

# MOTORS AND BATTERIES

IMDL Spring 2016

Andy Gray

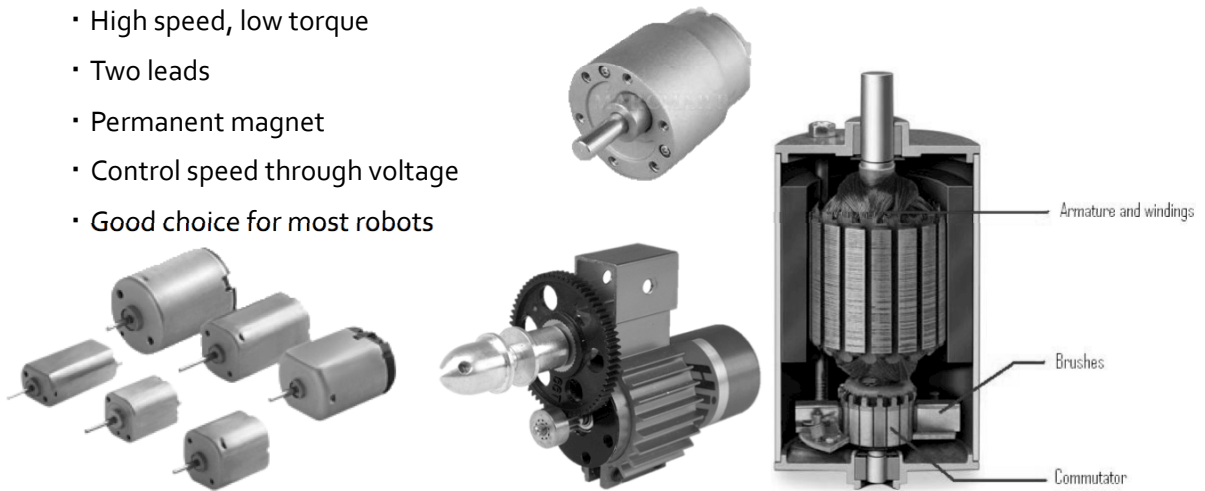
## OBJECTIVES

- Types of motors
- Selecting a motor
- Motor controllers
- Mounting motors/wheels/tracks/propellers
- Servos
- Servo accessories
- Linear actuators
- LiPo Batteries
- Charging LiPos
- Battery connectors



## BRUSHED MOTORS

- High speed, low torque
- Two leads
- Permanent magnet
- Control speed through voltage
- Good choice for most robots



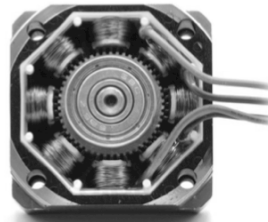
## HOBBY BRUSHLESS MOTORS

- No contact
- Continuous turn
- Permanent magnets
- Control speed through timing
- Light weight
- Powerful



## STEPPER MOTORS

- No contact
- High holding torque
- Stepped
- Permanent magnets
- Control speed/position through timing
- Heavier than brushless
- Less efficient
- Sometimes have gearbox



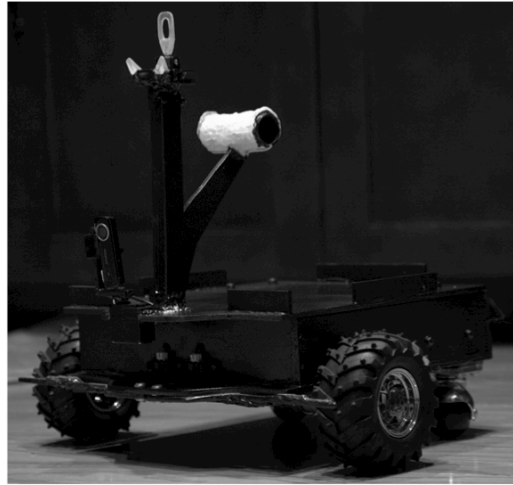
## SELECTING A MOTOR

- Weight of robot
- Size of robot
- Speed of robot
- Motor voltage
- Motor current
- Motor speed
- Motor torque
- Mounting options
- Size of motor
- Over-voltaging motors



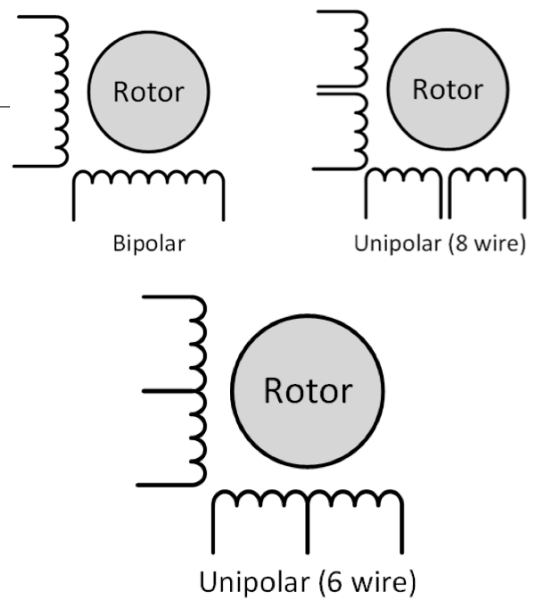
## BIRDBUGGY MOTORS

- 10 lbs
- Slow (.25 m/s)
- Medium size
- 6 V (8.4V at 60%)
- 2.4 A stall
- 85 oz-in
- 82 RPMs



## STEPPER MOTORS

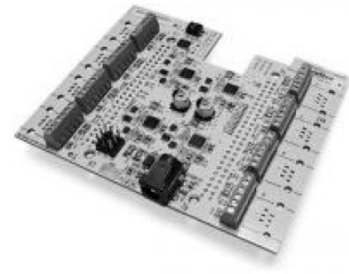
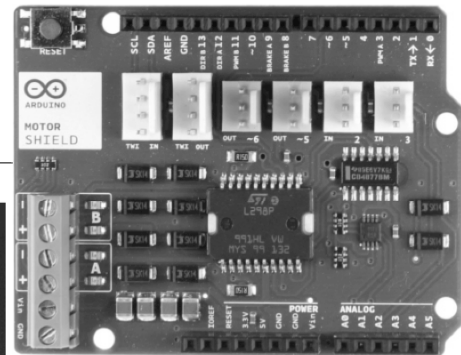
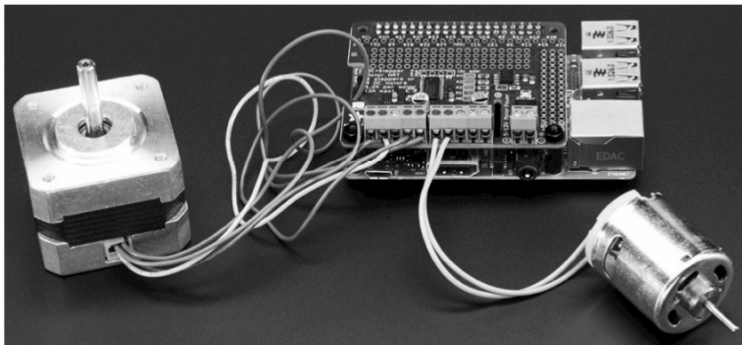
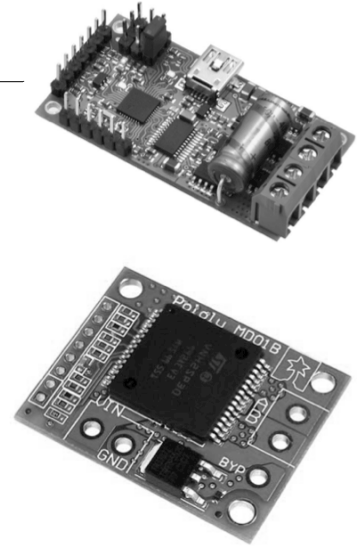
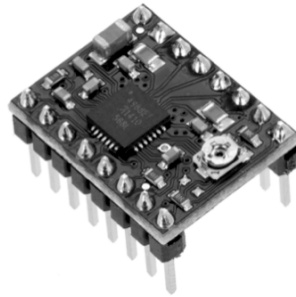
- Voltage (can overvoltage with driver)
- Current (very important)
- Step count (resolution)
  - Speed (low resolution)
  - Torque (high resolution)
- Gearing
- Bipolar (2 phase), Unipolar (4 phase)

