ENGR 4421: Robotics II

Servo Motors

09/15/2022

Outline

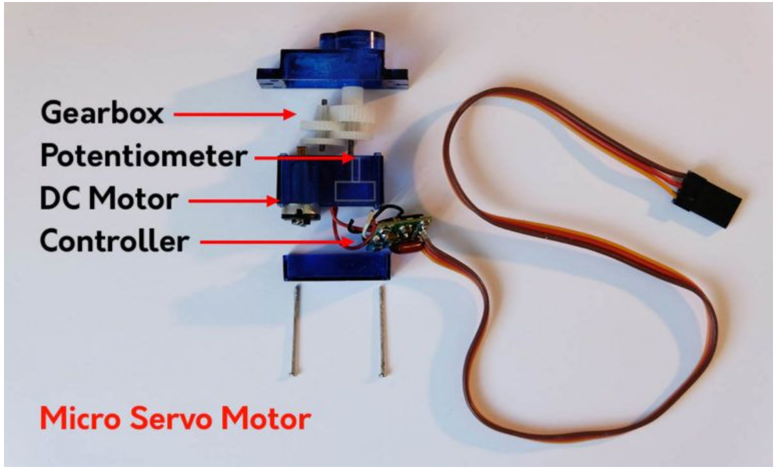
- What is A Servo Motor
- How does A Servo Motor Work
- PCA9685

What is A Servo Motor

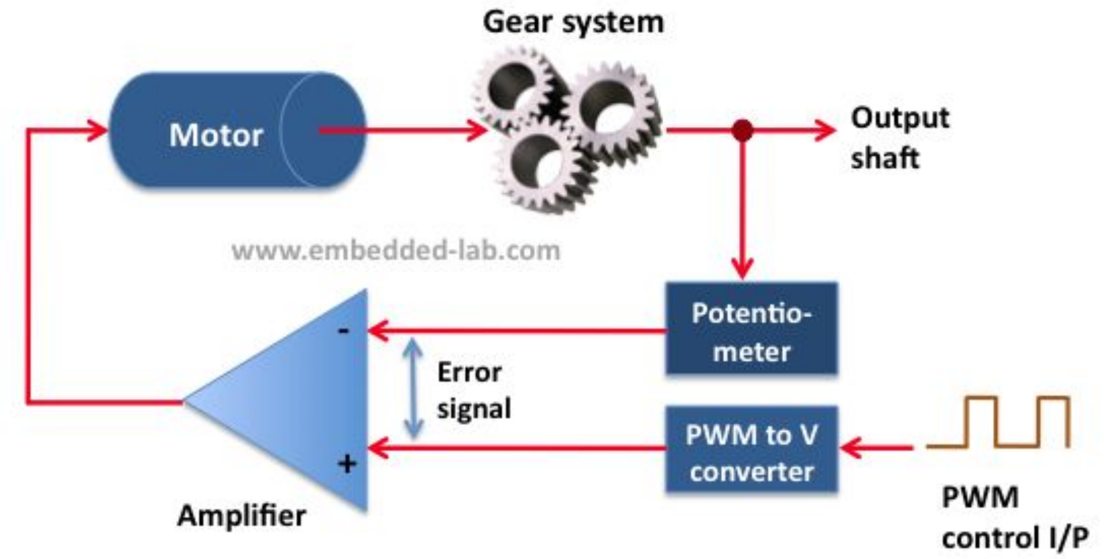
- Is a type of motor whose shaft position can be precisely controlled.
- Uses an internal “servomechanism” to provide positional feedback.
- Some servo motors use alternating current, others use direct current.
- Are widely used in industrial and hobbyist applications (robots, RC cars, etc.).

