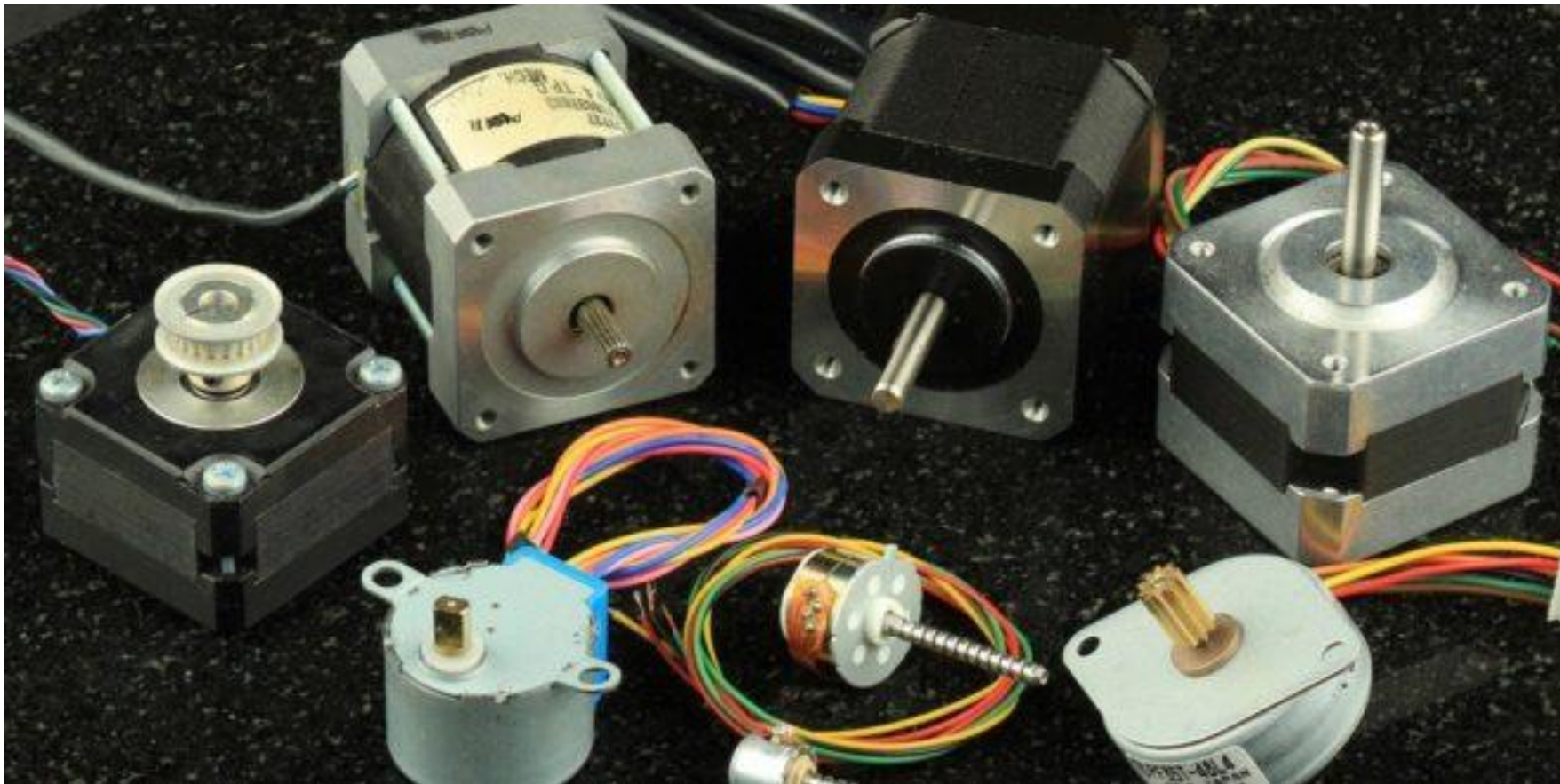
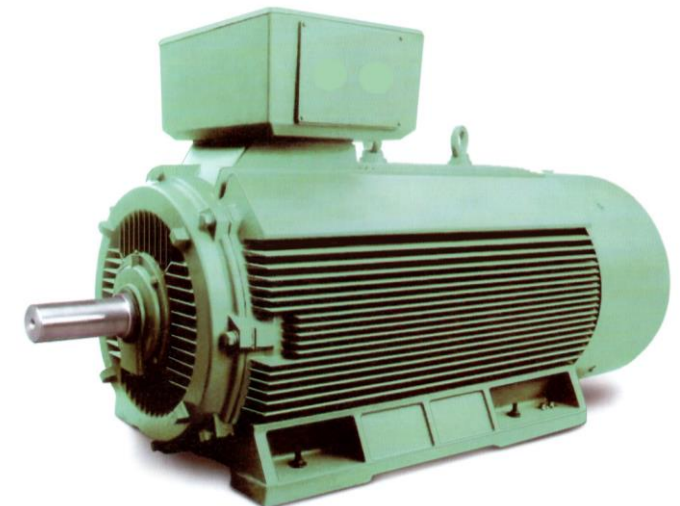
