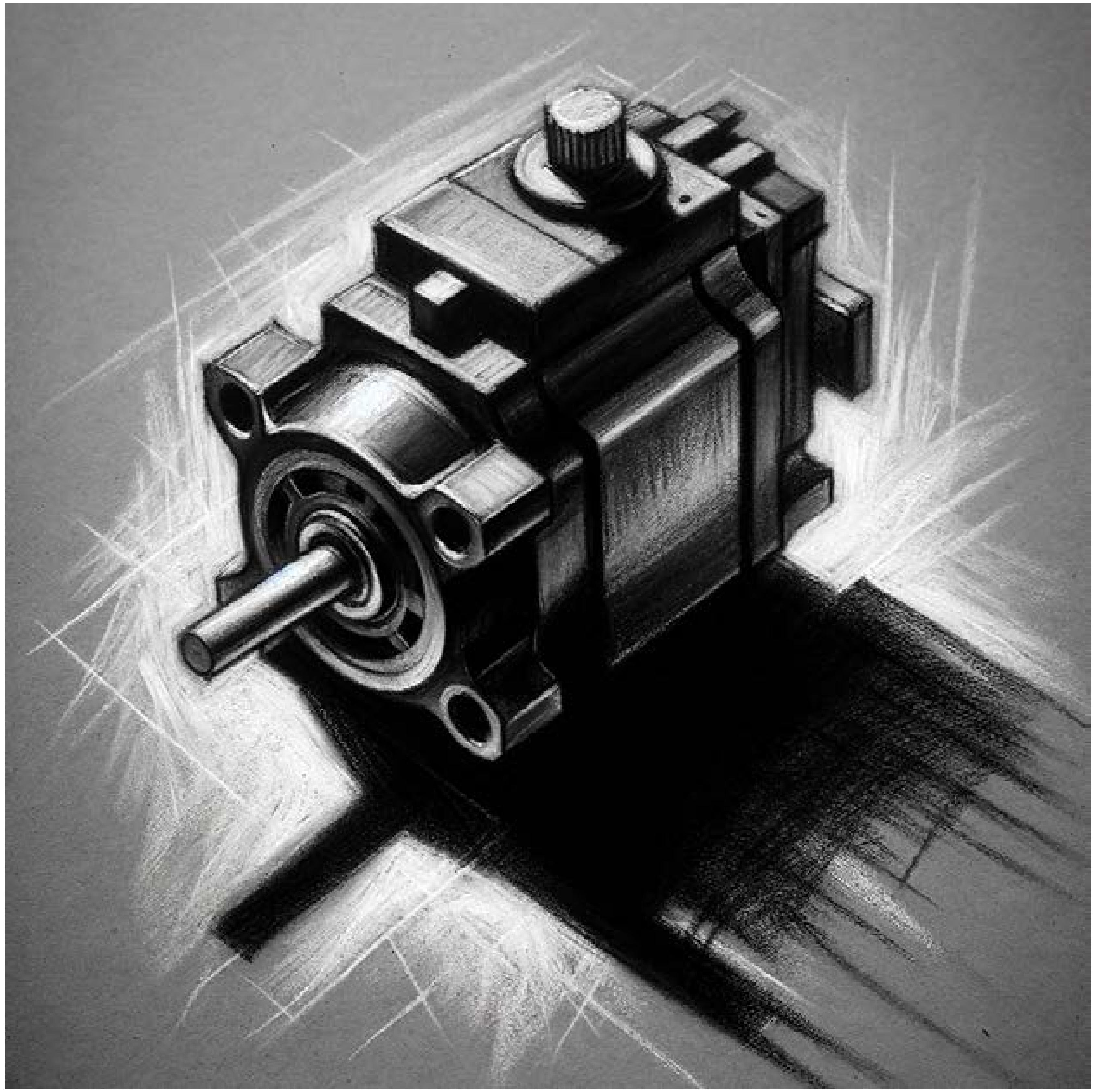
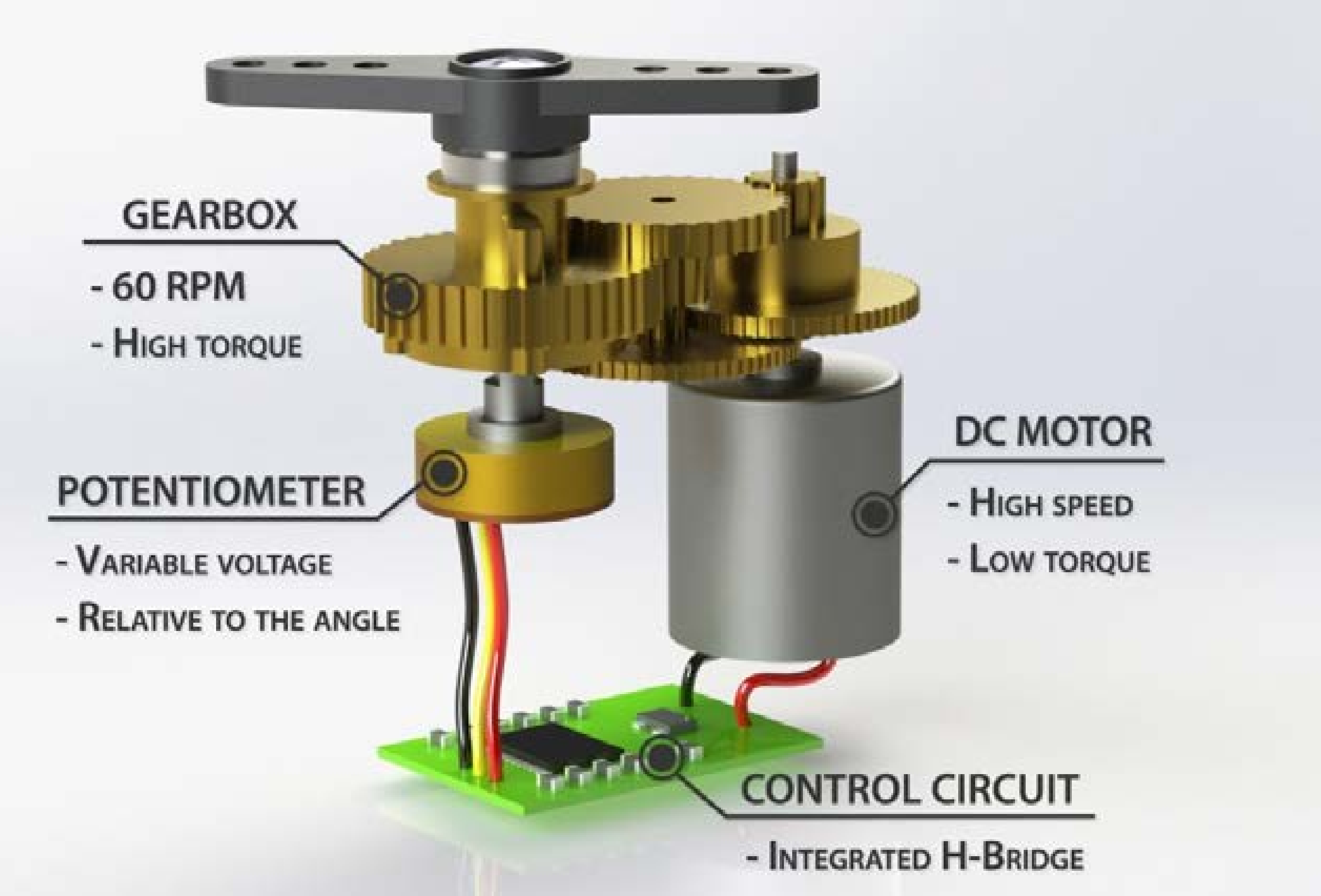
# Physical Computing
# Servos



