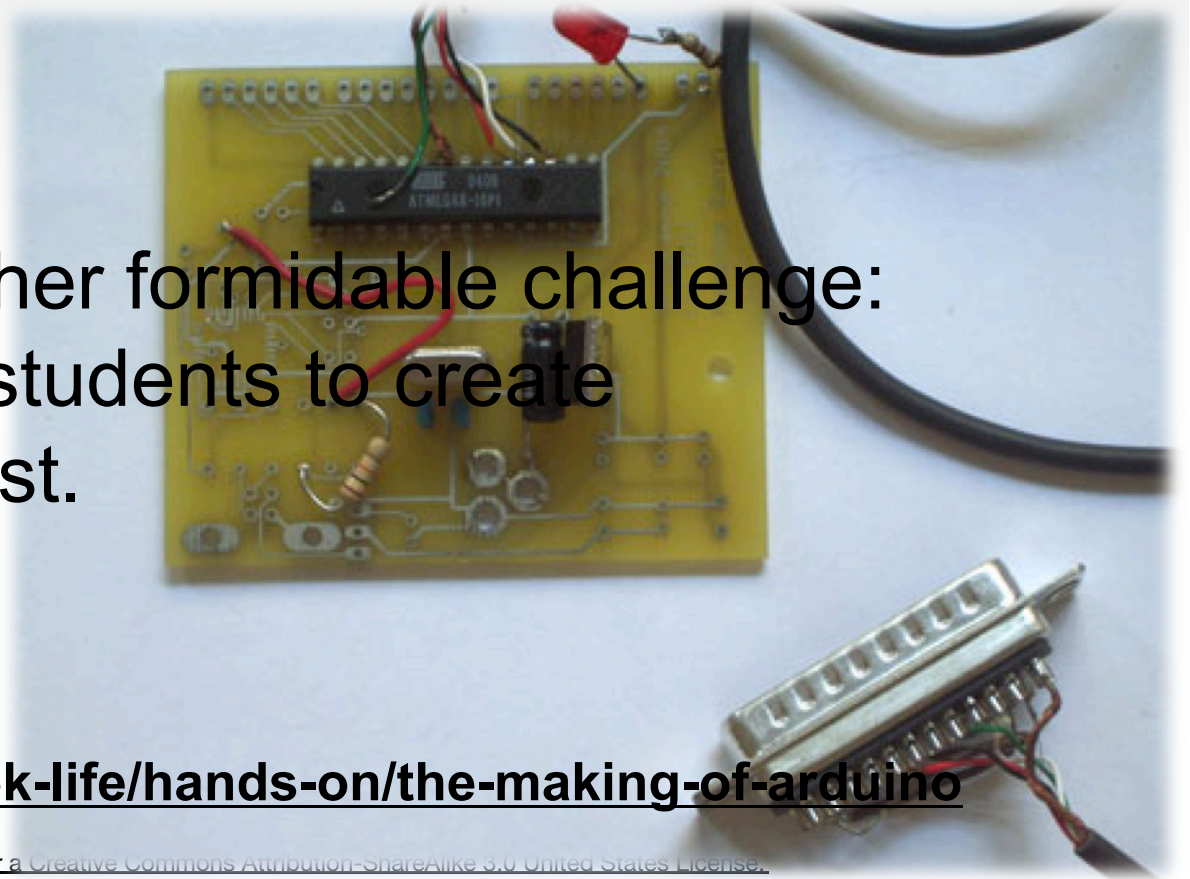
# Arduino...

is the go-to gear for artists, hobbyists, students, and anyone with a gadgetry dream.

rose out of another formidable challenge:  
how to teach students to create  
electronics, fast.

<http://spectrum.ieee.org/geek-life/hands-on/the-making-of-arduino>

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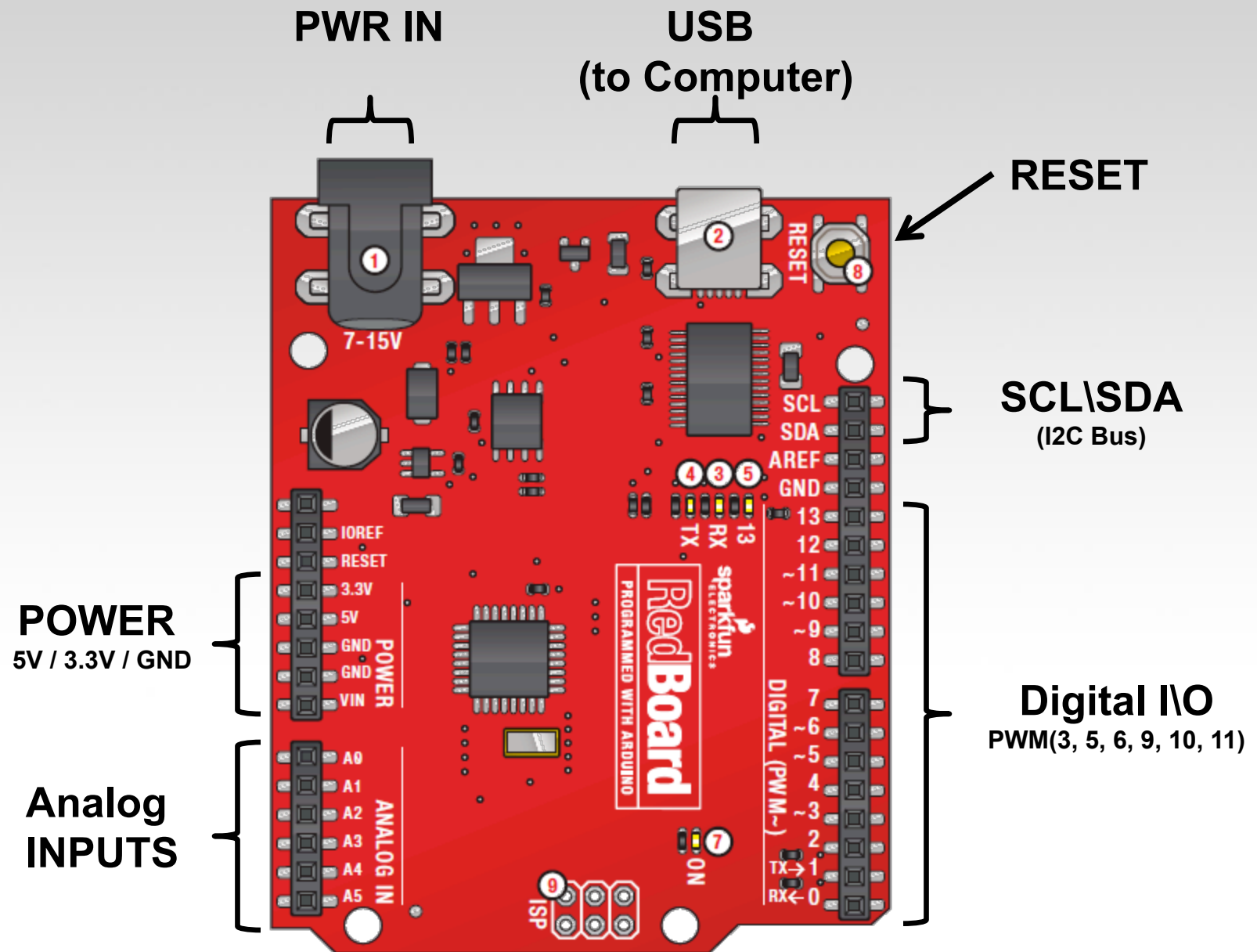


