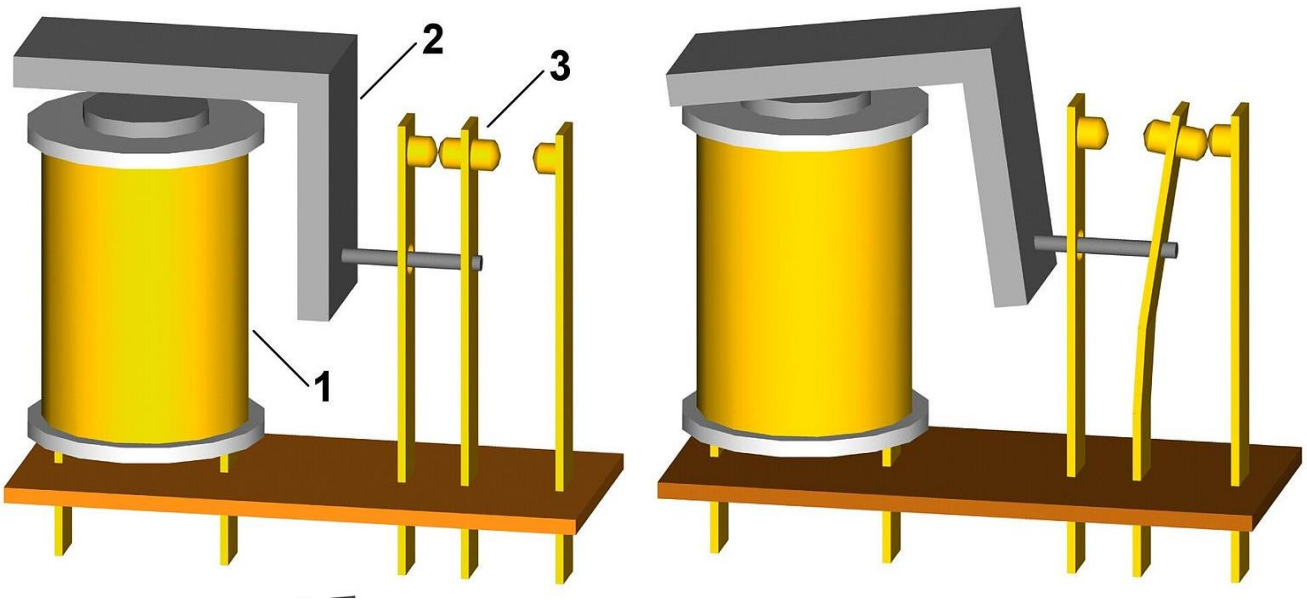
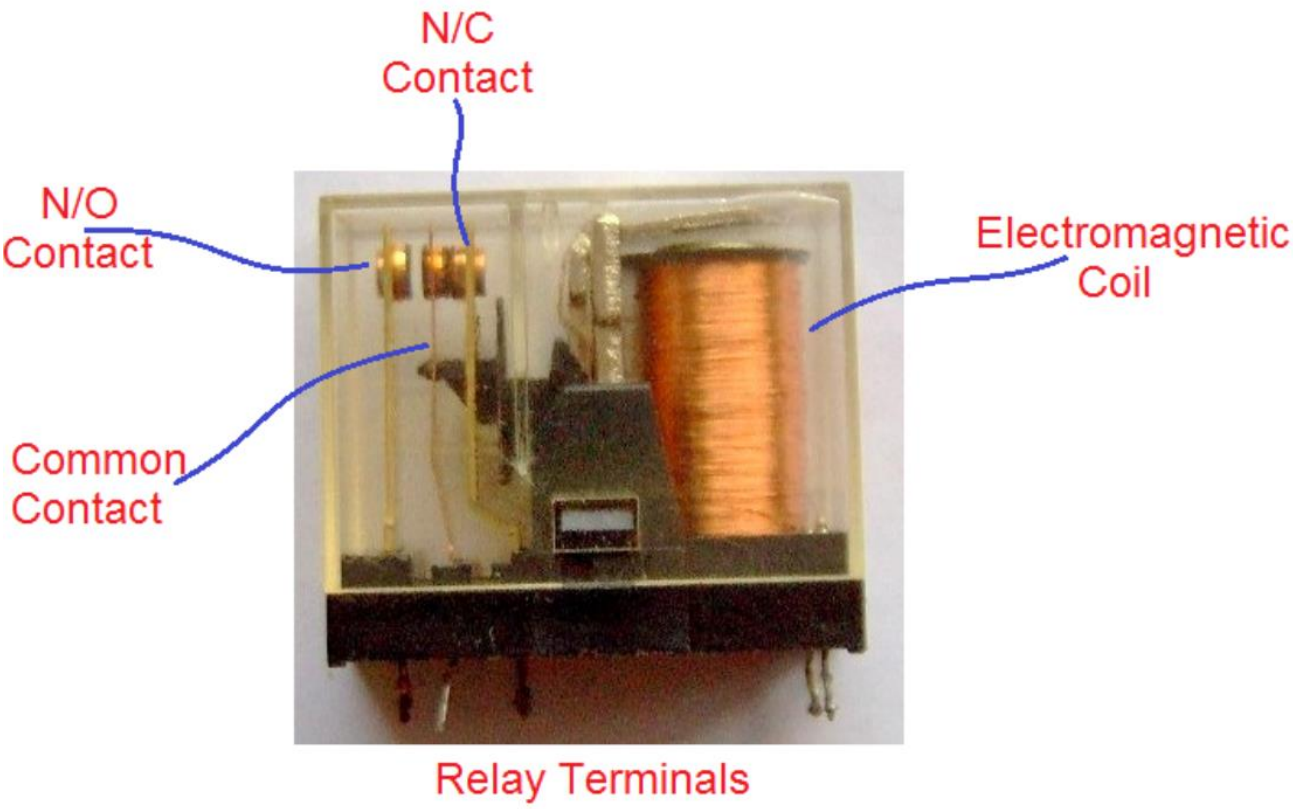
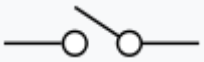
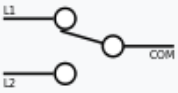
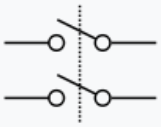
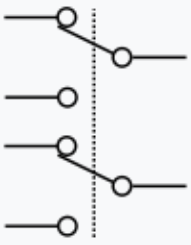
IL RELE’

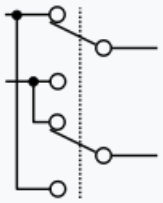
Il **relè** è un interruttore il cui azionamento avviene mediante un **elettromagnete** costituito da una *bobina di filo* avvolto intorno ad un nucleo di materiale ferromagnetico. Al passaggio della corrente le linguette vengono attratte una all'altra dove da **aperto** il circuito diventa **chiuso**