# Smart Servos Overview

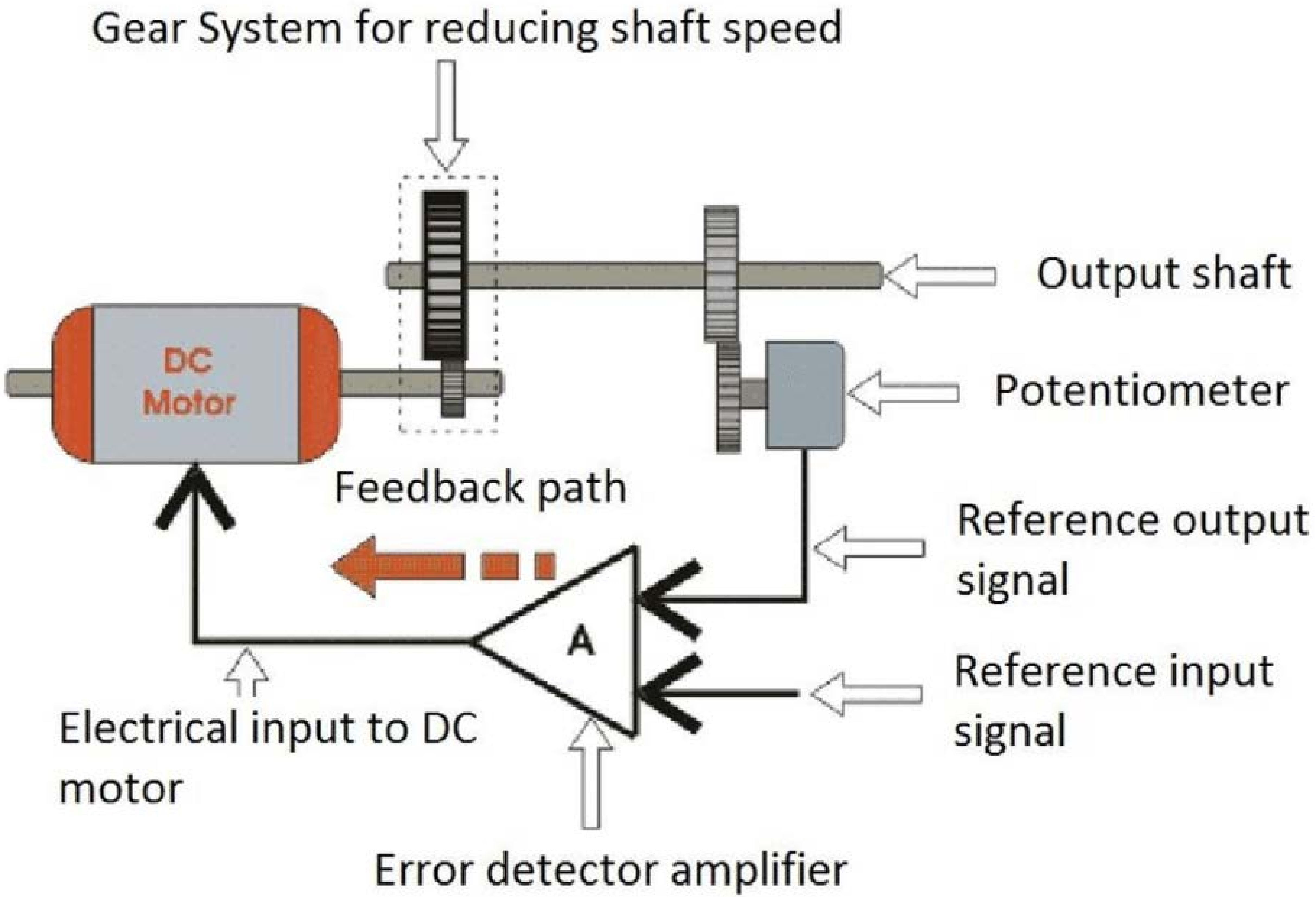
What are Servo Motors?