# Getting Started

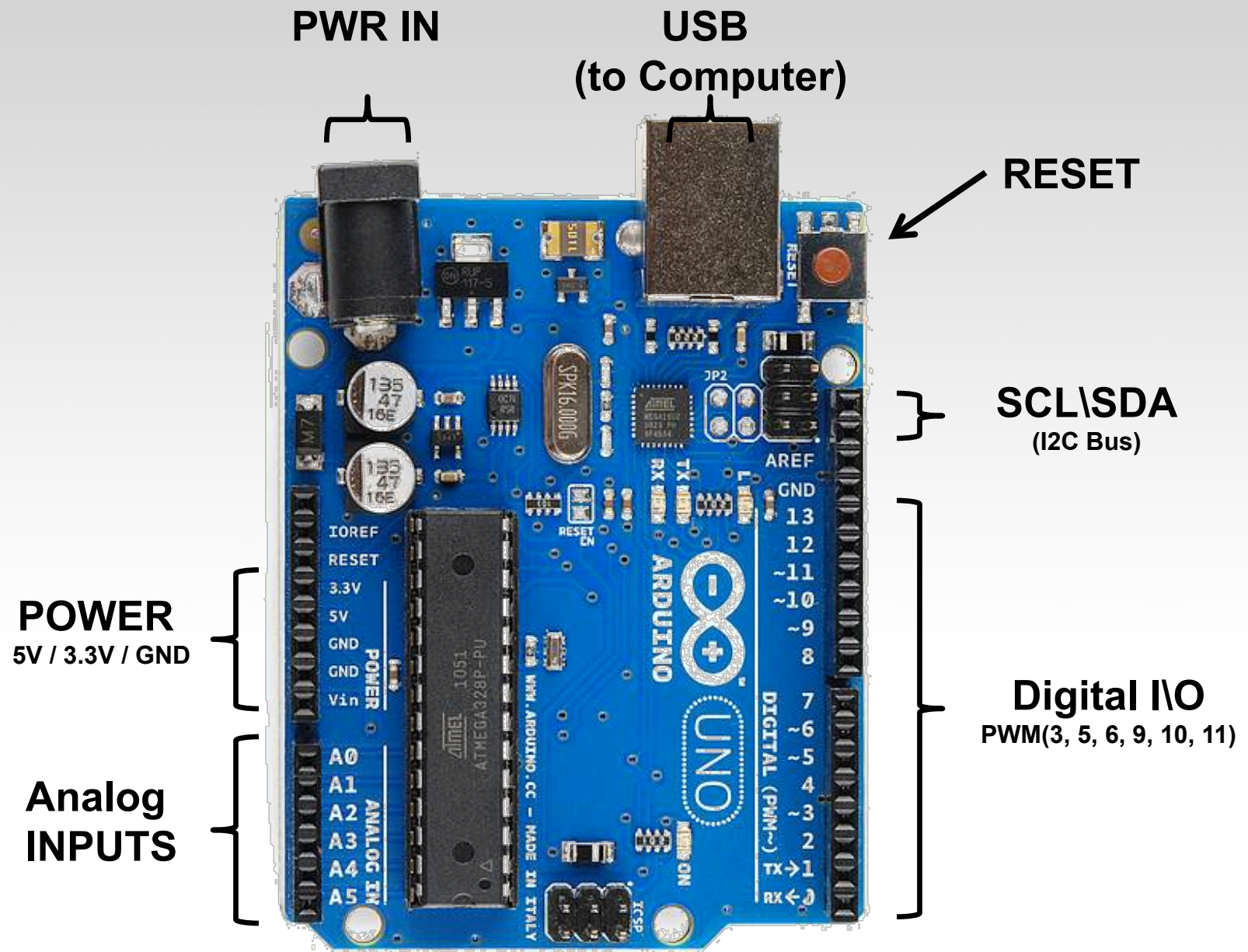
- **SW Installation:** Arduino (v.1.0+)  
Fritzing  
SIK Guide Code  
Drivers (FTDI)
- **Materials:** SIK Guide  
Analog I/O, Digital I/O, Serial,  
& Fritzing handouts  
Arduino CheatSheet



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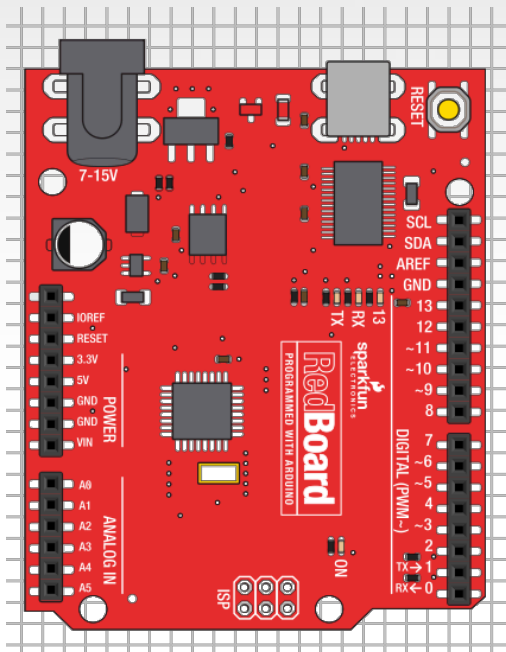


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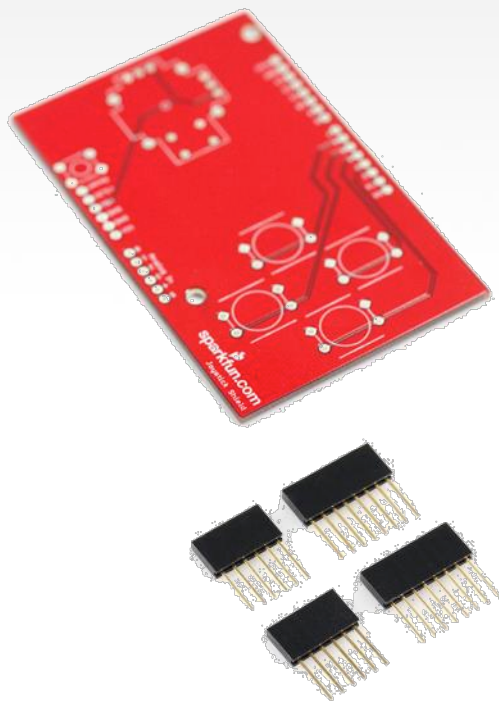
# Go ahead and plug your board in!



