

Project 19: Clock Rotation

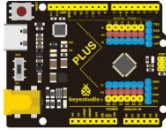


1. Project Introduction

Stepper motors can be positioned accurately and it is the most important part in industrial robots, 3D printers, large lathes and other mechanical equipment.

In this project, we will use a stepper motor and a clock paper card to make a clock model.

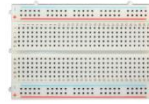
2. Project Hardware



Plus
Development
Board*1



Plus Board
Holder



400-Hole
Breadboard



USB Cable*1



Stepper
Motor*1



Stepper
Motor
driver*1



Jumper
Wire*6



Clock Paper
Card*1

2. Stepper Motor and Driver

Stepper Motor is a motor controlled by a series of electromagnetic coils. It can turn an exact amount of degrees (or steps) as desired, allowing you to move it to an exact location and hold that position. It does so by powering the coils inside the motor for very short periods of time, but you have to power the motor all the time to keep it in the position that you desire.

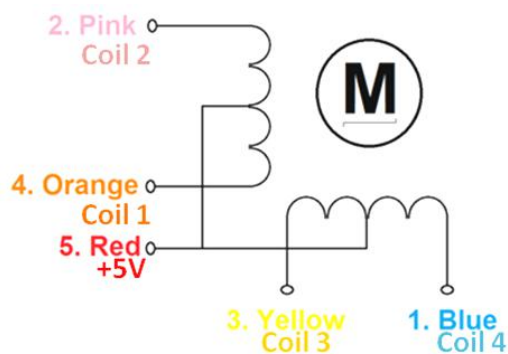
There are two basic types of stepper motors, unipolar steppers and bipolar steppers.

In this lesson, we use a Unipolar Stepper Motor 28-BYJ48.



Unipolar Stepper Motors

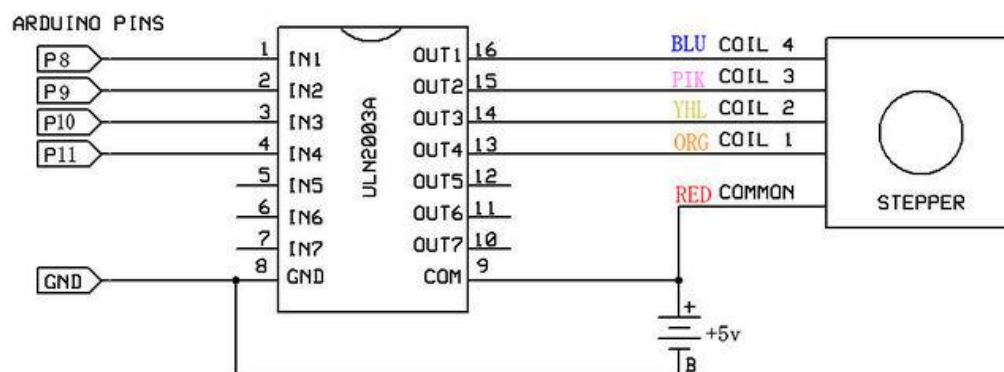
A unipolar stepper motor has one winding with a center tap per phase. Each section of windings is switched on for each direction of the magnetic field. Since in this arrangement a magnetic pole can be reversed without switching the direction of the current, the commutation circuit can be made very simple (e.g., a single transistor) for each winding. Typically, given a phase, the center tap of each winding is made common: giving three leads per phase and six leads for a typical two phase motor. Often, these two phase commons are internally joined, so the motor has only five leads.



