

Let's start with Arduino (3)

Lec_3

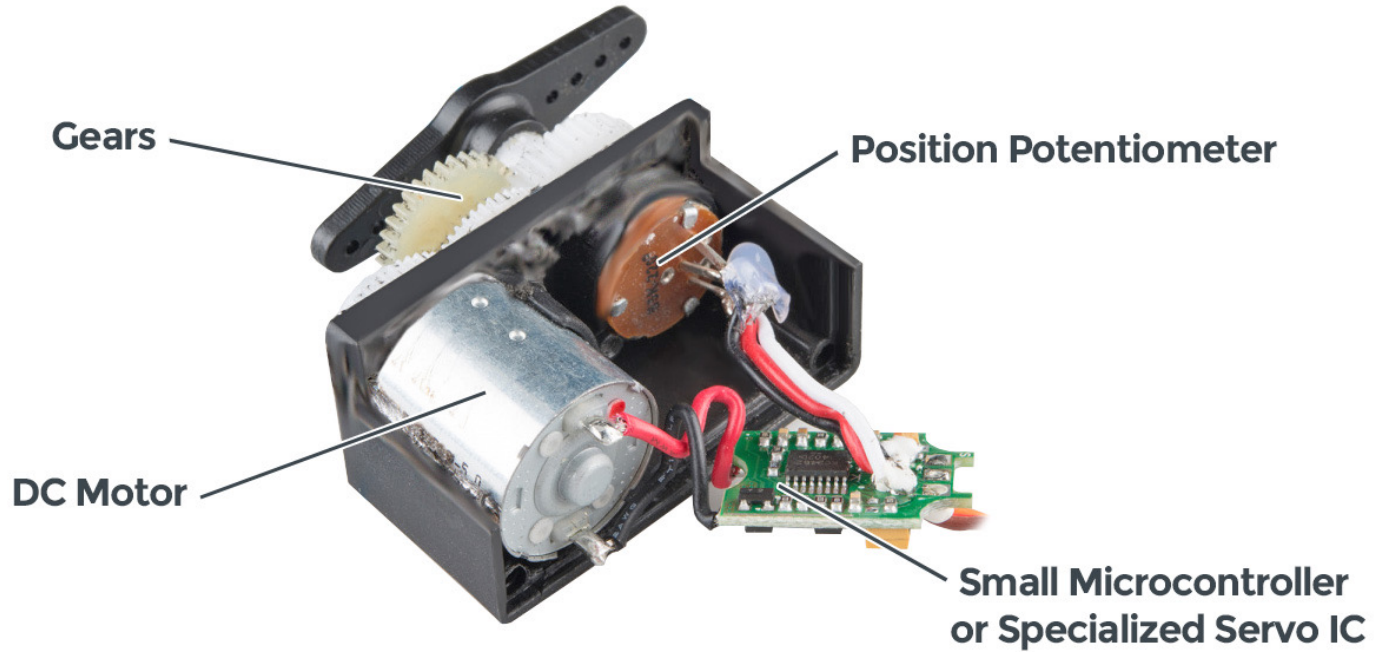
Reminder

- `pinMode(pin_number, direction)`
- `digitalWrite(pin_number, state)`
- `digitalRead(pin_number)`
- `analogRead(pin_number)`
- Serial monitor and LCD
- Libraries and Modules.

Summary

- Servo motor
- Stepper motor
- Homework_1

Servo Motor



Servo Motor



Test Voltage: 4.8V

Operating Speed: 0.21sec/60° at no load

Stall Torque: 3.3kg.cm(45.82oz.in)

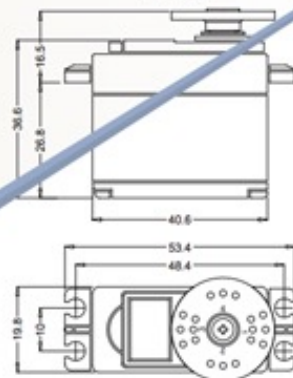
Test Voltage: 6V

Operating Speed: 0.16sec/60° at no load

Stall Torque: 4.1kg.cm(56.93oz.in)