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# Arduino Shields

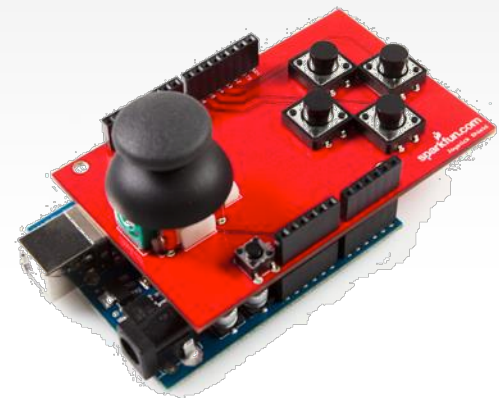
PCB



Built Shield



Inserted Shield

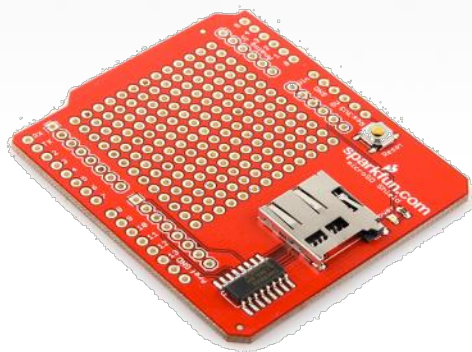


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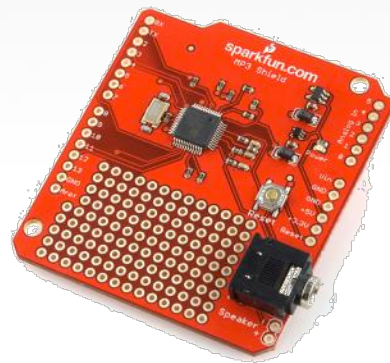


# Arduino Shields

Micro SD



MP3 Trigger


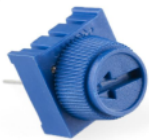








LCD



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# SIK Components

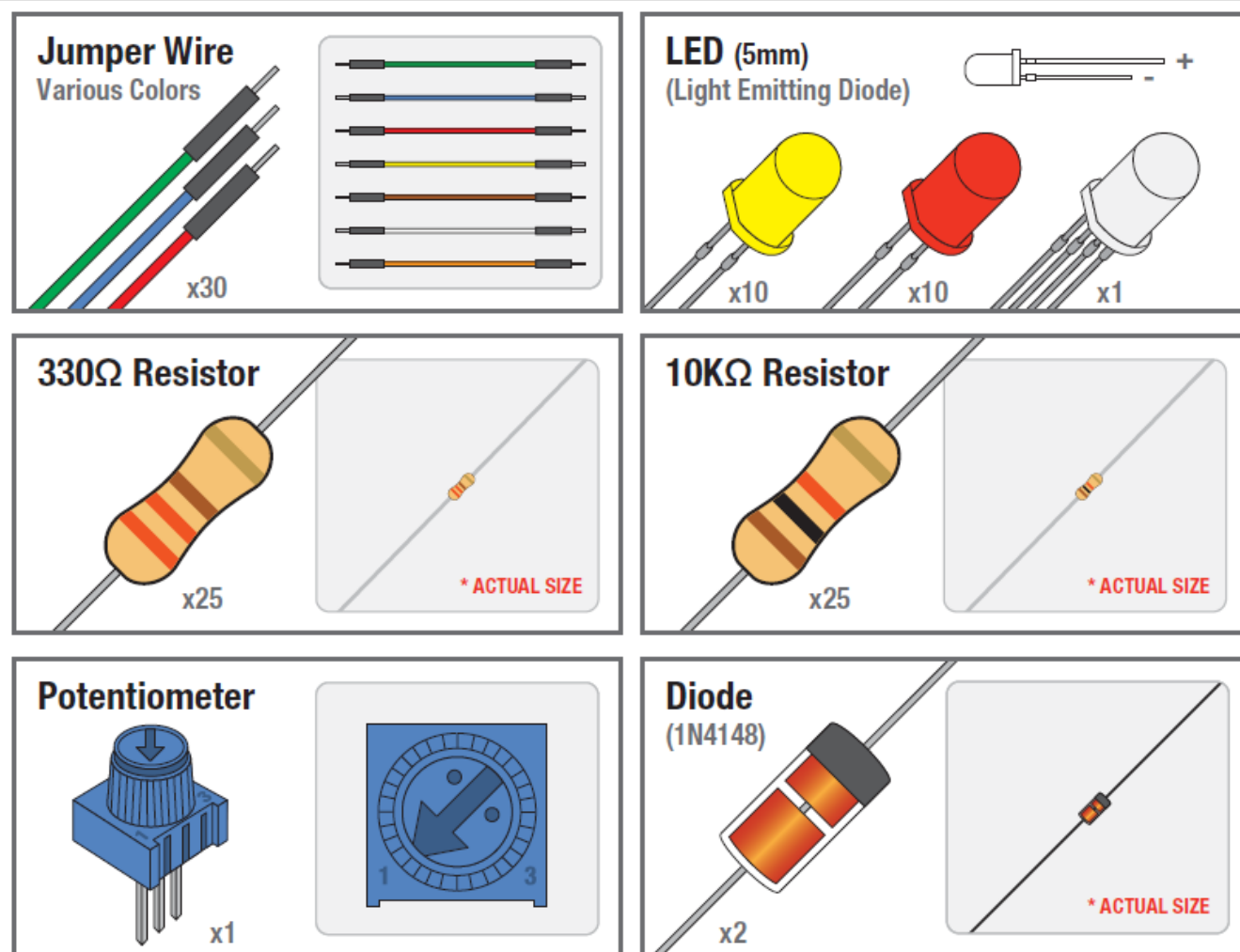
Name	Image	Type	Function	Notes
Push Button		Digital Input	Switch - Closes or opens circuit	Polarized, needs resistor
Trim potentiometer		Analog Input	Variable resistor	Also called a Trimpot.
Photoresistor		Analog Input	Light Dependent Resistor (LDR)	Resistance varies with light.
Relay		Digital Output	Switch driven by a small signal	Used to control larger voltages
Temp Sensor		Analog Input	Temp Dependent Resistor	
Flex Sensor		Analog Input	Variable resistor	
Soft Trimpot		Analog Input	Variable resistor	Careful of shorts
RGB LED		Dig & Analog Output	16,777,216 different colors	Ooh... So pretty.



