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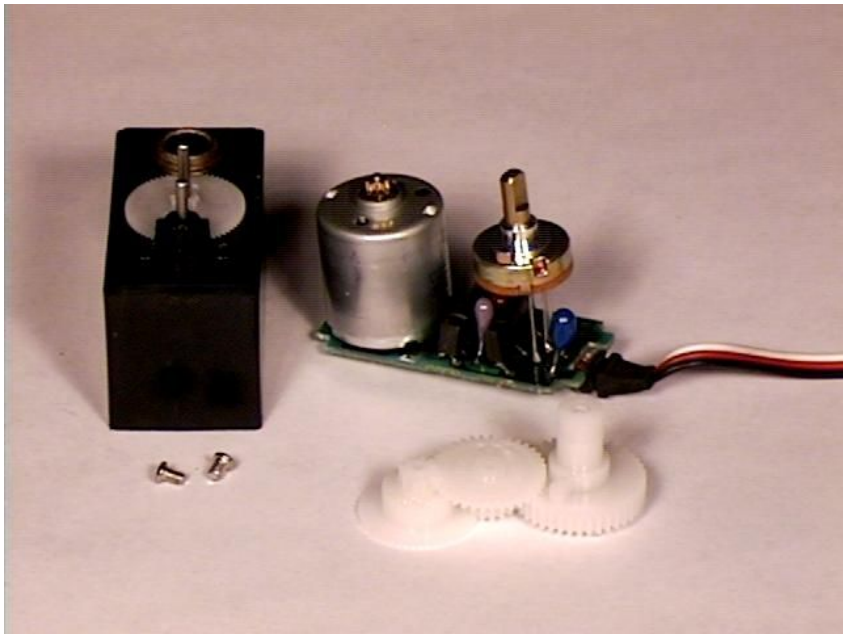
Servo Lab

Fall 2026

Servos! Like Motors But Cooler!





- Servos are motors with gearing and position control.

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http://www.pyroelectro.com/tutorials/servo_motor/servomotor.html

Servo Uses

- Servos are used when exact positioning is needed.













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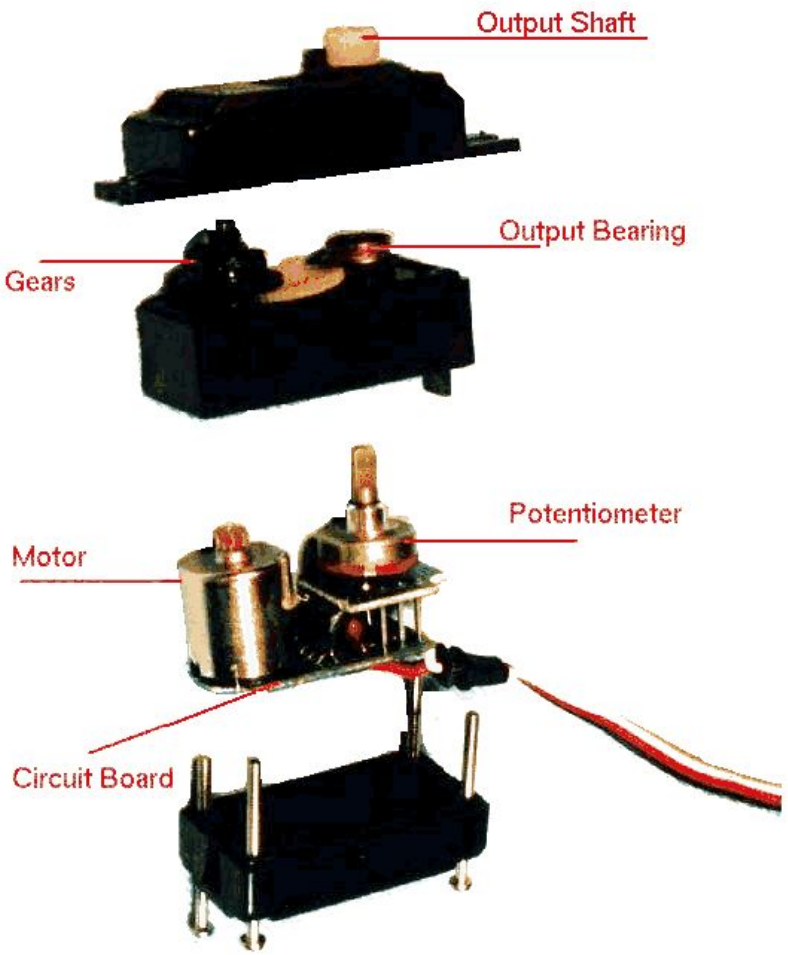
Servo Mechanical Control