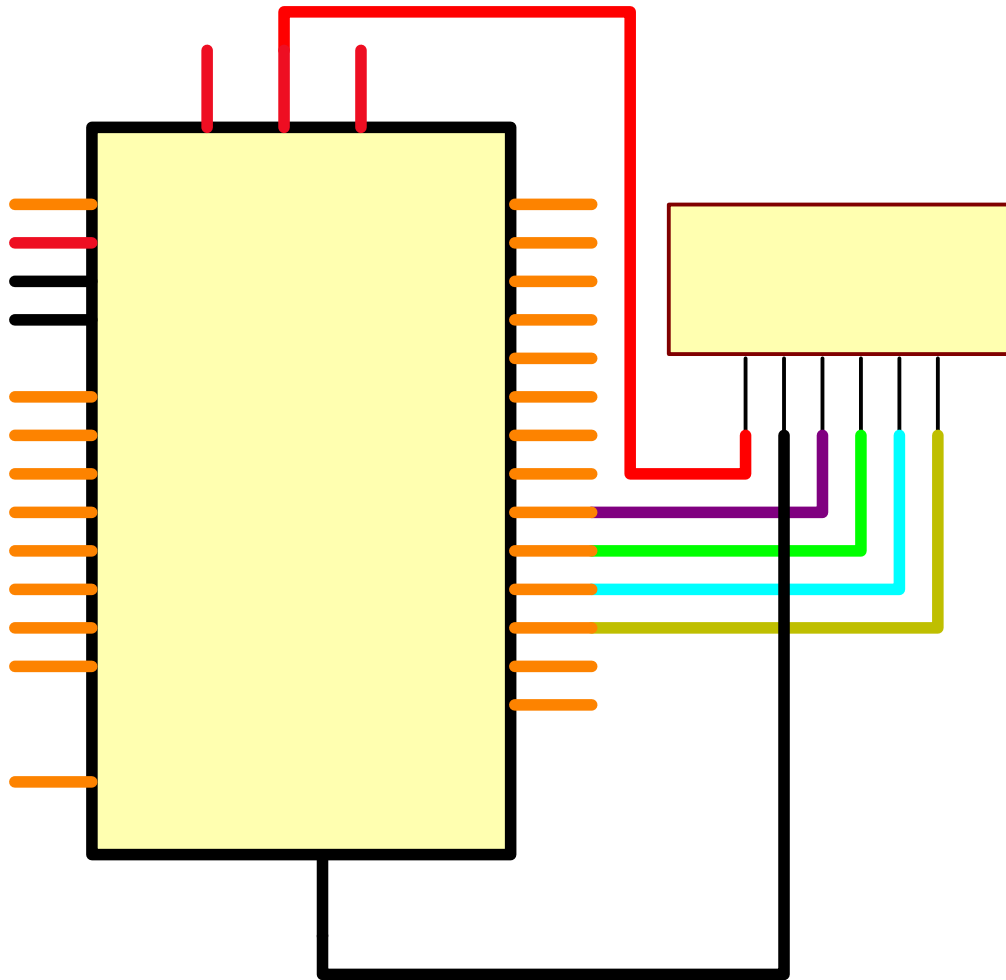
The simplest way of interfacing a unipolar stepper to Arduino is to use a breakout for ULN2003A transistor array chip. The ULN2003A contains seven darlington transistor drivers and is somewhat like having seven TIP120 transistors all in one package. The ULN2003A can pass up to 500 mA per channel and has an internal voltage drop of about 1V when on. It also contains internal clamp diodes to dissipate voltage spikes when driving inductive loads. To control the stepper, apply voltage to each of the coils in a specific sequence.