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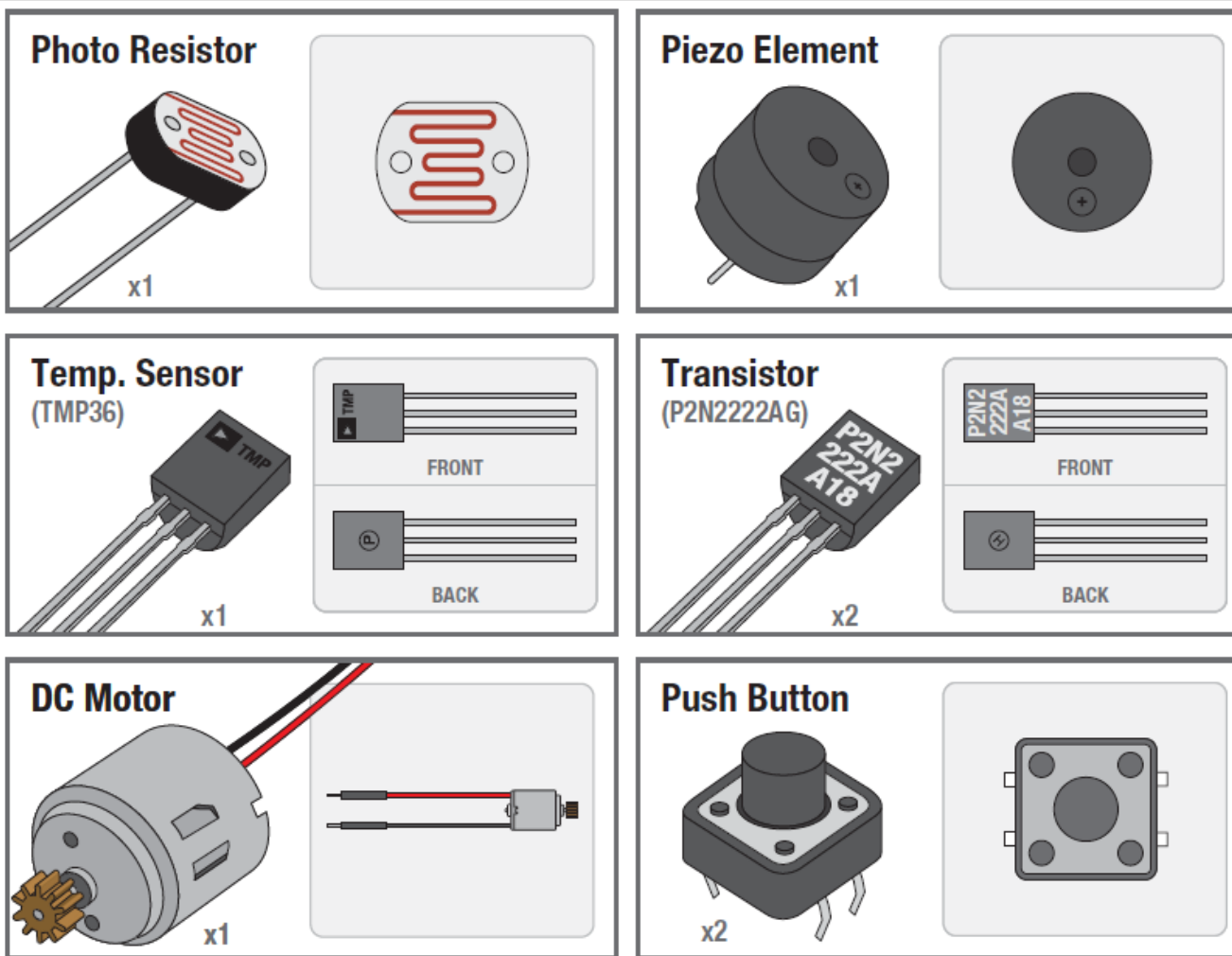


# SIK Components



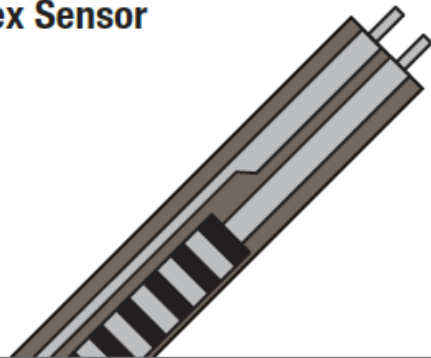
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# SIK Components



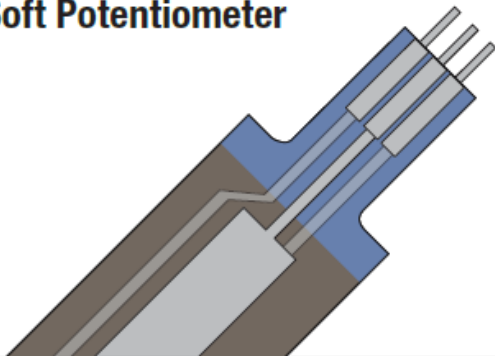
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**Flex Sensor**



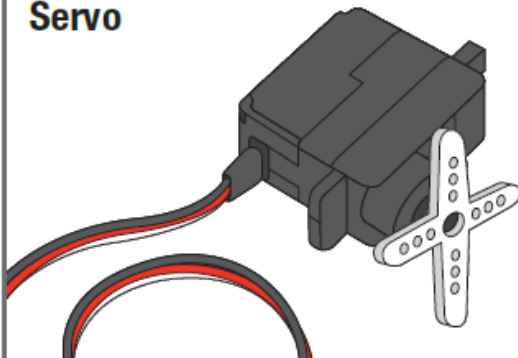
x1

**Soft Potentiometer**



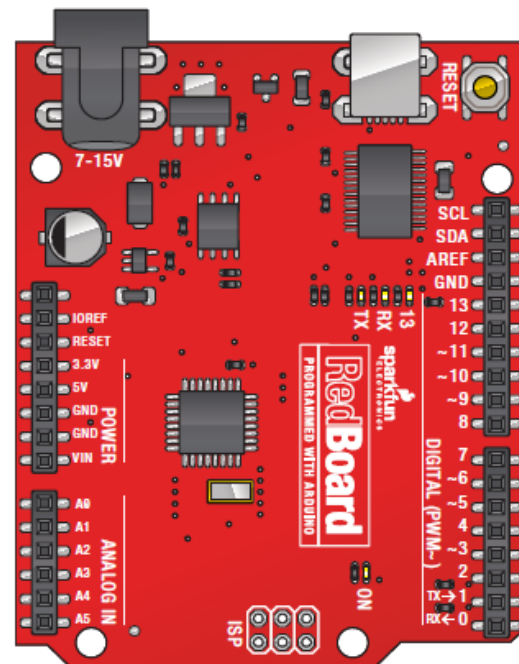
x1

**Servo**



x1

**SparkFun RedBoard**

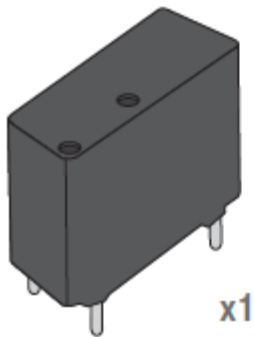


x1



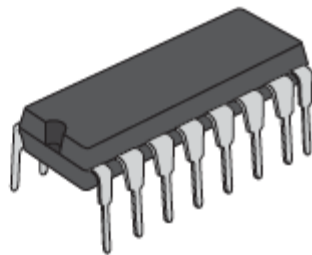
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**Relay**



x1

**Integrated Circuit  
(IC)**



x1

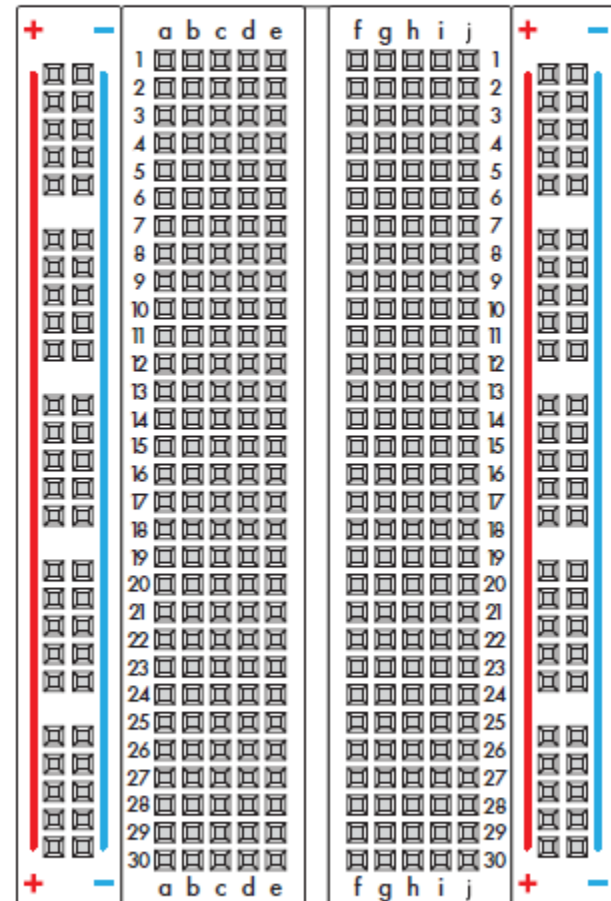
**LCD**



x1

## Breadboard

Standard Solderless (Color may vary)