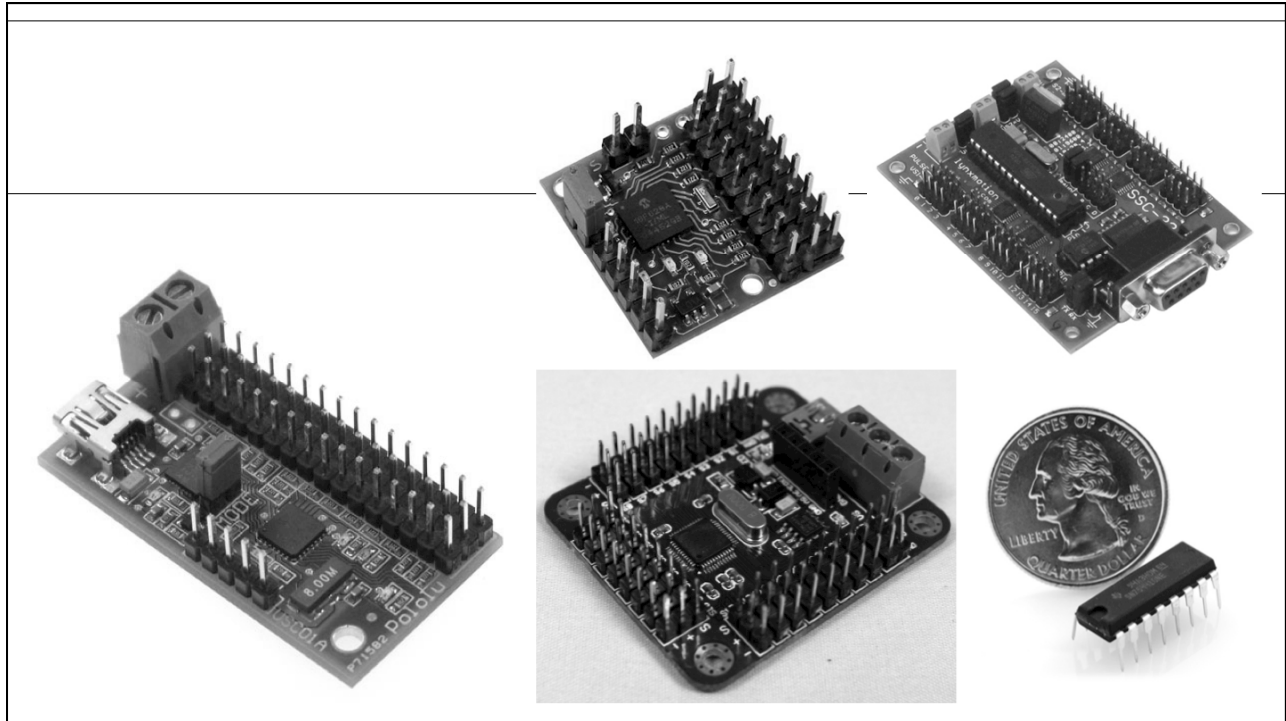




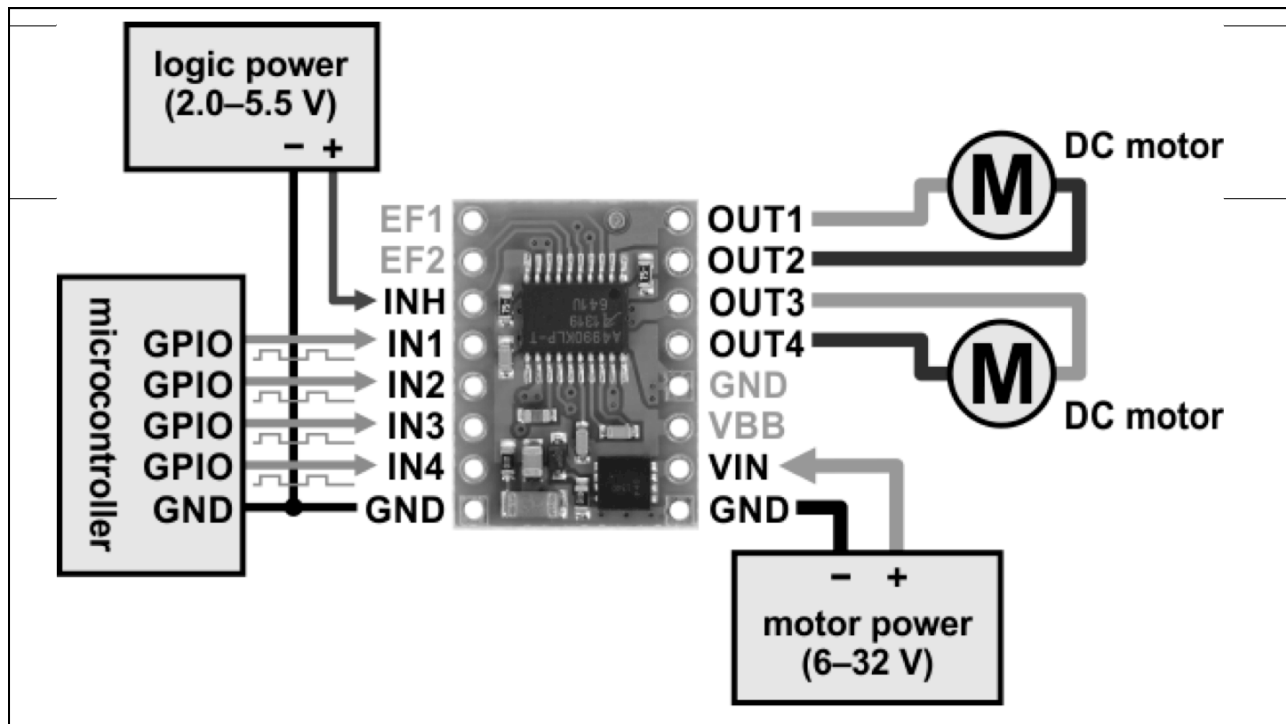
## MOTOR CONTROLLERS/DRIVERS

- Brushed DC Motor Controllers
- Brushed DC Motor Driver
- Stepper Motor Drivers
- ESCs