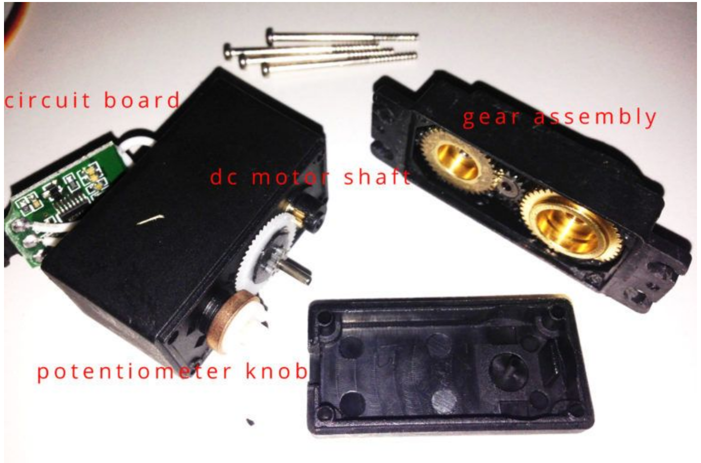
Facts

- Hobbyist servo motor uses a dc motor to spin its shaft.
- A potentiometer is used to provide positional feedback.
- A built-in H-bridge is used to drive the dc motor.
- Position control is achieved using Pulse Width Modulation control.
- We use MG966R



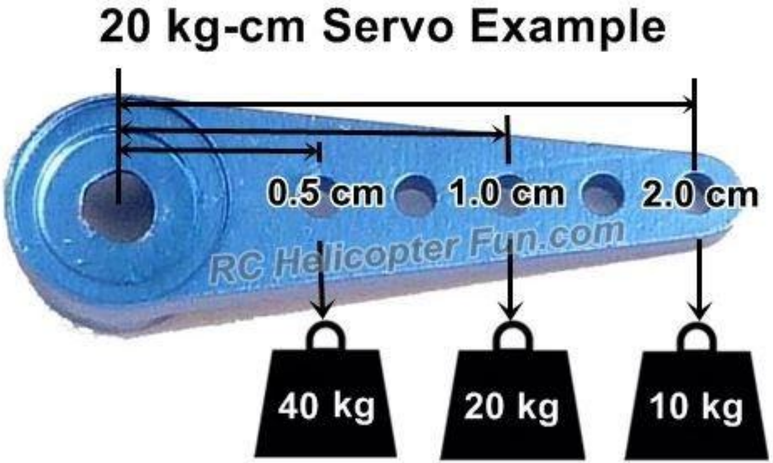
How does A Servo Motor Work





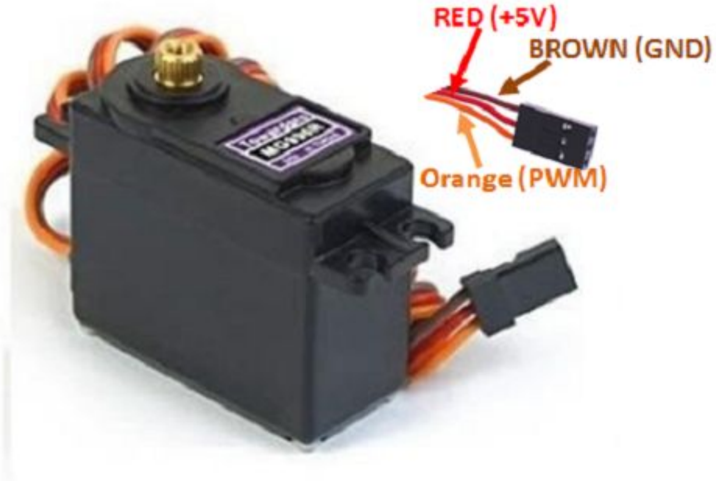
MG966R Specifications

- Operating Voltage is +5V typically
- Current: 2.5A (6V)
- Stall Torque: 9.4 kg-cm (at 4.8V)
- Maximum Stall Torque: 11 kg-cm (6V)
- Operating speed is 0.17 s/60º
- Gear Type: Metal
- Rotation : 0º-180º
- Weight of motor : 55gm