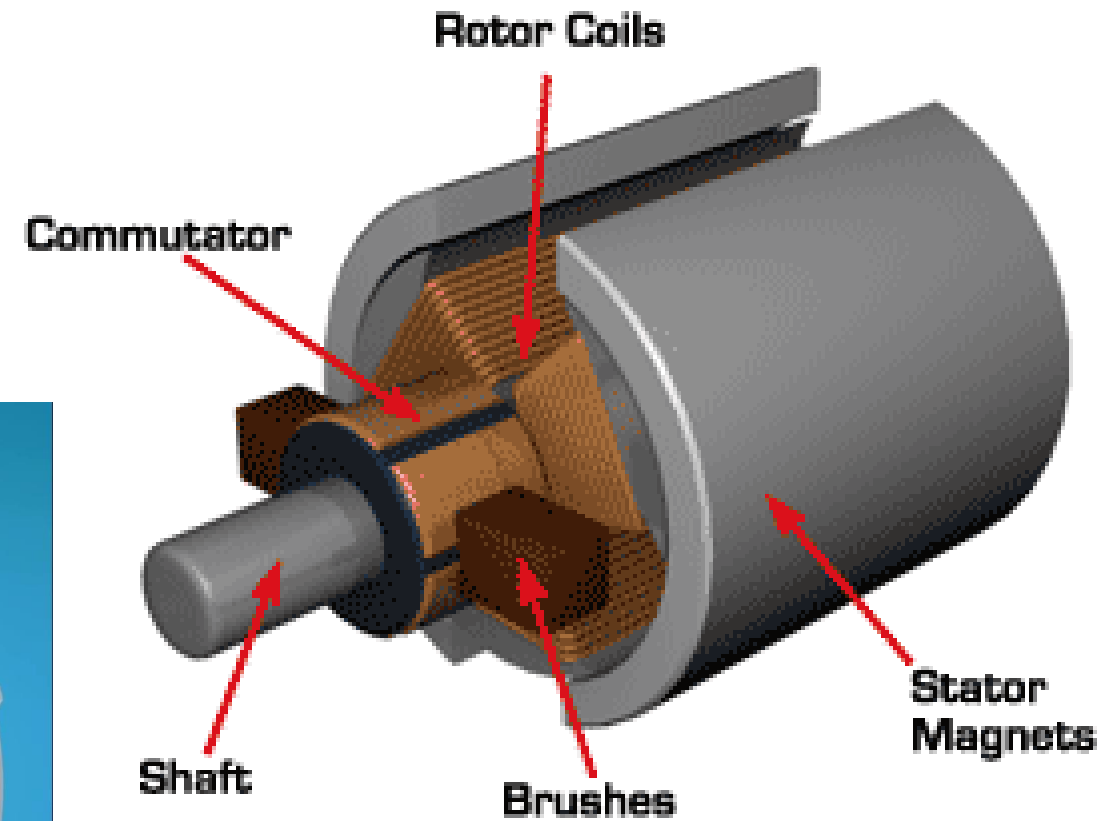


