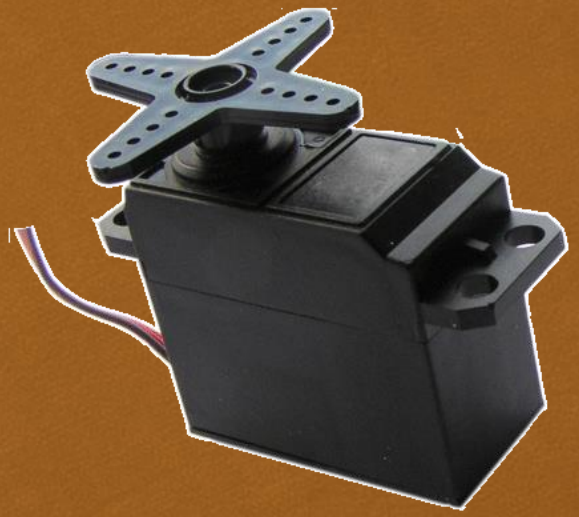
Servo Motors



Servo Motors

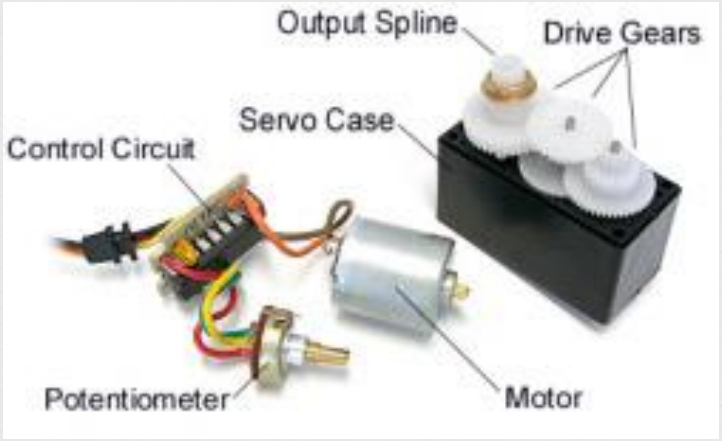
- Designed for linear or angular position, velocity, or acceleration applications. Typically used for angular movement for position or velocity.
- Used in applications such as robotics, in-line manufacturing, pharmaceutics, and CNC machining.
- Typically used in a closed-loop control system to control its motion and position. An input signal controls what position the motor should spin to. A position sensor provides feedback of the error of the actual position vs. the desired position.
- Servos are used for rudders, walking robots, grippers, rotating antennas, camera autofocus etc.

Industrial Servo Motor Example

- These are high torque industrial motors manufactured by Kollmorgen, a company that has hired our alumni based out of Radford, VA.

Parts of Servo Motors

- Servos typically consist of 3 main parts: a geared motor, a feedback mechanism, and circuitry.



Motor

- Most industrial servo motors use AC motors, whereas lighter duty applications will use DC motors. AC servos can handle higher current surges.
- We'll use DC servos in this course, which will consist of a brushed DC motor.

Feedback Mechanism

- Servo motors use feedback to determine its exact position or speed. The feedback mechanism for cheap DC servos is typically a potentiometer whereas its resistance changes as it turns. This changing resistance creates a voltage divider that outputs a voltage based on the motor's position.
- More expensive servos use optical encoders instead to determine position (we'll discuss optical encoders in a separate lecture).

Circuitry

- Servos contain circuitry to read in the input signal to control the desired rotation.
- For inexpensive DC servos, the input signal is pulse width modulation (PWM) to turn on/off a DC motor.
- More expensive servos may also use PWM, but they typically contain a Variable Frequency Drive (VFD) to control the the speed of the motor.

Controllers

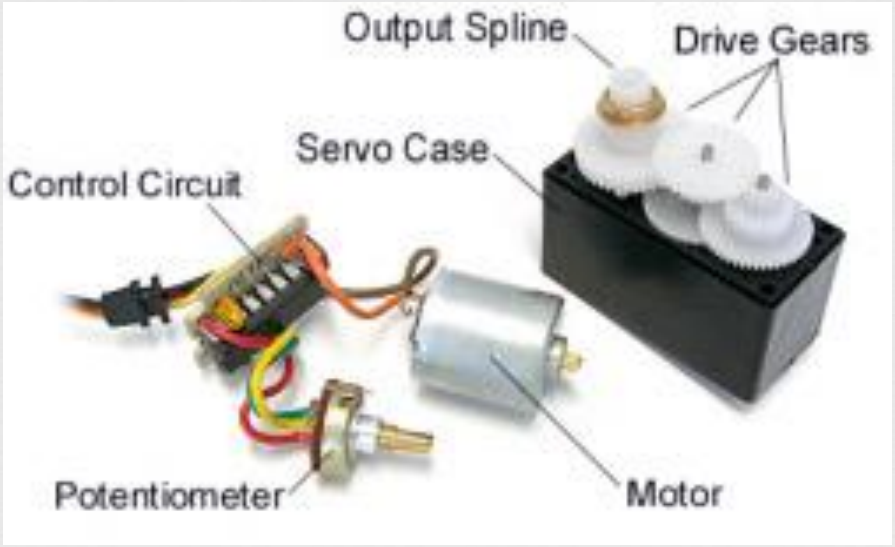
- Controllers create the input signal for the servo.
- Industrial servos may use Programmable Logic Controllers (PLCs) to control the motors.
- DC servos typically use a microcontroller as the input signal to control the motor.
- In this course, we'll use the counters on the DAQ board to create the input signal.