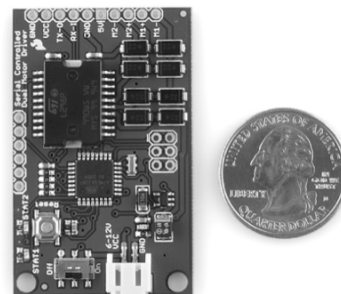


<p>GND VCC AO1 AO2 BO2 BO1 VMOT GND</p>		<p>PWMA AIN2 AIN1 <u>STBY</u> BIN1 BIN2 PWMB GND</p>
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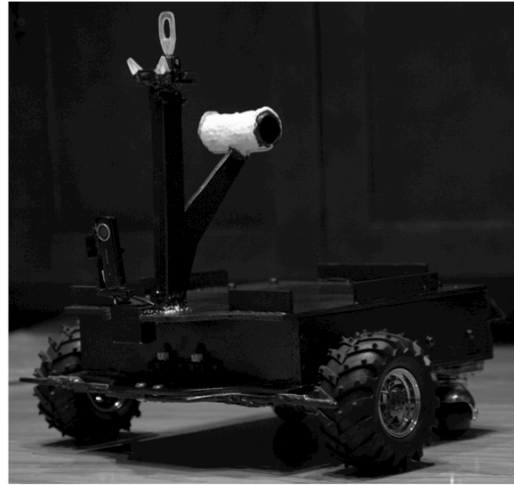
## SELECTING A DC MOTOR CONTROLLER/ DRIVER

- Voltage rating
- Current rating
- Cost
- Single or dual motor controller/driver
- Communication
  - GPIO pins (PWN)
  - Serial
  - USB
  - RS232



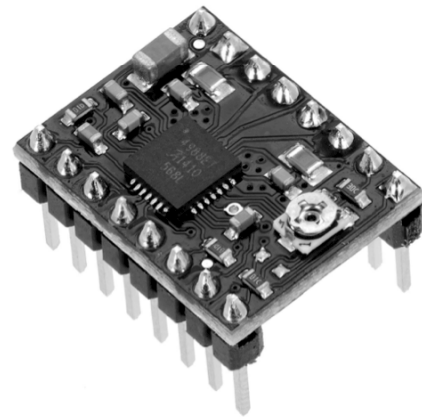
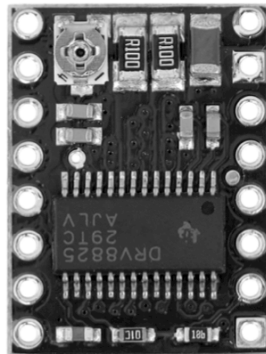
## BIRDBUGGY MOTORS

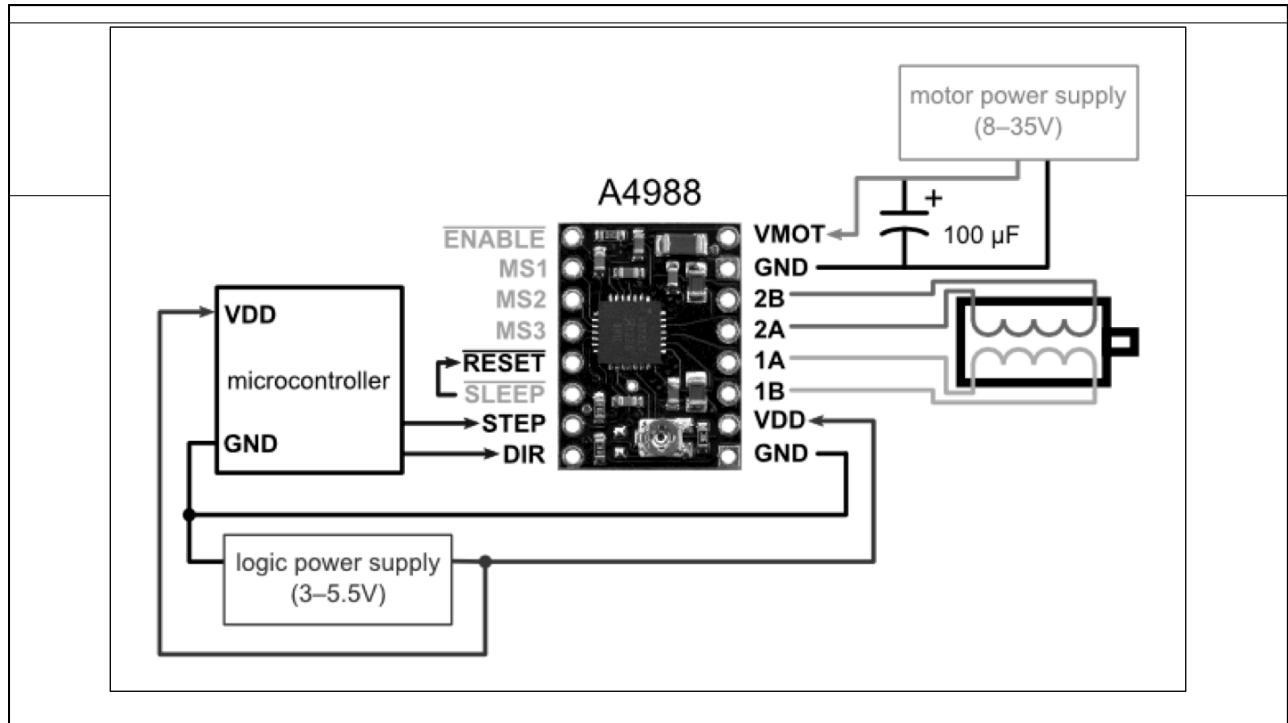
- Motors
  - 6 V (8.4V at 60%)
  - 2.4 A stall
  - 150 mA free-run
- Battery
  - 2 cell LIPO battery (8.4V)
- Motor Controller
  - Dual motor driver carrier
  - 4.5V-13.5V
  - 3A peak (1A continuous)



