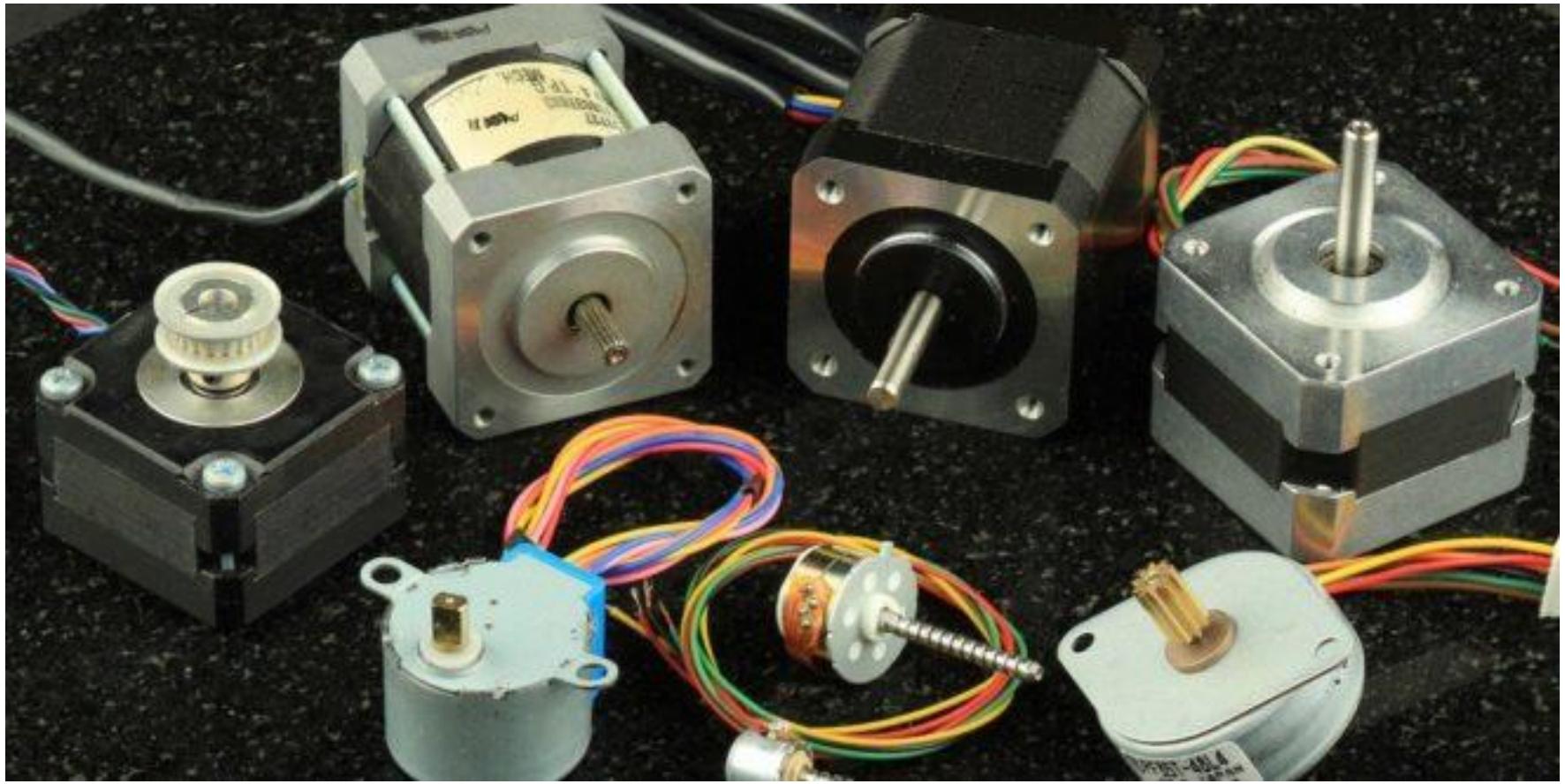
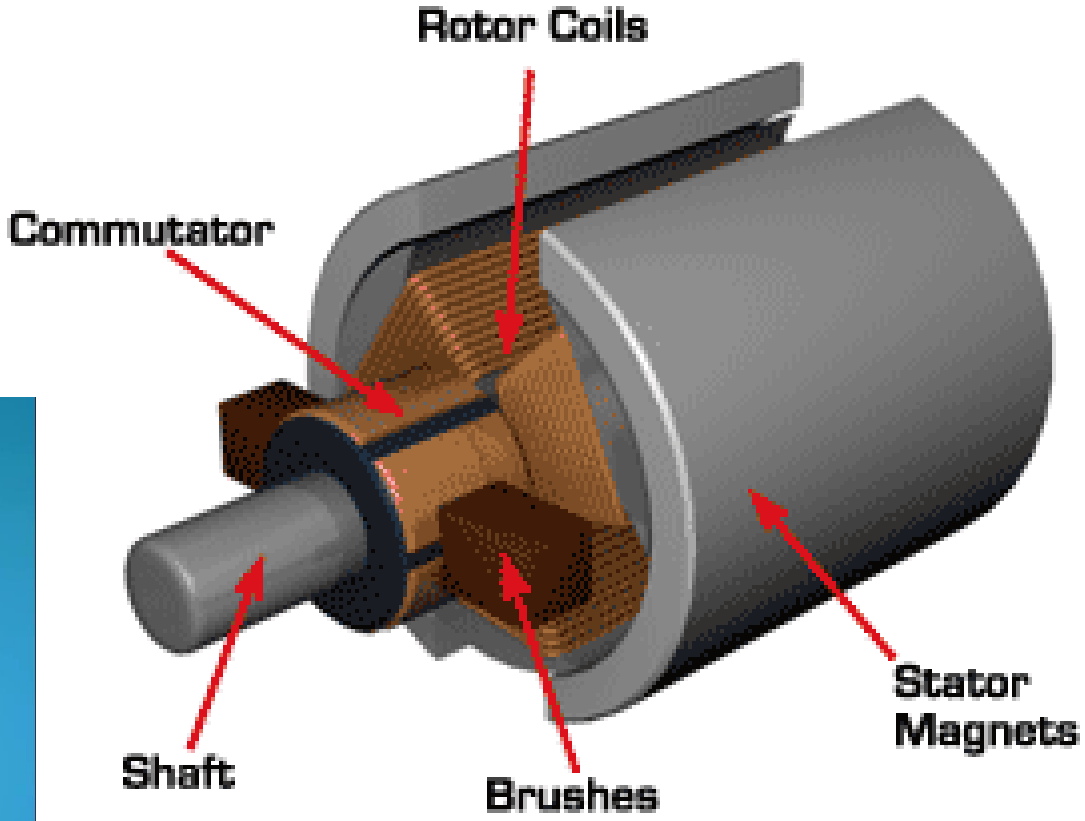
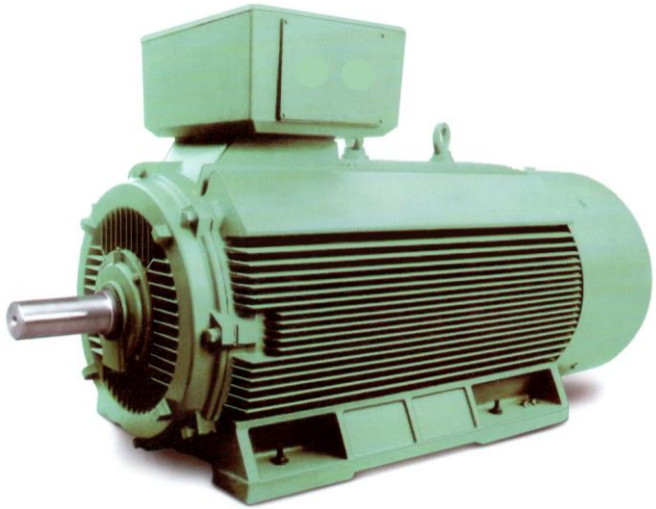
Stepper Motor Control