1. Bobina 2. Ancora 3. Contatto mobile



Sigla ed abbreviazioni	Significato della sigla	Nome britannico	Nome Americano	Descrizione	Simbolo
SPST	Singolo polo, singolo contatto *(Single pole, single throw)*	Una via	Due vie	È un semplice interruttore on-off: agendo sull'interruttore i due contatti possono essere connessi e disconnessi tra di loro.	
SPDT	Singolo polo, doppio contatto *(Single pole, double throw)*	Due vie	Tre vie	Semplice deviatore con un contatto (COM, Common) che può essere connesso o con L1 o con L2.	
SPCO SPTT, c.o.	Deviatore con posizione centrale stabile *(Single pole, centre off* o *Single Pole, Triple Throw)*			Simile al SPDT. Il contatto SPCO/SPTT presenta un'altra posizione stabile centrale non collegata agli altri due terminali.	
DPST	Doppio polo, singolo contatto *(Double pole, single throw)*	Doppia via	Doppia via	Questo interruttore equivale a due SPST controllati da un singolo meccanismo.	
DPDT	Doppio polo, doppio contatto *(Double pole, double throw)*			Equivalente a due SPDT controllati da un solo meccanismo.	
DPCO	Deviatore con posizione centrale stabile *(Single pole, centre off* o *Single Pole, Triple Throw)*			Equivale a due DPDT. Presenta un'altra posizione stabile centrale non collegata.	

		Interruttore intermedio *(Intermediate switch)*	Interruttore a quattro vie *(Four-way switch)*		

SPDT Relay

Single Pole Double Throw (SPDT) Relay contains two coil terminals and common terminal, then two switching terminals N/O (Normally Open), N/C (Normally Close)

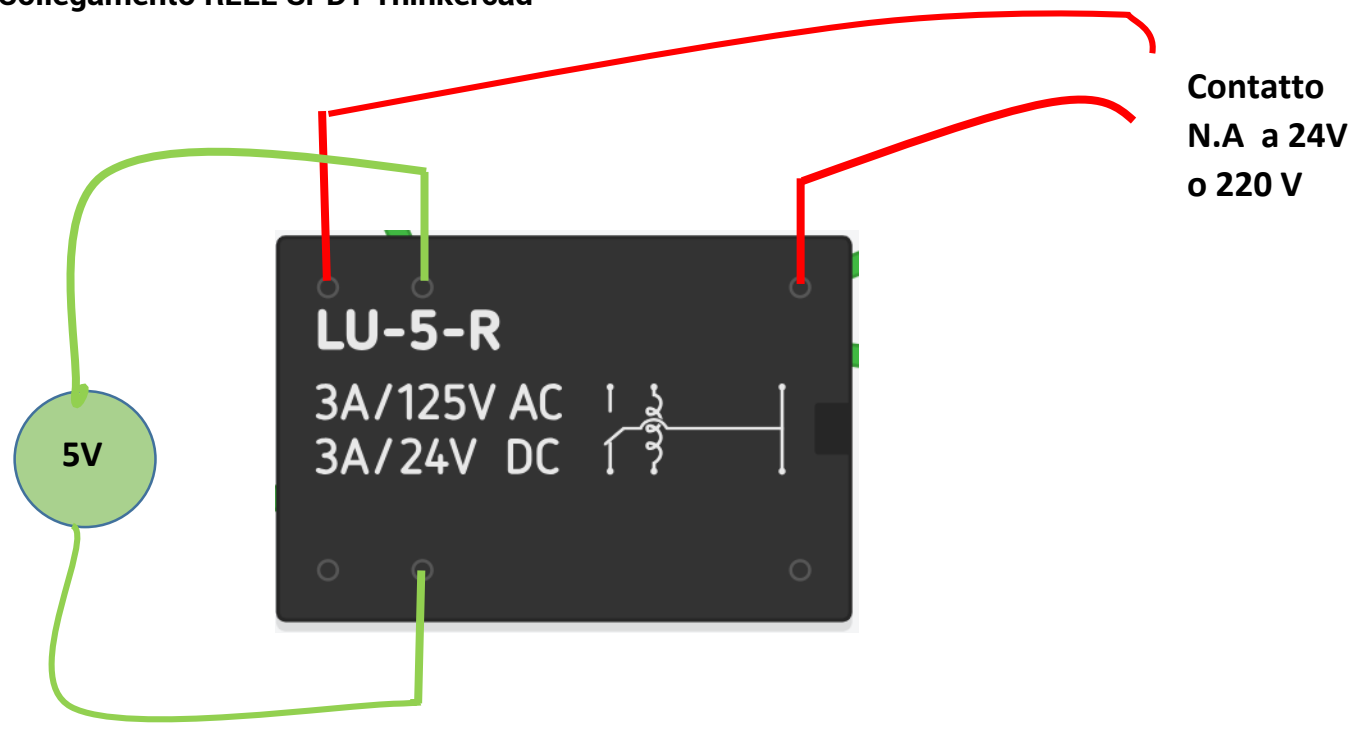
If there is not enough DC supply in coil terminals then Relay represents idle condition that is common terminal connected in N/C terminal. When the coil gets required DC supply then coil gets Magnetically Energized and this magnetic flux force attracts common terminal lever which is made of iron and makes the connection to N/O terminal, now the N/C becomes open.

DPDT Relay

Double Pole Double Throw (DPDT) Relay contains two coil terminals, two separate common terminals C1, C2 and two Normally Open (N/O1, N/O2), two Normally Close (N/C1, N/C2) terminals, this Relay makes two different connection and control with one control signal to the coil.