# Working Principle



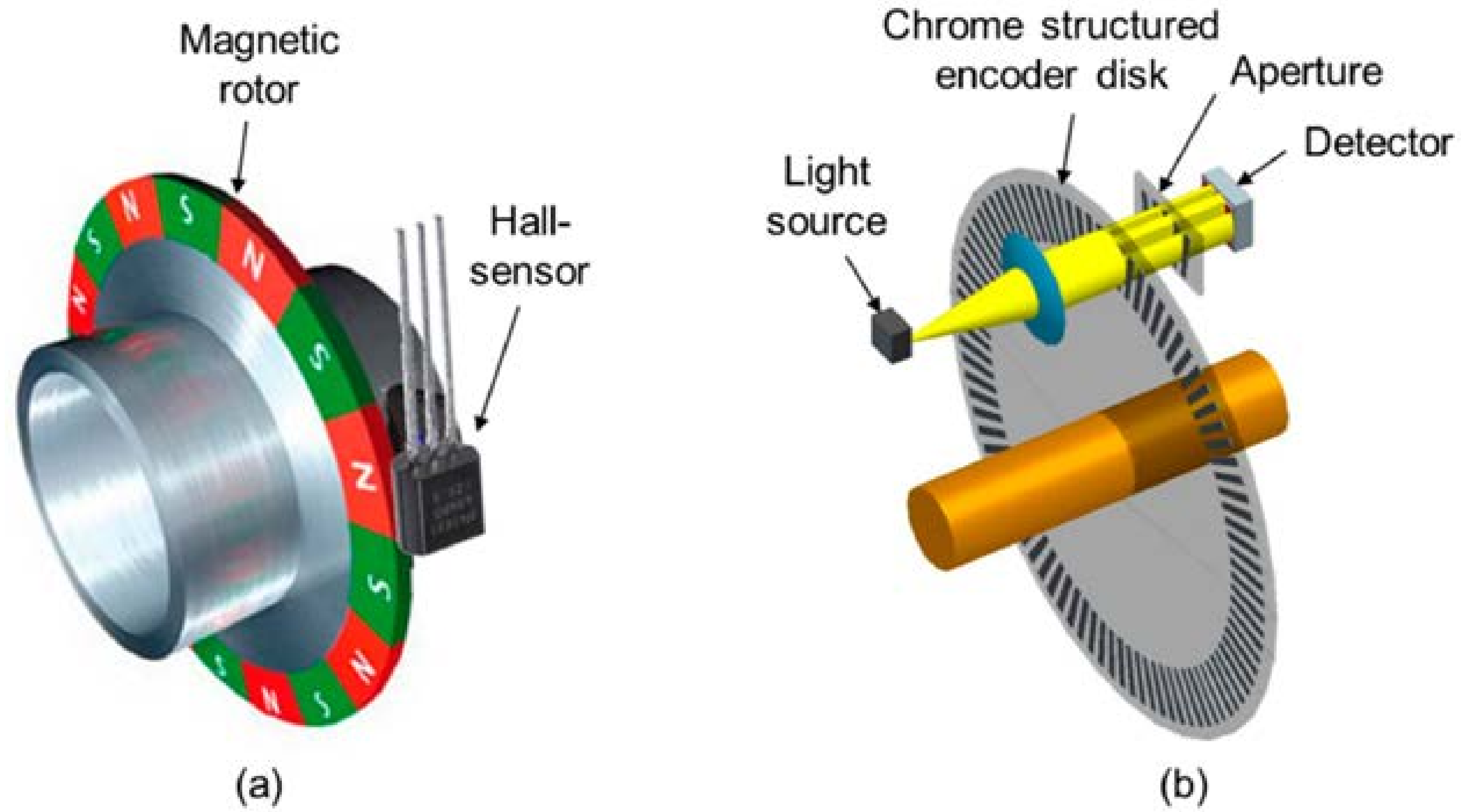
Motor with **closed loop** position controler