## STEPPER MOTOR DRIVERS

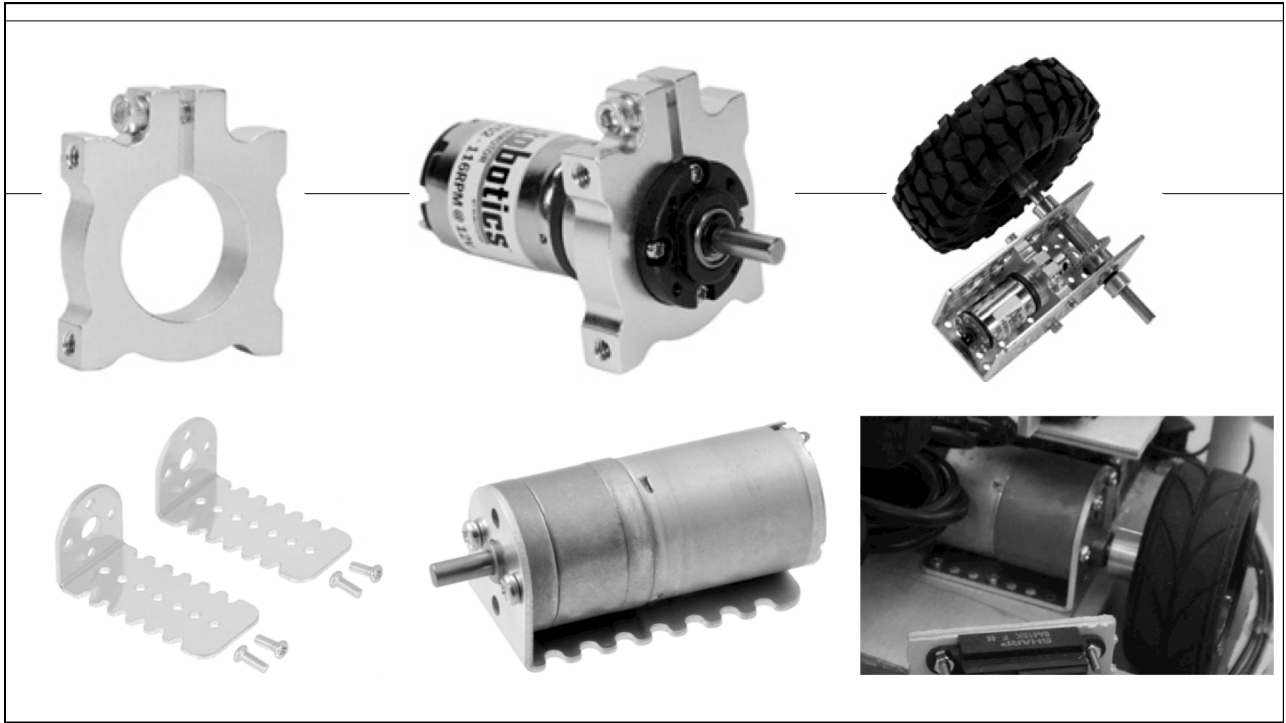
- Voltage rating
- Current rating (Adjustable current rating)
- Dual DC motor controller
- Bipolar or unipolar
- Microstepping

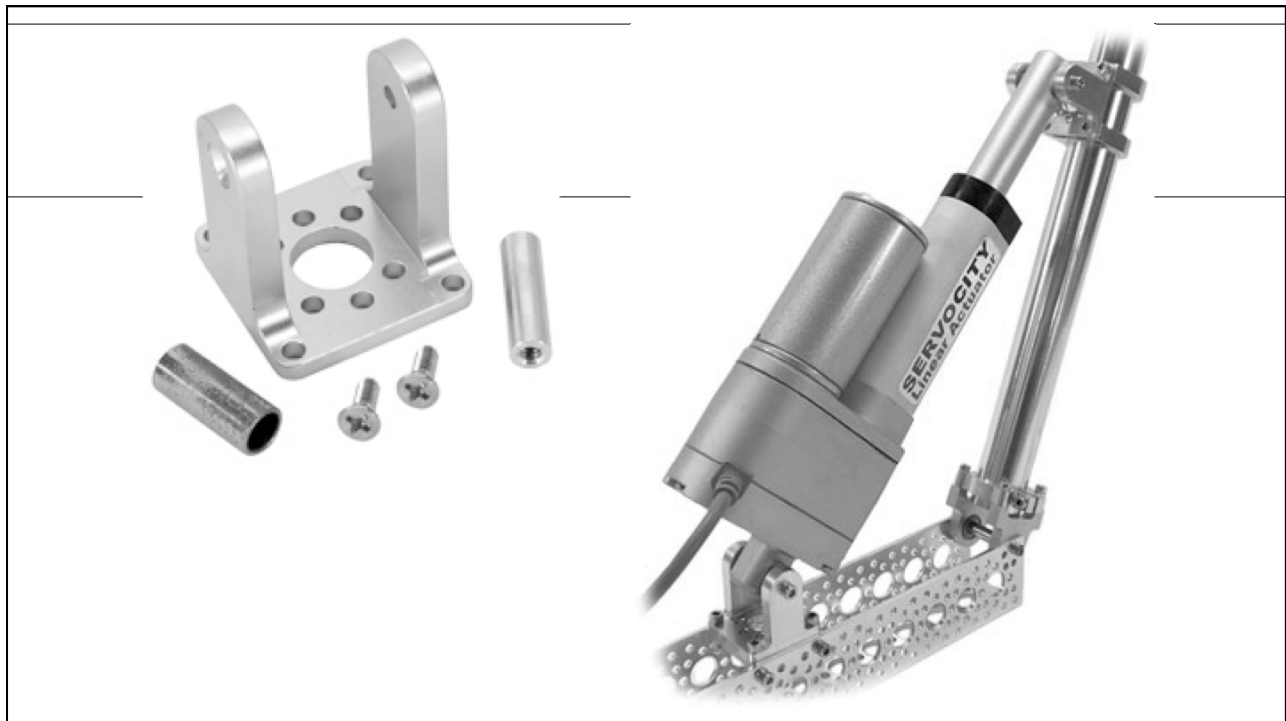
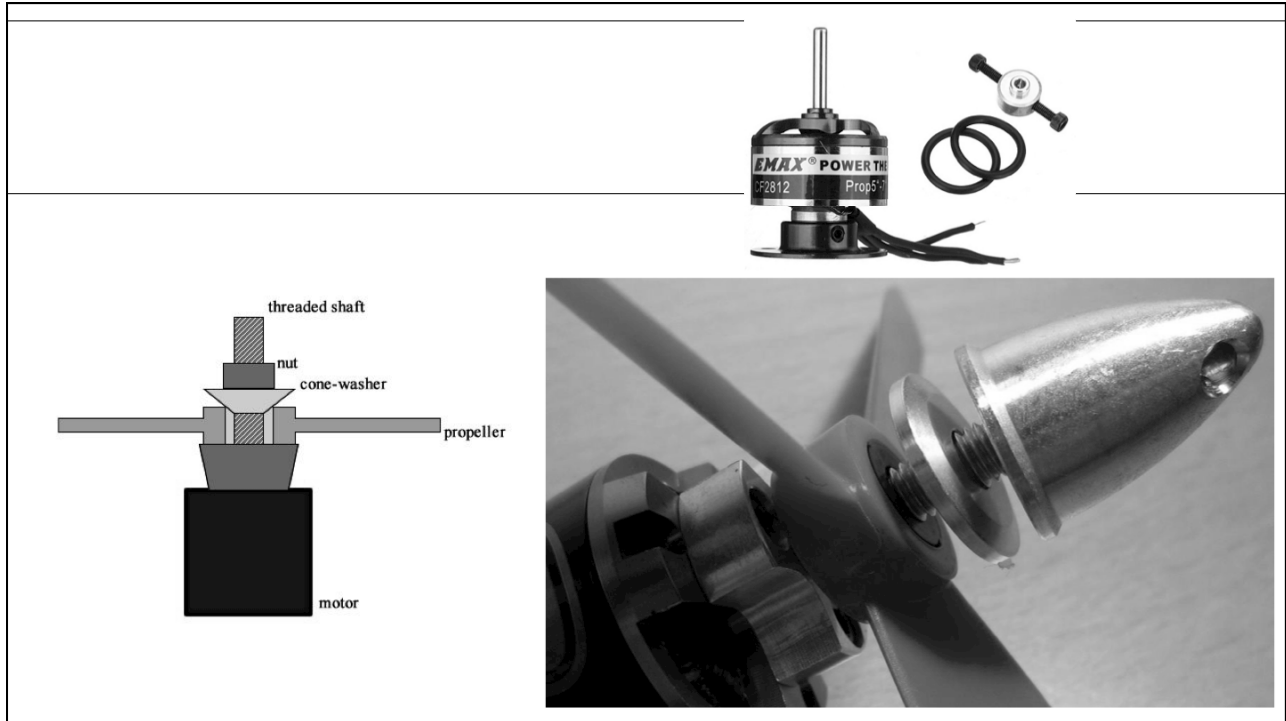


