Robotics Engineering Technology

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Lab Safety

Working in an electronics science lab is exciting, but it's important to follow safety rules to keep everyone safe. Here are some key guidelines to remember every time you step into the lab!

1. Safety Glasses: Always wear safety glasses while in the lab. Safety glasses will protect eyes from flying objects.
2. No loose jewelry or open-toed shoes.
3. No food or drink in the lab!
4. 4. Be Aware of Your Surroundings
    - Stay focused: Don't horse around or get distracted in the lab. Accidents can happen when you're not paying attention.
    - Know the emergency exits: Always know how to get out of the lab quickly in case of an emergency.
    - Be aware of where the fire extinguisher, eye wash station, and first aid kit are located.

Servo Project

Servo Introduction

What is a Servo Motor? A servo motor is a special kind of motor that can move to a specific position, like turning to a certain angle or lifting an object to just the right height. It doesn't just spin around like regular motors but follows specific commands to stop exactly where you want it.

How Does a Servo Work?

- Inside a servo motor, there's a small motor, gears, and a circuit.
- It works by receiving a signal (a command) to move to a specific angle (for example, 90 degrees).
- The gears inside help to slow down or speed up the motor, so it moves accurately.
- It uses feedback to know exactly where it is, so it can adjust itself if needed.

Where Do You Find Servo Motors?

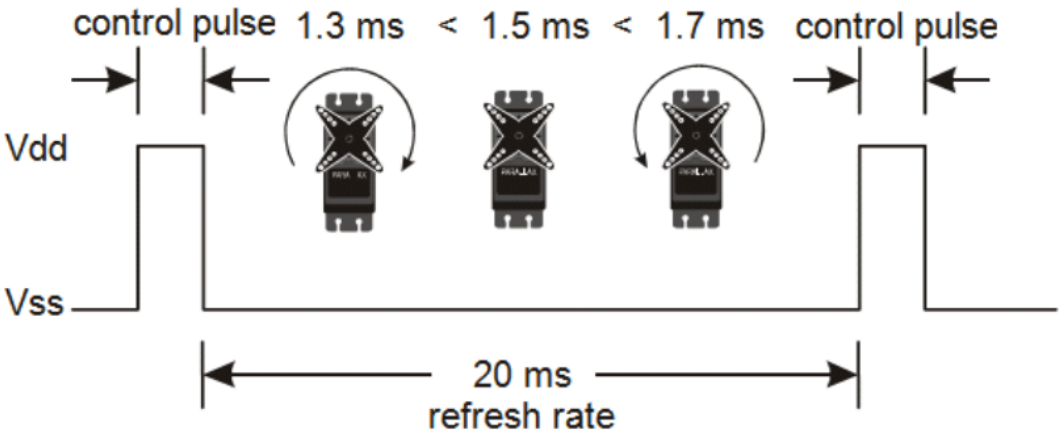
- Robots: Servos help robots move their arms, legs, or head with great precision.
- RC Cars/Airplanes: They control the wheels, flaps, or other parts of remote-controlled vehicles.
- Manufacturing Machines: In factories, servos are used in machines that need precise movements for making products.

Servo Specifications

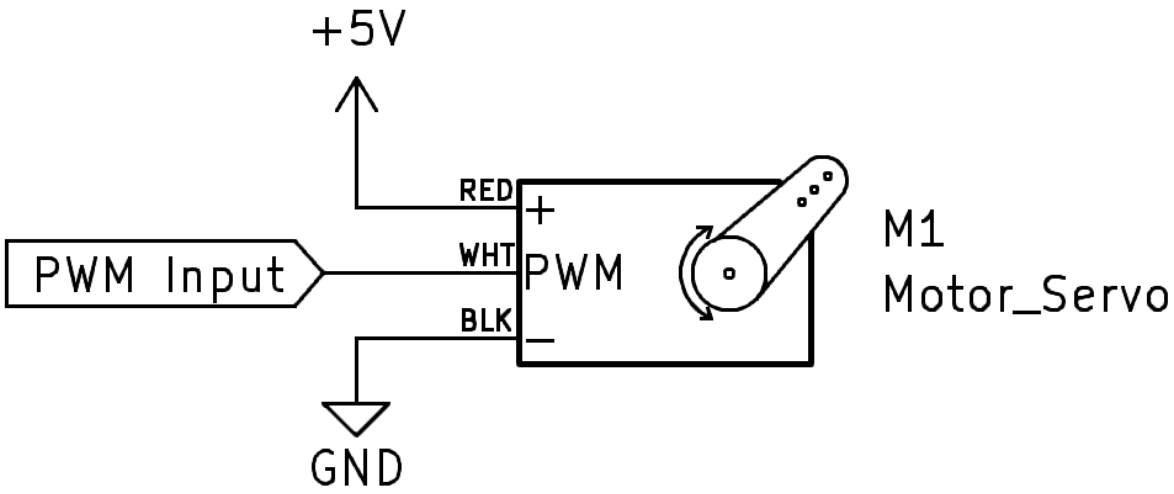
The servo is controlled using a standardized signal. Parallax manufactures servos. The Parallax High-Speed Continuous Rotation Servo (900-00025) data sheet details the standard servo control signals.