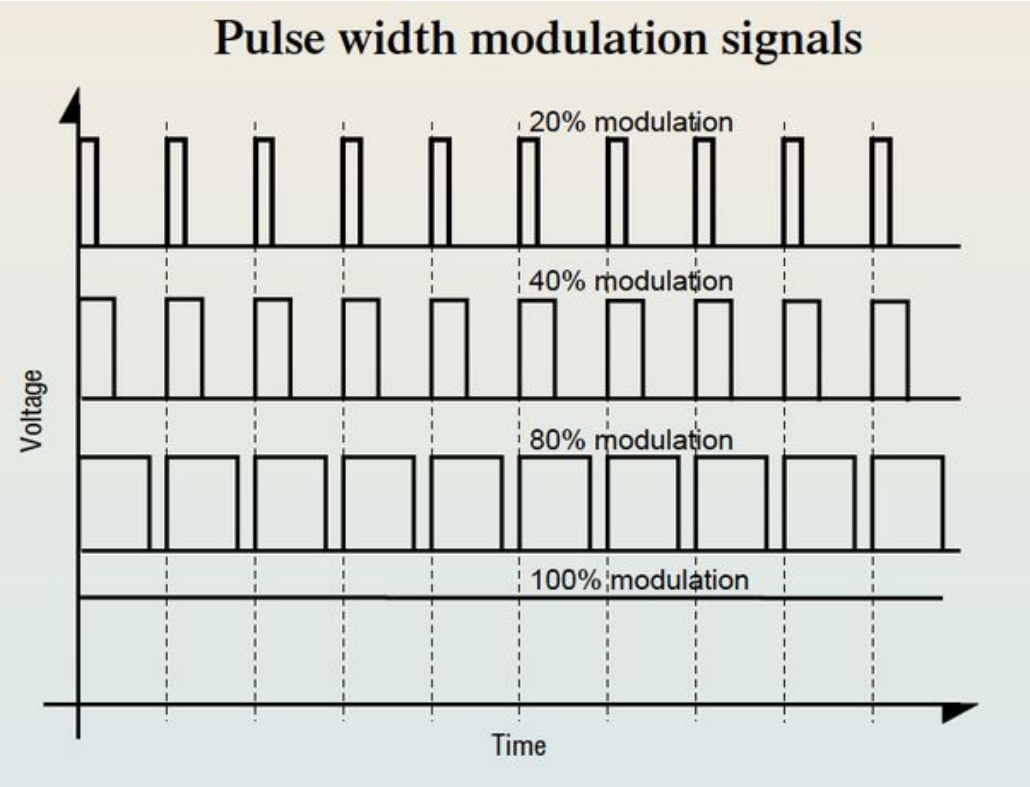
- The servo circuitry (usually a potentiometer) controls how much the motor turns, using the potentiometer to keep track of how far the motor's gone.

- Normally, servos go between 0 - 180 degrees due to a mechanical stop.



Servo Electronic Control

- Pulse Width Modulation is used when you want to convert a digital system to an analog system.



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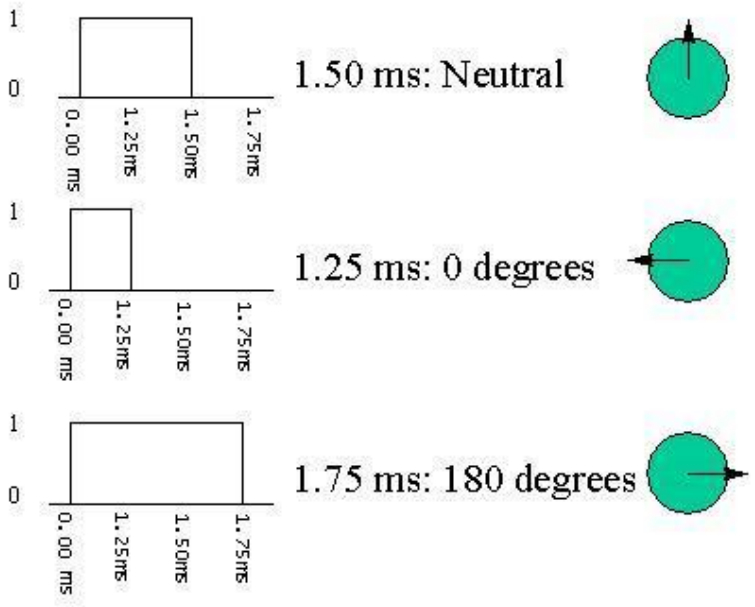
Pulse Coded Modulation

- Overall, the time of the pulse sent determines how far the servo will move.
- Every twenty milliseconds, another servo position is sent, allowing for the servo to move fluidly if needed.