x1



# Electricity \ Electronics Basic Concept Review

- Ohms Law
- Voltage
- Current
- Resistance
- Using a Multi-meter



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# Ohm's Law

Ohm's Law describes the direct relationship between the Voltage (V), Current (I), and Resistance (R) of a circuit.

The three different forms of Ohm's Law are as follows:

$$V = I \cdot R \quad I = \frac{V}{R} \quad R = \frac{V}{I}$$



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$$V = I R$$

# Electrical Properties

## Voltage

V

- Defined as the amount of potential energy in a circuit.
- Units: Volts (V)

## Current

I

- The rate of charge flow in a circuit.
- Units: Amperes (A)

## Resistance

R

- Opposition to charge flow.
- Units: Ohms ( $\Omega$ )

$$[V = I \cdot R]$$



$$V = I R$$

## Current Flow Analogy



High Current



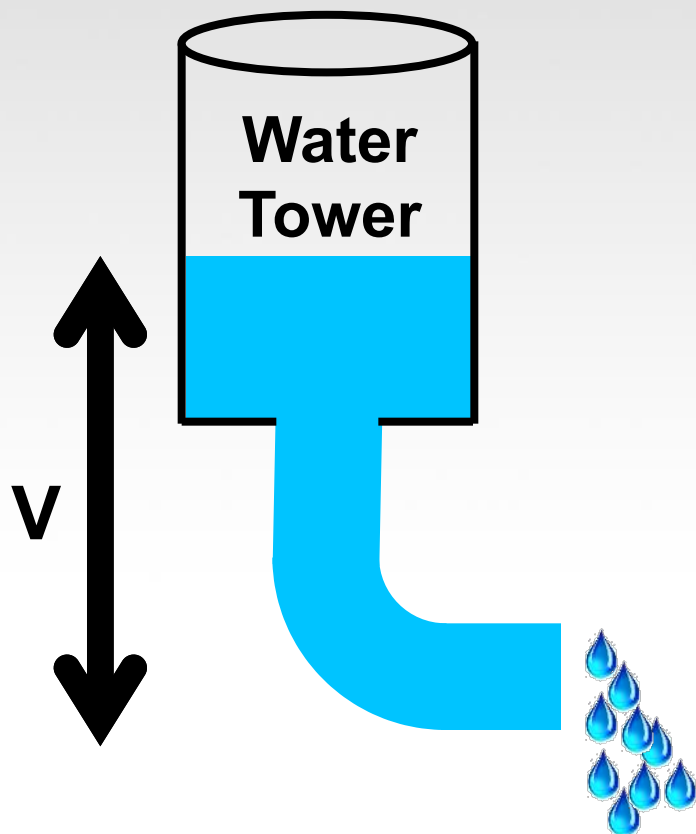
Low Current



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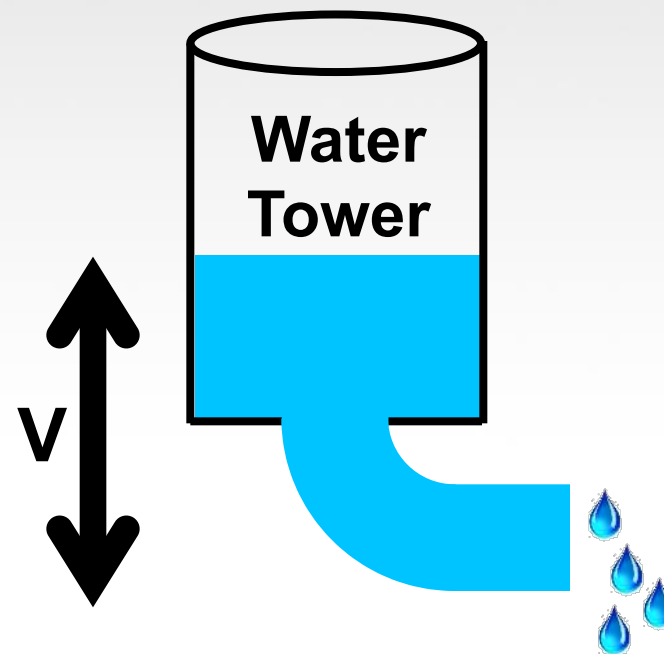
$$V = I R$$