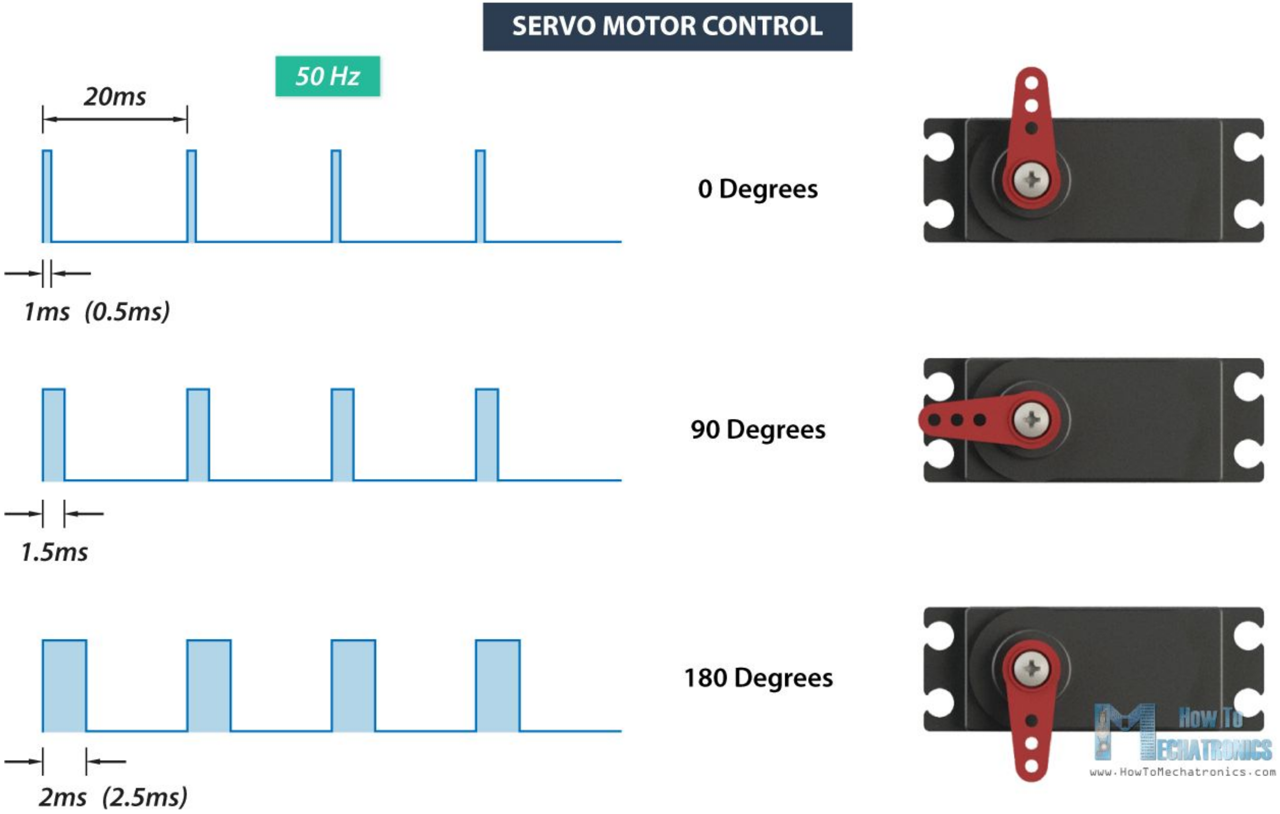


MG966R Wiring

Wire Colour	Description
Brown	Ground
Red	Powers the motor typically +5V is used
Orange	PWM signal