Stepper Motor Basics

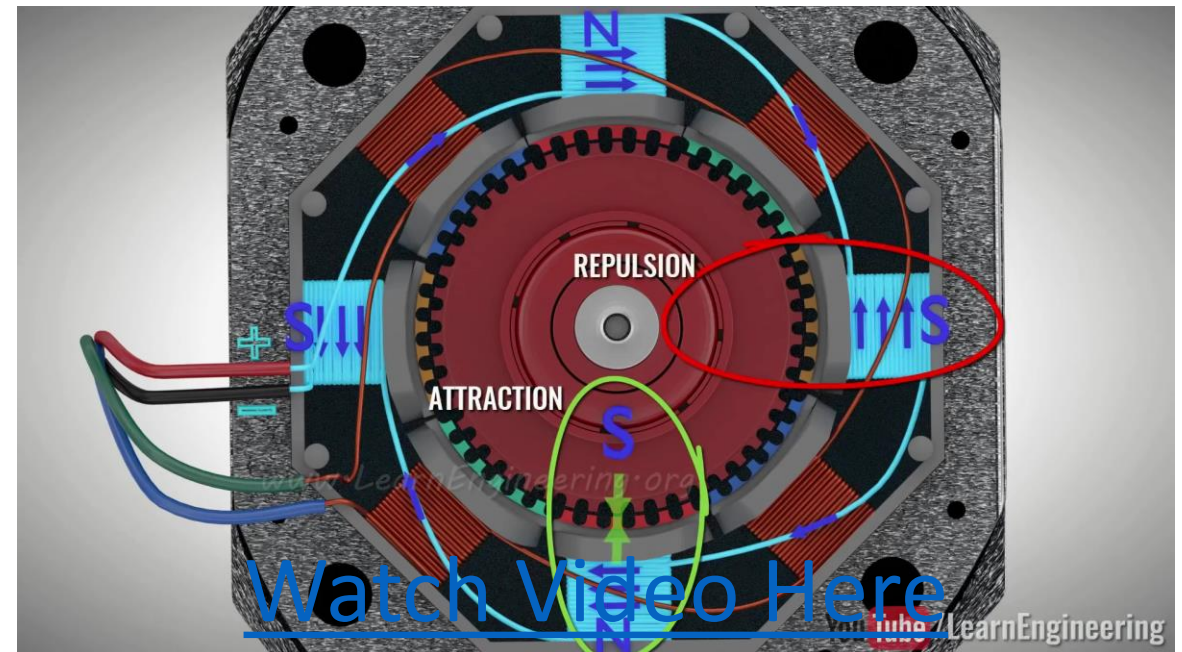
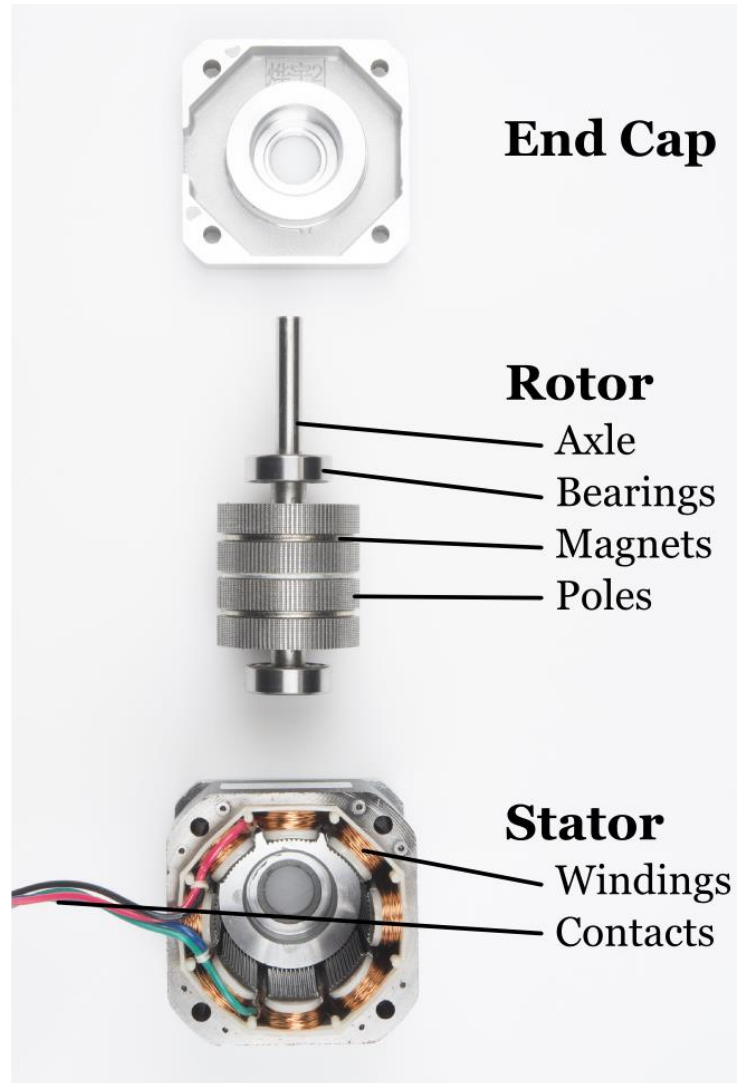