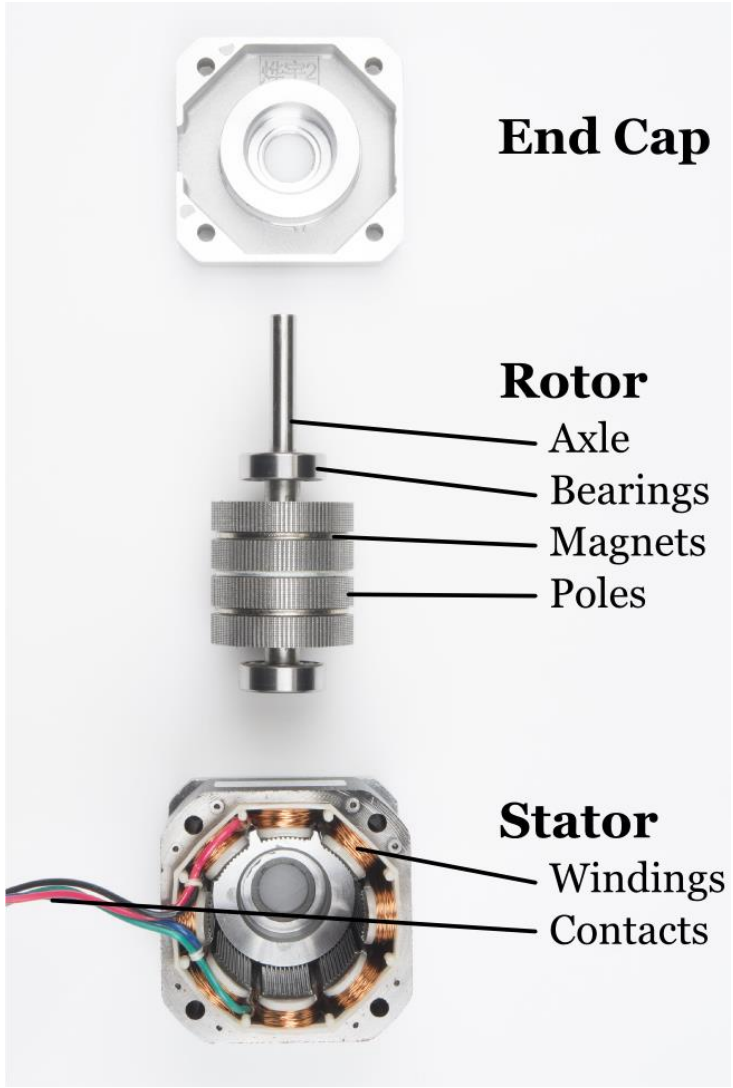
Common Motor Types

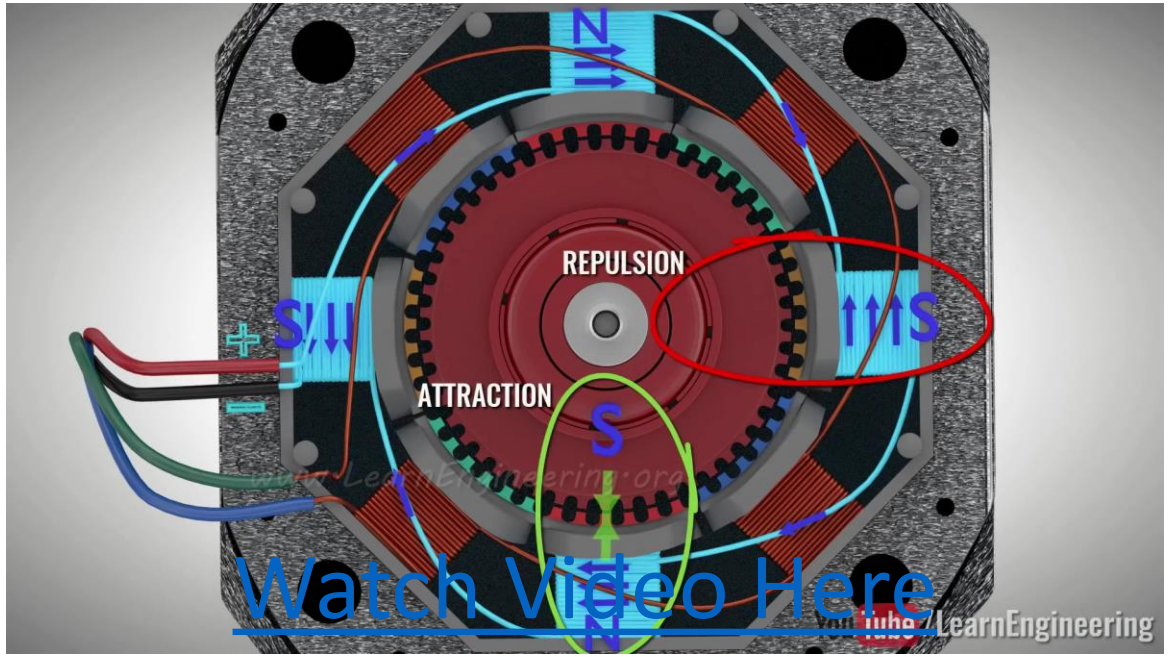
- DC Motors
- AC Motors
- Other Motors
  - Brushless
  - Stepper