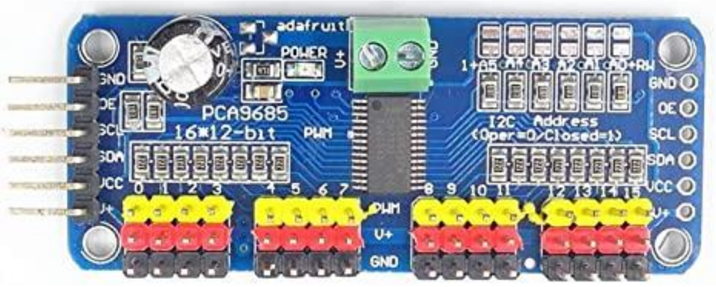


Control

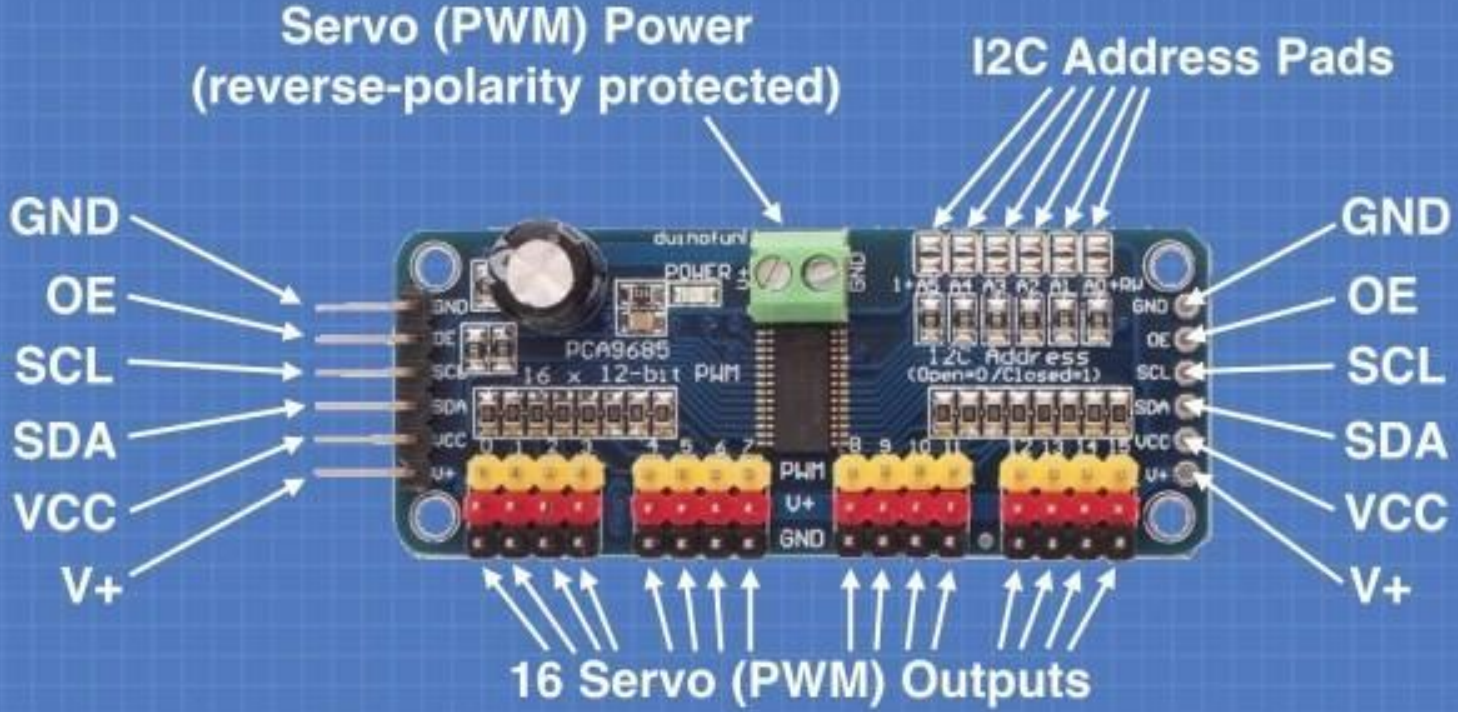

SERVO MOTOR CONTROL
50 Hz
20ms
1ms (0.5ms)
0 Degrees
1.5ms
90 Degrees
2ms (2.5ms)
180 Degrees
How To Mechatronics
www.HowToMechatronics.com

PCA9685 Features

- Has 16 channels of PWM ports.
- Uses I2C bus to communicate, can stack up to 62 boards and control 900+ motors.
- A built-in H-bridge is used to drive the dc motor.
- Position control is achieved using Pulse Width Modulation control.
- Duty-cycle is independently programmable for each of the 16 channels.
- Has 4096 steps (12-bit PWM) of control signal resolution.
- PWM signal frequency is adjustable from about 24 Hz to 1526 Hz.