Common Motor Types

- DC Motors
- AC Motors
- Other Motors
 - Brushless
 - Stepper



Stepper Motor Anatomy



Stepper Motor Wiring

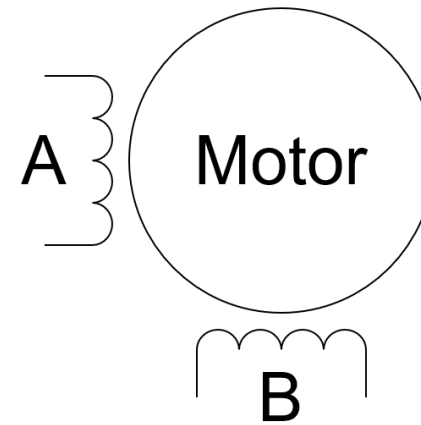
Unipolar (5, 6, 8-lead)

- 2 windings per phase
- Simpler to drive/control
- Current does not need to be reverse

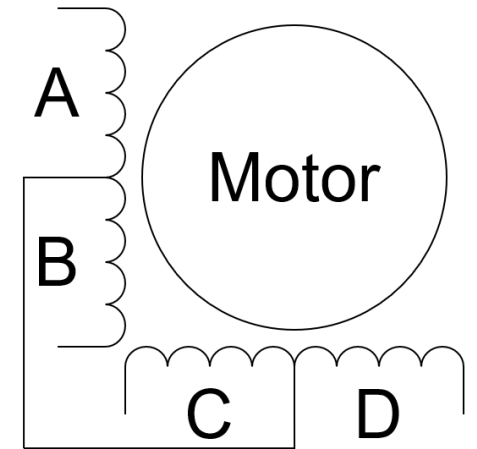
Bipolar (4-lead)