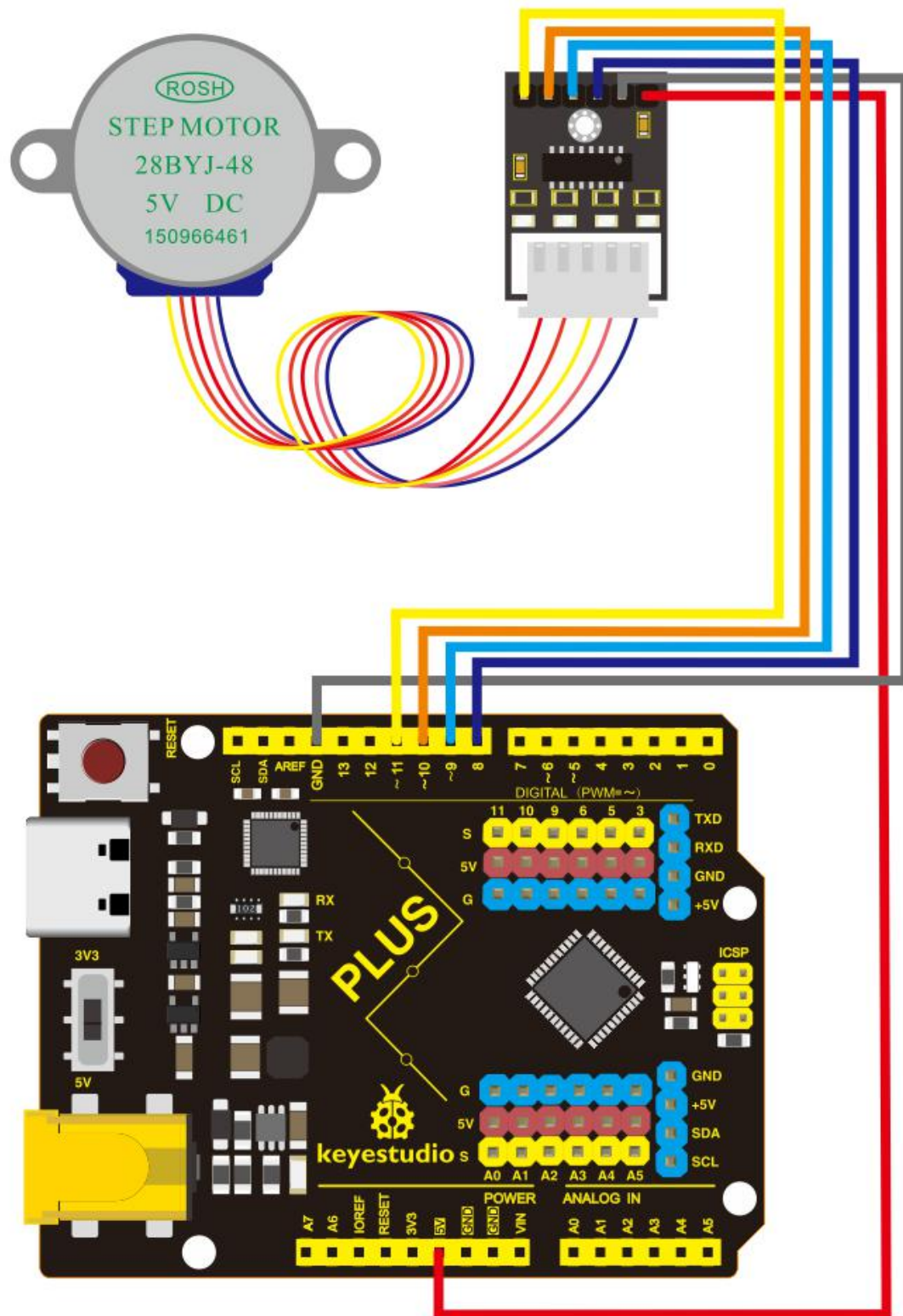
Lead Wire Color	---> CW Direction (1-2 Phase)								
	1	2	3	4	5	6	7	8	
4 ORG	-	-							-
3 YEL		-	-	-					
2 PIK				-	-	-			
1 BLU						-	-	-	

Here are schematics showing how to interface a unipolar stepper motor to four controller pins using a ULN2003A, and showing how to interface using four TIP120 's.



4.Circuit Connection





5.Project Code

```
/*  
keyestudio STEM Starter Kit  
Project 19  
Analog clock rotation  
http://www.keyestudio.com  
*/  
  
// Stepper motor pin numbers  
const int IN1_pin = 8;  
const int IN2_pin = 9;  
const int IN3_pin = 10;  
const int IN4_pin = 11;  
int val;  
void setup() {  
  Serial.begin(9600);  
  // Arduino pin setup for stepper motor  
  pinMode(IN1_pin,OUTPUT);  
  pinMode(IN2_pin,OUTPUT);  
  pinMode(IN3_pin,OUTPUT);  
  pinMode(IN4_pin,OUTPUT);  
}  
void loop() {  
  int a = 1024;
```

```
int b = 1024;

val=Serial.read();

if(val=='A')
{
while(a--)
{
digitalWrite(IN1_pin, HIGH);
digitalWrite(IN2_pin, LOW);
digitalWrite(IN3_pin, LOW);
digitalWrite(IN4_pin, LOW);
delay(10);

digitalWrite(IN1_pin, LOW);
digitalWrite(IN2_pin, HIGH);
digitalWrite(IN3_pin, LOW);
digitalWrite(IN4_pin, LOW);
delay(10);

digitalWrite(IN1_pin, LOW);
digitalWrite(IN2_pin, LOW);
digitalWrite(IN3_pin, HIGH);
digitalWrite(IN4_pin, LOW);
delay(10);

digitalWrite(IN1_pin, LOW);
```



```
digitalWrite(IN2_pin, LOW);
digitalWrite(IN3_pin, LOW);
digitalWrite(IN4_pin, HIGH);
delay(10);
}
}
if(val=='C')
{
while(b--)
{
digitalWrite(IN4_pin, HIGH);
digitalWrite(IN3_pin, LOW);
digitalWrite(IN2_pin, LOW);
digitalWrite(IN1_pin, LOW);
delay(10);
digitalWrite(IN4_pin, LOW);
digitalWrite(IN3_pin, HIGH);
digitalWrite(IN2_pin, LOW);
digitalWrite(IN1_pin, LOW);
delay(10);
digitalWrite(IN4_pin, LOW);
digitalWrite(IN3_pin, LOW);
```

