Electrical Training
Session 2

September 15, 2014

Announcements

- All teams are now meeting at the shop
  - Carpool pickup locations at *CULC* & *Love*
  - Green Route bus (last pickup @ 9:00pm)
- Attendance will be taken at all RoboJackets events starting 09/15/2014

RoboJackets

Announcements

- Everyone should know what team of RoboJackets they wish to participate with

- Everyone should know what subteam they wish to join by the end of this week

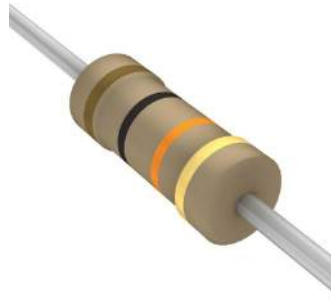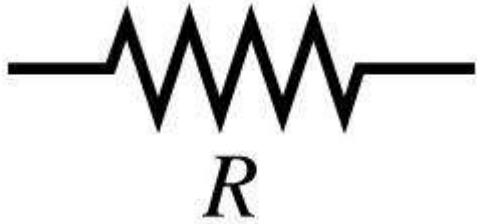- Is anyone not subscribed to their team's mailing list?

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Outline

- Electrical circuit elements

- Motor basics (Brushed vs. Brushless)

- Exercises and preparation for next week

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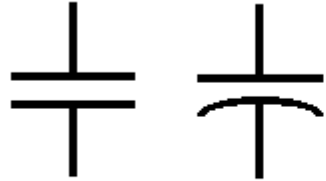# What is a Resistor?

- Element that inhibits the flow of electrons

What is a Capacitor?

- Element that temporarily stores electrical energy

What is an Inductor?

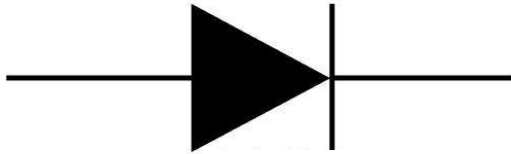- Element that temporarily stores energy in the form of a magnetic field among its coils

What is a Diode?

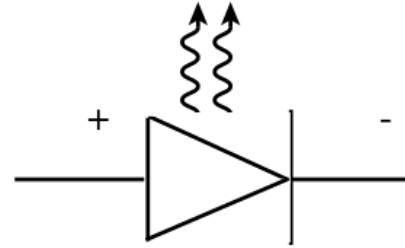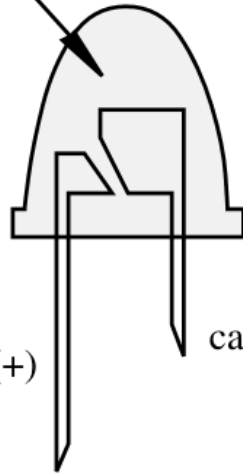- Element that limits the flow of electrons to one direction

What is an LED?
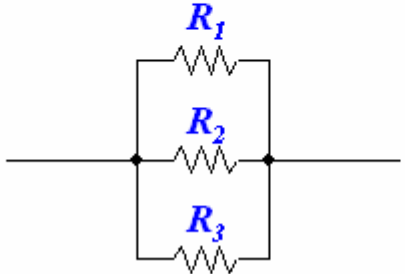
- Type of diode that emits light

colored plastic lens

anode (+)

cathode (-)

schematic symbol

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Series vs. Parallel

Series: R_1 R_2 R_3 = $R_{eq}=R_1+R_2+R_3$

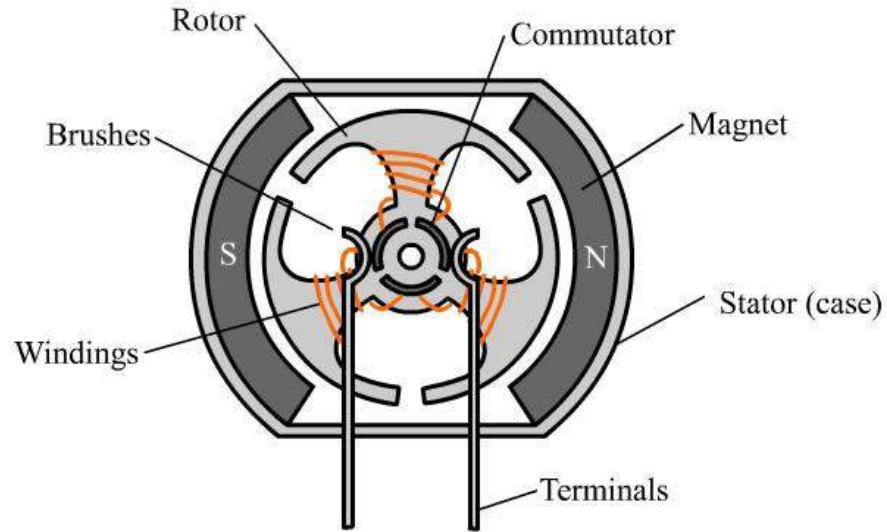Parallel: R_1 R_2 R_3 = $R_{eq}=(1/R_1+1/R_2+1/R_3)^{-1}$

Motor Control

- IGVC uses two (2) *brushed DC motors*
  - controlled with 2 arduinos and two Open Source Motor Controllers
- Battlebots uses similar motors to IGVC
- RoboCup uses five (5) *brushless DC motors*
  - controlled by an FPGA on custom PCB board
  - 4 *drive* motors, 1 *dribbler* motor