Required Connections:
+ Voltage
GND
Signal


Gear System for reducing shaft speed
Output shaft
DC Motor
Potentiometer
Feedback path
Reference output signal
A
Reference input signal
Electrical input to DC motor
Error detector amplifier

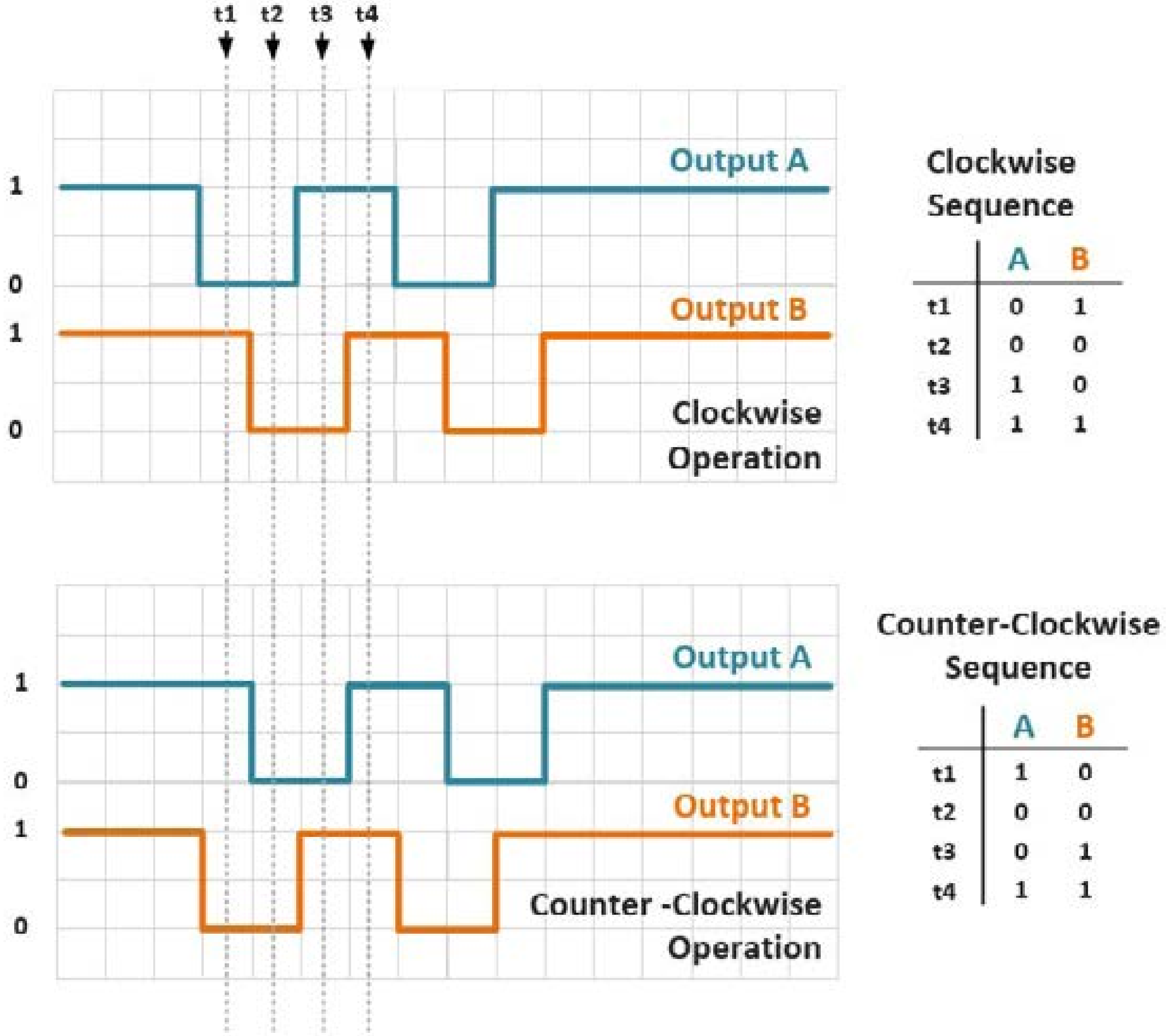
# Working Principle

## Feedback Sources



# Working Principle

## Encoder Signal

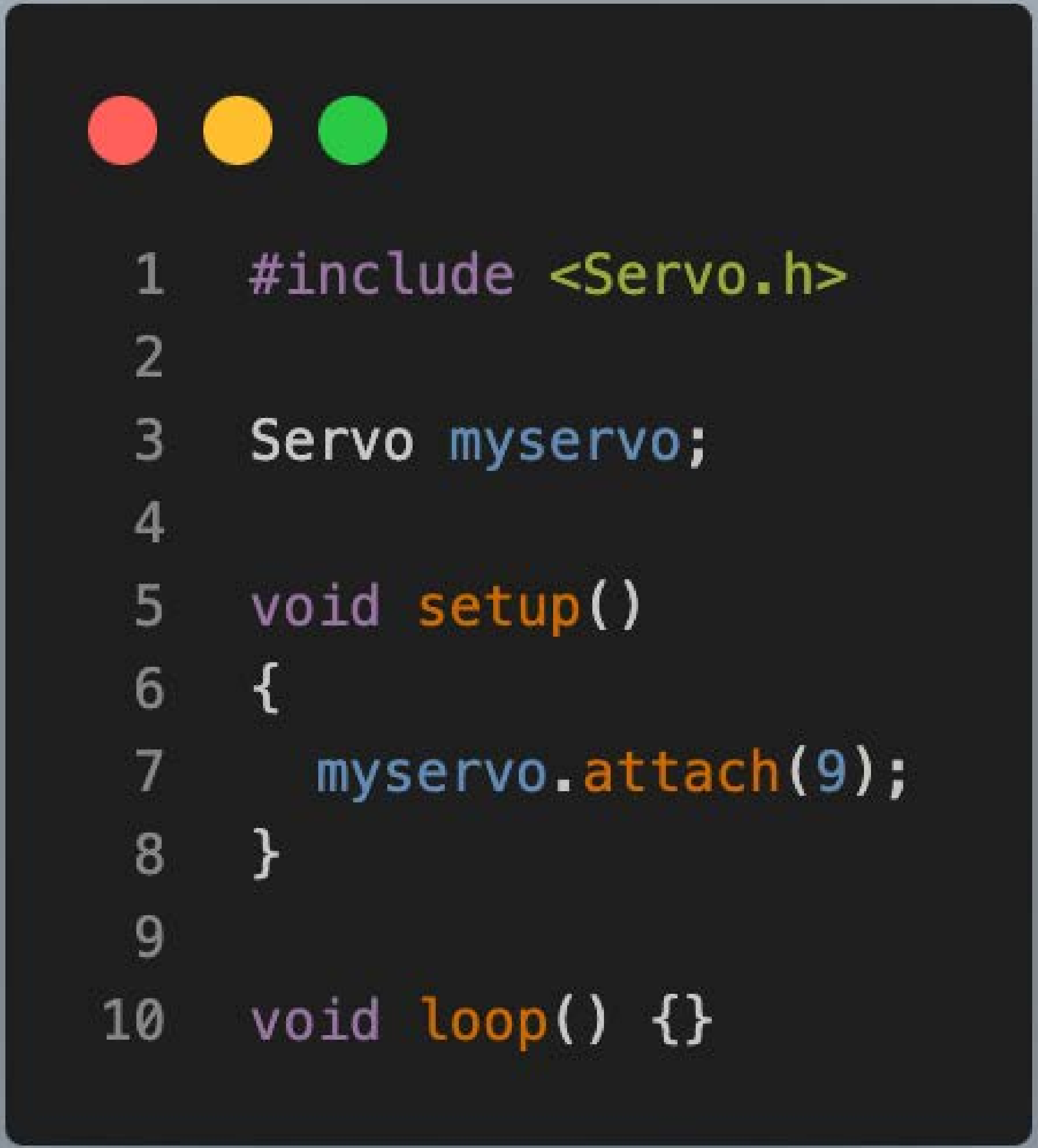


Clockwise Sequence

| | A | B |
|---|---|---|
| t1 | 0 | 1 |
| t2 | 0 | 0 |
| t3 | 1 | 0 |
| t4 | 1 | 1 |

Counter-Clockwise Sequence

| | A | B |
|---|---|---|
| t1 | 1 | 0 |
| t2 | 0 | 0 |
| t3 | 0 | 1 |
| t4 | 1 | 1 |



```
#include <Servo.h>

Servo myservo;

void setup()
{
  myservo.attach(9);
}

void loop() {}
```