- 1 winding per phase
- More complex to drive/control
- Current must be reverse

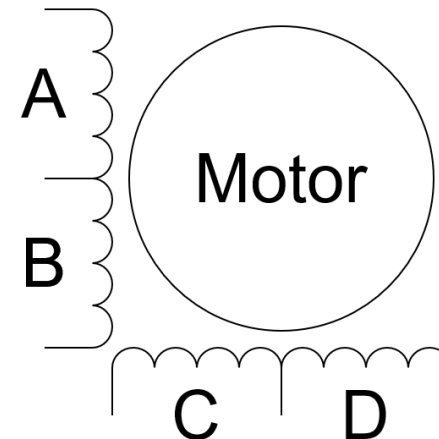
4-lead



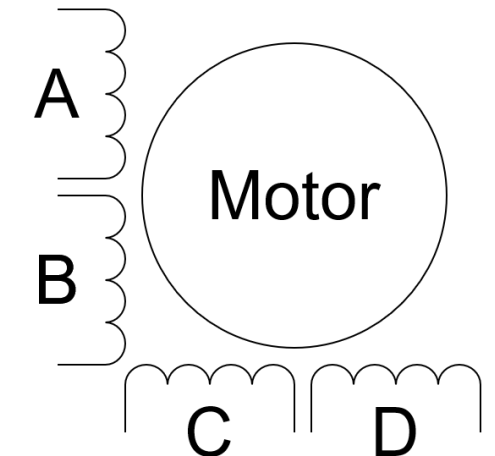
5-lead



6-lead



8-lead

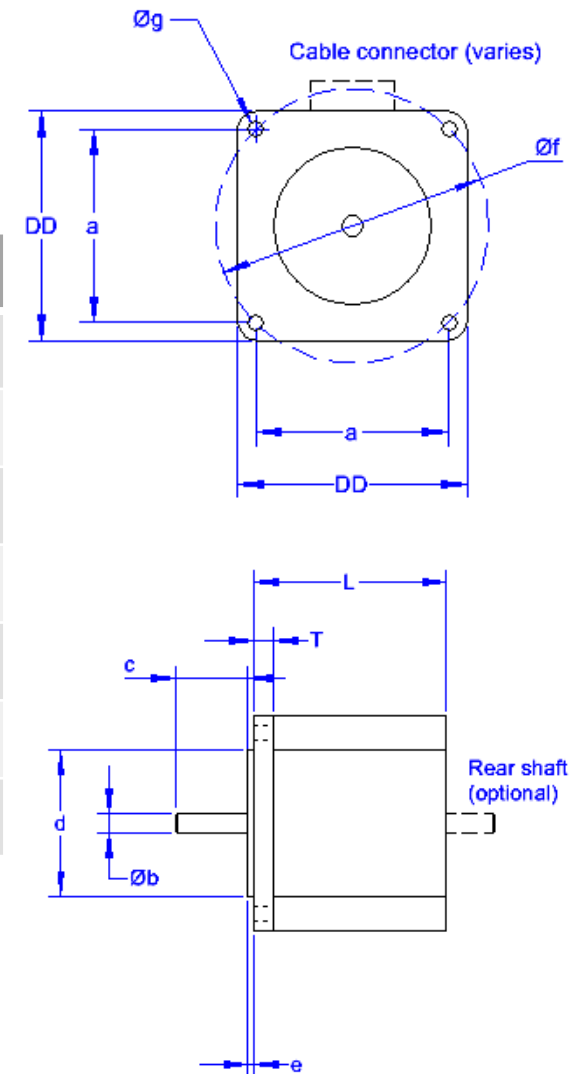


NEMA Motor Dimensions

Motor	DD (mm)	a (mm)	b (mm)	c* (mm)	d (mm)	e* (mm)	f (mm)	g (mm)
NEMA 8	20.3	16	4		15	1.5	22.6	3
NEMA 11	27.9	23	5		22	2	32.5	4
NEMA 14	35.6	26	5		22	2	36.8	4
NEMA 17	43.2	31	5	24	22	2	43.8	4-40 UNC
NEMA 23	58.4	47.1	6.35	20.6	38.1	1.6	66.7	5
NEMA 34	86.4	69.7	9.5	31.8	73	1.6	98.4	5.5
NEMA 42	106.7	88.9	16	35.1	55.5	1.6	125.7	7.1

