ECSESS Robotics Club

Week 1 – Basics of Hobby Electronics

Point of this club

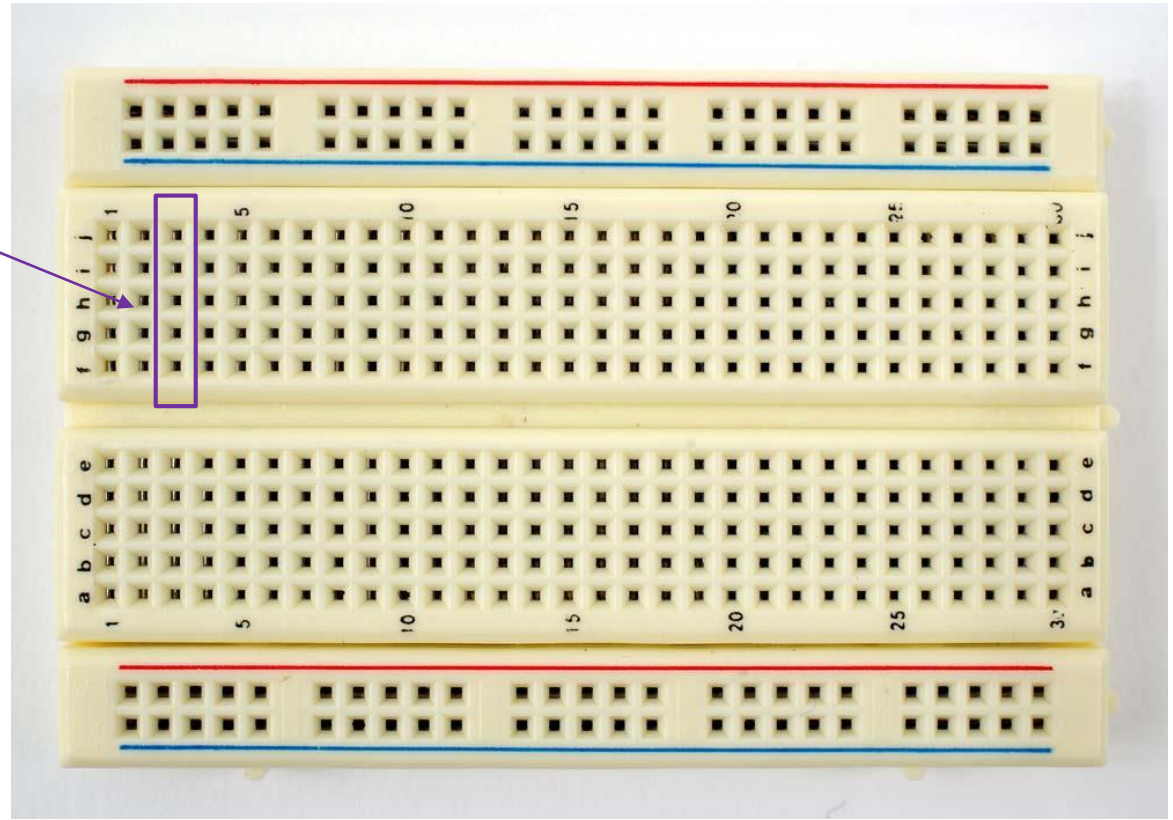
- To teach you some basic building blocks
  - Simple power supply, using microcontrollers, protoboard assembly
- With all the basics, you will be able to tackle larger projects
- Introduce you to applying what you learn/will learn in your classes
- Build super cool stuff, on your own time or at the Factory every second Thursday

Week 1 – Basics of Hobby Electronics

- Lets cover:
  - Breadboards
  - Commonly used voltage levels
  - Resistors
  - Ohms Law
  - LEDs
  - Soldering demo
  - Setting up Pickit 2 as power supply

Breadboards

Groups of 5 are connected

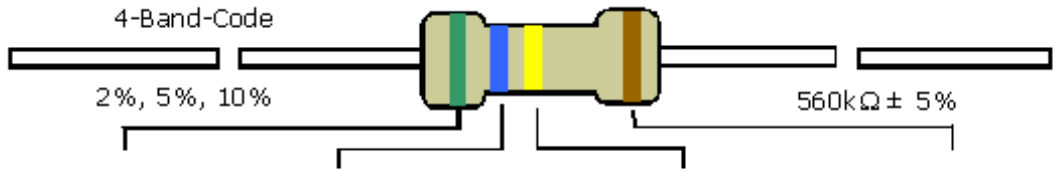


Commonly used voltage levels

- Some very common and “standard” voltage levels are 5V, 3.3V
  - You might also see 12V, etc.