Stepper Motor Anatomy





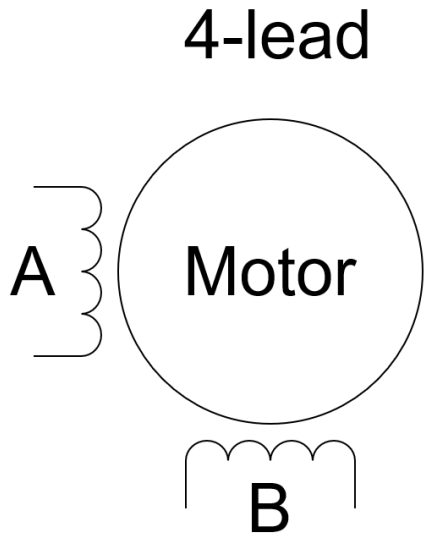
Stepper Motor Wiring

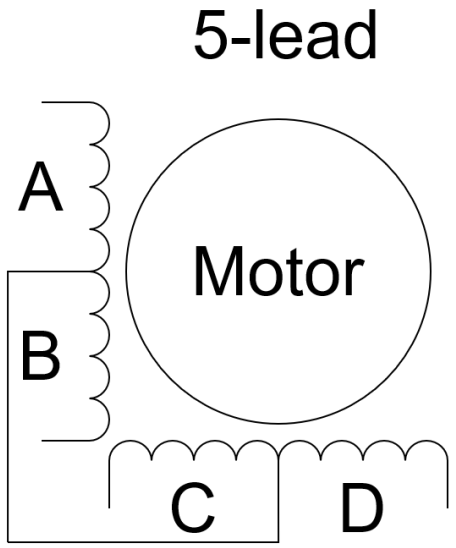
Unipolar (5, 6, 8-lead)

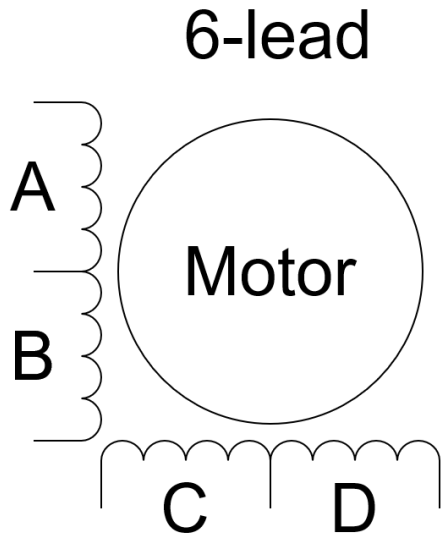
- 2 windings per phase
- Simpler to drive/control
- Current does not need to be reverse