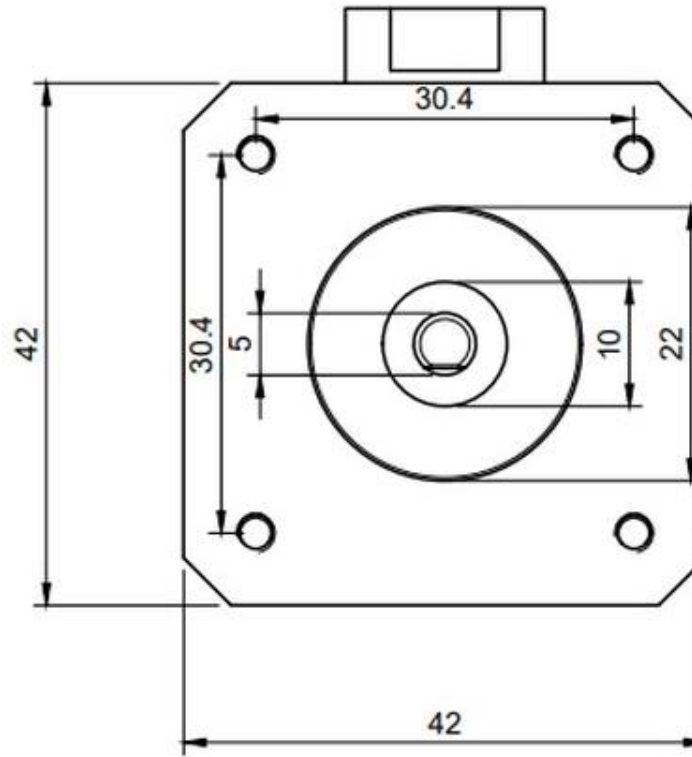
*max length





Source

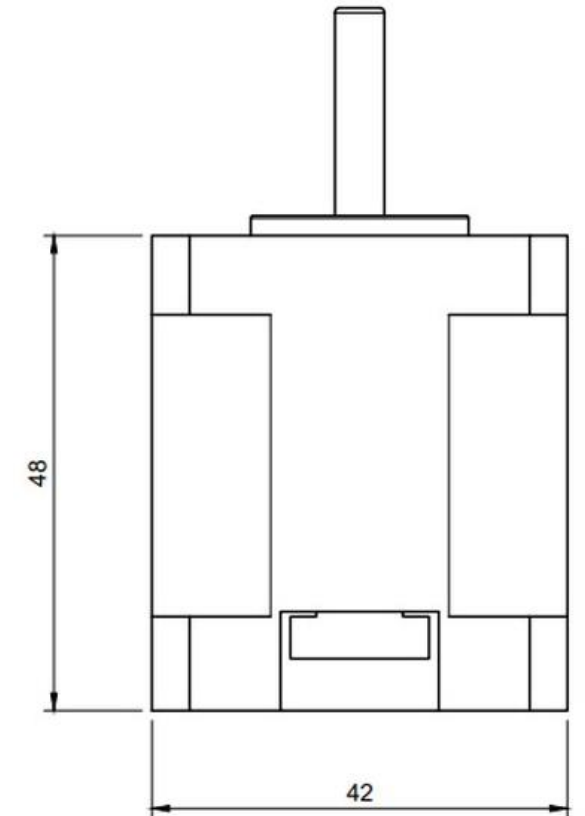


Your NEMA 17

- Bipolar, 4-lead
- 1.8° Step Angle
- 1.7 A current max
- 0.59 Nm holding torque



	Coil 1B	Red
	Coil 1A	Blue
	Coil 2A	Green
	Coil 2B	Black



[Vender](#)

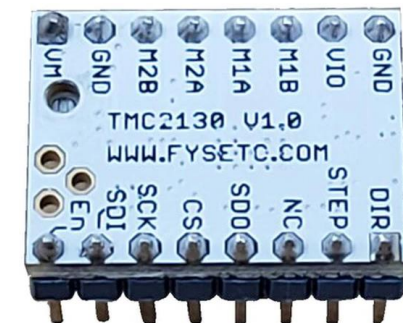
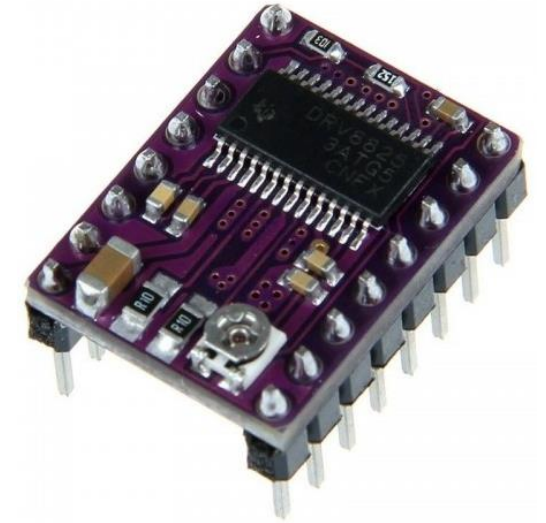
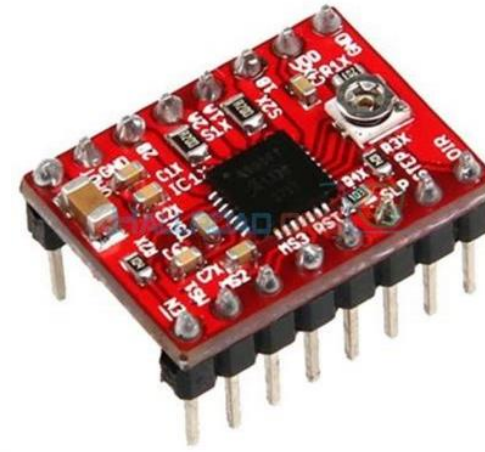
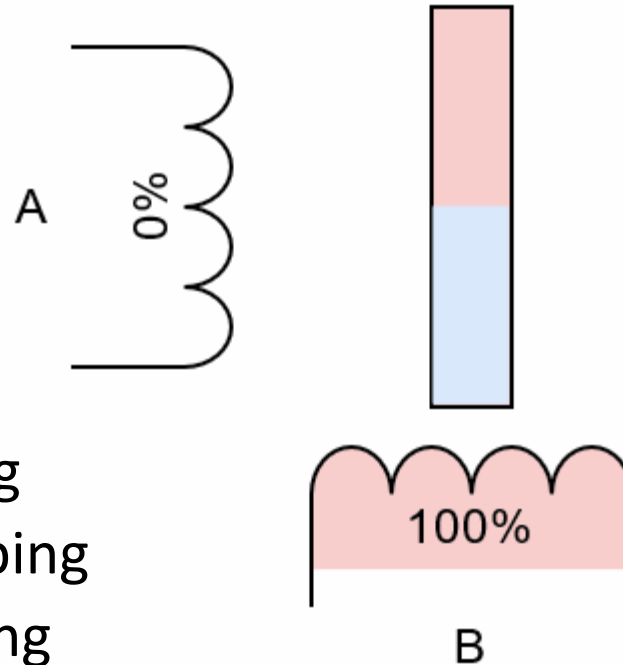
Stepper Motor Control