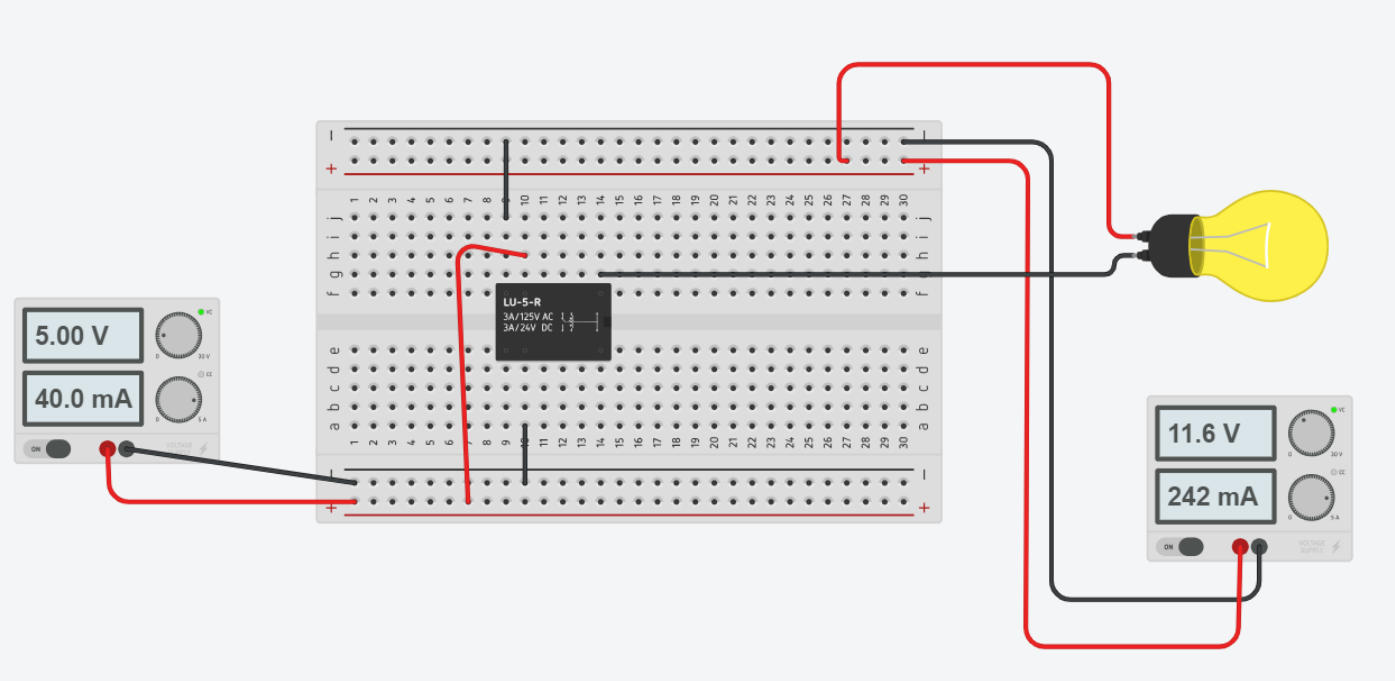
If there is no bias at coil then Relay stays in idle condition that is common terminals are connected with N/C terminals, when DC bias arrives to coil then it gets magnetically energized and attract common terminal levers and makes connection between common terminals and N/O terminals, now the N/C terminals becomes open and those terminals are works with their pairs.