## Voltage Analogy



More Energy == Higher Voltage

$$V = I R$$



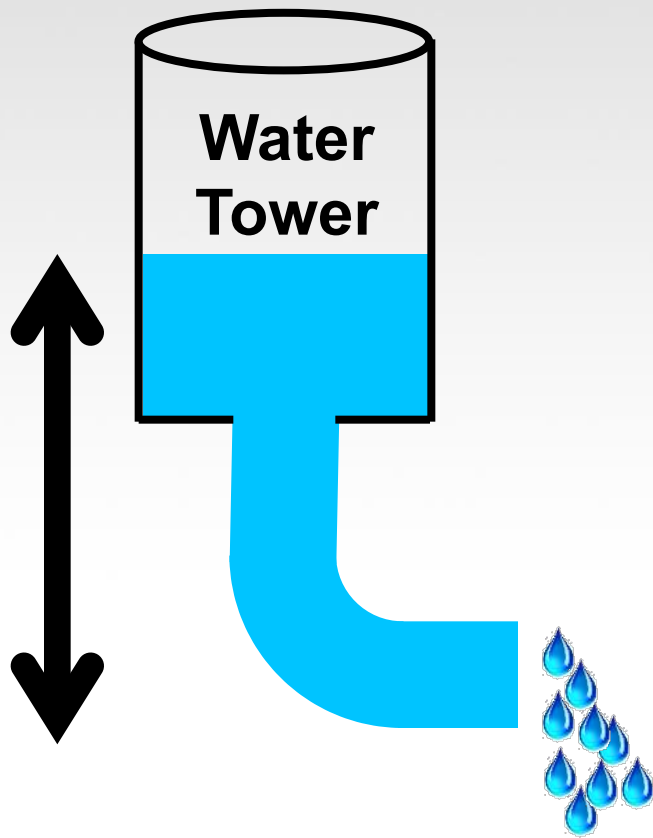
Less Energy == Lower Voltage

$$V = I R$$



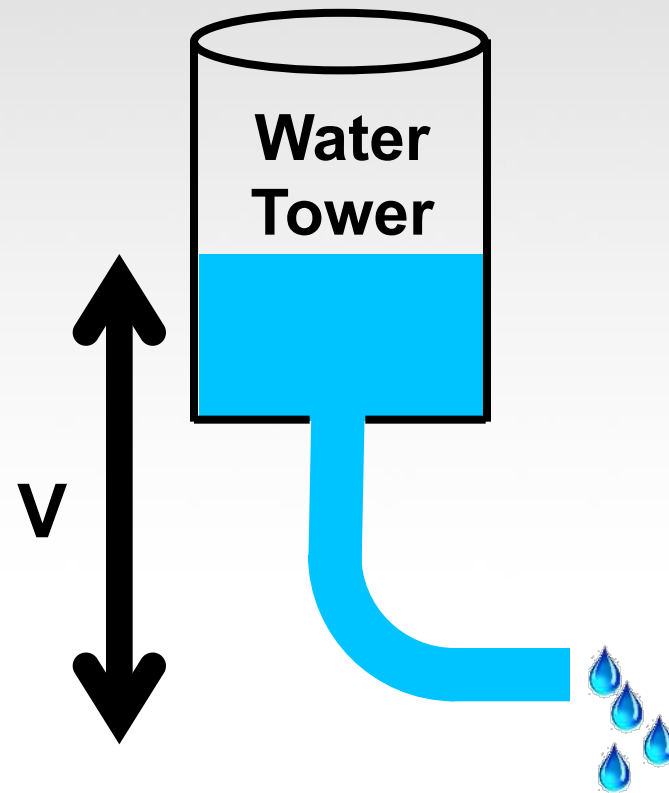
$$V = I R$$

## Resistance Analogy



Big Pipe == Lower Resistance

$$V = I R$$

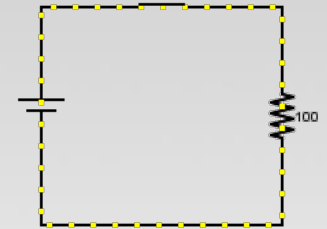


Small Pipe == Higher Resistance

$$V = I R$$



# Continuity – Is it a Circuit?



The word “circuit” is derived from the circle. An Electrical Circuit must have a continuous LOOP from Power ( $V_{cc}$ ) to Ground (GND).

Continuity is important to make portions of circuits are connect. Continuity is the simplest and possibly the most important setting on your multi-meter. Sometimes we call this “ringing out” a circuit.

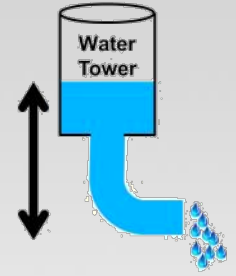


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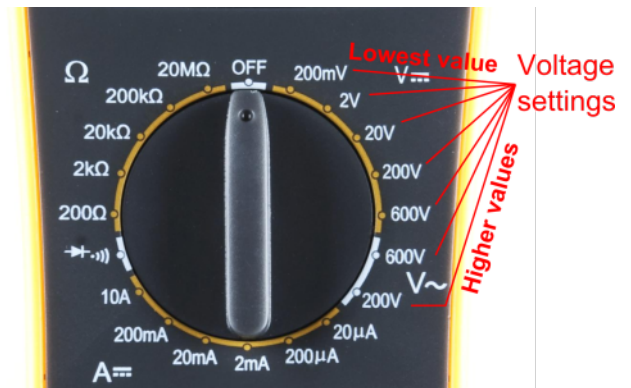
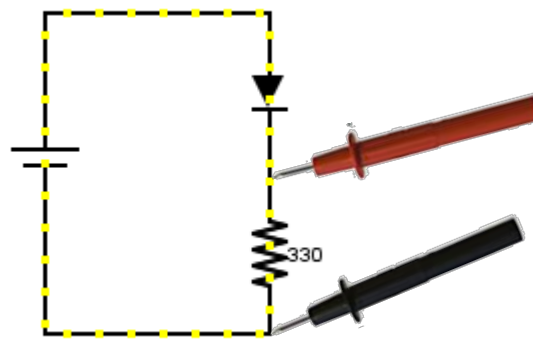
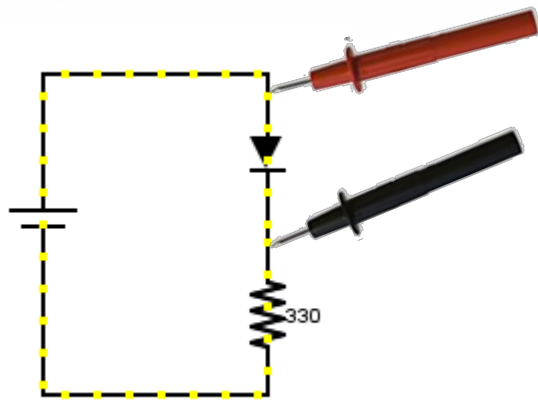
Continuity  
setting



# Measuring Electricity – Voltage

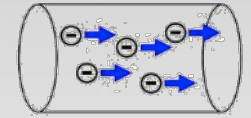


Voltage is a measure of potential electrical energy. A voltage is also called a potential difference – it is measured between two points in a circuit – across a device.



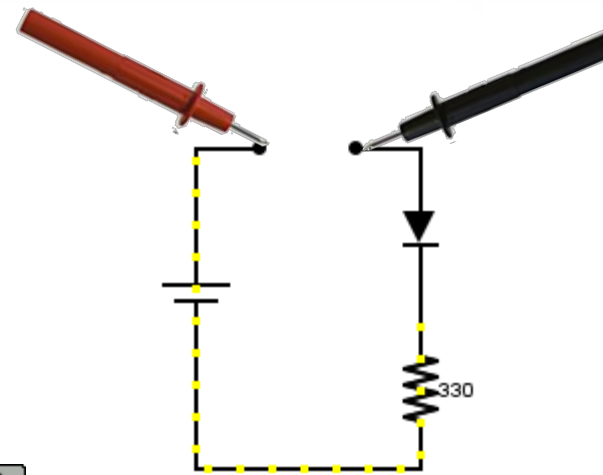
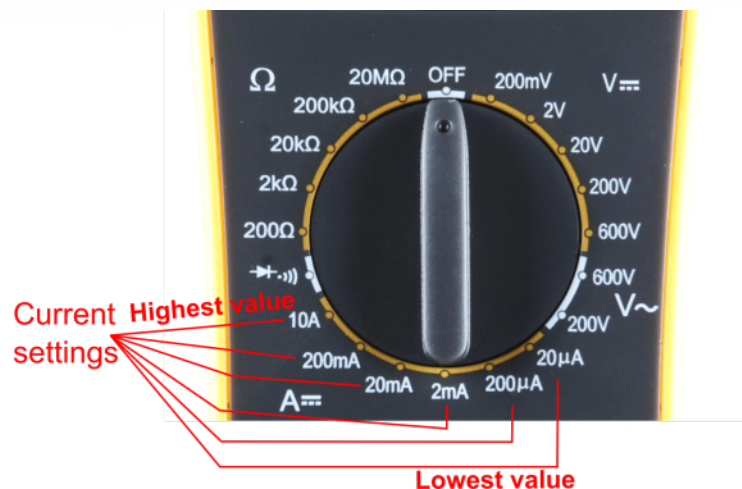


# Measuring Electricity -- Current



Current is the measure of the rate of charge flow. For Electrical Engineers – we consider this to be the movement of electrons.