Brushed DC Motors

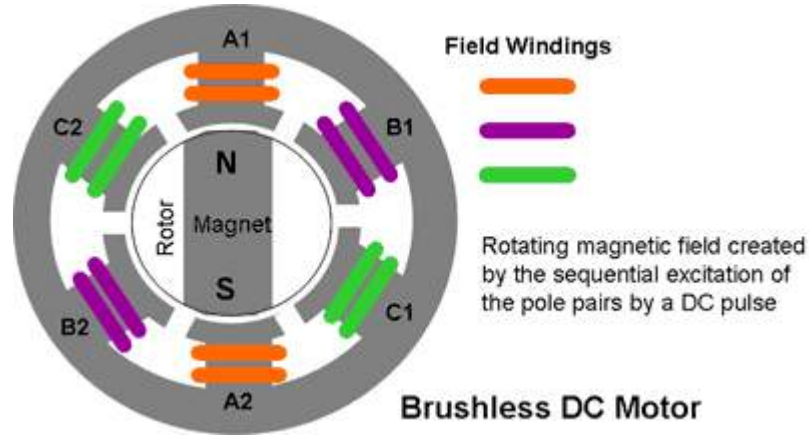Typical Brushed Motor in Cross-section

Rotor · Commutator · Magnet · Brushes · Windings · Stator (case) · Terminals · S · N

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Brushless DC Motors (BLDC)

Brushless DC Motor

https://www.youtube.com/watch?v=ZAY5JInyHXY

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Applications of each

Brushed

- Lower cost
- Less efficient
- Shorter lifespan
- Easy to operate

Brushless

- Higher cost
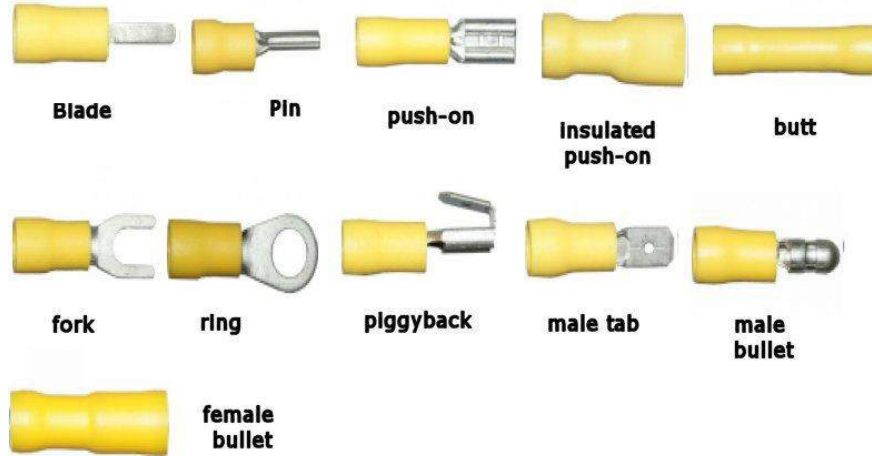- More efficient
- Longer lifespan
- Complex to operate

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Wire Crimping

Large Gauge Crimping

Blade   Pin   push-on   Insulated push-on   butt

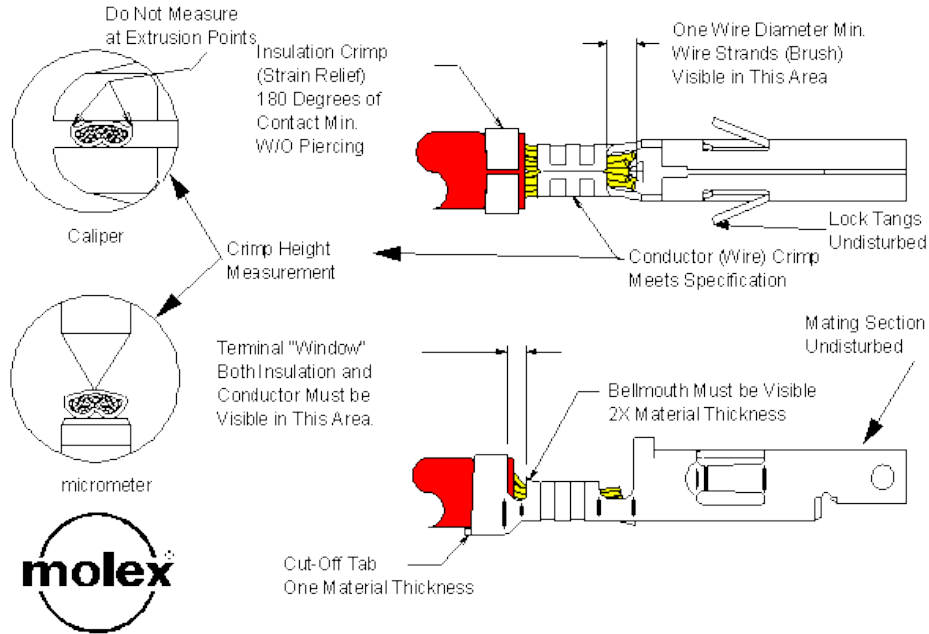fork   ring   piggyback   male tab   male bullet

female bullet

https://learn.sparkfun.com/tutorials/working-with-wire/how-to-crimp-an-electrical-connector

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Small Gauge Crimping

GOOD CRIMP

Preparation for next week

- Watch this video on Kirchoff's Voltage Law
  - https://www.youtube.com/watch?v=JOGygS0AvQE
- There will be a exercise next week using concepts from the video. Explore further if needed - many resources online.

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Next Week

- Special soldering session
  - CCB 337 @ 6:00 PM

Resources for Learning

- IGVC's **O**pen **S**ource **M**otor **C**ontroller (OSMC)
  - http://www.robotpower.com
- RoboJackets *Wiki How to Guides*
  - http://wiki.robojackets.org/w/How_to_Guides
- Git Cheat Sheet
  - https://training.github.com/kit/downloads/github-git-cheat-sheet.pdf