- Names for “positive terminal” or “power out”:
  - **Vcc, Vdd, V+**
  - Make it a habit to make these wires **RED** for hot.
- Names for “negative terminal” or “ground”:
  - **Vee, Vss**
  - Make it a habit to make these wires **BLACK**.

Resistors + Resistor Color Code



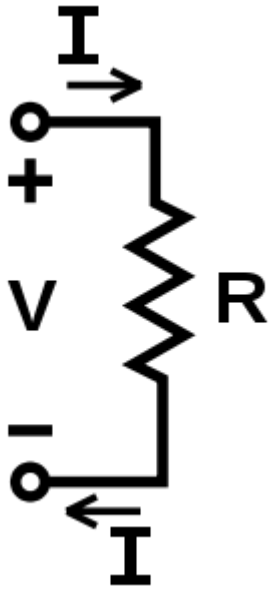
COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE	
Black	0	0	0	1Ω		
Brown	1	1	1	10Ω	± 1%	(F)
Red	2	2	2	100Ω	± 2%	(G)
Orange	3	3	3	1KΩ		
Yellow	4	4	4	10KΩ		
Green	5	5	5	100KΩ	±0.5%	(D)
Blue	6	6	6	1MΩ	±0.25%	(C)
Violet	7	7	7	10MΩ	±0.10%	(B)
Grey	8	8	8		±0.05%	
White	9	9	9			
Gold				0.1	± 5%	(J)
Silver				0.01	± 10%	(K)

Electronix Express / RSR
http://www.elexp.com

1-800-972-2225
In NJ 732-381-8020

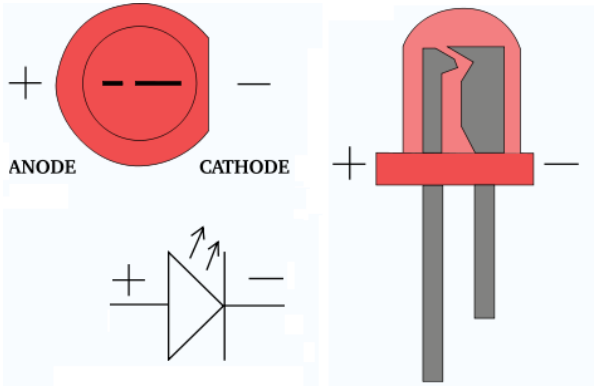
Ohms Law $V = IR$

- Resistors “slow down” current and have a voltage drop



LEDs

- LEDs are diodes which drop a voltage across them and output light in the visible spectrum.
- Different colors will have a different voltage drop from 2V to 3V
- The SHORTER leg goes towards ground
- Max current of 20mA is our limitation



Different voltage drops for different colors

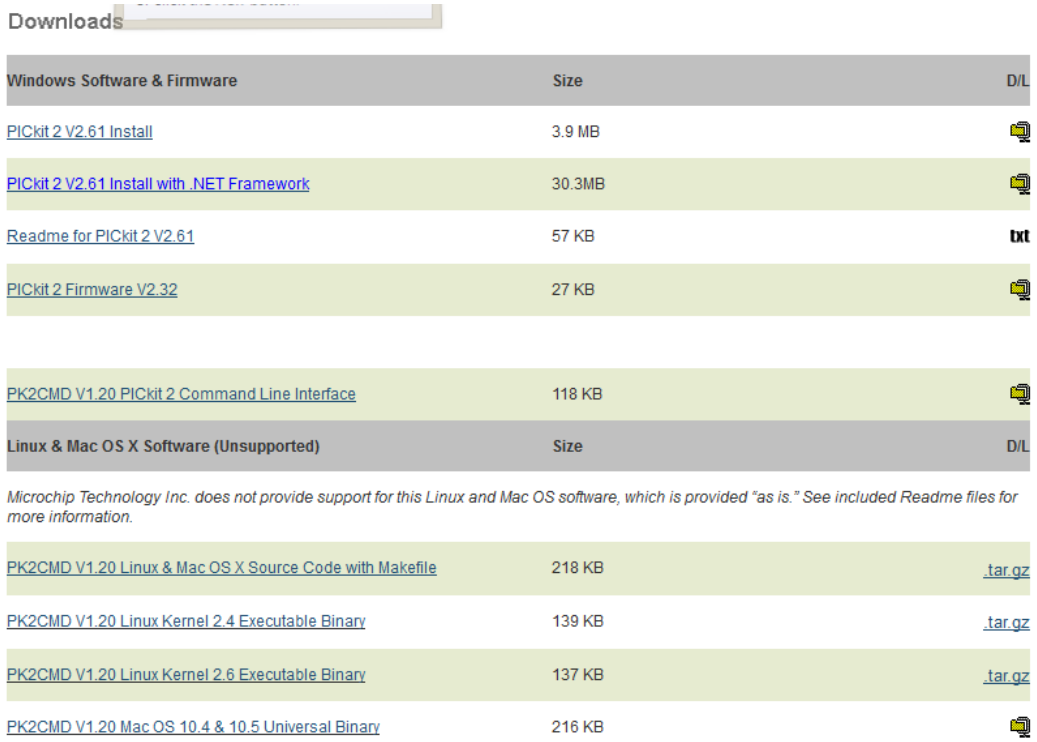
Use: Blue, Green = 3V drop; Yellow, Red, Orange = 2V drop