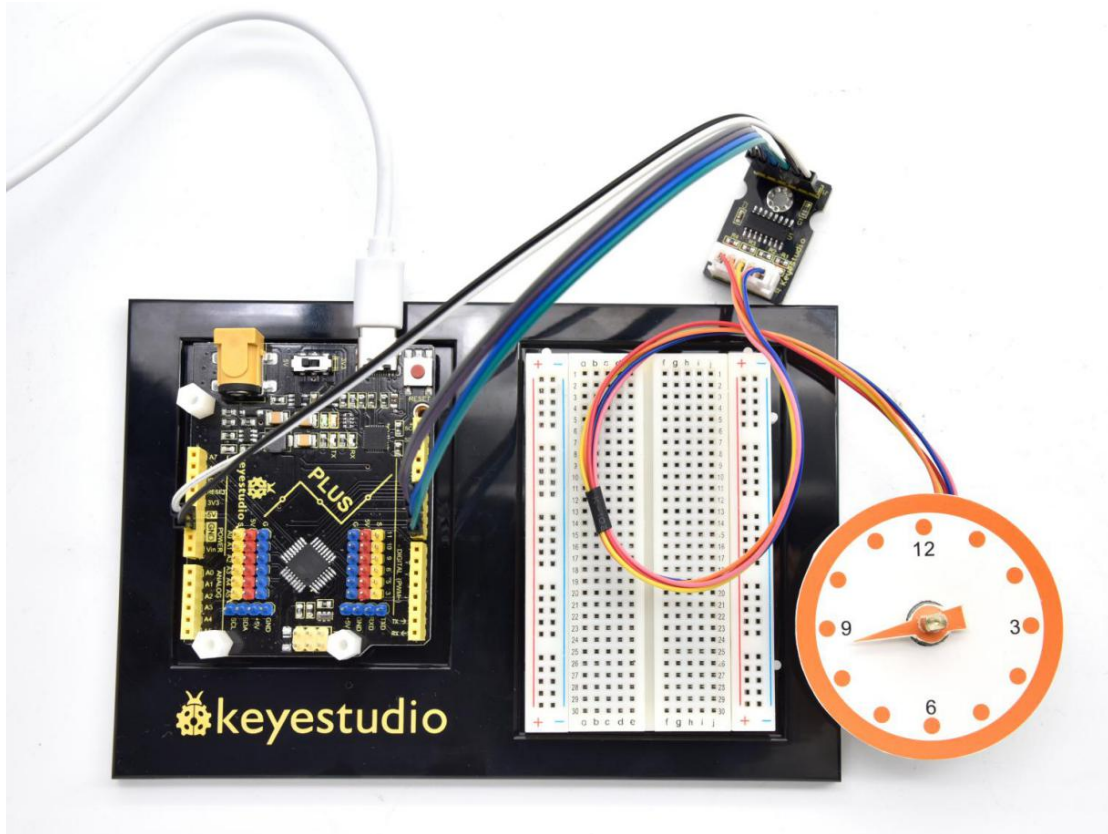
```

digitalWrite(IN2_pin, HIGH);
digitalWrite(IN1_pin, LOW);
delay(10);
digitalWrite(IN4_pin, LOW);
digitalWrite(IN3_pin, LOW);
digitalWrite(IN2_pin, LOW);
digitalWrite(IN1_pin, HIGH);
delay(10);
}
}
digitalWrite(IN4_pin, LOW);
digitalWrite(IN3_pin, LOW);
digitalWrite(IN2_pin, LOW);
digitalWrite(IN1_pin, LOW);
}
////////////////////////////////////

```

6.Project Result

Upload the code to the PLUS development board. Open the serial monitor and set the baud rate to 9600, we input A in the serial monitor, the stepper motor is forwarding, and input C in the serial monitor, the stepper motor is reversed.



*****next

project*****