

# ARDUINO WEEK 3 – OUTPUTS & FIRMATA

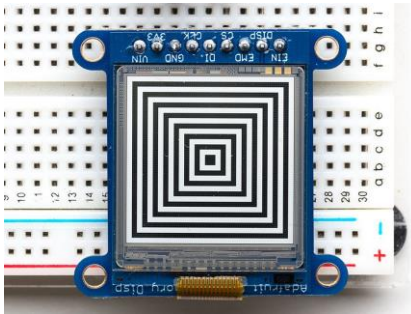
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CCLab 2016

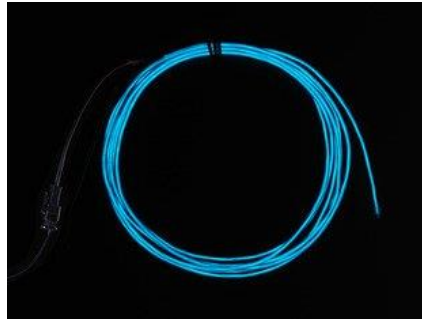
GO TO  
SPARKFUN.COM/SIKCODE

copy the “SIK Guide Code” folder into Arduino’s folder  
named “examples”

# There are many other outputs besides LEDs for use with Arduino 😊



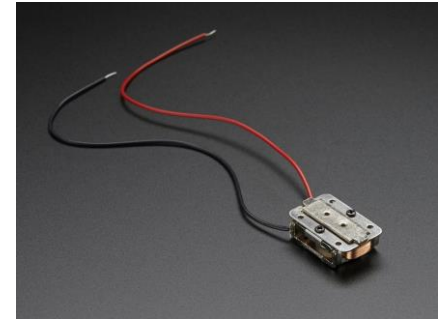