ANNOUNCED SPECIFICATION OF HS-422 STANDARD DELUXE SERVO

1. TECHNICAL VALUES		
CONTROL SYSTEM	: +PULSE WIDTH CONTROL 1500μsec NEUTRAL	
OPERATING VOLTAGE RANGE	: 4.8V TO 6.0V	
OPERATING TEMPERATURE RANGE	: -20 TO +60°C	
OPERATING SPEED	: AT 4.8V	: AT 6.0V
	: 0.21sec/60° AT NO LOAD	: 0.16sec/60° AT NO LOAD
	: 3.3kg.cm(45.82oz.in)	: 4.1kg.cm(56.93oz.in)
OPERATING ANGLE	: 45° (CLOCKWISE) TRAVELING 4000μsec	
DIRECTION	: CLOCK WISE/PULSE TRAVELING 1500 TO 1900μsec	
CURRENT DRAIN	: 8mA/IDLE AND 150mA/NO LOAD RUNNING	
DEAD BAND WIDTH	: 8μsec	
CONNECTOR WIRE LENGTH	: 300mm(11.81in)	
DIMENSIONS	: 40.6x19.8x36.6mm(1.59x0.77x1.44in)	
WEIGHT	: 45.5g(1.6oz)	

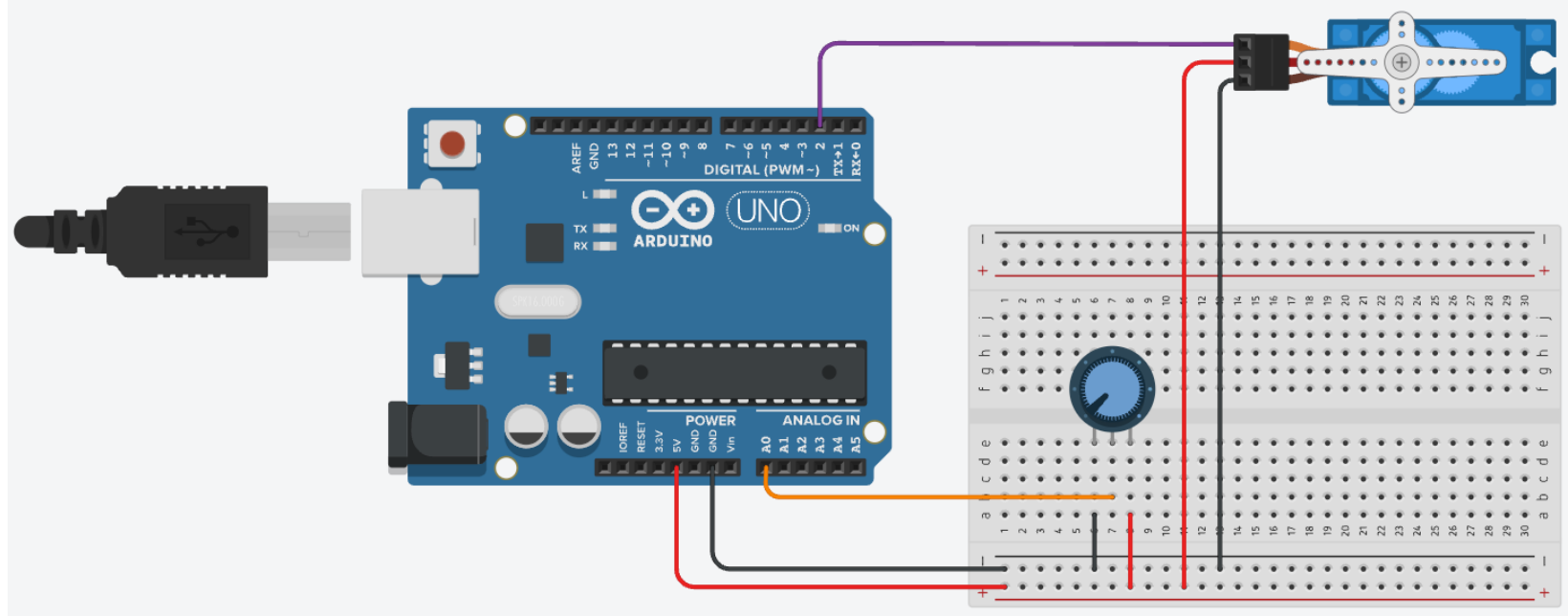


Servo Motor

Let's try to control a servo motor position using a pot (potentiometer):

- Arduino Uno or Mega
- Servo motor
- Pot
- Jumper wires

Servo Motor(Connection Diagram)



Servo Motor (Code)

We will use the following functions:

- pinMode(pin_number, Direction);
- analogRead(pin_number);
- Serial.begin(baud_rate);
- Serial.println(string_message);
- Servo library
- my_servo.attach(pin_number);
- my_servo.write(angle_degree);

map(value, in_min, in_max, out_min, out_max)

Servo Motor (Code)

```
1  #include<Servo.h> // Servo library
2
3  Servo my_servo; // Declare servo device
4
5  #define Pot A0
6  #define Servo_pin 2
```