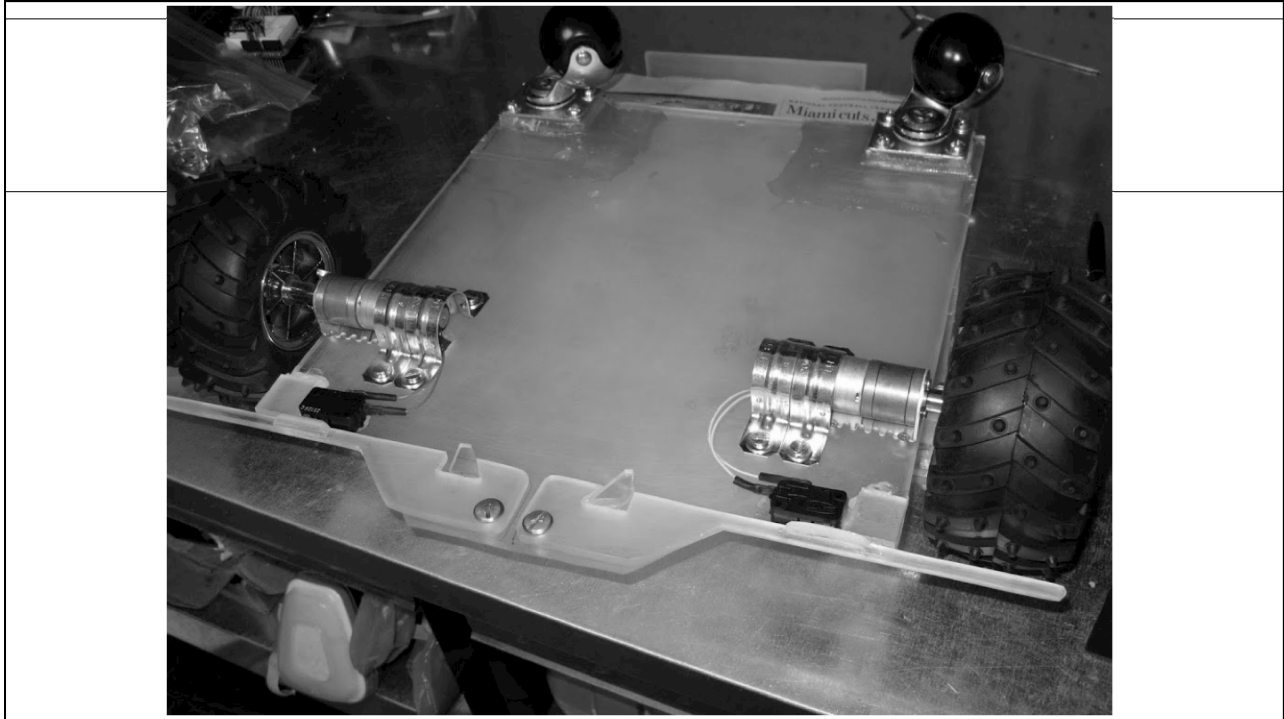


## MOUNTING COMPONENTS

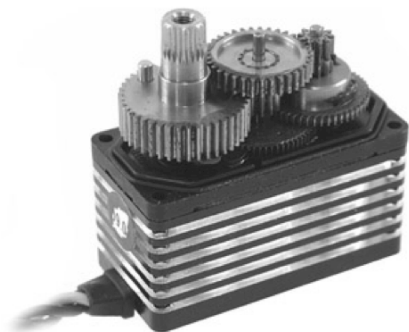
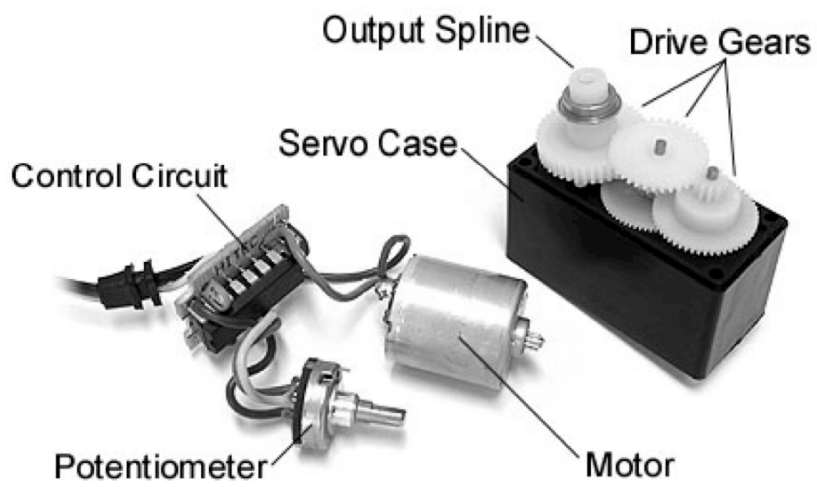