eInk Display



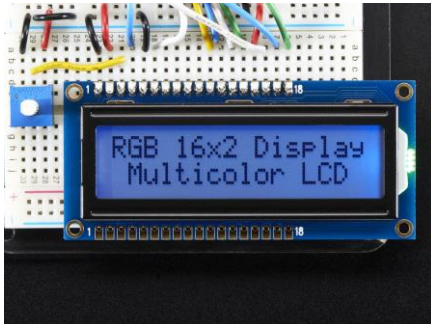
EL Wire



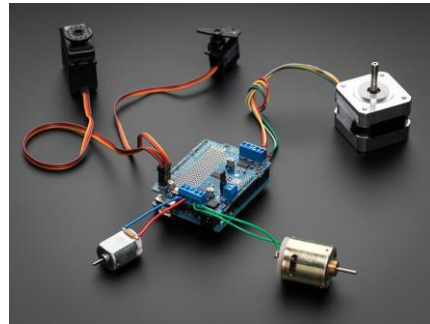
Speakers



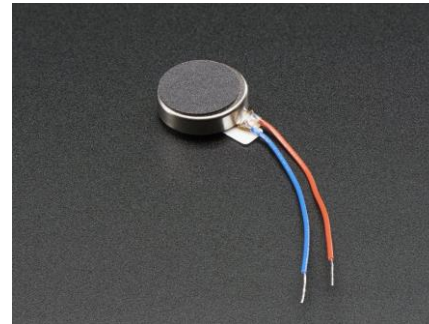
Bone Conduction Transducer



LCD Display



Motors

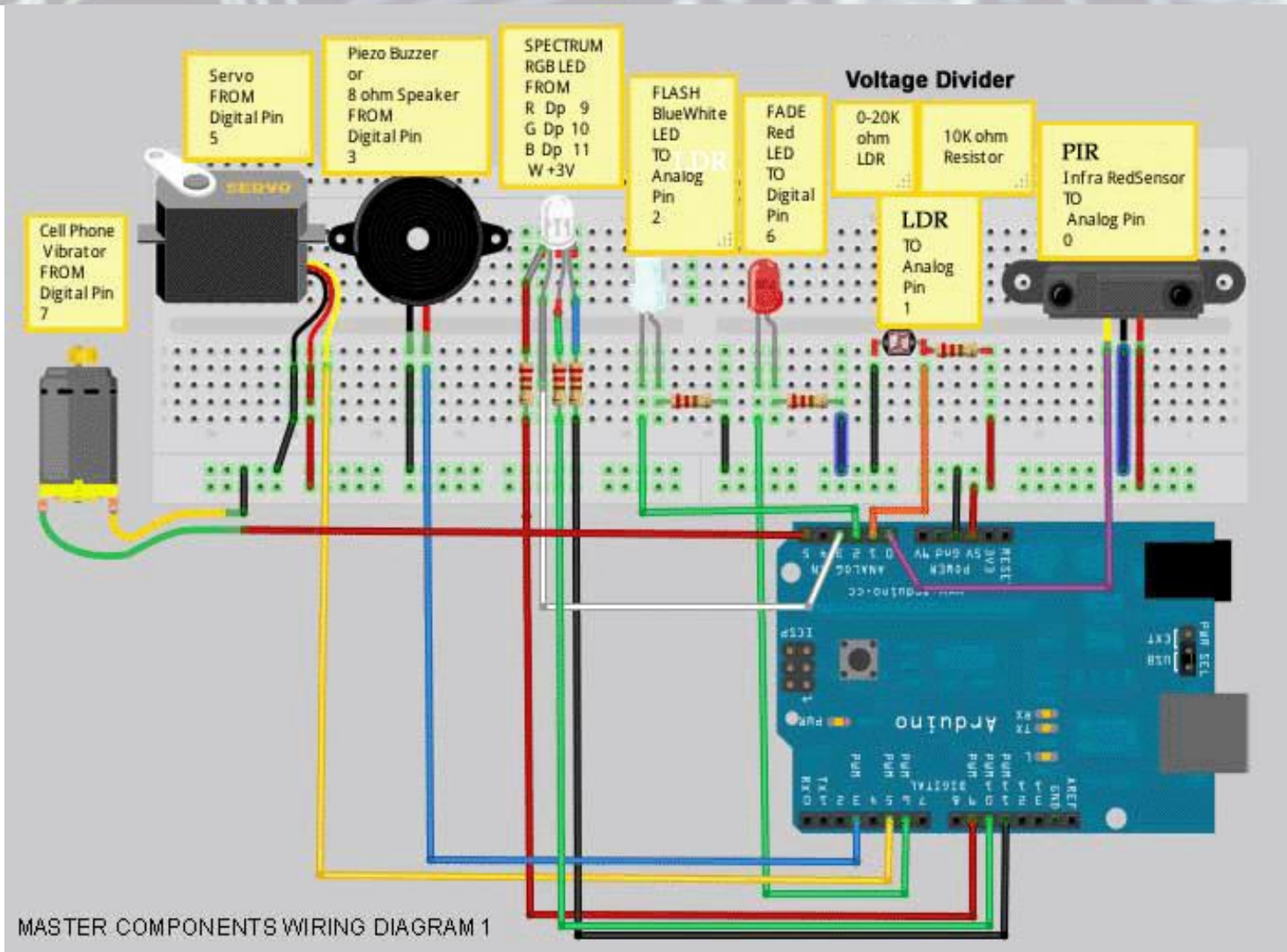


Vibrating Motor Disc



Receipt Printer

# Creating Outputs

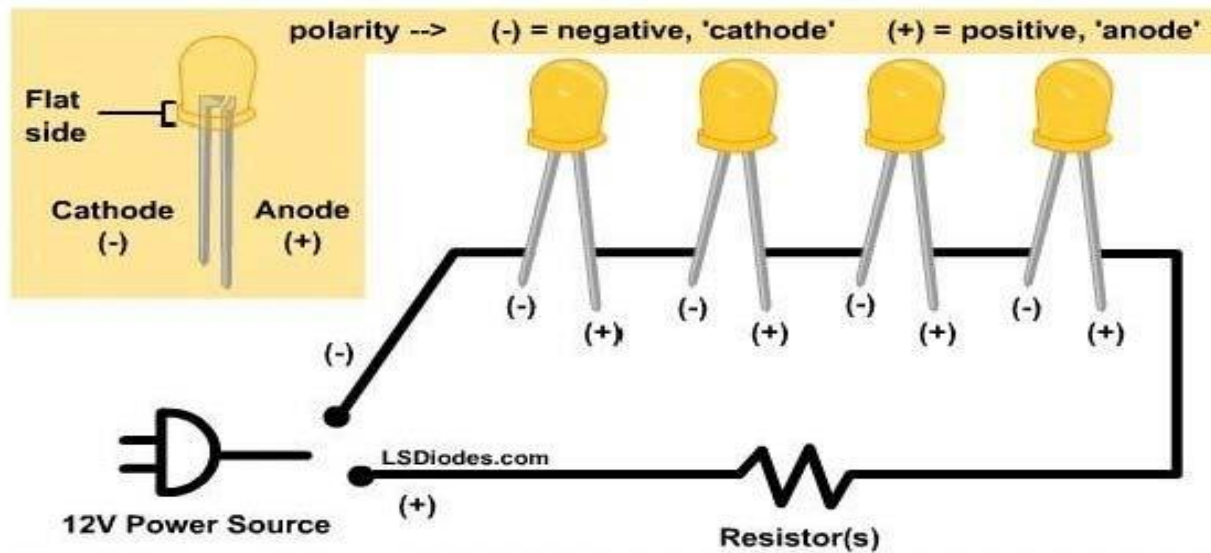


MULTIPLE LEDs