Servo Motor (Code)

```
8 void setup() {
9   // put your setup code here, to run once:
10  pinMode(Pot, INPUT);
11  pinMode(Servo_pin, OUTPUT);
12
13  Serial.begin(115200);
14  Serial.println("Program Start");
15
16  my_servo.attach(Servo_pin); // Attach servo to a specific pin
17  my_servo.write(0); // Send the desired position 0 degree
18
19  delay(500); // Delay 500 ms
20 }
```

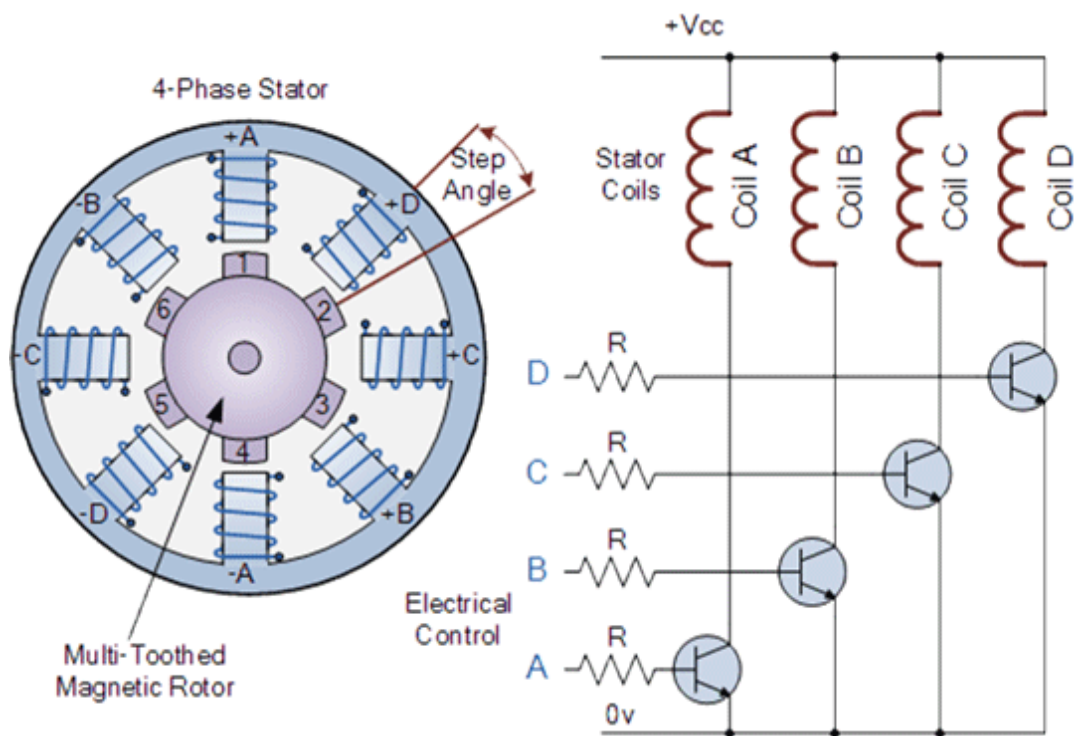
Servo Motor (Code)

```
22 void loop() {  
23   // put your main code here, to run repeatedly:  
24   int Pot_val = analogRead(Pot);           // reads the value of the potentiometer (value between 0 and 1023)  
25  
26   Serial.print("Pot value = "); Serial.println(Pot_val);  
27   Pot_val = map(Pot_val, 0, 1023, 0, 180);   // scale it for use with the servo (value between 0 and 180)  
28   Serial.print("Servo value = "); Serial.println(Pot_val);  
29  
30   my_servo.write(Pot_val);                  // sets the servo position according to the scaled value  
31   delay(15);                                // waits for the servo to get there  
32 }
```