Collegamento RELE SPDT Thinkercad

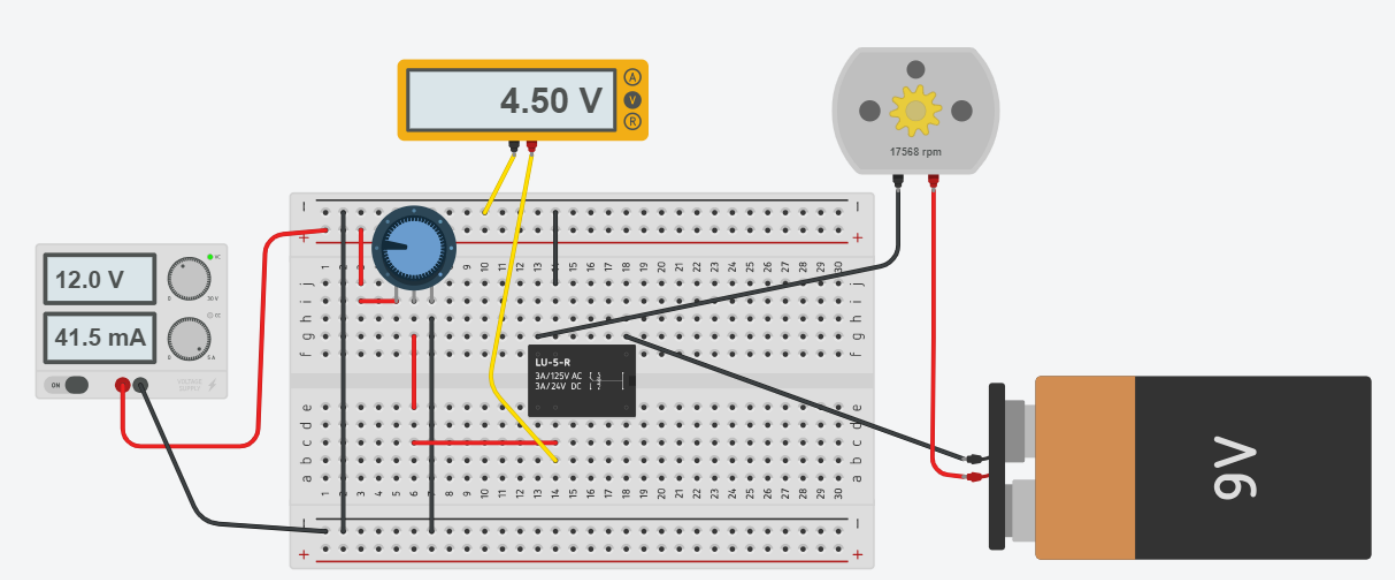


Schemi RELE’ con Thinkercad

Comando lampada 12-24 volt DC o 220 volt AC

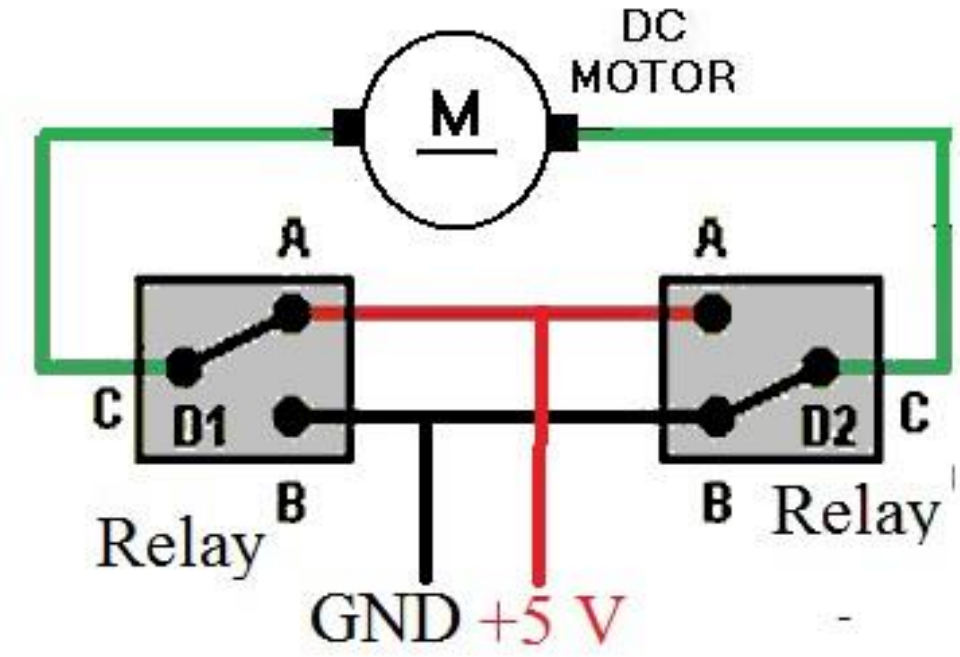


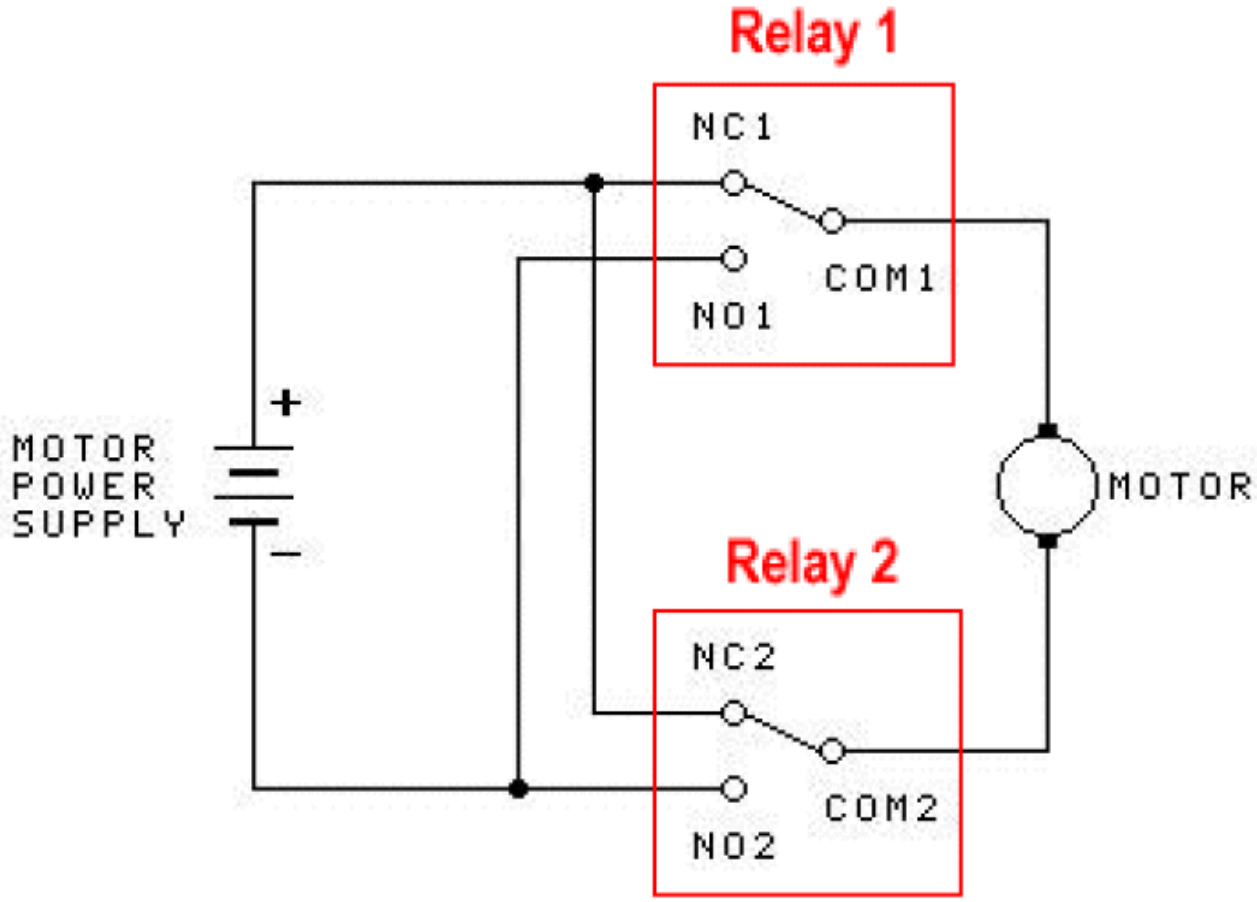
Comando motore DC

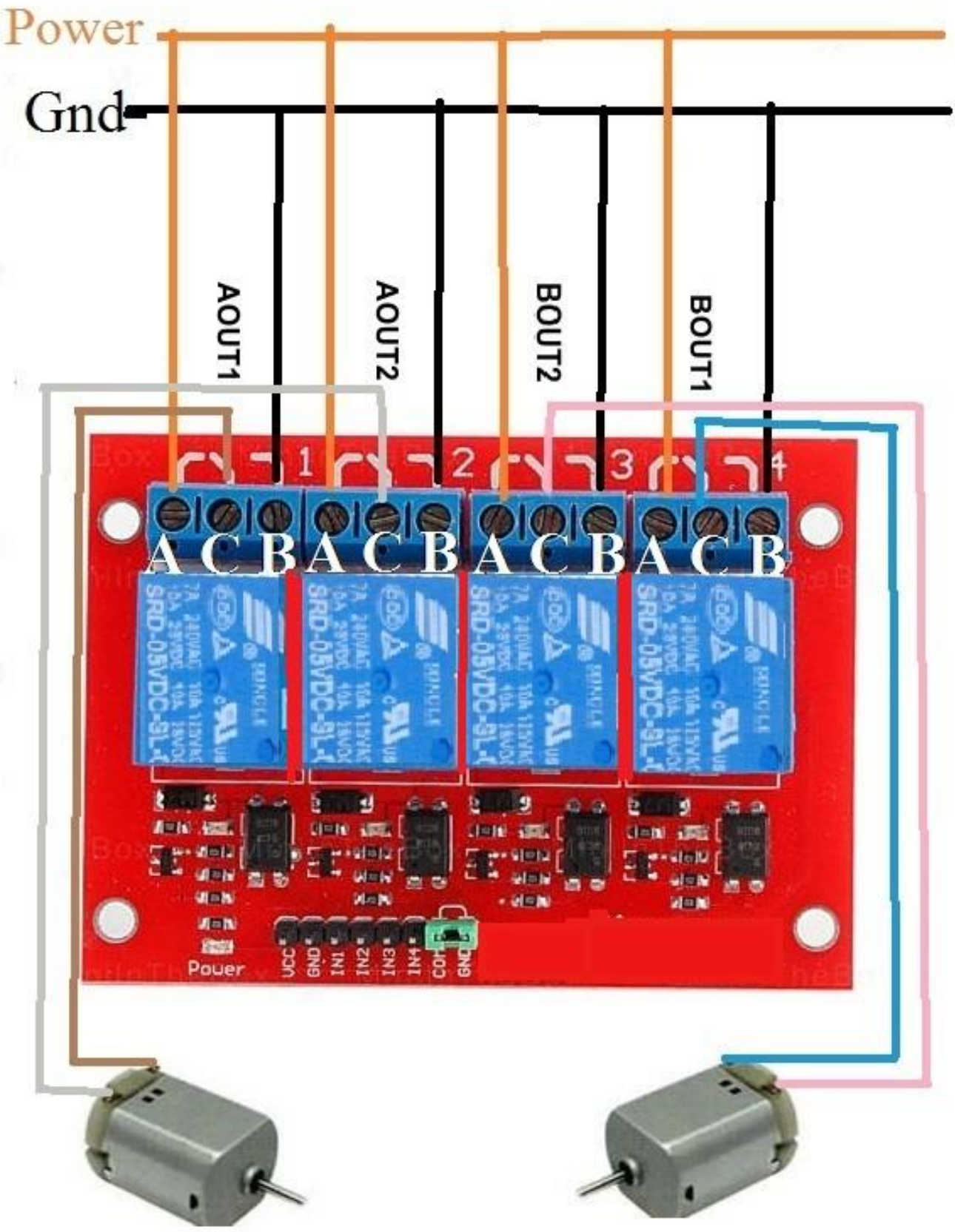


Controllo verso di rotazione motore DC (PONTE A H)