# Series Circuit

## LEDS++

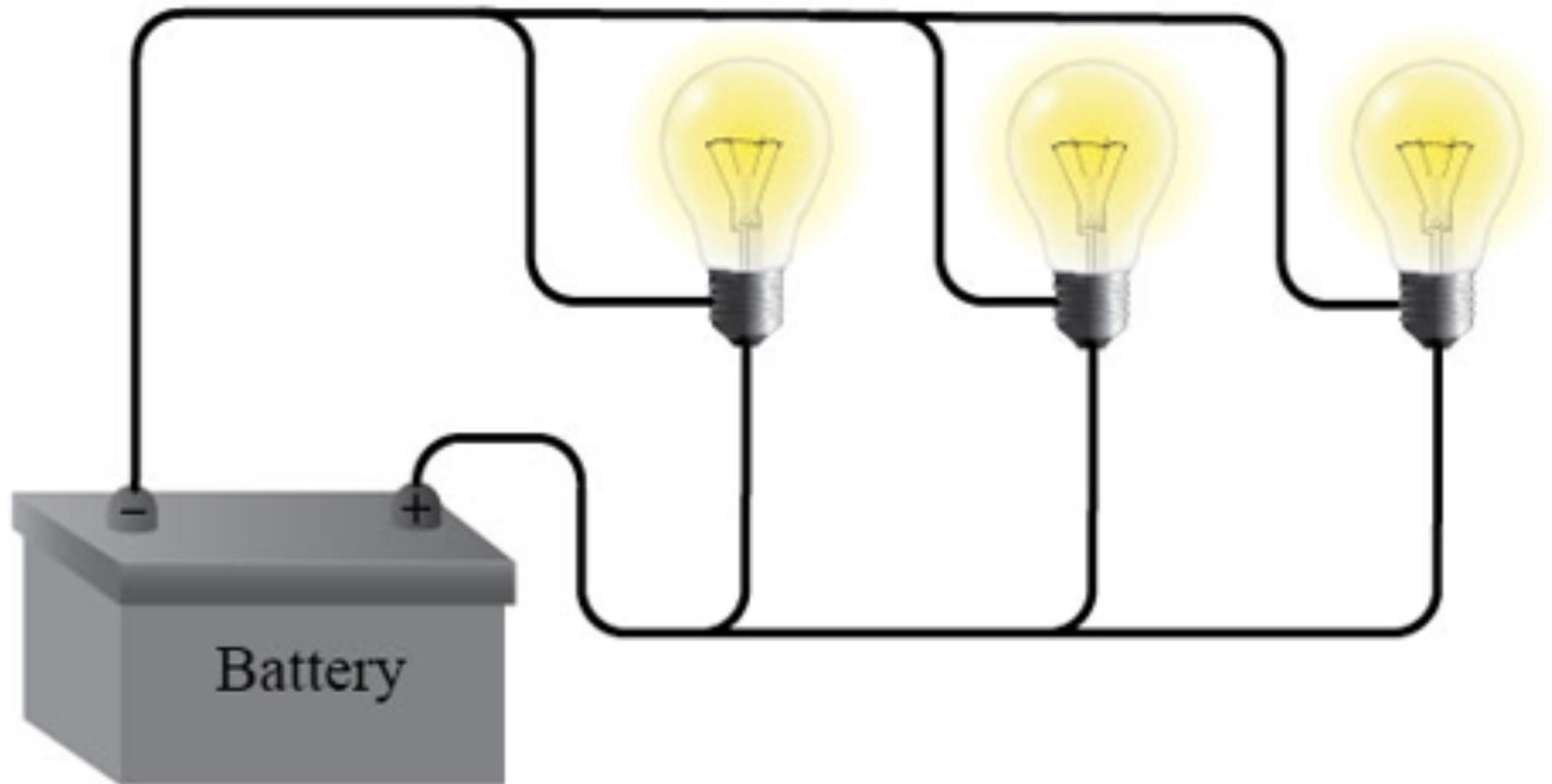
Two components are in series if they share a common node and if the **same current** flows through them.



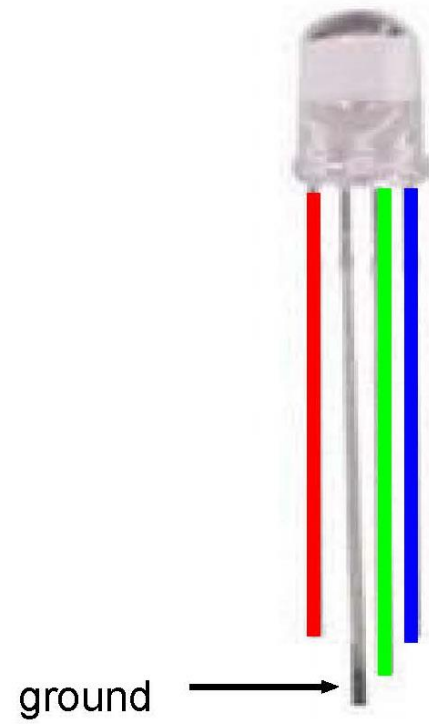
$$\frac{\text{Volts}}{\text{LEDs}} = \frac{12}{4} = 3\text{V going through each LED}$$

# Parallel Circuit

If components share *two* common nodes, they are in parallel.