PCA9685



Servo (PWM) Power
(reverse-polarity protected)

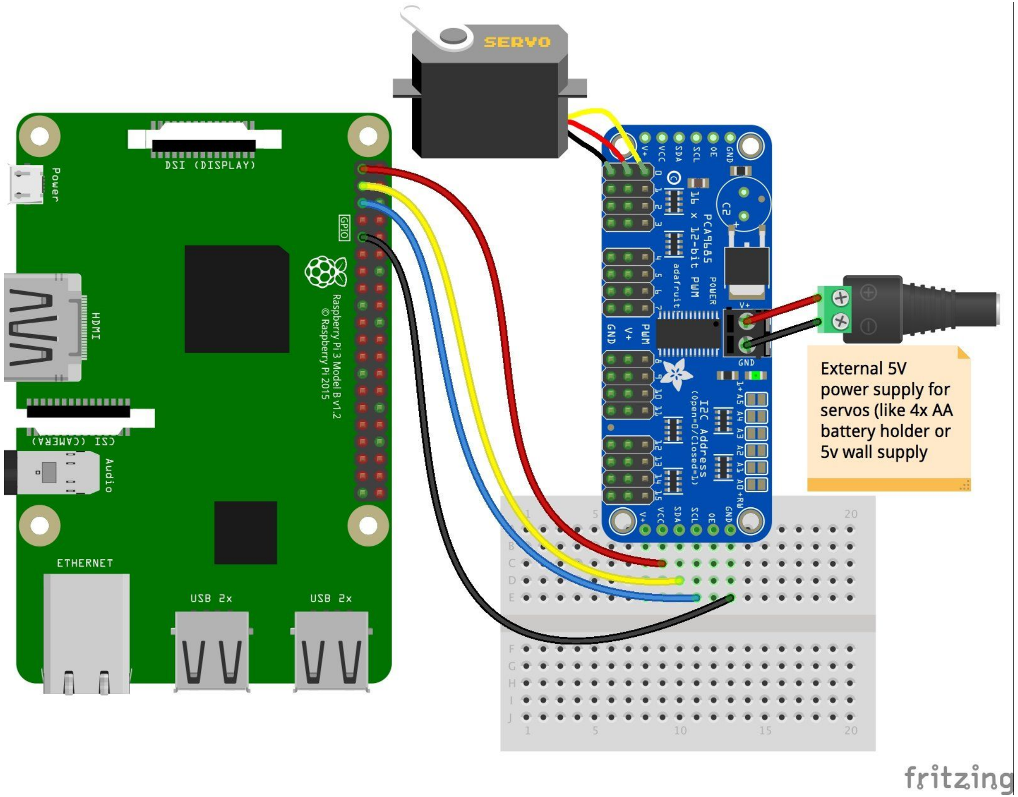
I2C Address Pads

GND
OE
SCL
SDA
VCC
V+

GND
OE
SCL
SDA
VCC
V+

16 Servo (PWM) Outputs

PCA9685 RPi Wiring



External 5V power supply for servos (like 4x AA battery holder or 5v wall supply

Circuit-Python Driving

```
from board import SCL, SDA
import busio
from adafruit_pca9685 import PCA9685
from adafruit_servokit import ServoKit
from time import sleep

# Create the I2C bus interface.
i2c_bus = busio.I2C(SCL, SDA)
# Create a simple PCA9685 class instance.
pca = PCA9685(i2c_bus)
# Set the PWM frequency to 60hz.
pca.frequency = 50
# Set Servo
kit = ServoKit(channels=16)

kit.servo[0].angle = 180
sleep(1)
kit.servo[0].angle = 0
sleep(1)
kit.servo[0].angle = 90
sleep(1)
```