Con 2 RELE



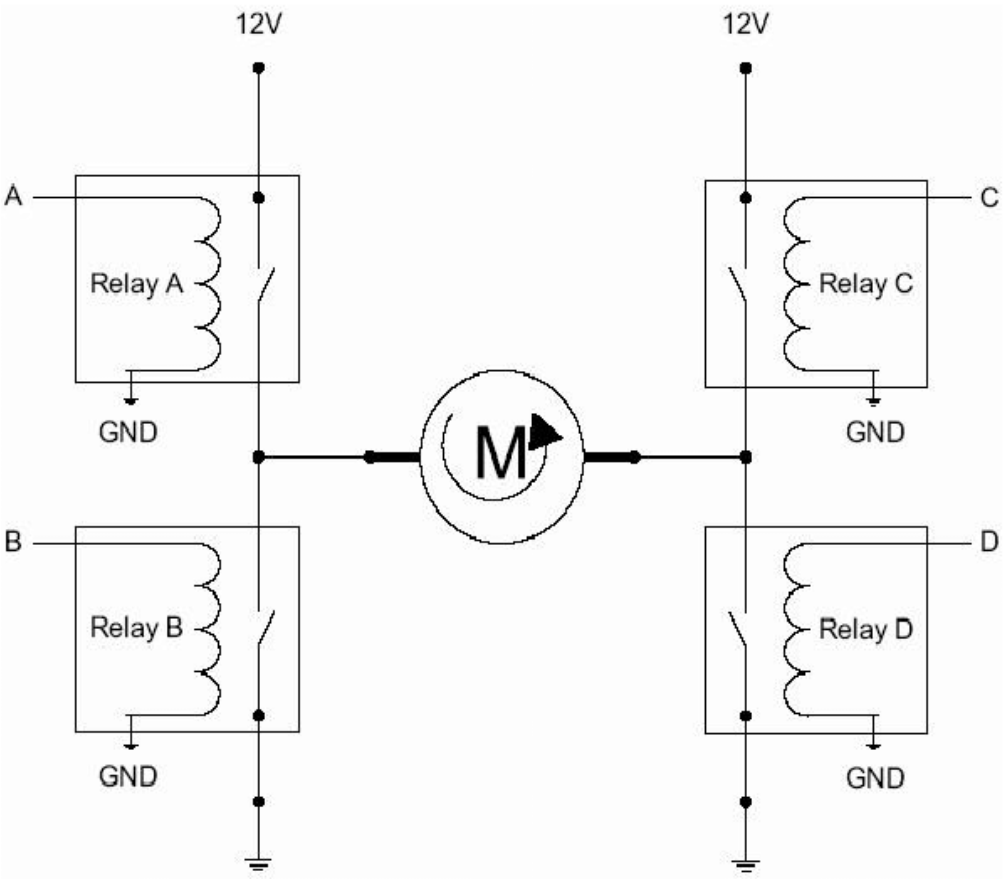


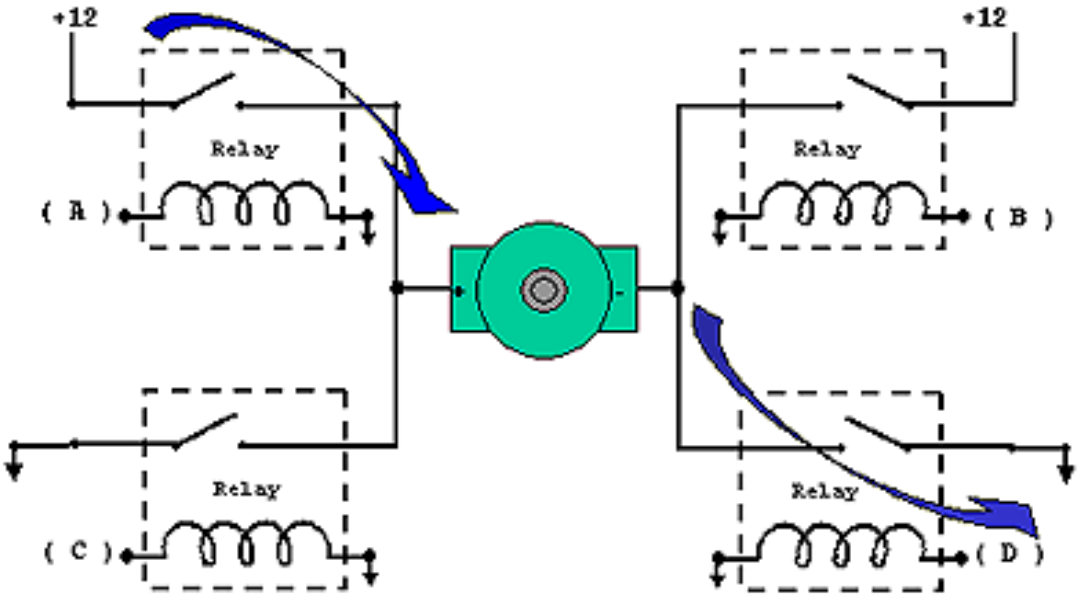


motor 1

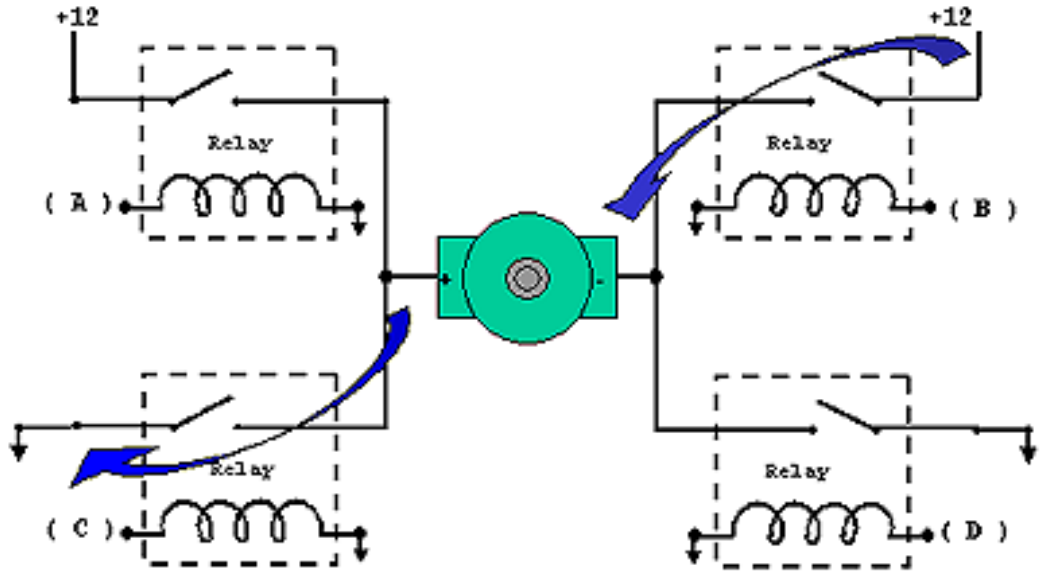
motor 2