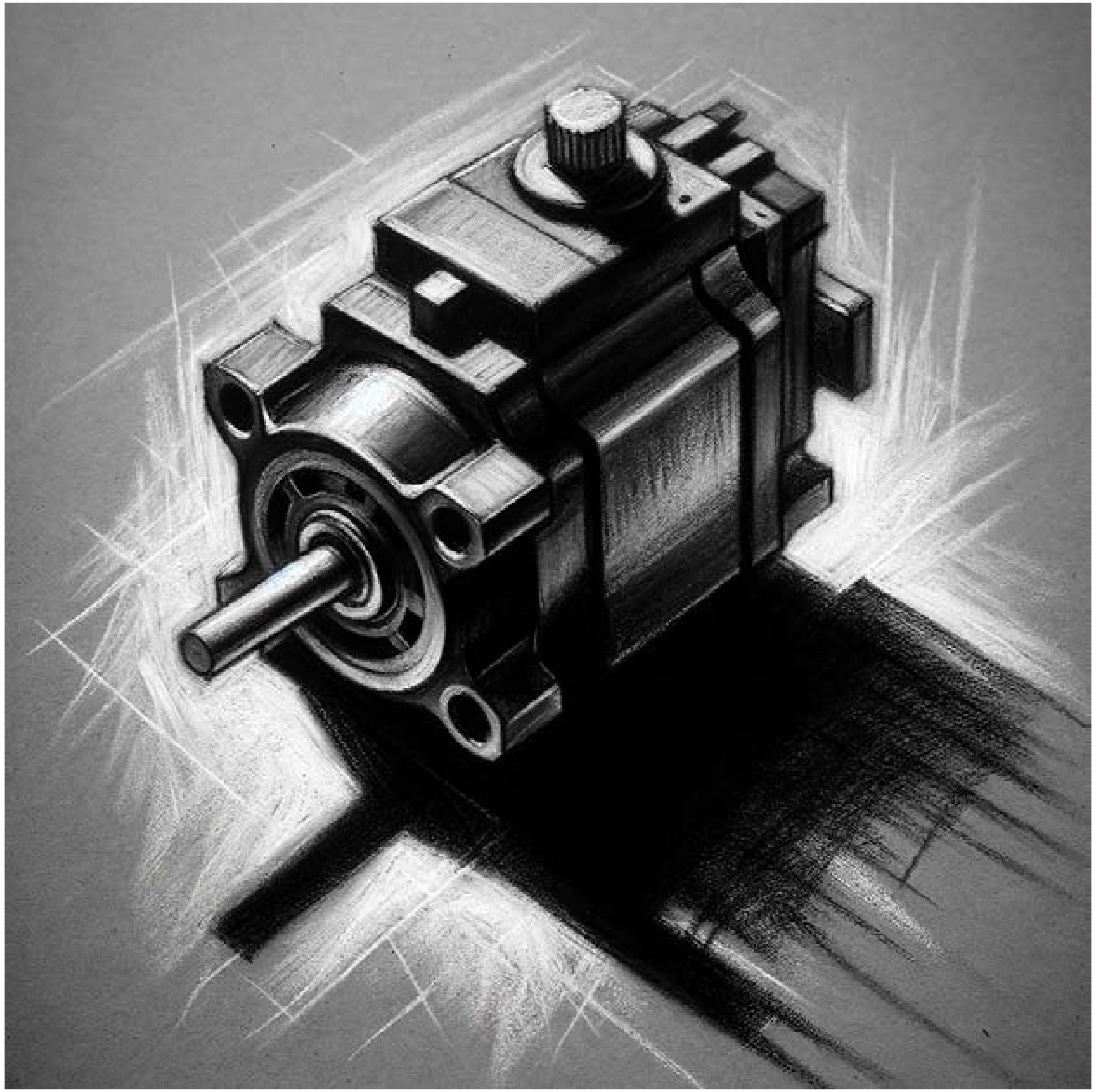
# Setup

Add the library

Create a servo object

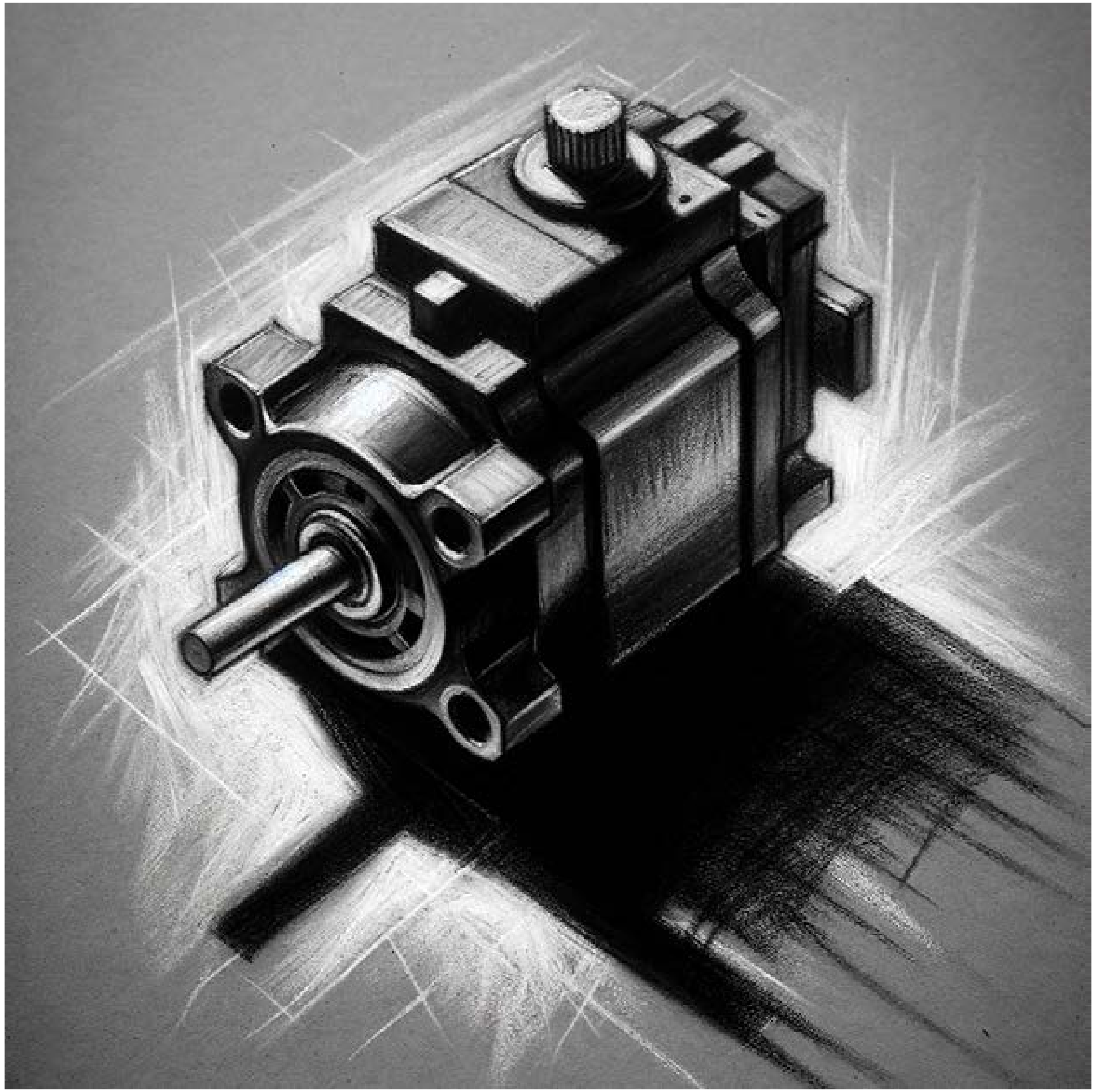
Tell the object which PWM-Pin (~) the servo is connected to

Servo object expects an angle (in Degrees) as an input:
    myservo.write(angle)



# Exercise 1

Make the servo sweep back and forth.