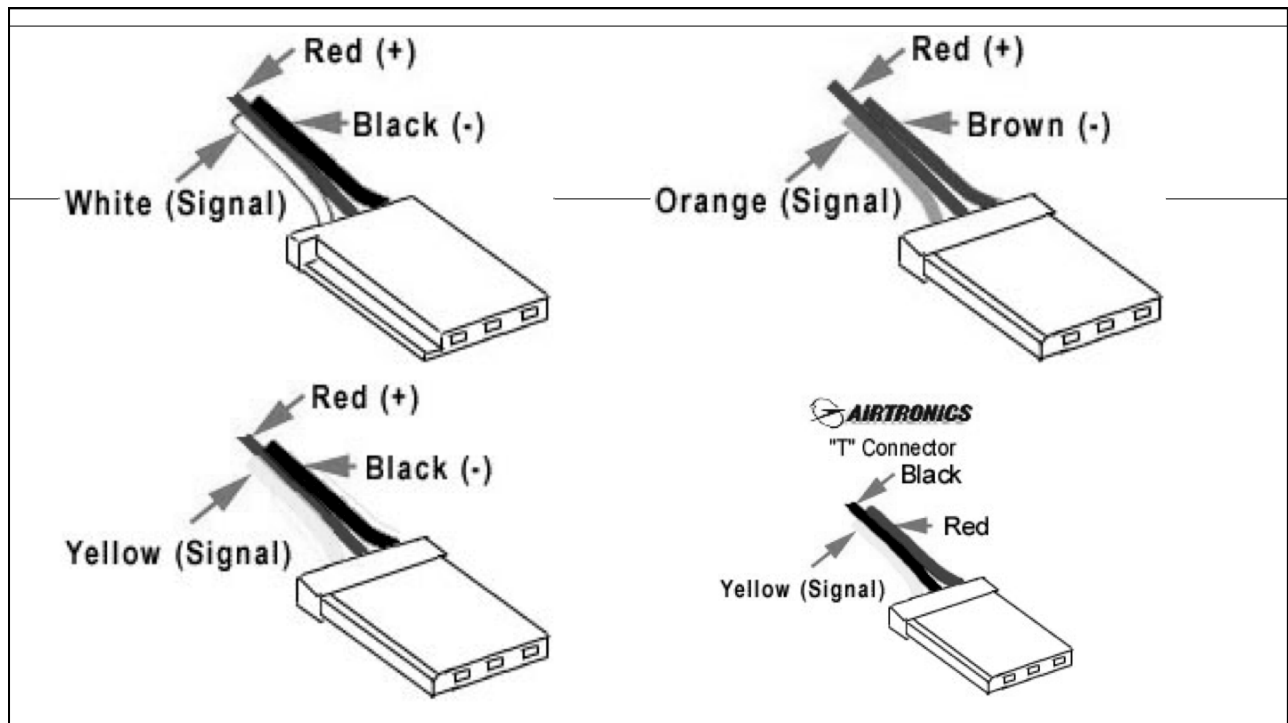
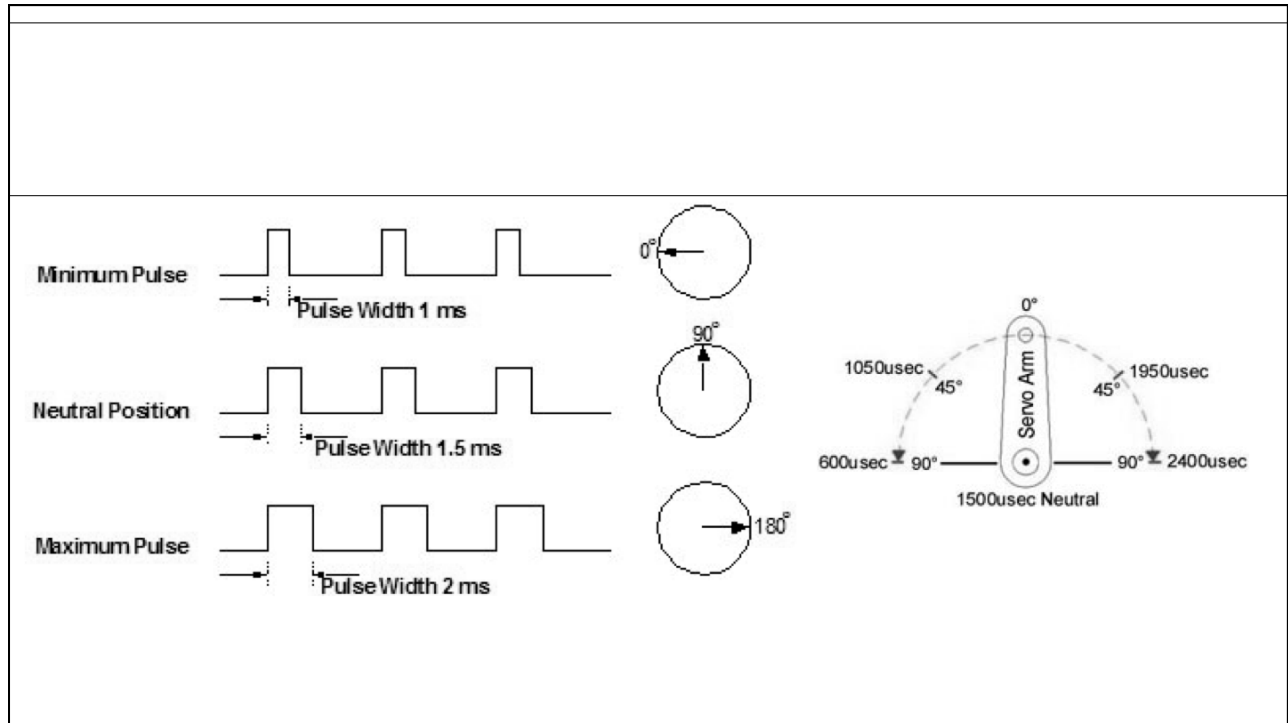




# SERVOS





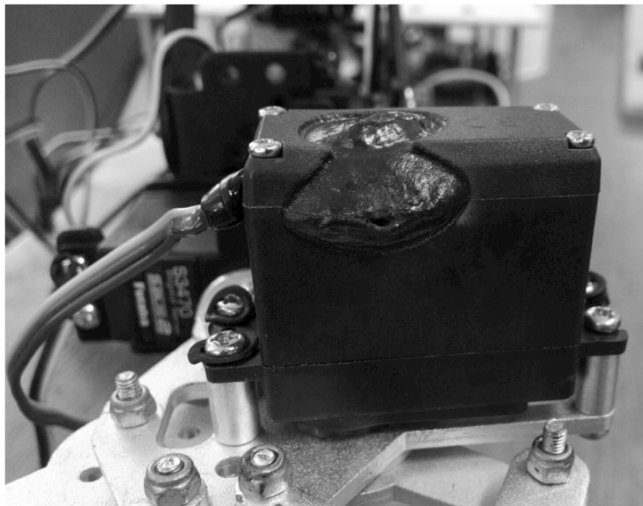


## WHAT TO LOOK FOR

- Torque
- Speed
- Cost
- Servo range (90-180 deg)
- Size
- Type
- Voltage

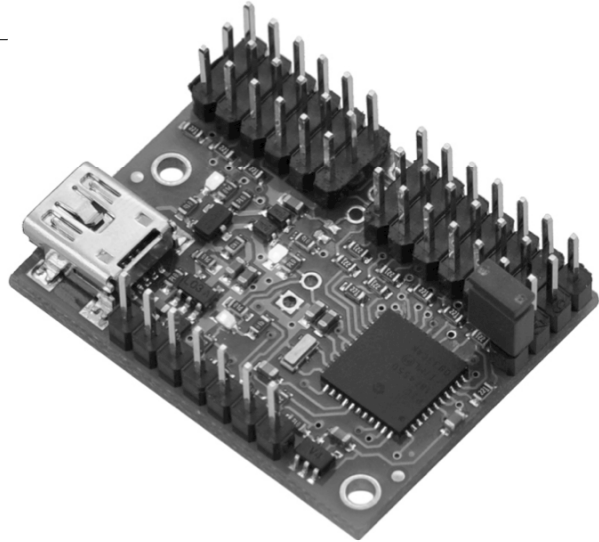
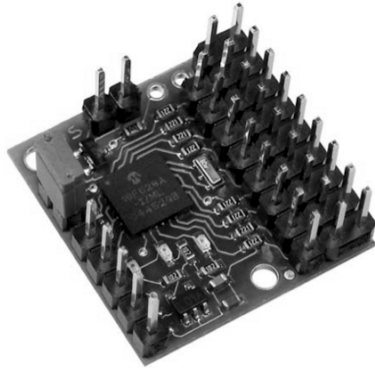