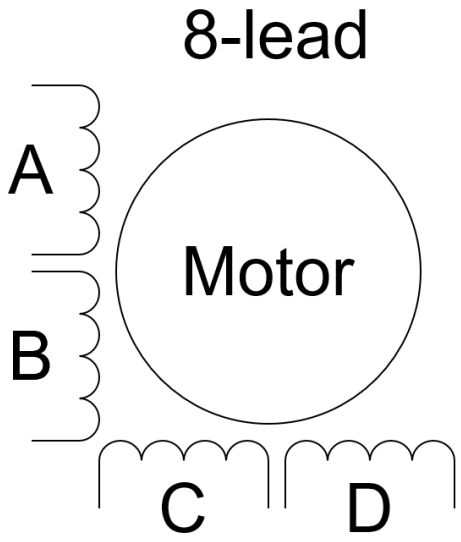
Bipolar (4-lead)

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



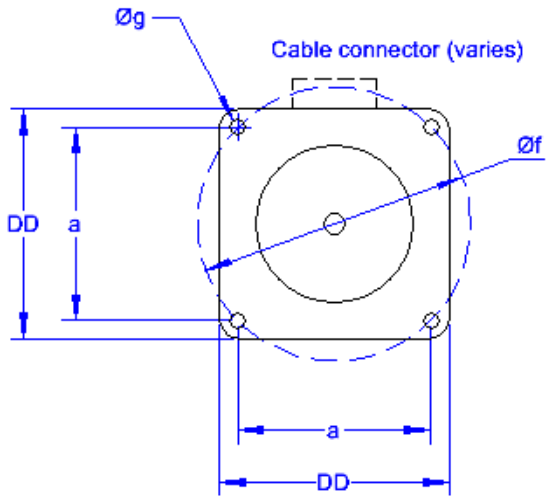


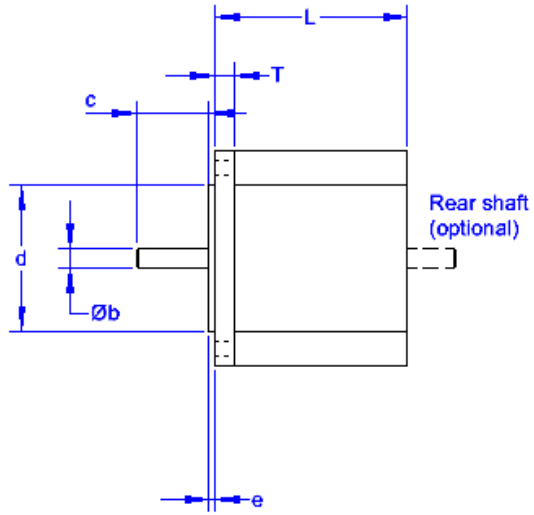




NEMA Motor Dimensions