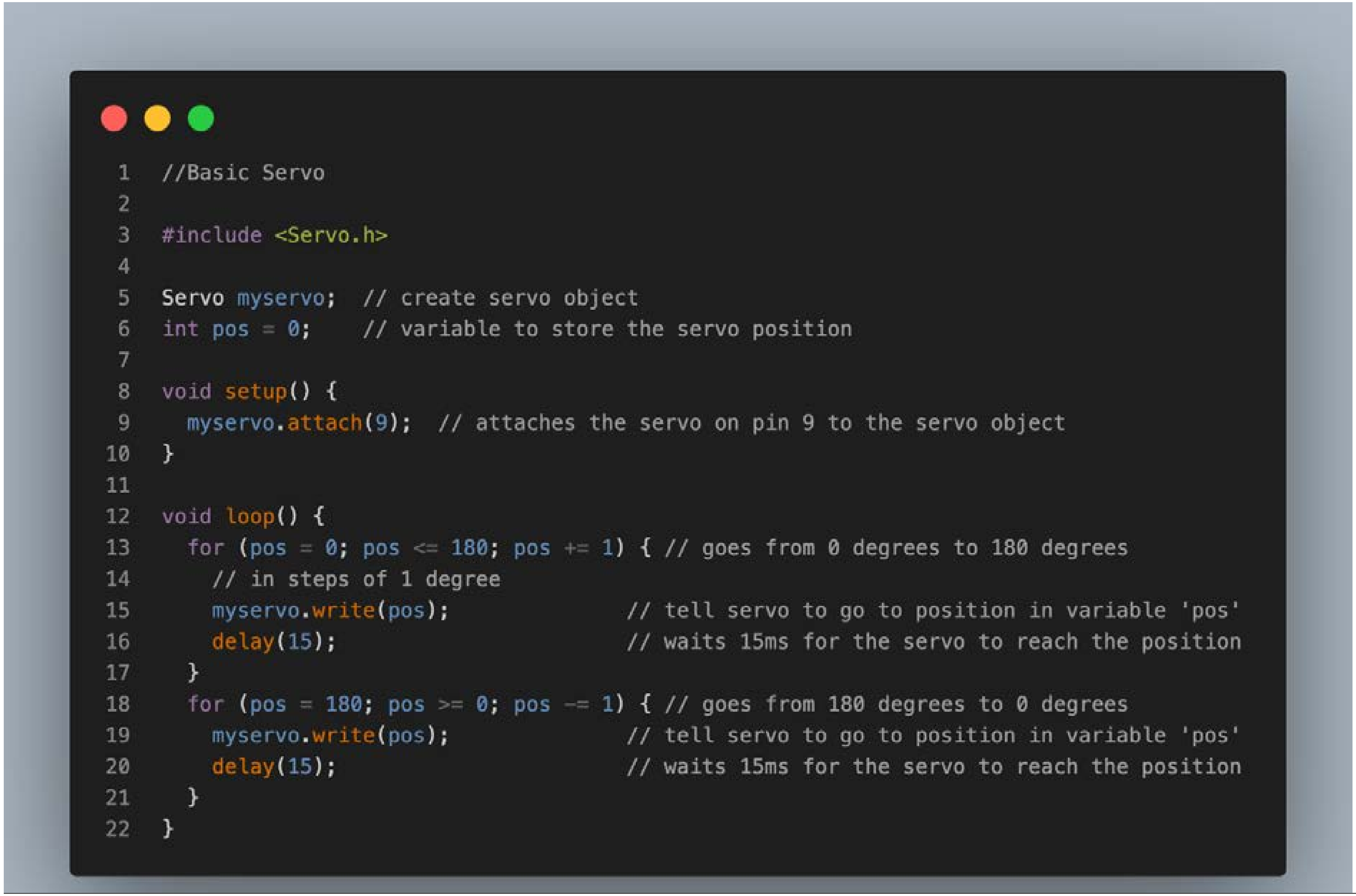


# Hobby Servos

Reduced movement based on potentiometer as feedback source

RC-Vehicles
Small / Precise Movement

# Exercise 1



```
//Basic Servo

#include <Servo.h>

Servo myservo;  // create servo object
int pos = 0;    // variable to store the servo position

void setup() {
  myservo.attach(9);  // attaches the servo on pin 9 to the servo object
}

void loop() {
  for (pos = 0; pos <= 180; pos += 1) { // goes from 0 degrees to 180 degrees
    // in steps of 1 degree
    myservo.write(pos);              // tell servo to go to position in variable 'pos'
    delay(15);                       // waits 15ms for the servo to reach the position
  }
  for (pos = 180; pos >= 0; pos -= 1) { // goes from 180 degrees to 0 degrees
    myservo.write(pos);              // tell servo to go to position in variable 'pos'
    delay(15);                       // waits 15ms for the servo to reach the position
  }
}
```