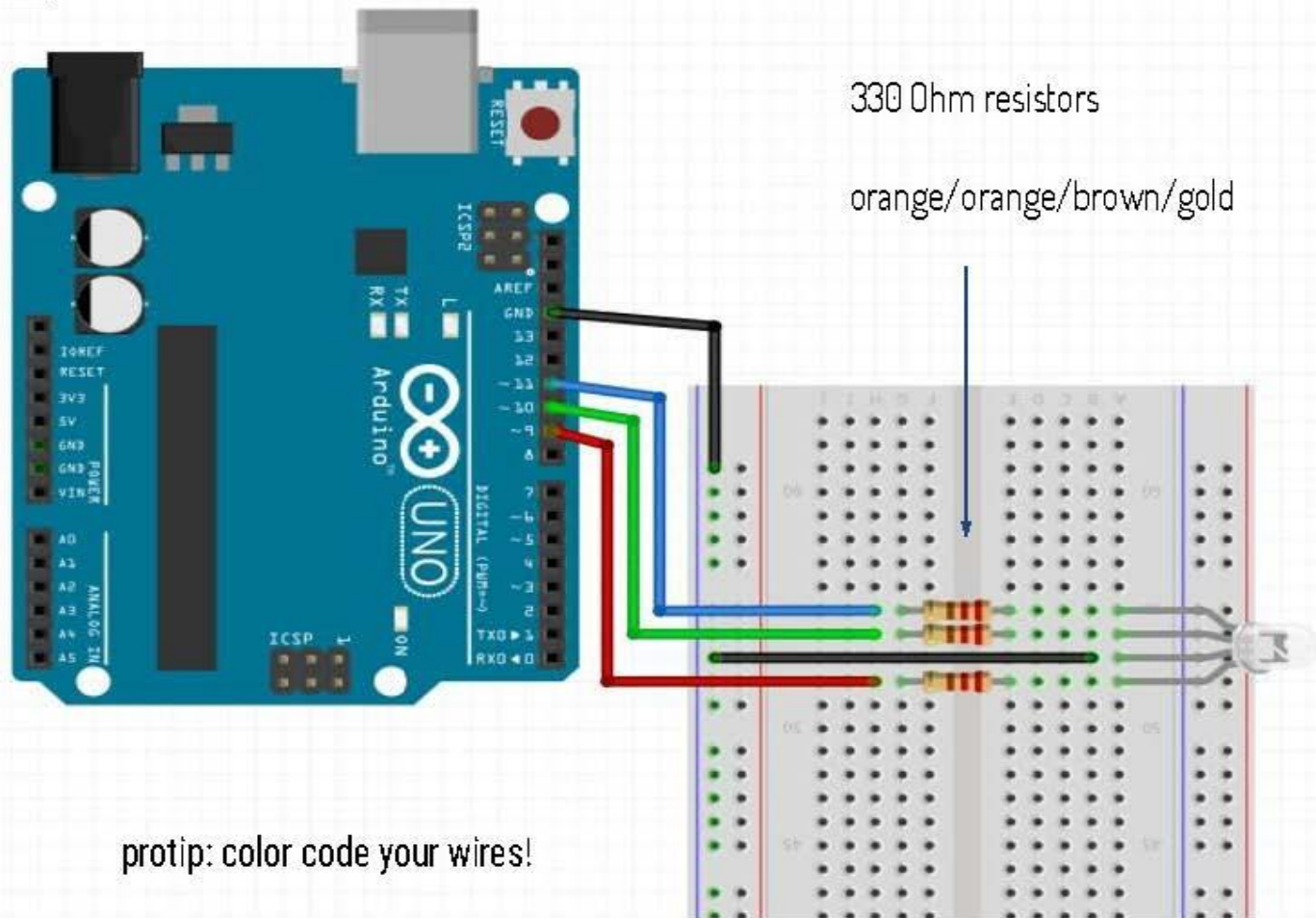
# RGB LED





# RGB LEDs

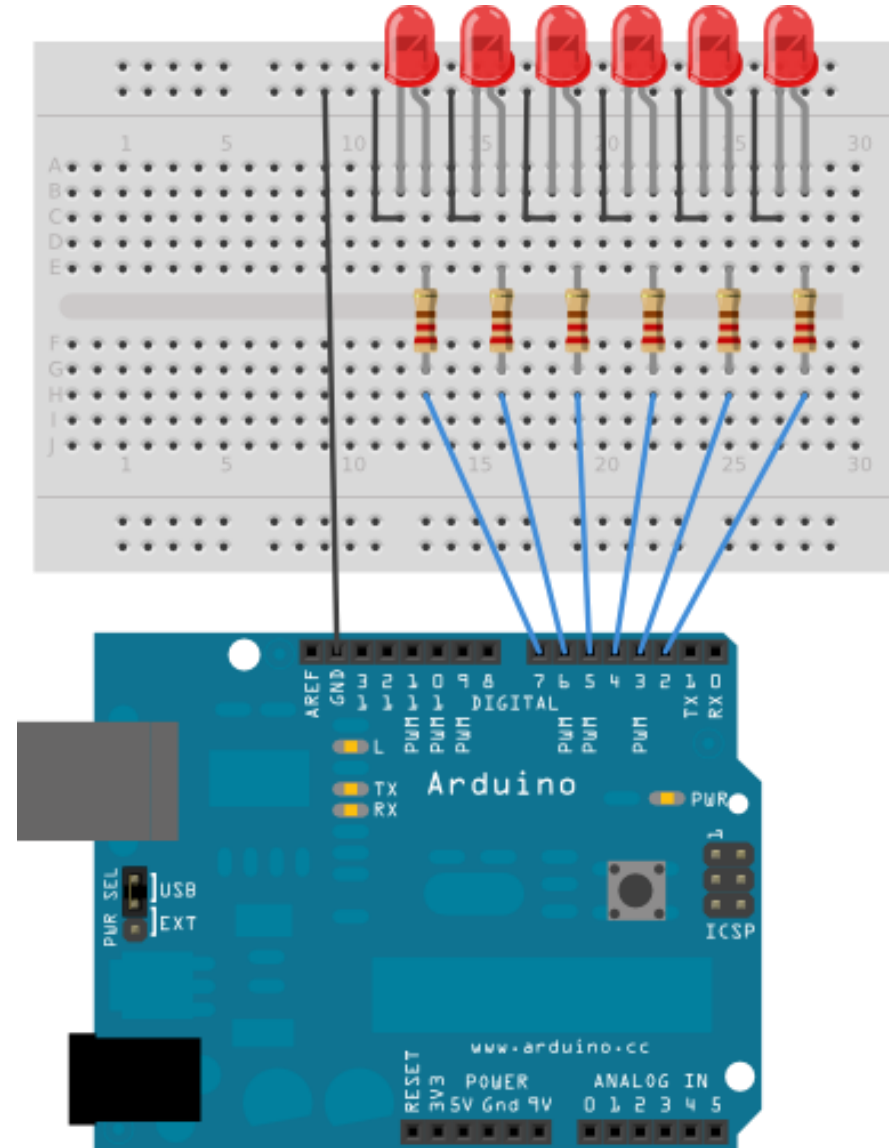
file->example->SIK Guide Code->Circuit\_03