In order to measure this – you must break the circuit or insert the meter in-line (series).



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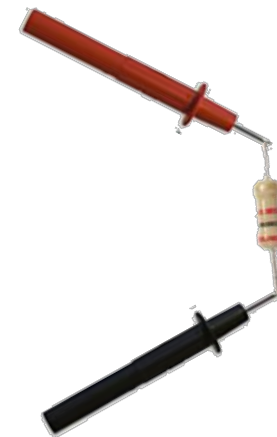
# Measuring Electricity -- Resistance



Resistance is the measure of how much opposition to current flow is in a circuit.

Components should be removed entirely from the circuit to measure resistance. Note the settings on the multi-meter. Make sure that you are set for the appropriate range.

Resistance  
settings



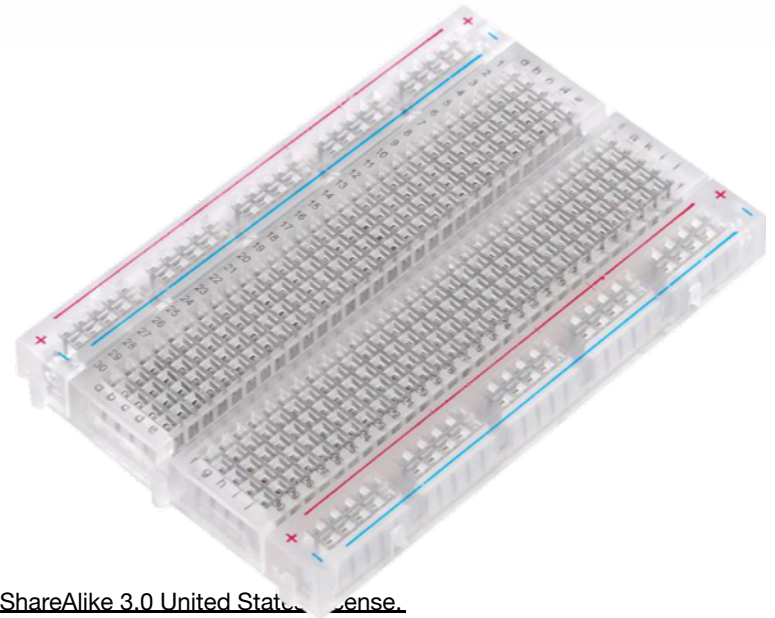
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# Prototyping Circuits

## Solderless Breadboard

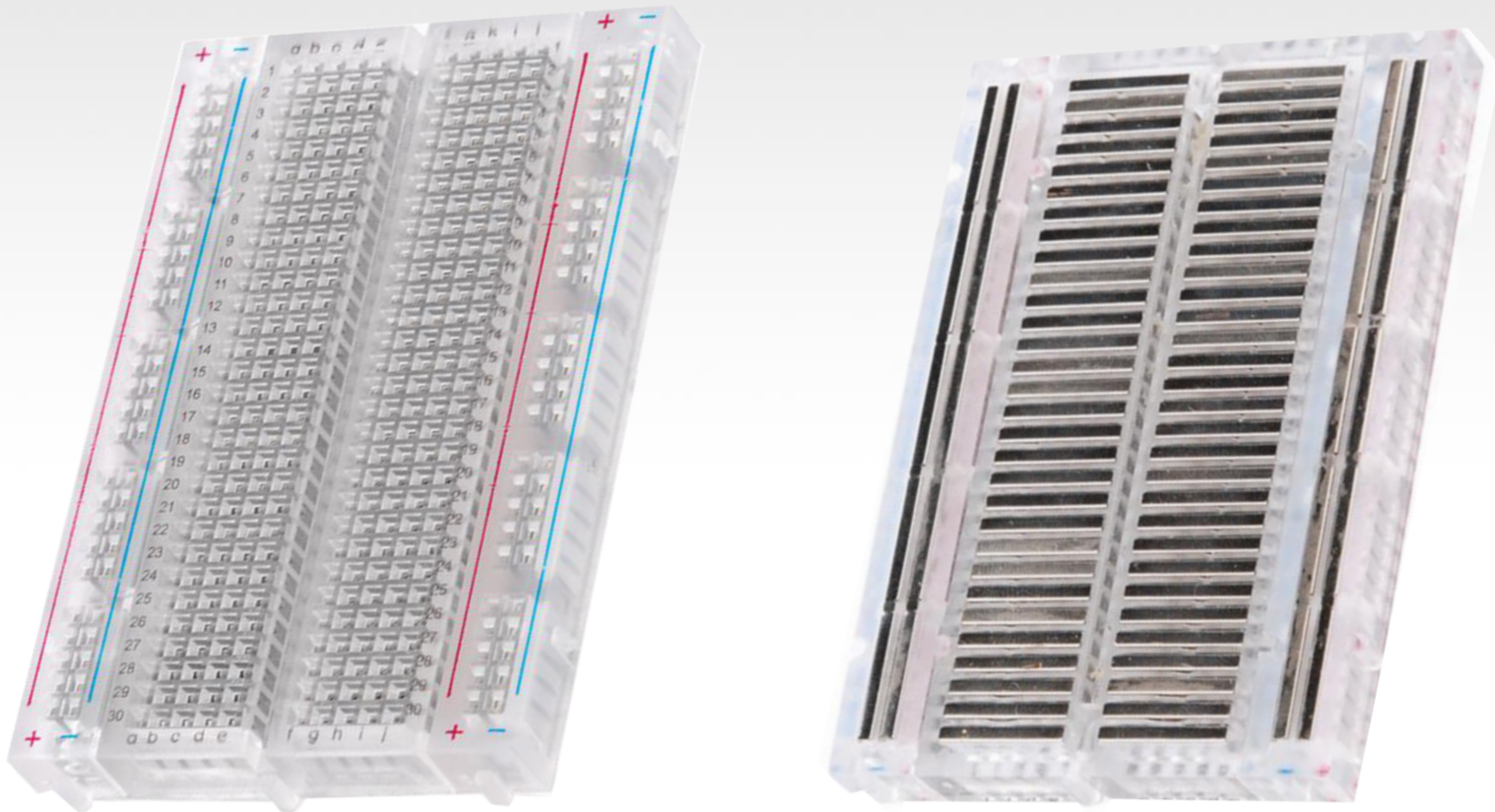
One of the most useful tools in an engineer or Maker's toolkit. The three most important things:

- A breadboard is easier than soldering
- A lot of those little holes are connected, which ones?
- Sometimes breadboards break