- Common Controllers

- A4988
- DRV8825
- TB6560AHQ
- TMC2130

- Microstepping

- A4988 – 16th stepping
- DRV8825 – 32nd stepping
- TB6560AHQ – 16th stepping
- TMC2130 – 256th stepping



[Interesting article about microstepping accuracy](#)

Your Stepper Motor Driver (A4988)

Pin 1 – Enable pin, Low is enabled

Pin 2 – Microstep selection pin 1

Pin 3 – Microstep selection pin 2

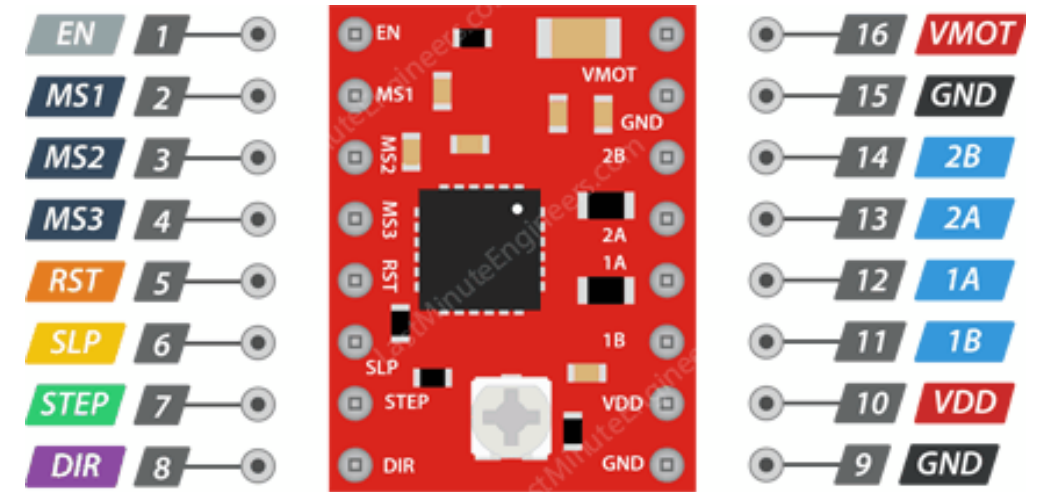
Pin 4 – Microstep selection pin 3

Pin 5 – Reset pin, Low resets

Pin 6 – Sleep pin, Low puts to sleep

Pin 7 – Step control pin

Pin 8 – Direction control pin, Low is CCW



MS1	MS2	MS3	Microstep Resolution
Low	Low	Low	Full step
High	Low	Low	Half step
Low	High	Low	Quarter step
High	High	Low	Eighth step
High	High	High	Sixteenth step