Con 4 RELE

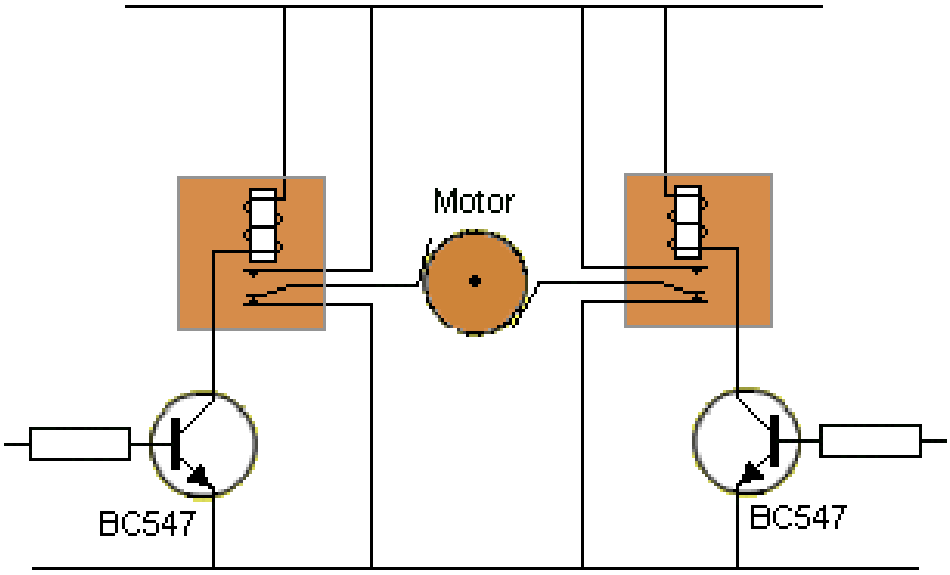




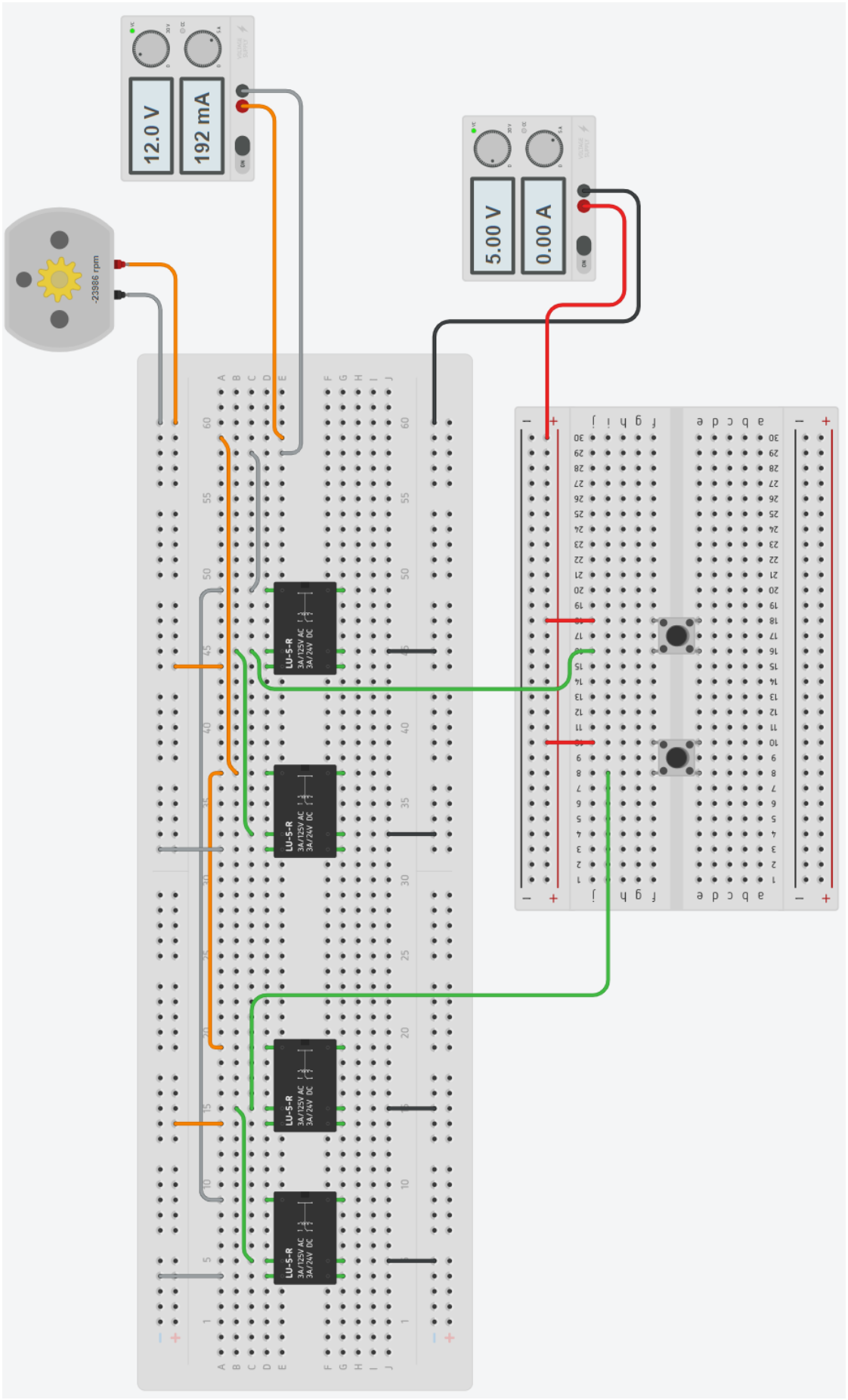
A	B	C	D	Function
-	-	-	-	----------
1	0	0	1	Forward