With a 3.3V supply: Use 56ohm for 3v, 150ohm for 2v

1206 smd LEDs 3.2x1.6x1.1MM		Forward voltage		Dominant wavelength		Luminous Intensity		Viewing angle
Part number	Emitting Color	(V) IF=20mA		IF=20mA		(mcd) IF=20mA		
		TYP	MAX	MIN	MAX	TYP	MAX	(degree)
SS-1206R	Red	2.1	2.3	640	650	650	660	120
SS-1206Y	Yellow	2.2	2.8	590	600	550	560	120
SS-1206O	Orange	2.2	2.8	635	645	470	480	130
SS-1206B	Blue	3.2	3.4	465	475	650	660	120
SS-1206G	Plain Green	3.2	3.4	568	573	420	430	120
SS-1206JG	Jade-green	3.2	3.4	530	540	590	600	120
SS-1206W	White	3.2	3.4	X=0.285	Y=0.295	500	800	120
SS-1206P	Pink	3.2	3.4	----	---	300	400	120
SS-1206UV	UV(Purple)	3.2	3.4	380	400	120	160	120

How to set up your programmer as a power supply.

- Download and install Pickit 2 driver from: http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en023805

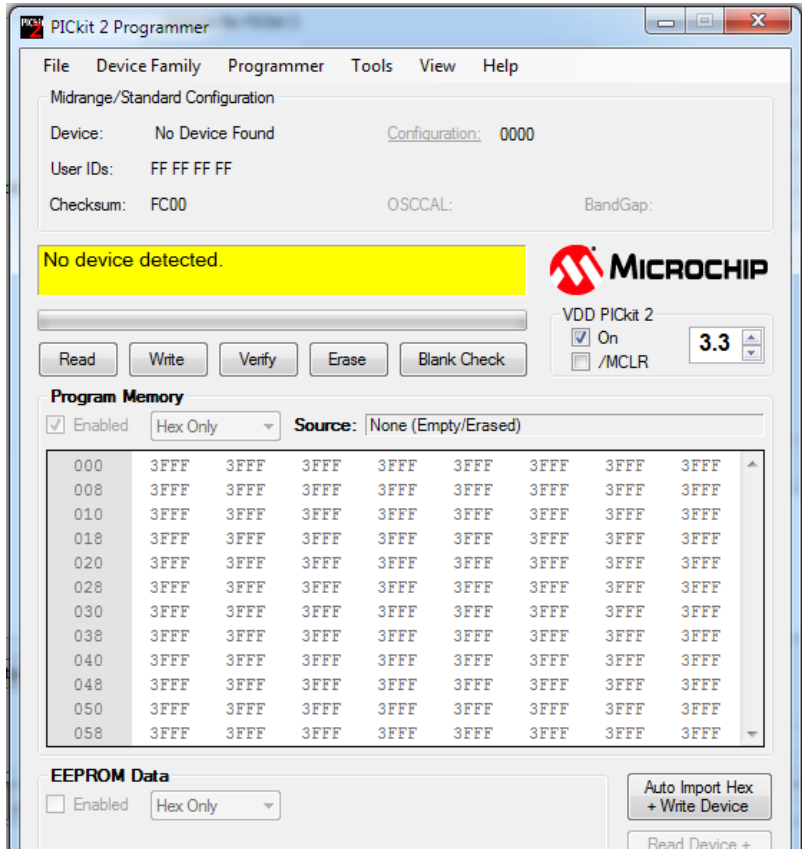


Downloads

Windows Software & Firmware	Size	D/L
PICkit 2 V2.61 Install	3.9 MB	
PICkit 2 V2.61 Install with .NET Framework	30.3MB	
Readme for PICkit 2 V2.61	57 KB	txt
PICkit 2 Firmware V2.32	27 KB	
PK2CMD V1.20 PICkit 2 Command Line Interface	118 KB	
Linux & Mac OS X Software (Unsupported)	**Size**	**D/L**
Microchip Technology Inc. does not provide support for this Linux and Mac OS software, which is provided "as is." See included Readme files for more information.		
PK2CMD V1.20 Linux & Mac OS X Source Code with Makefile	218 KB	.tar.gz
PK2CMD V1.20 Linux Kernel 2.4 Executable Binary	139 KB	.tar.gz
PK2CMD V1.20 Linux Kernel 2.6 Executable Binary	137 KB	.tar.gz