Finite & Continuous Spin Servo Motors

- Finite spin: These motors spin for a finite number of turns. Typically, these servos have a maximum turning range of 180 to 210 degrees.
- Continuous spin: These motors spin for a continuous number of turns. These servos turn for as long as they receive the input signal.

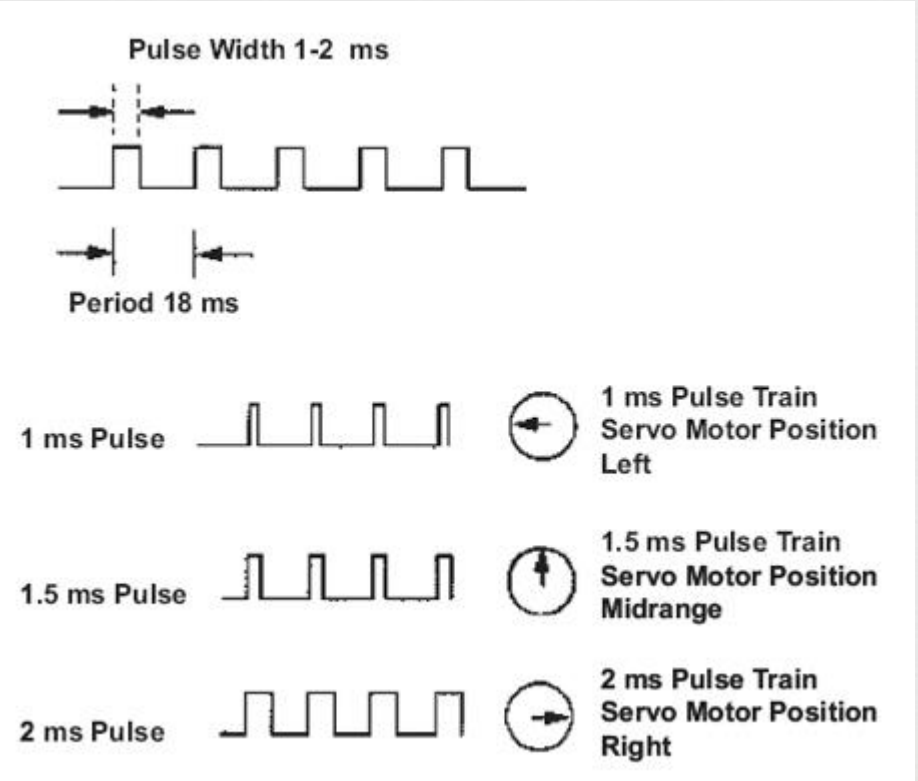
Breaking Feedback

- It's possible to break the feedback mechanism so that you can convert a finite turn servo motor to a continuous turn servo motor (you may have to replace it with a resistor and break off a rotation limiting tab).



How Finite Spin DC Servo Motors Work

- The servos work by measuring the pulse width of the input signal. A 1 ms pulse width may turn the servo all the way left, 1.5 ms pulse will center the servo, and 2 ms pulse will turn the motor all the way right.



Compensating the Motors

- Sometimes the motors will spin when a 1.5 ms pulse is applied. Some motors have a compensating screw for adjustments in case this happens. Simply apply 1.5 ms pulses and adjust the screw until the motor doesn't spin.

How Continuous Spin DC Servo Motors Work

Continuous spin servo motors work similarly to the finite spin. If you send a 1 ms pulse, then the motor turns left as fast as possible. If you send a 1.5 ms pulse, the motor will stop. If you send a 2 ms pulse, then the motor will turn right as fast as possible.

Use these boundaries loosely since some servo motors may have different boundaries such as 1.2 ms and 1.8 ms (or some other value).


Continuous
Rotation
Servo
BotBrain.com