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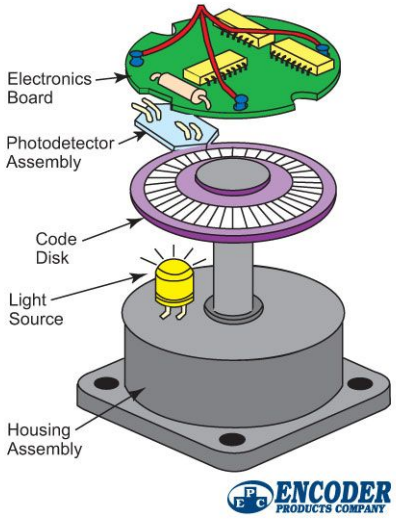
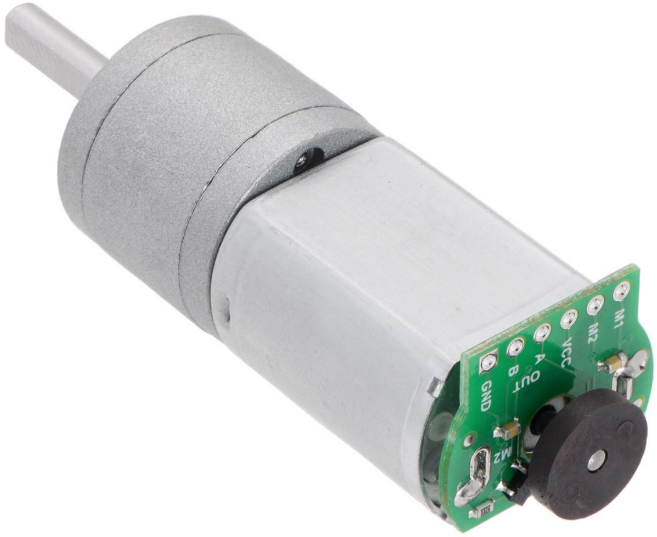
Encoders: Review

- Encoders are the black disks, and corresponding circuitry, on the motors of your robot how much the axle has rotated, and by extension, how far the motor's gone.
- Measures how many "ticks" have gone by, on the magnetic disk or using a light source, to see the rotation.







Candy Time!

How can encoders fail?

If the motor slips (imagine the robot running on ice), the wheel is spinning but the robot isn't going anywhere. In this circumstance, the encoder count would not be an accurate measurement of distance.



Your Task...

- Draw something interesting using your robot's encoders and a servo!



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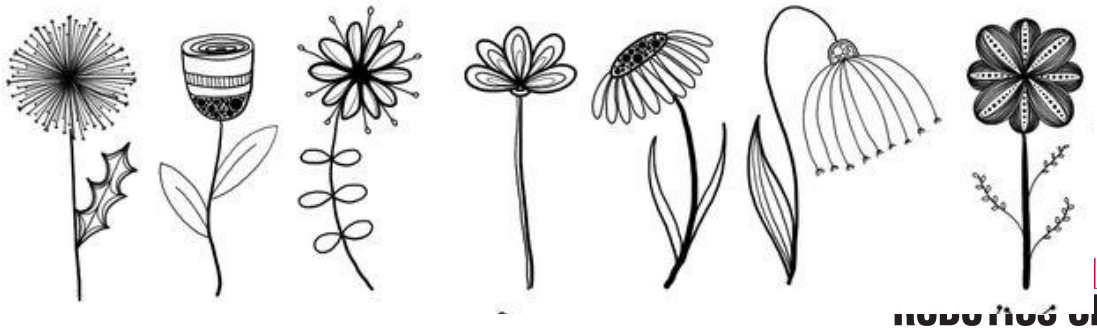
What's Interesting?

- Use your encoders and a servo.
- Lift your pen off the paper and put it back down once
- That's it! Ideas include...
  - Your name!
  - Smiley face!
  - Etc.
- The competition will be who has the best drawing and who can write "FWR" the fastest while still being legible.





Encoder Code Runthrough

```
void loop() {

  while(encoders.getCountsLeft()<200 && encoders.getCountsRight()<200){
    motors.setSpeeds(300, 300);
    delay(10);
  }

  motors.setSpeeds(0,0);
  delay(1000);

  while(encoders.getCountsLeft()<900 && encoders.getCountsRight()<900){
    //Goes for 700 count; 900-300
    motors.setSpeeds(300, 300);
    delay(10);
  }


}
```

Gets left encoder count

Gets right encoder count

While loop: moves until conditional is met

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Be Careful!