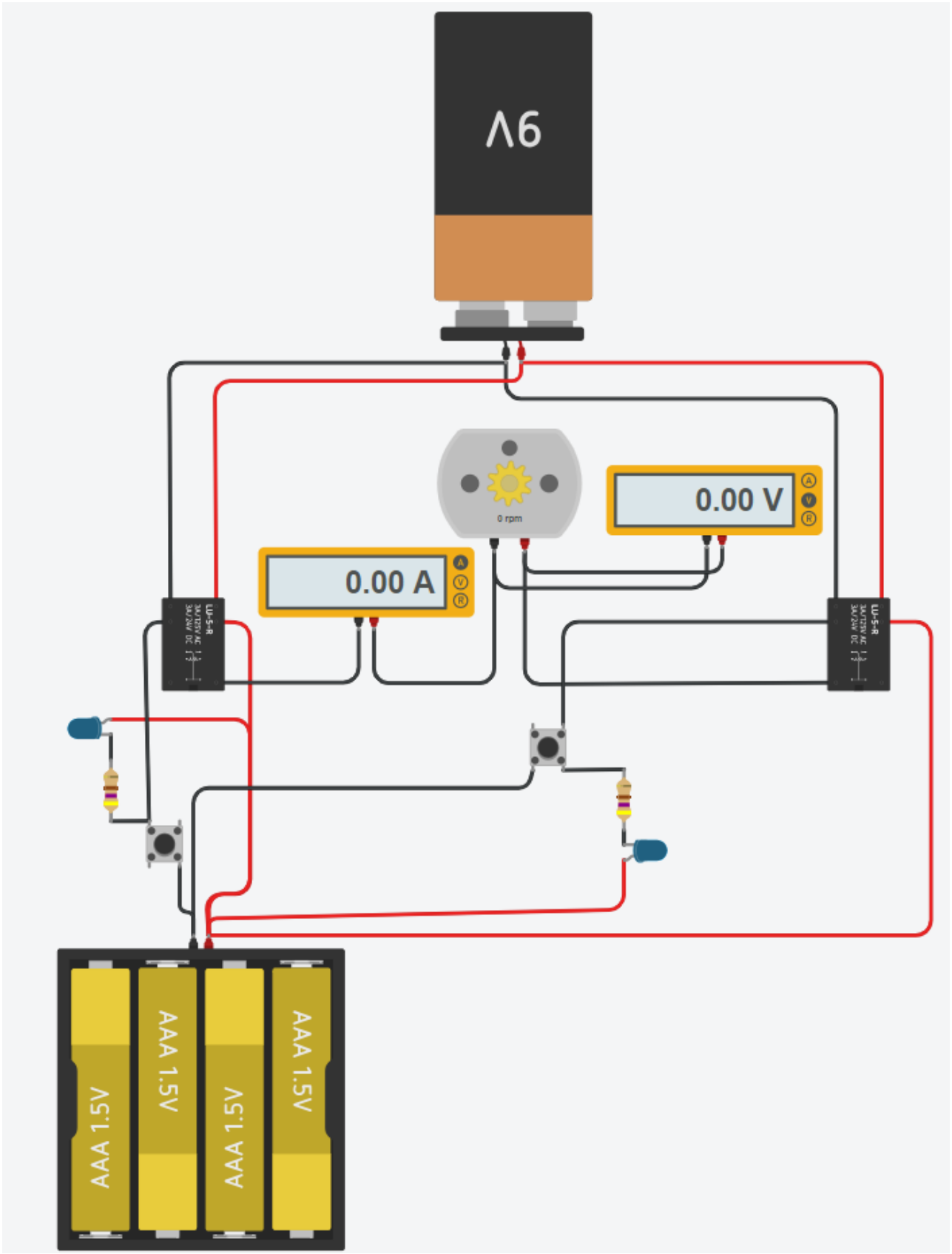
A	B	C	D	Function
-	-	-	-	----------
0	1	1	0	Reverse