## TOWER PRO



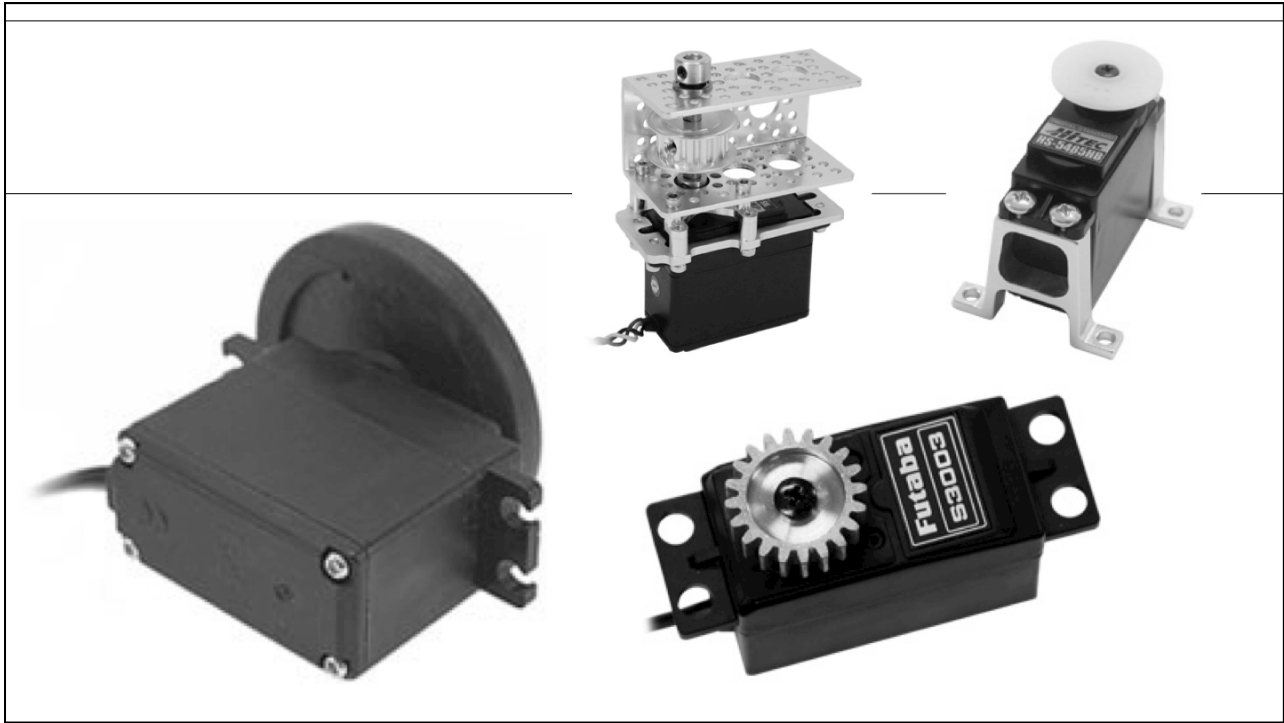
## SERVO CONTROLLERS

- Number of servos supported
- Communication method

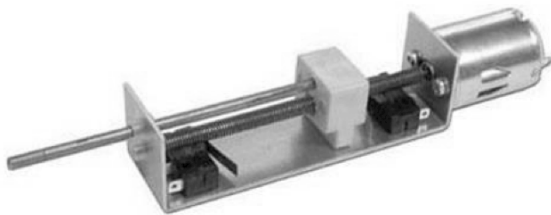


## SERVO ACCESSORIES

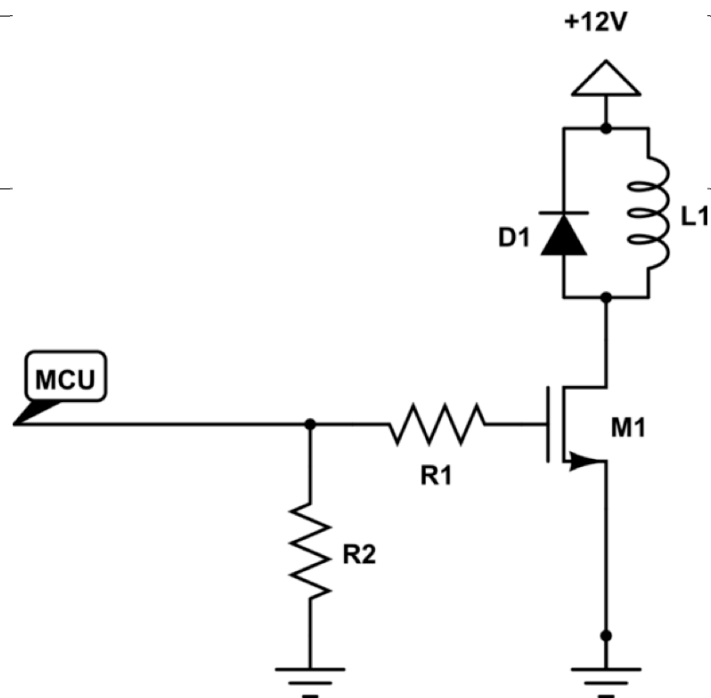
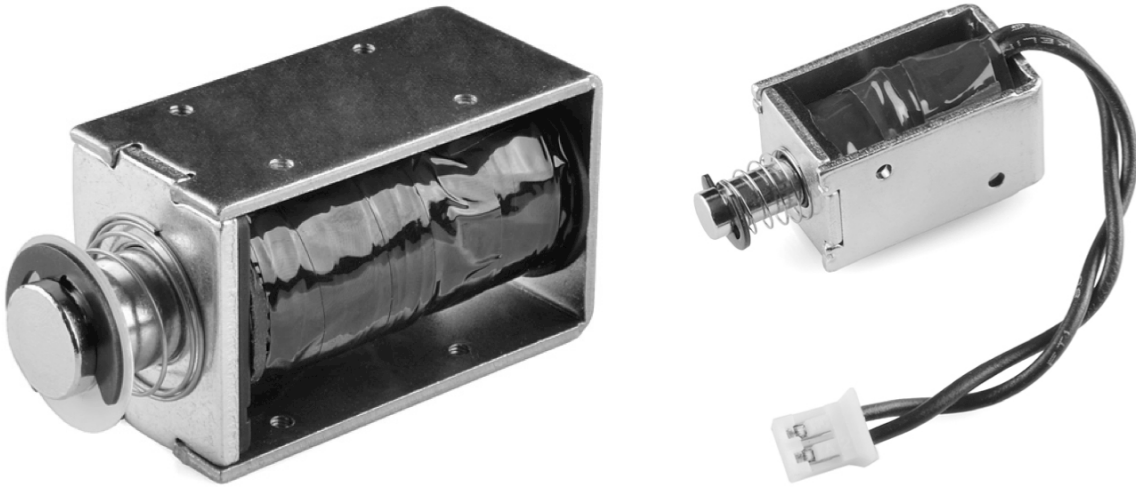