# Multiple LEDs

Arduino>Examples>Control>Arrays

Arduino>Examples>Control>ForLoopIteration



# Motors

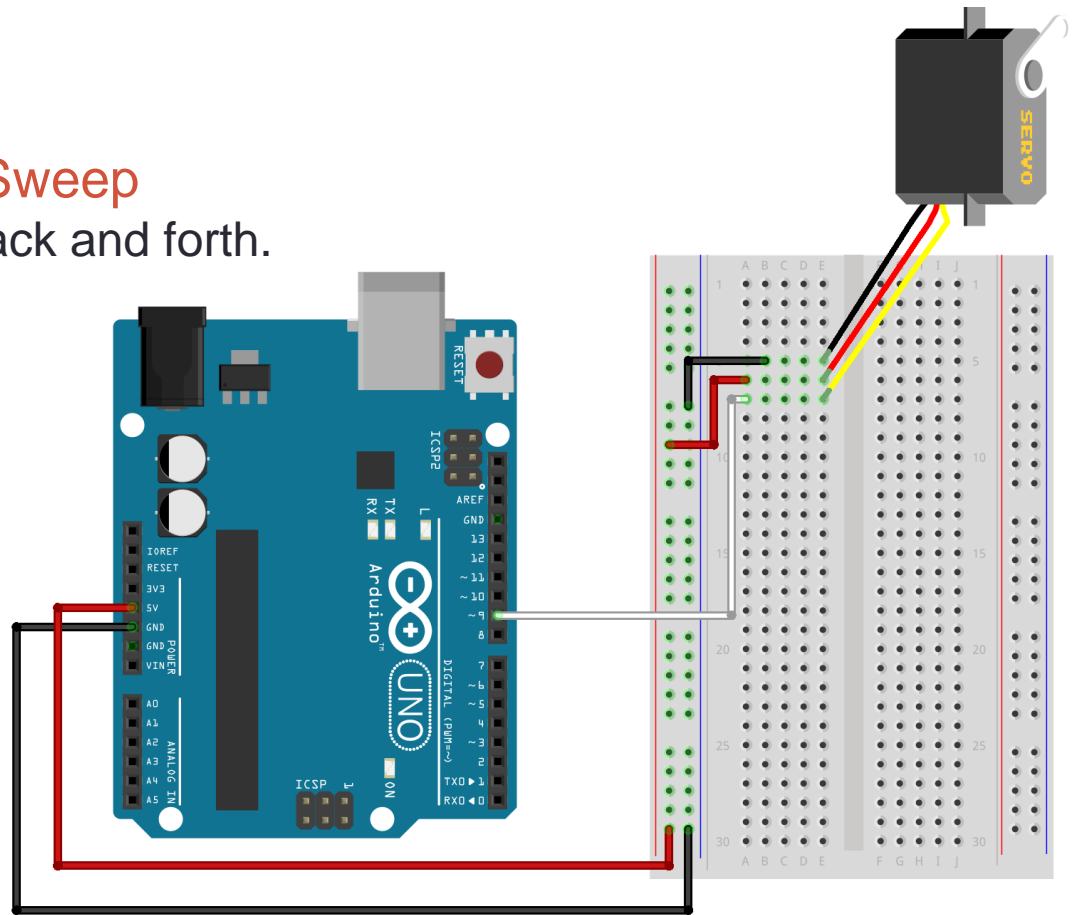
# Servo Motor

- Can be precisely controlled
  - On standard servos, the shaft can be positioned at various angles between 0 and 180 degrees
  - Continuous rotation servos allow the rotation to be set to various speeds



# Servo Sweep

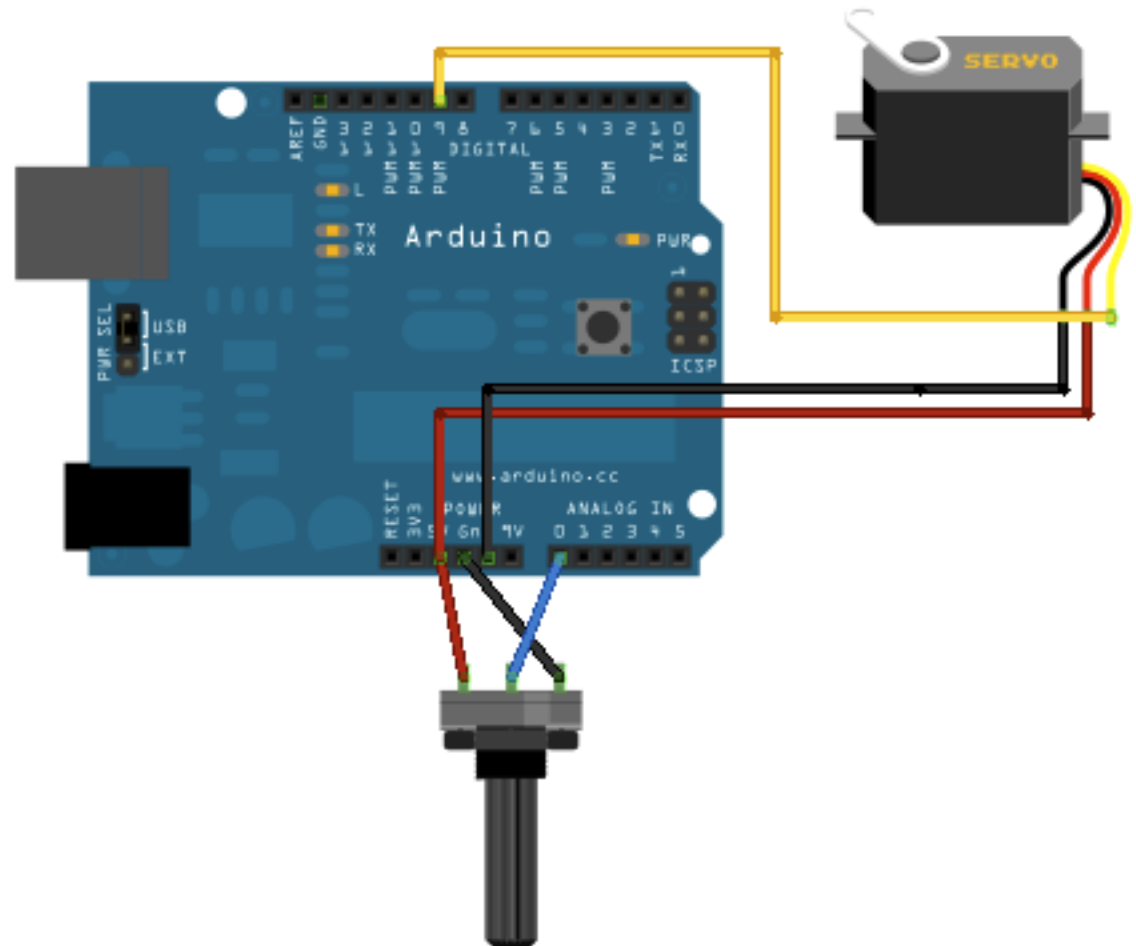
Arduino > Examples > Servo > Sweep  
Sweep the shaft of a servo motor back and forth.