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



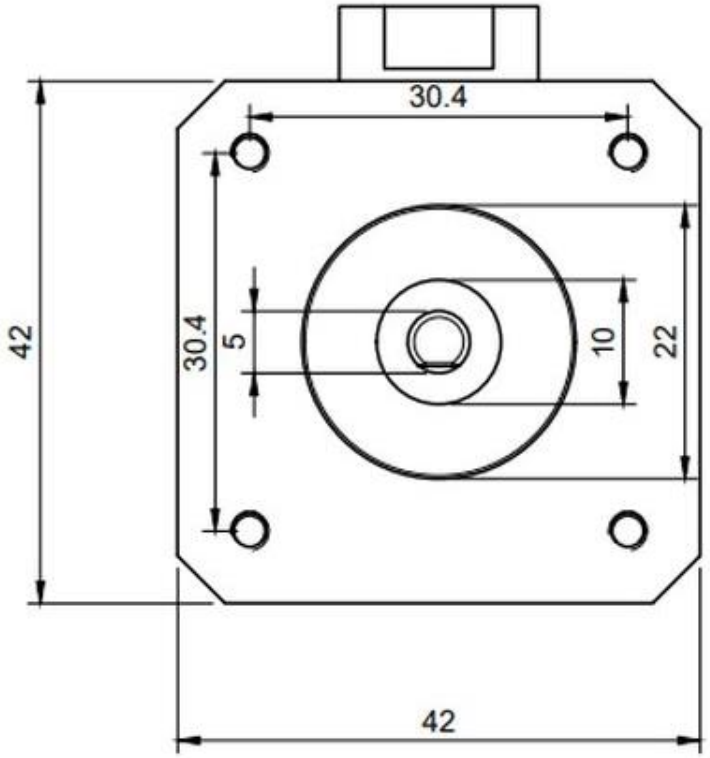


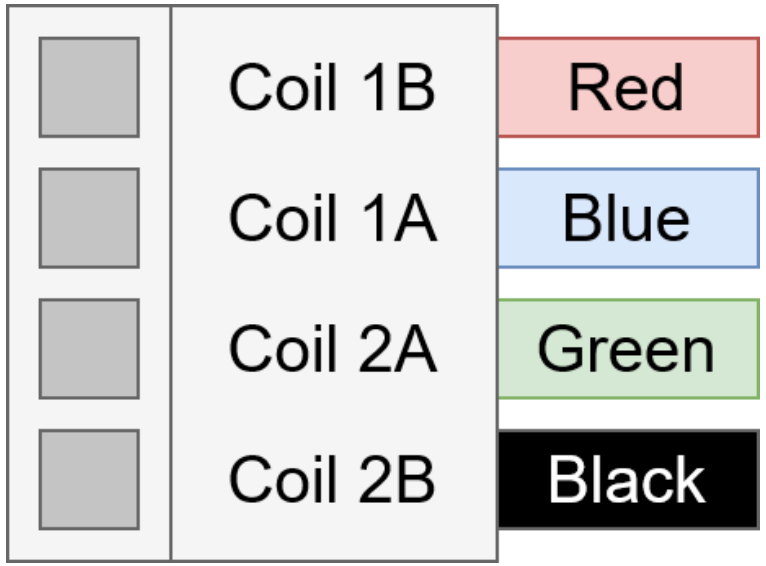
*max length

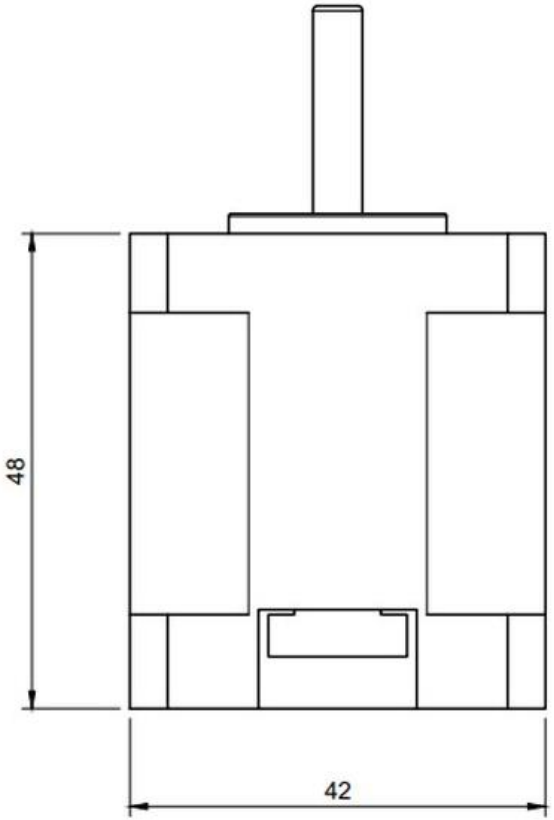
[Source]