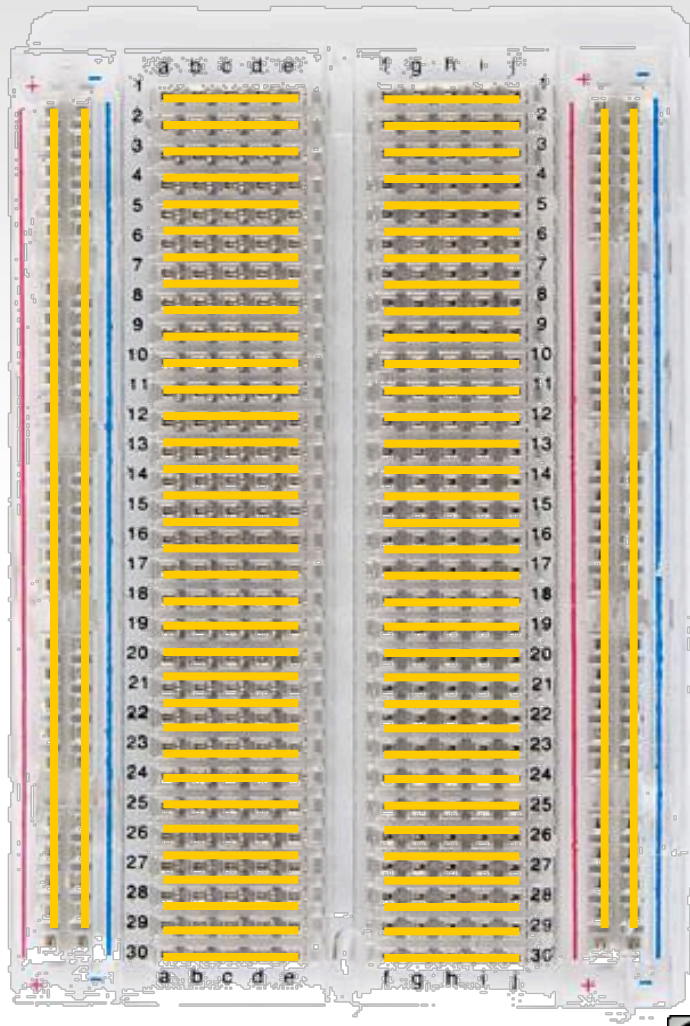
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# What's a Breadboard?



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# Solderless Breadboard

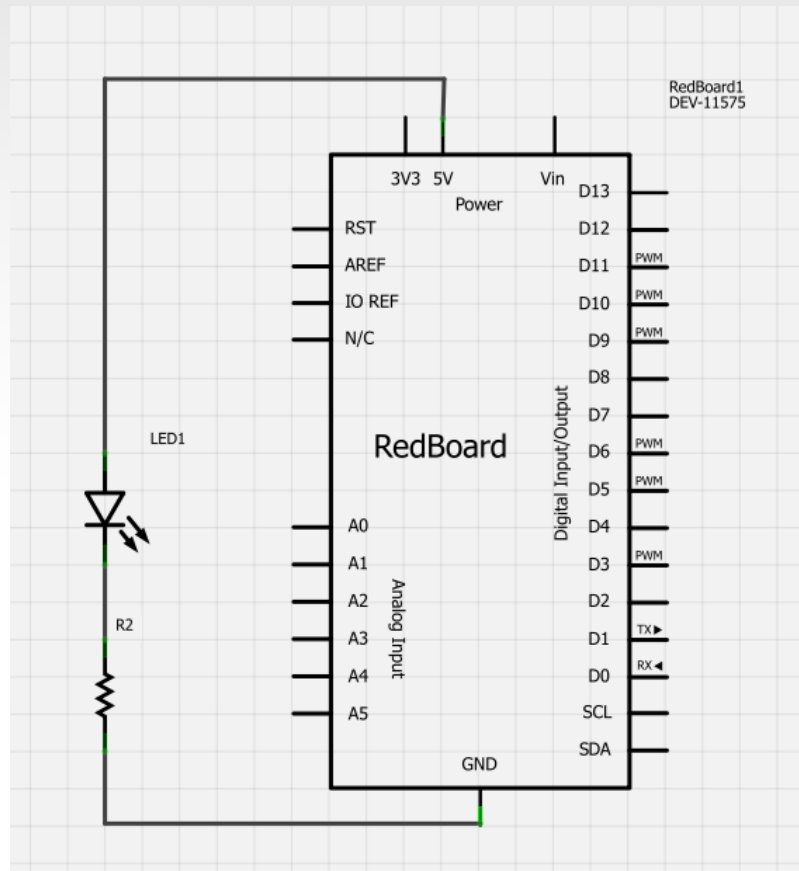


Each row (horiz.) of 5 holes are connected.

Vertical columns – called power bus are connected vertically



# Using the Breadboard to built a simple circuit



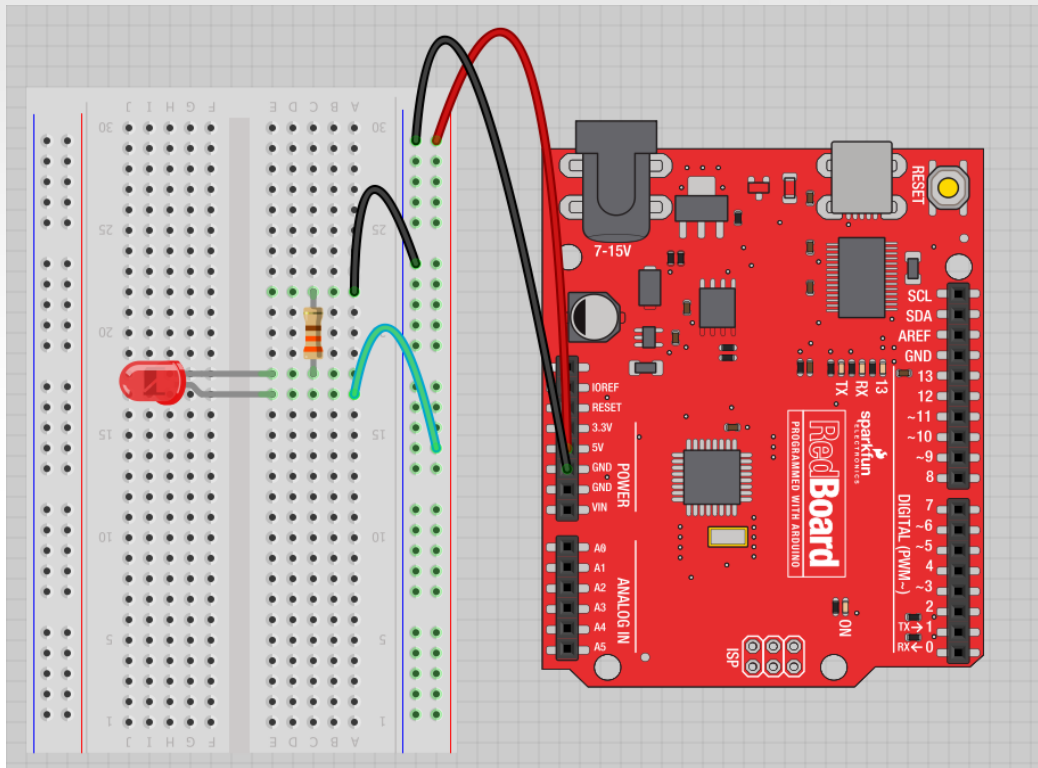
Use the breadboard to wire up a single LED with a 330 Ohm Resistor (Orange-Orange-Brown).

Note: the longer leg on the LED is the positive leg and the shorter leg is the negative





# Fritzing View of Breadboard Circuit



What happens when you break the circuit?

What if you wanted to add more than one LED?



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