fritzing

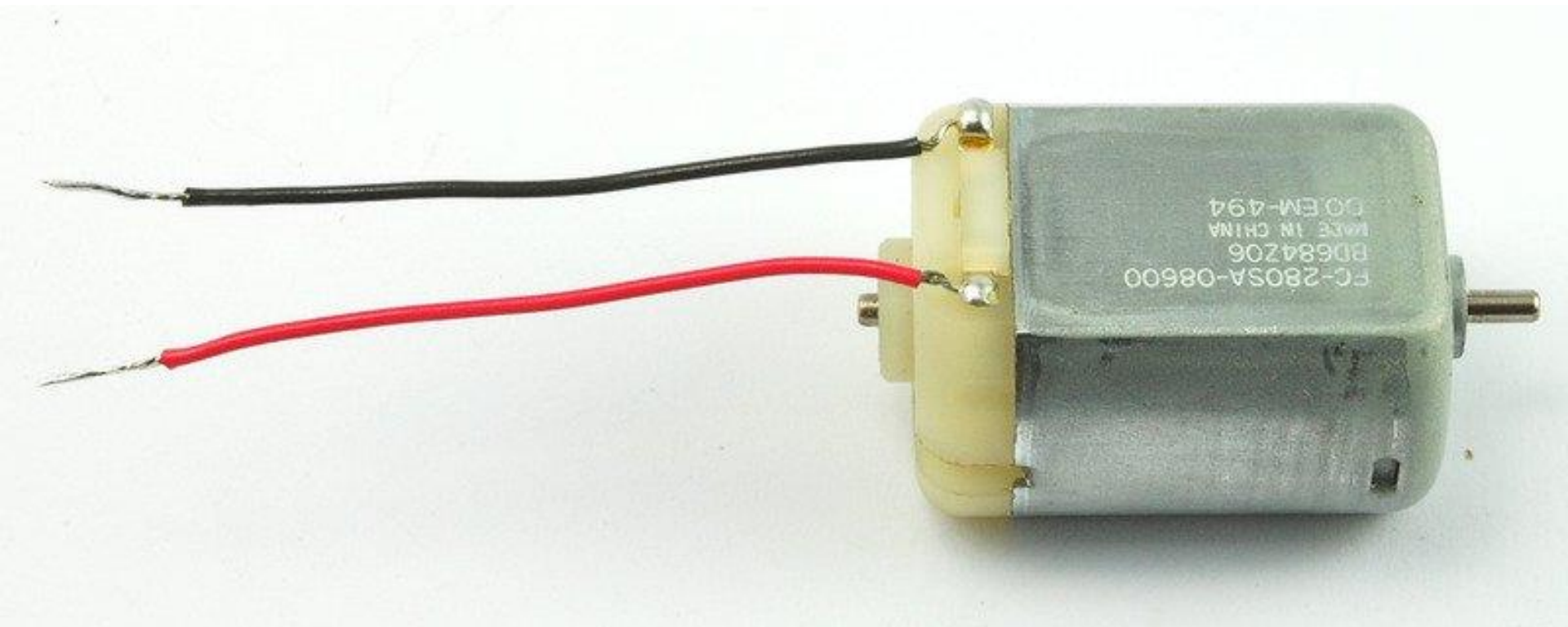
# Servo Knob

Arduino > Examples > Servo > Knob  
Control the position of a servo with a potentiometer.



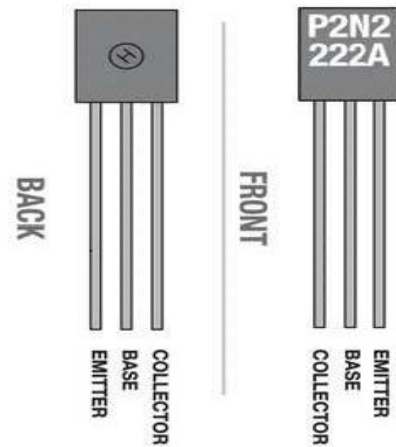
# DC Motor

- The most common type of motor
- Normally they have just two leads, one positive and one negative



# Transistor

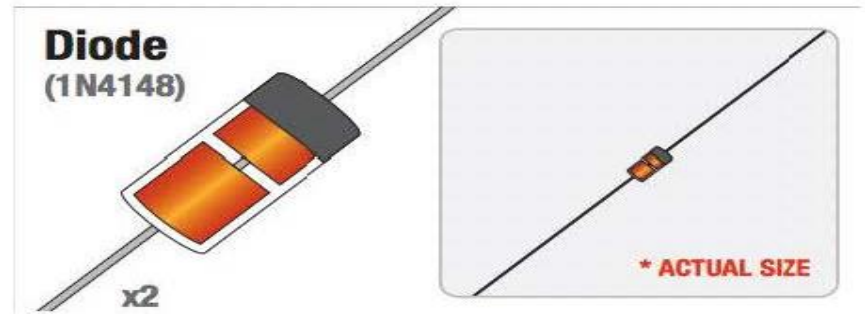
A semiconductor device used to amplify and switch electronic signals and electrical power



A transistor is a solid-state switch. When we give it a small amount of current, it can switch a much larger current.