- The encoder counts do not reset until you restart the code.
- That means if you want the encoders to move 300 “ticks”, do something, and then move another 300 ticks, then you have to have to have one while loop for 0-300, do something, and then have another while loop for 300 - 600 ticks.



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Servo Code Runthrough

```
void setup()
{
  buttonA.waitForButton();
  delay(1000);
  myservo.attach(20);
}

void loop()
{

  myservo.write(0);
  delay(3000);

  myservo.write(55); //45 ok but margin of safety
  delay(1000);


}
```

Tells robot where the servo is attached

Tells servo where to go, and gives it time to do so

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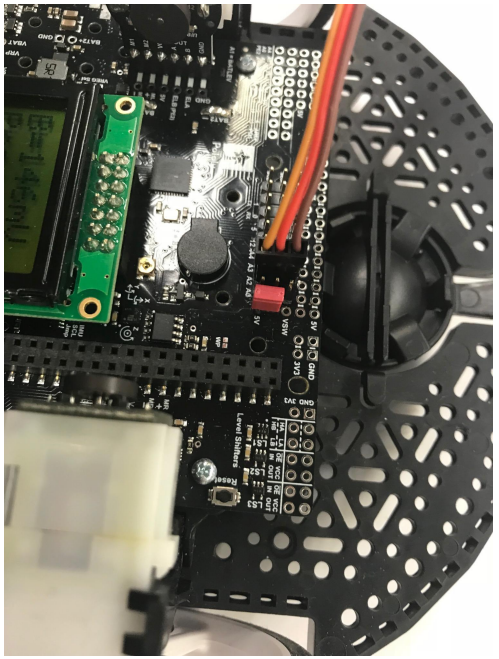
All Together Now!

```
  myservo.attach(20);
}

int goal = 0;

void loop() {
  myservo.write(0);
  delay(100);

  goal = 1000 + goal;

  left_count = encoders.getCountsLeft();
  right_count = encoders.getCountsRight();

  while(left_count < goal && right_count < goal){
    motors.setSpeeds(50, 50);
    delay(10);

    left_count = encoders.getCountsLeft();
    right_count = encoders.getCountsRight();
  }

  motors.setSpeeds(0, 0);
  myservo.write(90);
  delay(1000);
```

Increases the goal every iteration so the robot can continue to go forward



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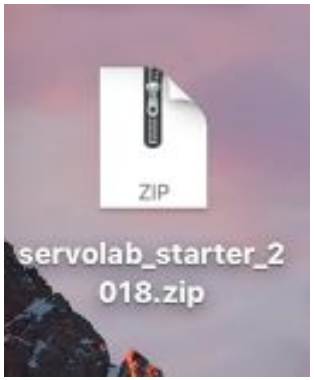
Why a Zip File?

- Arduino is annoying, so the servos and the motors are assigned to the same timer. As a result, with their code, you cannot run a motor and a servo at the same time.
- To remedy this, we have made a new library for you!
- All you need to do is keep all the code in the same folder and include the library at the top of your code.







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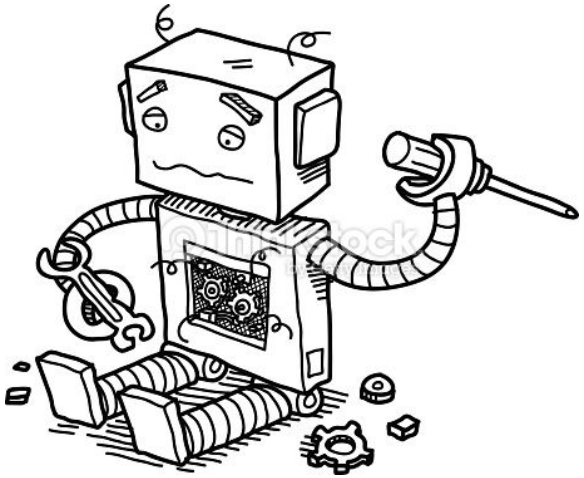
My Servo Doesn't Work!

- Check that you have the right port in your code and have plugged the servo into the correct port on your robot
- Make sure you have plugged the cord into your robot in the correct orientation
- Simplify your code (i.e, just have code that moves your servo) and see if the servo moves at all.
- OR: your servo might just be broken! No worries!



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