Servo Control

The Parallax High Speed Continuous Rotation Servo is controlled through pulse width modulation. Rotational speed and direction are determined by the duration of a high pulse, refreshed every 20 ms.



Servo Control Signal



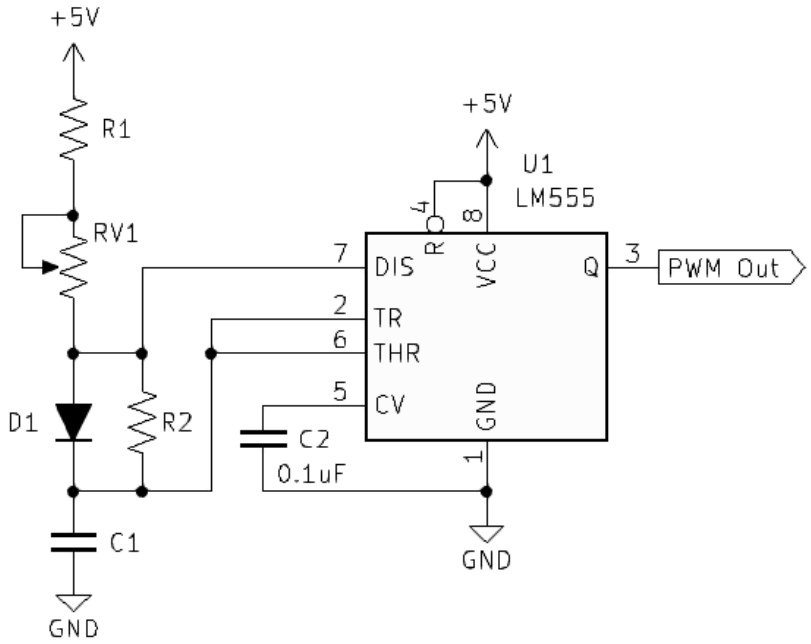
Basic Servo Schematic

Download Parallax High-Speed Continuous Rotation Servo (900-00025) Data Sheet

Initial Servo Test Steps:

1. Use an Oscilloscope to measure and set a DC power supply output to 5VDC.
2. Setup a Function Generator to produce a 0 to 5v, pulse waveform with a positive pulse of 1.5ms and a 20ms off time ($\approx 50hz$). Use an Oscilloscope to verify the signal.
3. Once the 5VDC and the 0 to 5V pulse waveform has been verified, the servo can be connected as follows.
    - Red to 5VDC
    - Black (sometimes Brown) to Reference
    - White (sometimes yellow) to Function Generator (0 to 5V pulse waveform)
    - Incrementally adjust the pulse width of the waveform from 1.5ms to 2.0ms and back down to 1.0ms and observe the Servo motion.

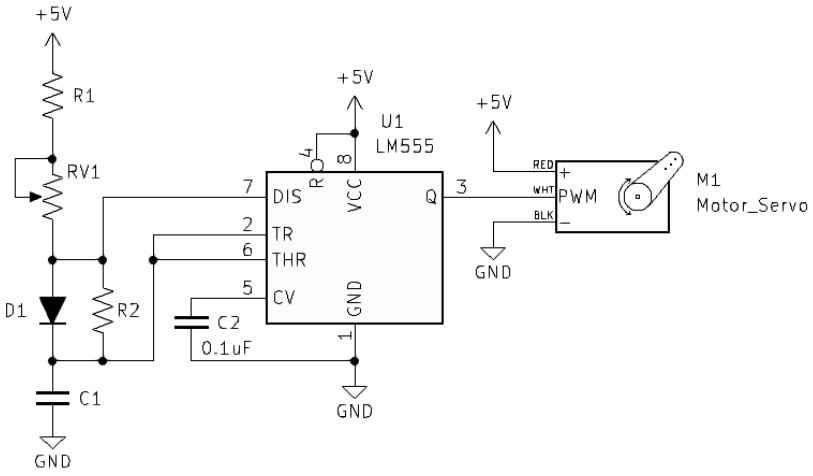
555 Timer



555 Timer Test Circuit

4. Verify the PWM Out waveform using an Oscilloscope.

   - $Time_{On} \approx 0.693(R1 + RV1)(C1)$
   - $Time_{Off} \approx 0.693(R2)(C1)$
   - Calculate circuit C1, R1, RV1, and R2.
   - Build the circuit, adjust RV1 and observe the pulse width will vary from 1.3ms to 1.7ms.
   - Verify that the pulse space is approximately 20ms.
   - Verify that the waveform voltage is 0 to 5V.



555 Timer Servo Circuit

5. Test the final circuit with the servo motor.