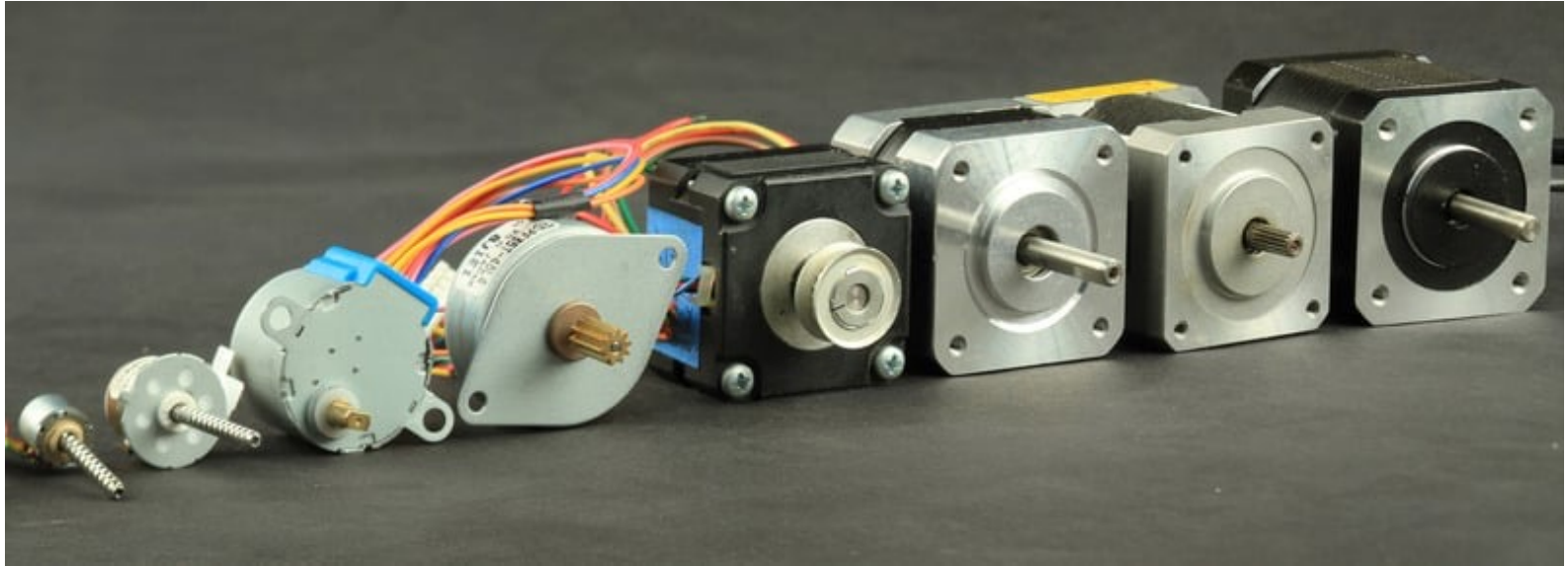
Practice

- Try to change the servo working angle from 45 to 90 instead from 0 to 180.