PK2CMD V1.20 Mac OS 10.4 & 10.5 Universal Binary	216 KB	

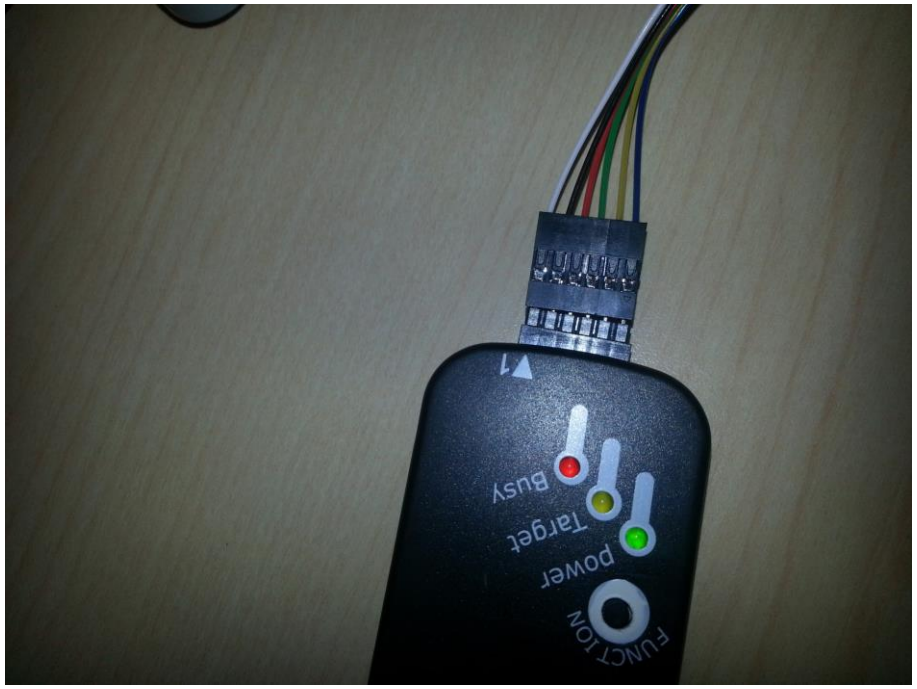
How to set up your programmer as a power supply.

- Run the pickit2 software
- Turn on 3.3 V
- Target light on your programmer will turn yellow



How to set up your programmer as a power supply.

- If you follow this picture, the **black wire** will be **power (3.3V)** and the **red** wire will be **ground**. This is because the company randomly chose which wire colors go where. It is the exact OPPOSITE of the color convention so be careful!



Week 1 To-Do

- Design your robot on paper, then build it!
- Solder on wires for the motors, make sure they are at least 10cm each. Use a color other than red or black.
- Get one team member to work on the Yellow / Blue LEDs + Pickit 2 Power supply.
- Once your motor box is assembled and built, bring it to the power station and make sure the motors work!

Week 1 To-Do Continued

- You must leave room for the proto board and battery packs. Look at my design for size reference.
- Make sure it is solid, people wanted robo-carnage.
- Size constraint: it must fit inside the box you were given, with enough room for your tools and equipment.
- I found that 3 pieces of foam board thick was the perfect high to have robot off ground but wheels touching.
- Detach the **LED cover** for today, you will be soldering those wires next week

Bonus

- Try playing around with the tri-color LED
- Can you make it make the following colors?
  - Blue
  - Green
  - Red
  - Yellow
  - Cyan
  - Magenta
  - White