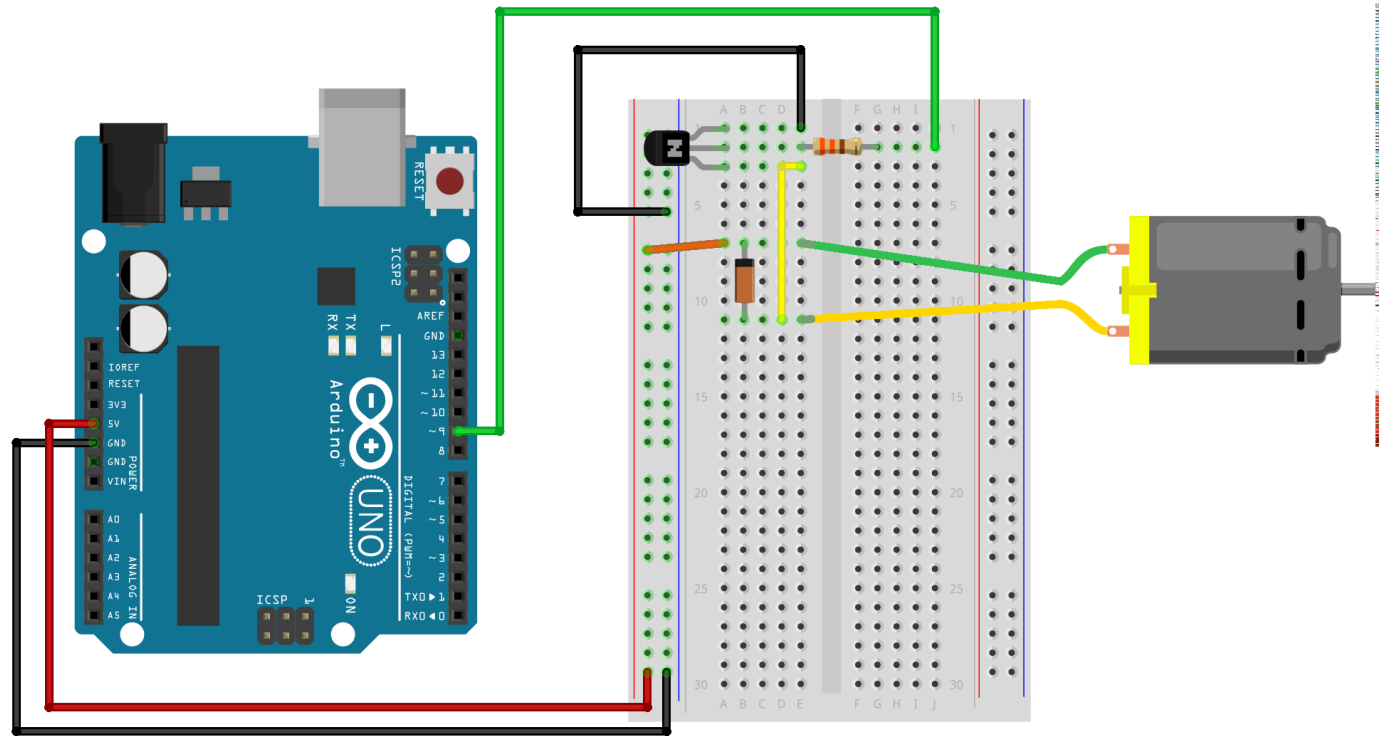
# Diode



Allows an electric current to pass in one direction, while blocking current in the opposite direction.

# DC Motor

Arduino>file>example>SIK Guide Code>Circuit\_12



# Communication Protocols

## Quick Question!

What are protocols?

Why are they important?

Give an example.

# FIRMATA



# What is Firmata?

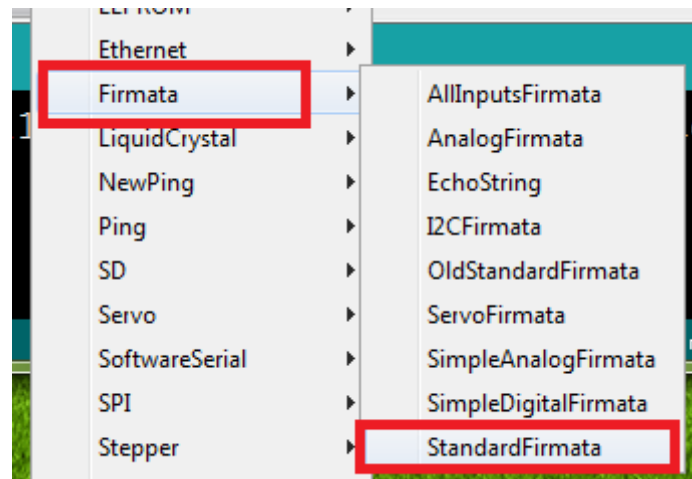
Firmata is a generic protocol for communicating with microcontrollers from software on a host computer.

# Why use Firmata?

ATmega328P microcontroller running at 16MHz, the 32Kb of memory space on an Arduino is not enough for larger projects. It would be great if we can harness the power of our PC to do the complex processing while the Arduino can be the platform for the sensors and motor controls.