Your NEMA 17

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

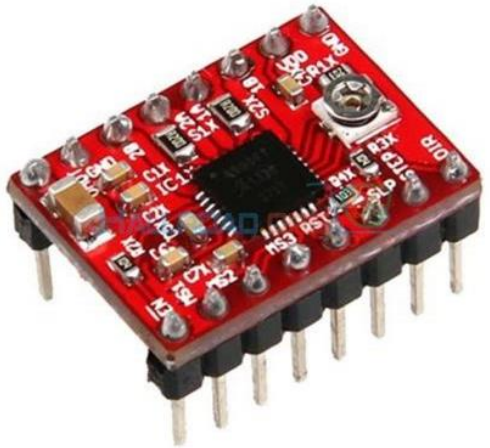


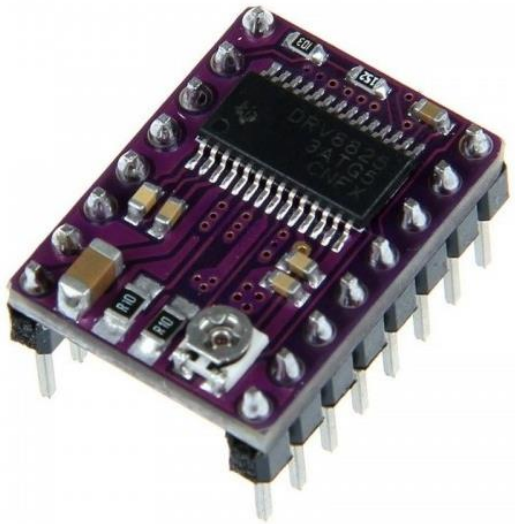




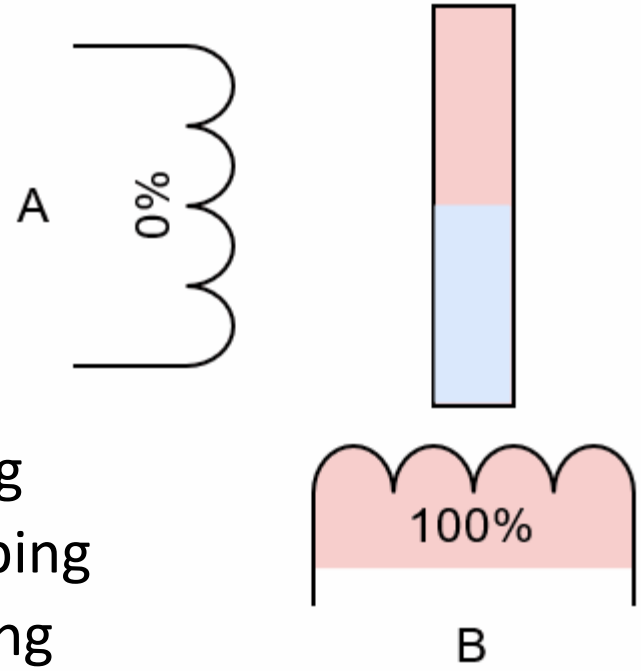
[Vender]