Stepper Motor



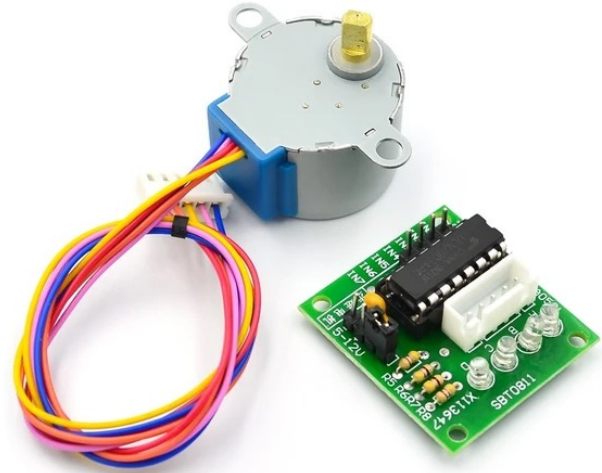
Stepper Motor



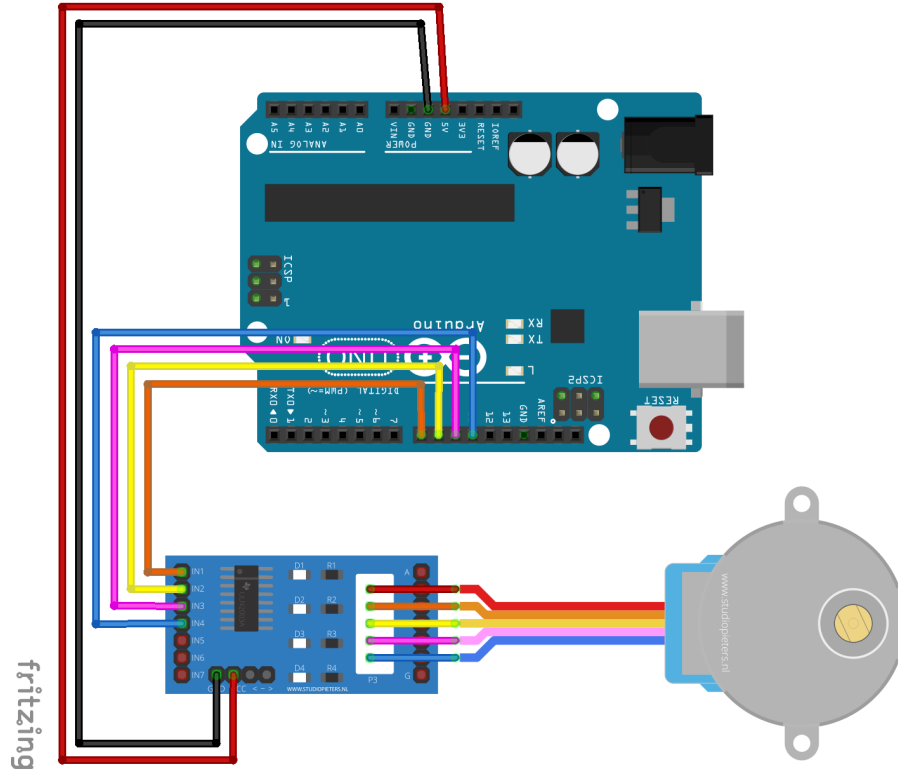
Stepper Motor

Let's try to control a stepper motor:

- Arduino Uno or Mega
- Stepper motor
- Stepper motor driver.
- Jumper wires



Stepper Motor(Connection Diagram)



Stepper Motor (Code)

We will use the following functions:

- pinMode(`pin_number`, `Direction`);
- digitalWrite(`pin_number`);
- Serial.begin(`baud_rate`);
- Serial.println(`string_message`);

Stepper Motor (Code)

```
1  #define A 8
2  #define B 9
3  #define C 10
4  #define D 11
5
6  void setup() {
7      // put your setup code here, to run once:
8      pinMode(A, OUTPUT);
9      pinMode(B, OUTPUT);
10     pinMode(C, OUTPUT);
11     pinMode(D, OUTPUT);
12 }
```

Stepper Motor (Code)

Try to do the followig logic:

1. Only A **on**.
2. Delay 50 ms
3. All **off**.
4. Delay 50 ms
5. Only B **on**.
6. Delay 50 ms
7. All **off**.
8. Delay 50 ms
9. Only C **on**.
10. Delay 50 ms
11. All **off**.
12. Delay 50 ms
13. Only D **on**.
14. Delay 50 ms
15. All **off**.

Try to do the followig logic:

1. Only A **on**.
2. Delay 50 ms
3. Only B **on**.
4. Delay 50 ms
5. Only C **on**.
6. Delay 50 ms
7. Only D **on**.
8. Delay 50 ms.

Servo Motor (Code)

```
14 void loop() {  
15     // put your main code here, to run repeatedly:  
16     digitalWrite(A, 1);  
17     delay(50);  
18     digitalWrite(A, 0);  
19     delay(50);  
20  
21     digitalWrite(B, 1);  
22     delay(50);  
23     digitalWrite(B, 0);  
24     delay(50);  
25  
26     digitalWrite(C, 1);  
27     delay(50);  
28     digitalWrite(C, 0);  
29     delay(50);  
30  
31     digitalWrite(D, 1);  
32     delay(50);  
33     digitalWrite(D, 0);  
34     delay(50);  
35 }
```

```
14 void loop() {  
15     // put your main code here, to run repeatedly:  
16     digitalWrite(A, 1);  
17     delay(50);  
18     digitalWrite(A, 0);  
19     digitalWrite(B, 1);  
20     delay(50);  
21     digitalWrite(B, 0);  
22     digitalWrite(C, 1);  
23     delay(50);  
24     digitalWrite(C, 0);  
25     digitalWrite(D, 1);  
26     delay(50);  
27     digitalWrite(D, 0);  
28 }
```

Practice

Try to do the following logic:

1. Only A **on**.
2. Delay 50 ms
3. A and B **on**.
4. Delay 50 ms
5. Only B **on**.
6. Delay 50 ms
7. B and C **on**.
8. Delay 50 ms.
9. Only C **on**.
10. Delay 50 ms
11. C and D **on**.
12. Delay 50 ms
13. Only D **on**.
14. Delay 50 ms
15. D and A **on**.
16. Delay 50 ms.

Homework_1

- Worth 25% of the final grade.
- Work in groups (up to 6 members recommended) or individually.
- Deadline: Friday 28/07/2024 – 23:45.
- For assistance, you can ask me or your friends.
- Choose one of the two available tasks.
- Use TinkerCad (<https://www.tinkercad.com/dashboard>) for simulation and testing.
- Submit your code on Moodle. Include the names of all group members in a comment at the beginning of the code.

That's All for Today