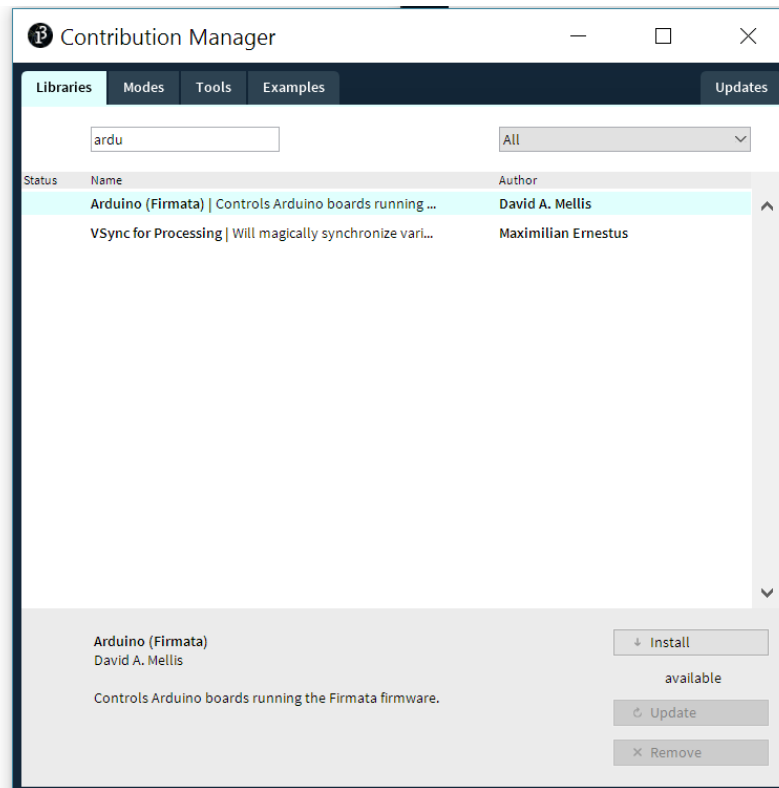
Processing = Master  
Arduino = Slave

# Load Firmata on Arduino





# Install Firmata library in Processing

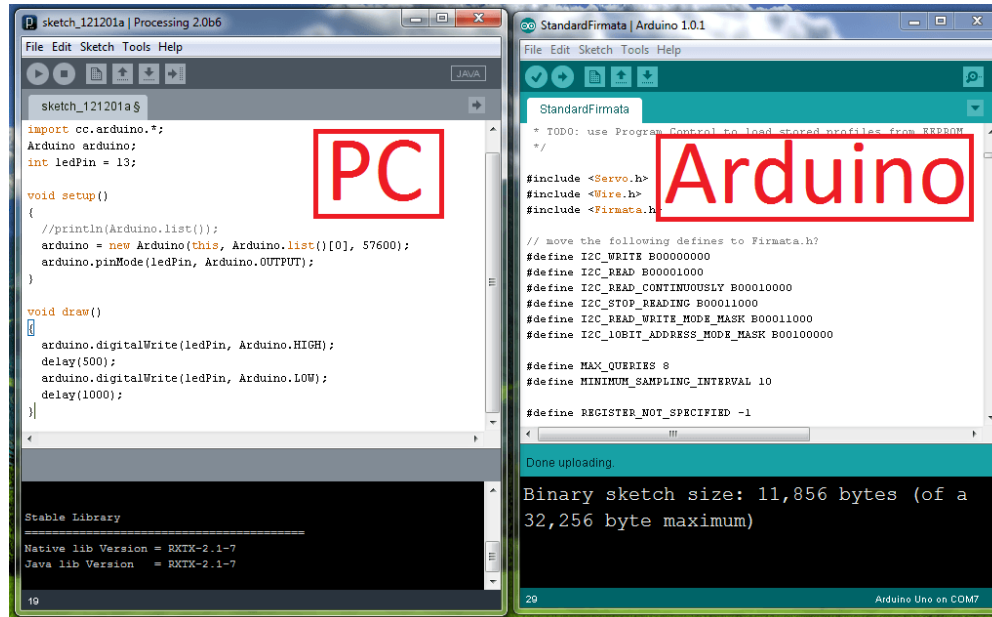


# Processing code

Now use "Open..." to open the example in the Arduino library (in Processing).

Processing Folder -> libraries -> arduino -> examples ->  
arduino\_input -> arduino\_input.pde

Now that we have both systems connected, there is no need to compile and upload to the Arduino anymore.



this is an old screenshot  
(disregard the code)

# Processing code

The sketch will :-

- draw a filled box for each **digital pin** that's HIGH (5 volts).
- draw a circle whose size corresponds to the value of an **analog input**.

# Pro Tip

Read up on OSC libraries

You can use OSC library in processing to 'talk' to other applications on same network over WiFi. Now you can clearly make much larger interconnected systems!

Processing Lib: <http://www.sojamo.de/libraries/oscP5/>

OpenFrameworks Lib: <https://github.com/palida/ofxOsc>

Full Spec: [http://opensoundcontrol.org/spec-1\\_0](http://opensoundcontrol.org/spec-1_0)

# Homework

**Use Firmata Serial library to control hardware connected to your Arduino from an interactive processing sketch.**

You know the drill:

- Submit code on github
- Video link in readme.md

Bonus Points:

Plot a visualization of a sensor data in a processing sketch

**Insane bonus:** Implement everything without firmata:

Helper code from Large Systems, MFADT Spring 2015 (Ramsey Nasser)

<https://gist.github.com/nasser/476fb7ee2e744cdc88b0>



Oh yes, midterms...  
It's time to shine!