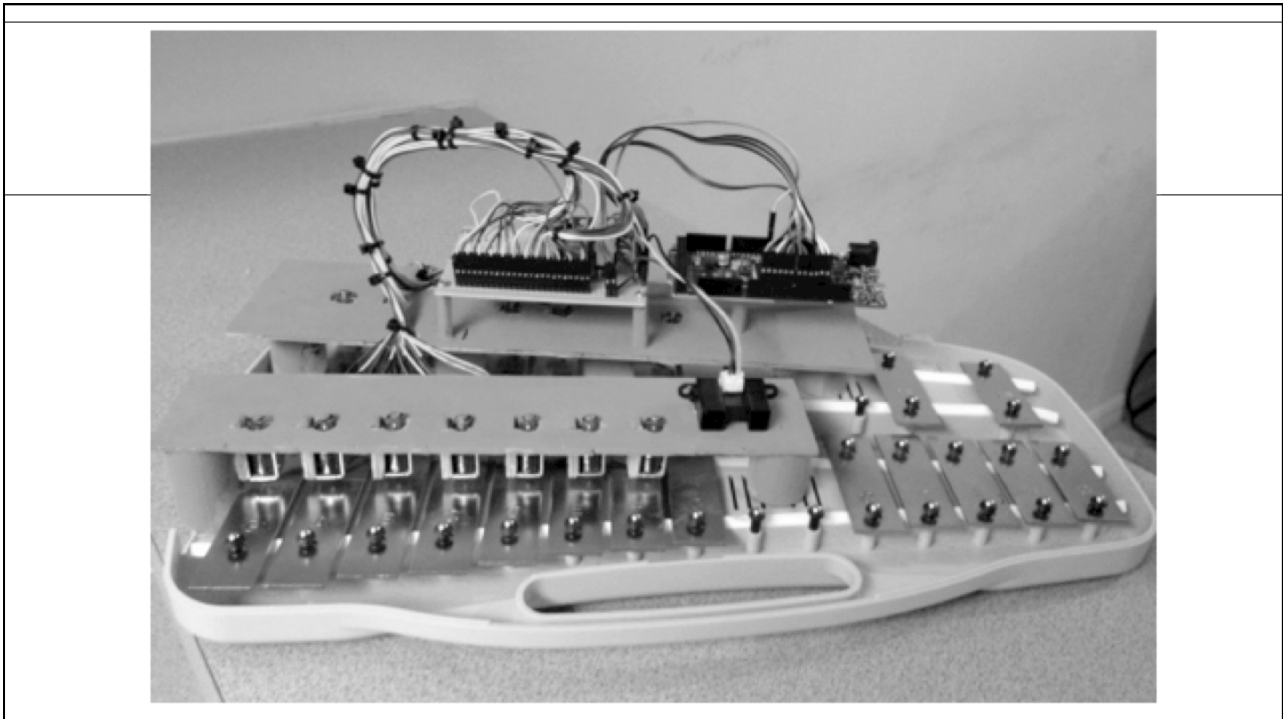


## LINEAR ACTUATORS



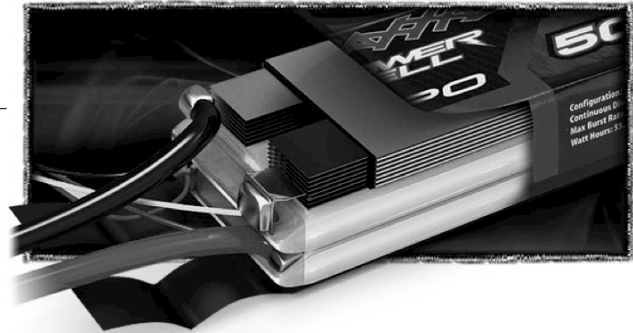
## SOLENOIDS





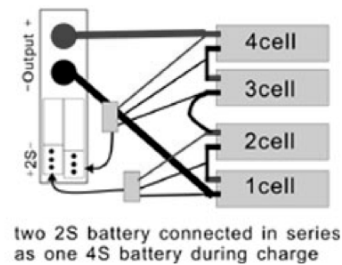
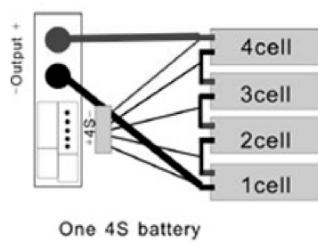
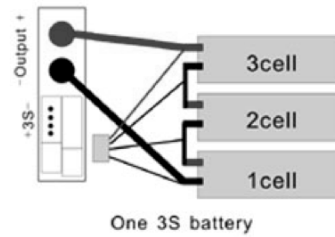
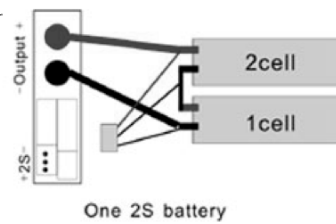
# LIPO BATTERIES

- Energy dense
- Fast charge
- High discharge
- Popular



# LIPO BATTERY CELLS

Charging Connection diagram for CHARGER 0410B



## CHOOSING A LIPO

- Cells voltage: 3.3 – 4.2 (3.7)V
- Current rating
- Cost
- Discharge rating
- Size



## ESTIMATING RUN TIME

- Time desired: 3 hours
- BeagleBone Black: 350 mA (5V)
- Motors: 2 x 200 mA (6V)
- Web cam: 100 mA (5V)
- WiFi USB: 100 mA (5V)
- uController: 50 mA (6V)
- What mah rating do I want?
- How many cells?





## BAD LIPOS

- Don't pierce the casing
- Don't overcharge
- Don't overdraw



## CHARGING BATTERIES

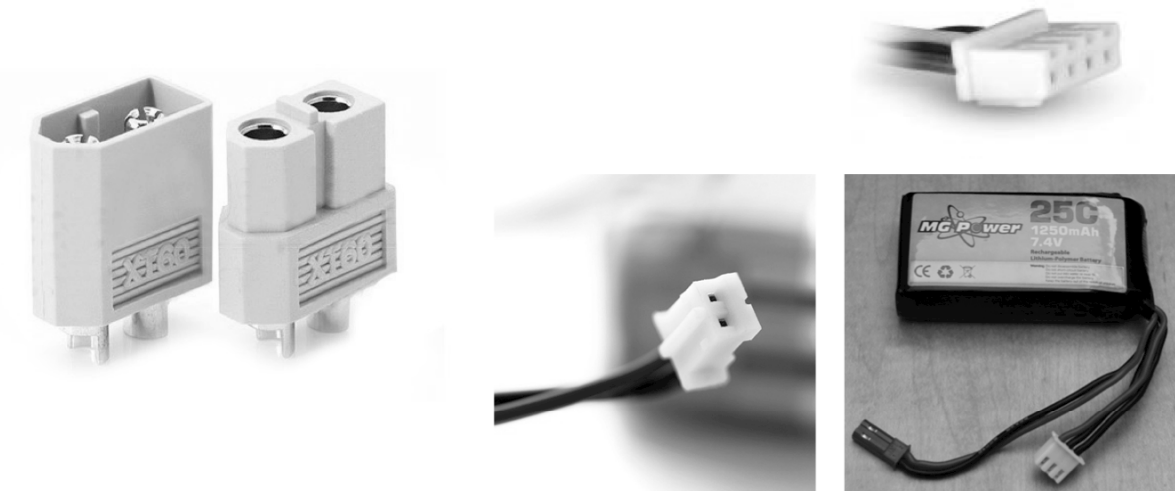
- Support amount of cells
- Match current rating (preferably)



## BATTERY MONITOR



## BATTERY CONNECTORS



QUESTIONS