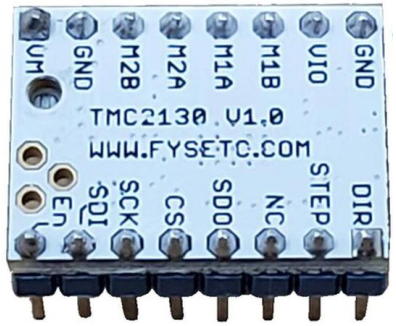
Stepper Motor Control





- 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

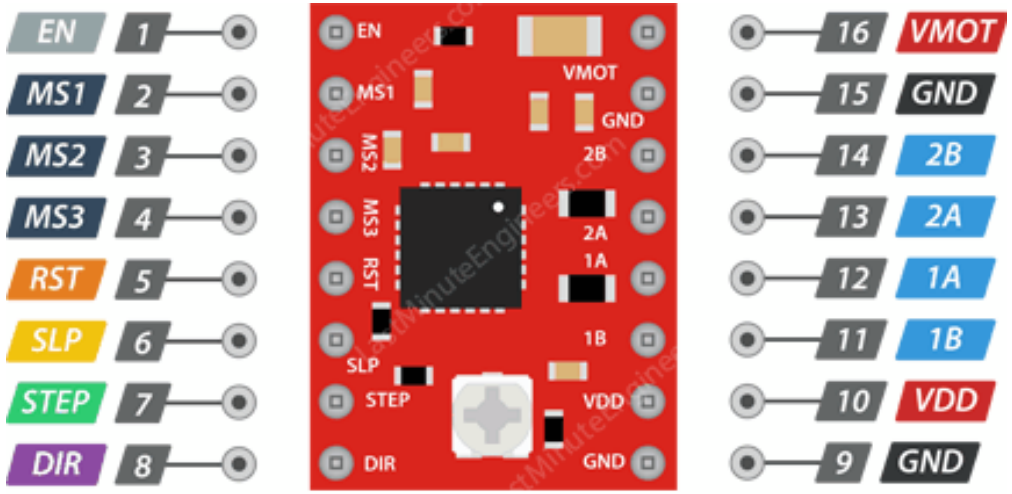
Pin 4 – Microstep selection pin 3

Pin 5 – Reset pin, Low resets

Pin 6 – Sleep pin, Low puts to sleep

Pin 7 – Step control pin

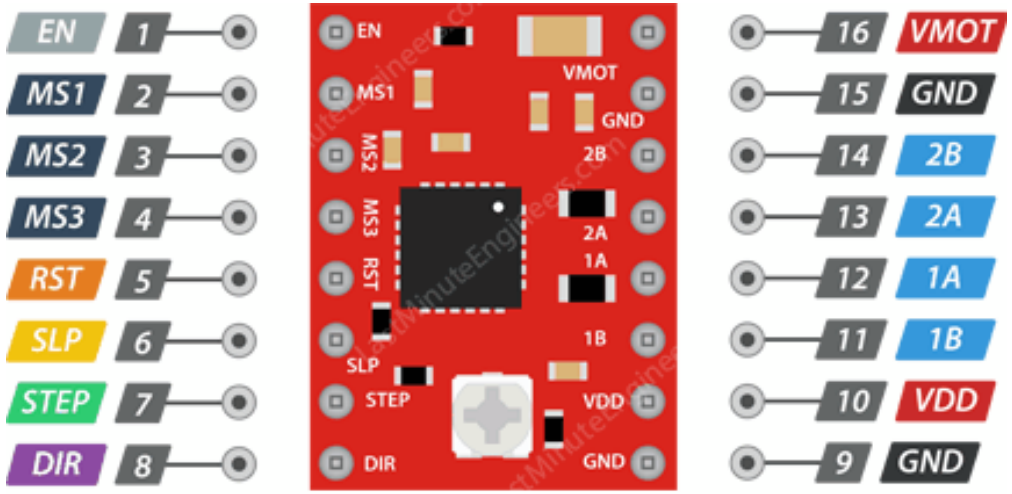
Pin 8 – Direction control pin, Low is CCW



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

Source Vender

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

[Source] [Vender]

Arduino Code

```
// Define pin connections & motor's steps per revolution
const int dirPin = 2;
const int stepPin = 3;
const int stepsPerRevolution = 200;

void setup()
{
  // Declare pins as Outputs
  pinMode(stepPin, OUTPUT);
  pinMode(dirPin, OUTPUT);
}
```

```
void loop(){
  // Set motor direction clockwise
  digitalWrite(dirPin, HIGH);

  // Spin motor slowly
  for(int x = 0; x < stepsPerRevolution; x++){
    digitalWrite(stepPin, HIGH);
    delayMicroseconds(2000);
    digitalWrite(stepPin, LOW);
    delayMicroseconds(2000);
  }
  delay(1000); // Wait a second
}
```

Source

Arduino Code using AccelStepper

```
// Include the AccelStepper Library
// http://www.airspayce.com/mikem/arduino/AccelStepper/
#include <AccelStepper.h>

// Define pin connections
const int dirPin = 2;
const int stepPin = 3;

// Define motor interface type
#define motorInterfaceType 1

// Creates an instance
AccelStepper myStepper(motorInterfaceType, stepPin, dirPin);

void setup() {
  // set the maximum speed, acceleration factor,
  // initial speed and the target position
  myStepper.setMaxSpeed(1000);
  myStepper.setAcceleration(50);
  myStepper.setSpeed(200);
  myStepper.moveTo(200);
}
```

```
void loop() {
  // Change direction once the motor reaches target position
  if (myStepper.distanceToGo() == 0)
    myStepper.moveTo(-myStepper.currentPosition());

  // Move the motor one step
  myStepper.run();
}
```

Source

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