Your Stepper Motor Driver (A4988)

Pin 9 – Ground

Pin 10 – Logic voltage supply, 5V

Pin 11 – Bipolar motor pin, coil 1B

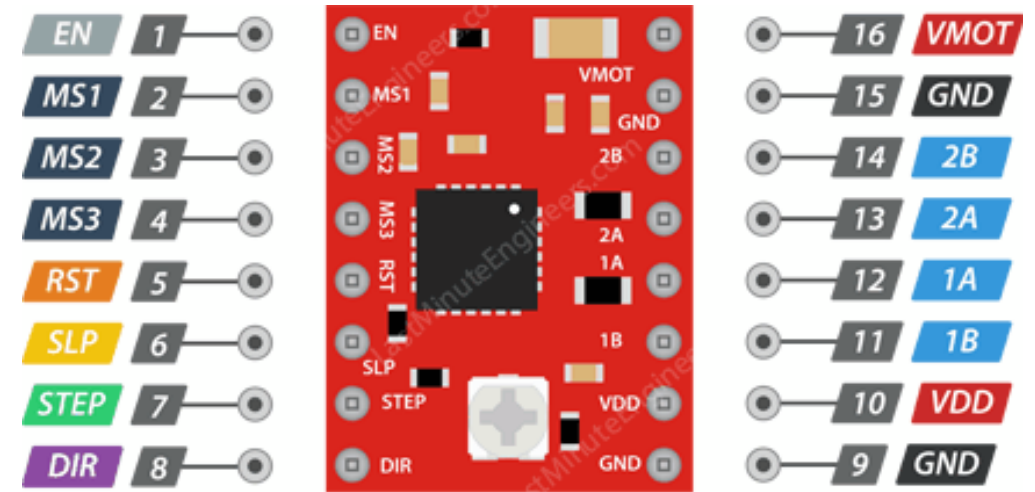
Pin 12 – Bipolar motor pin, coil 1A

Pin 13 – Bipolar motor pin, coil 2A

Pin 14 – Bipolar motor pin, coil 2B

Pin 15 – Ground

Pin 16 – Motor voltage supply, 12V



35V and 2A maximum rating

Arduino Code

```
1 // Define pin connections & motor's steps per revolution
2 const int dirPin = 2;
3 const int stepPin = 3;
4 const int stepsPerRevolution = 200;
5
6 void setup()
7 {
8     // Declare pins as Outputs
9     pinMode(stepPin, OUTPUT);
10    pinMode(dirPin, OUTPUT);
11 }
12
13 void loop() {
14     // Set motor direction clockwise
15     digitalWrite(dirPin, HIGH);
16
17     // Spin motor slowly
18     for(int x = 0; x < stepsPerRevolution; x++){
19         digitalWrite(stepPin, HIGH);
20         delayMicroseconds(2000);
21         digitalWrite(stepPin, LOW);
22         delayMicroseconds(2000);
23     }
24     delay(1000); // Wait a second
25 }
```

[Source](#)

Arduino Code using AccelStepper

```
1 // Include the AccelStepper Library
2 // http://www.airspayce.com/mikem/arduino/AccelStepper/
3 #include <AccelStepper.h>
4
5 // Define pin connections
6 const int dirPin = 2;
7 const int stepPin = 3;
8
9 // Define motor interface type
10 #define motorInterfaceType 1
11
12 // Creates an instance
13 AccelStepper myStepper(motorInterfaceType, stepPin, dirPin);
14
15 void setup() {
16     // set the maximum speed, acceleration factor,
17     // initial speed and the target position
18     myStepper.setMaxSpeed(1000);
19     myStepper.setAcceleration(50);
20     myStepper.setSpeed(200);
21     myStepper.moveTo(200);
22 }
23
24 void loop() {
25     // Change direction once the motor reaches target position
26     if (myStepper.distanceToGo() == 0)
27         myStepper.moveTo(-myStepper.currentPosition());
28
29     // Move the motor one step
30     myStepper.run();
31 }
```

[Source](#)

To install AccelStepper, go to Sketch > Include Library > Manage Libraries ... and search for AccelStepper then select Install.