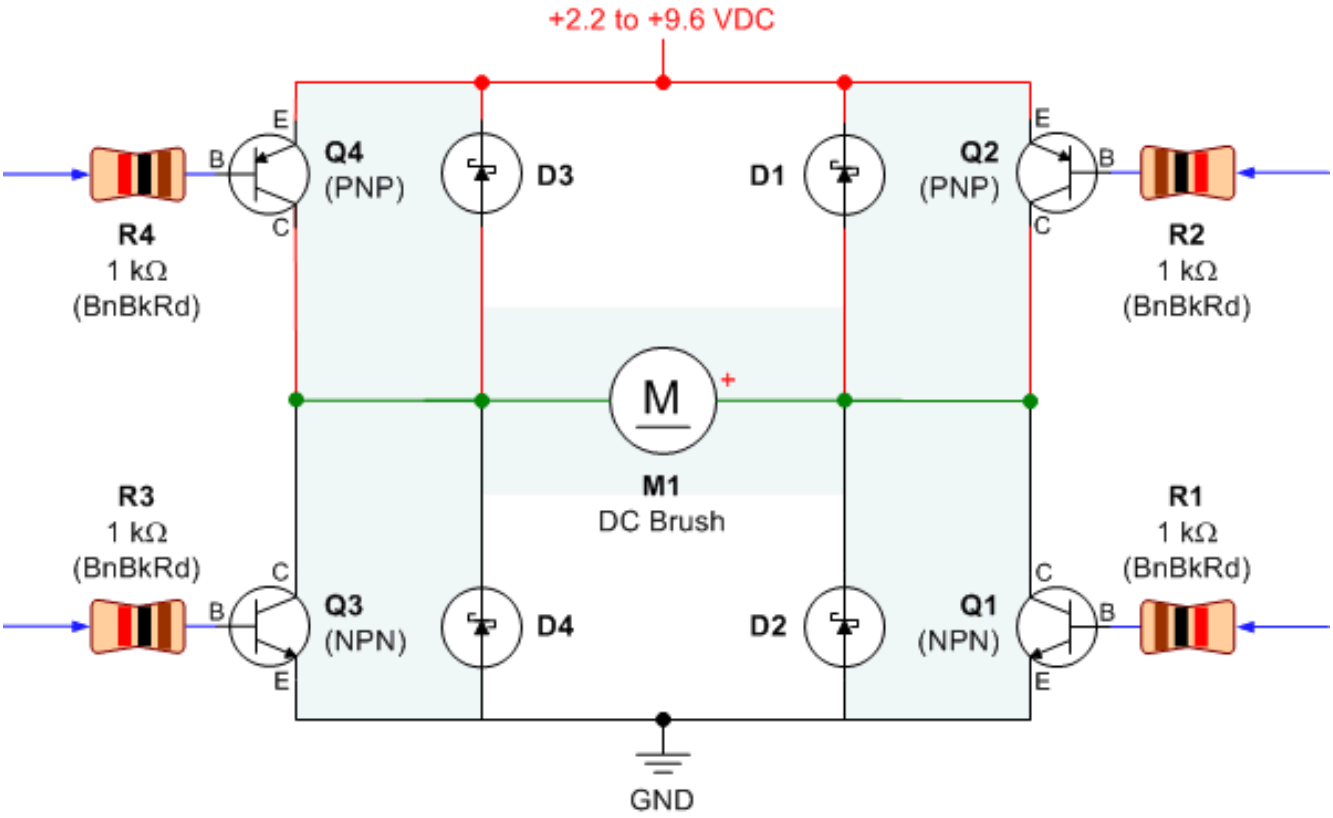
4 RELE



2 RELE



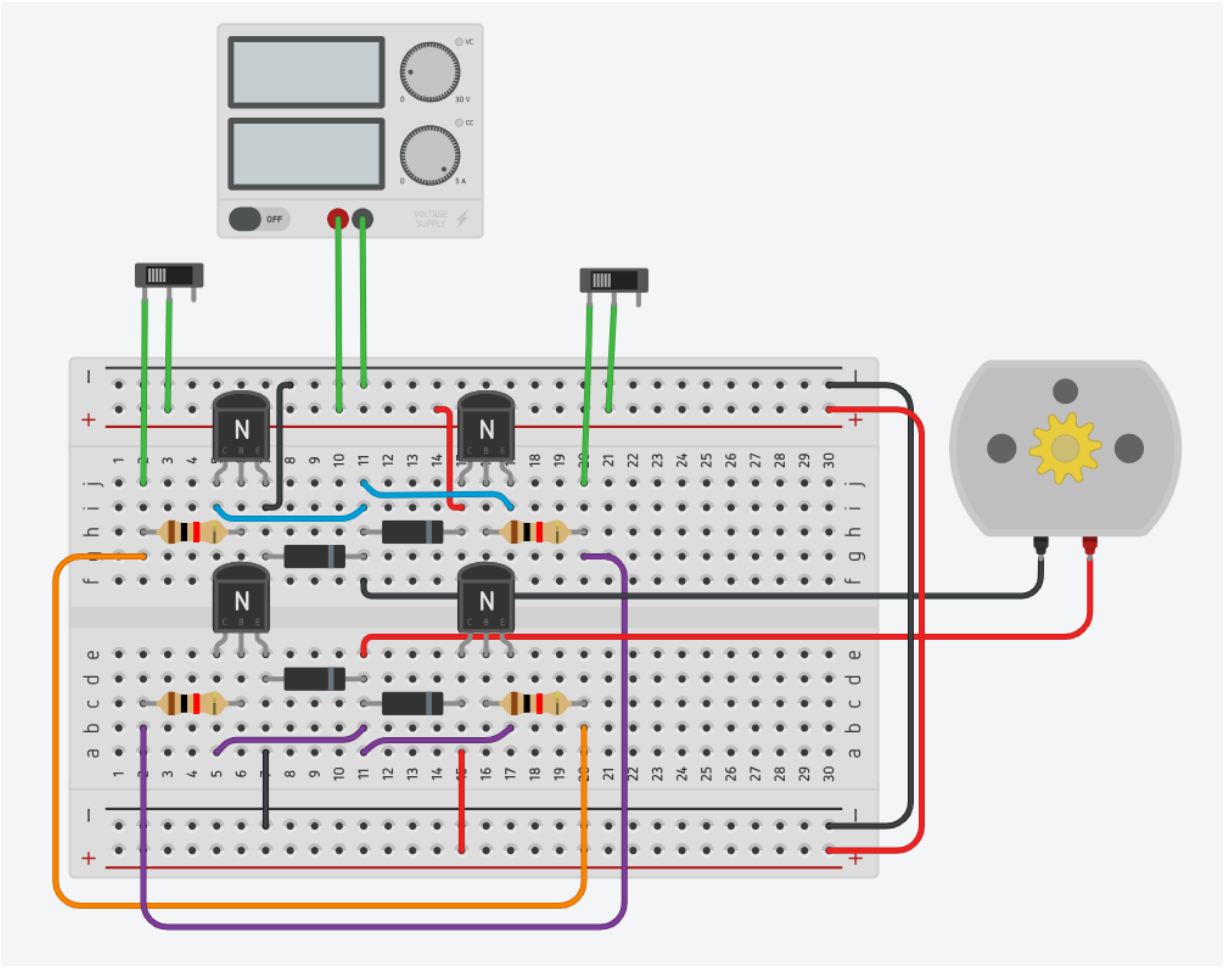
Con transistor

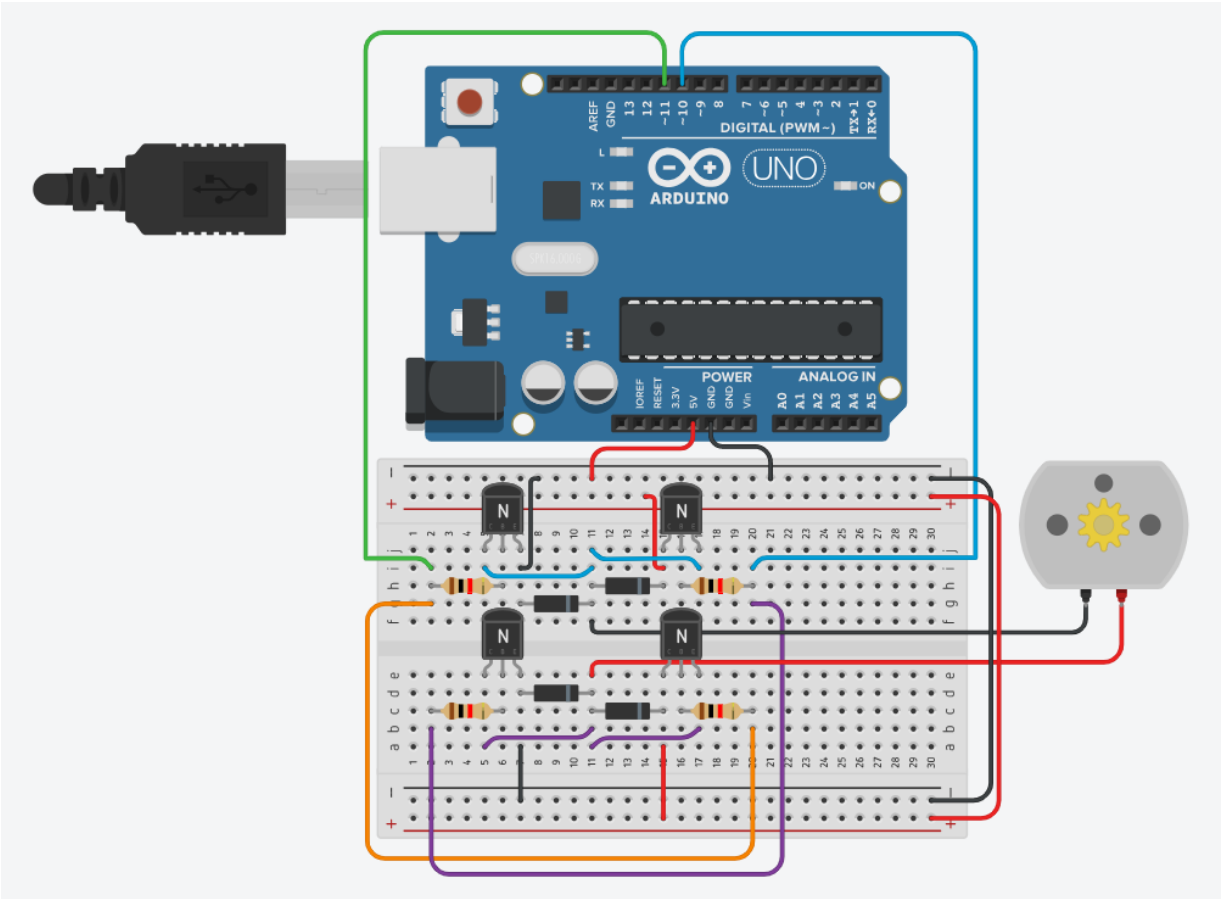


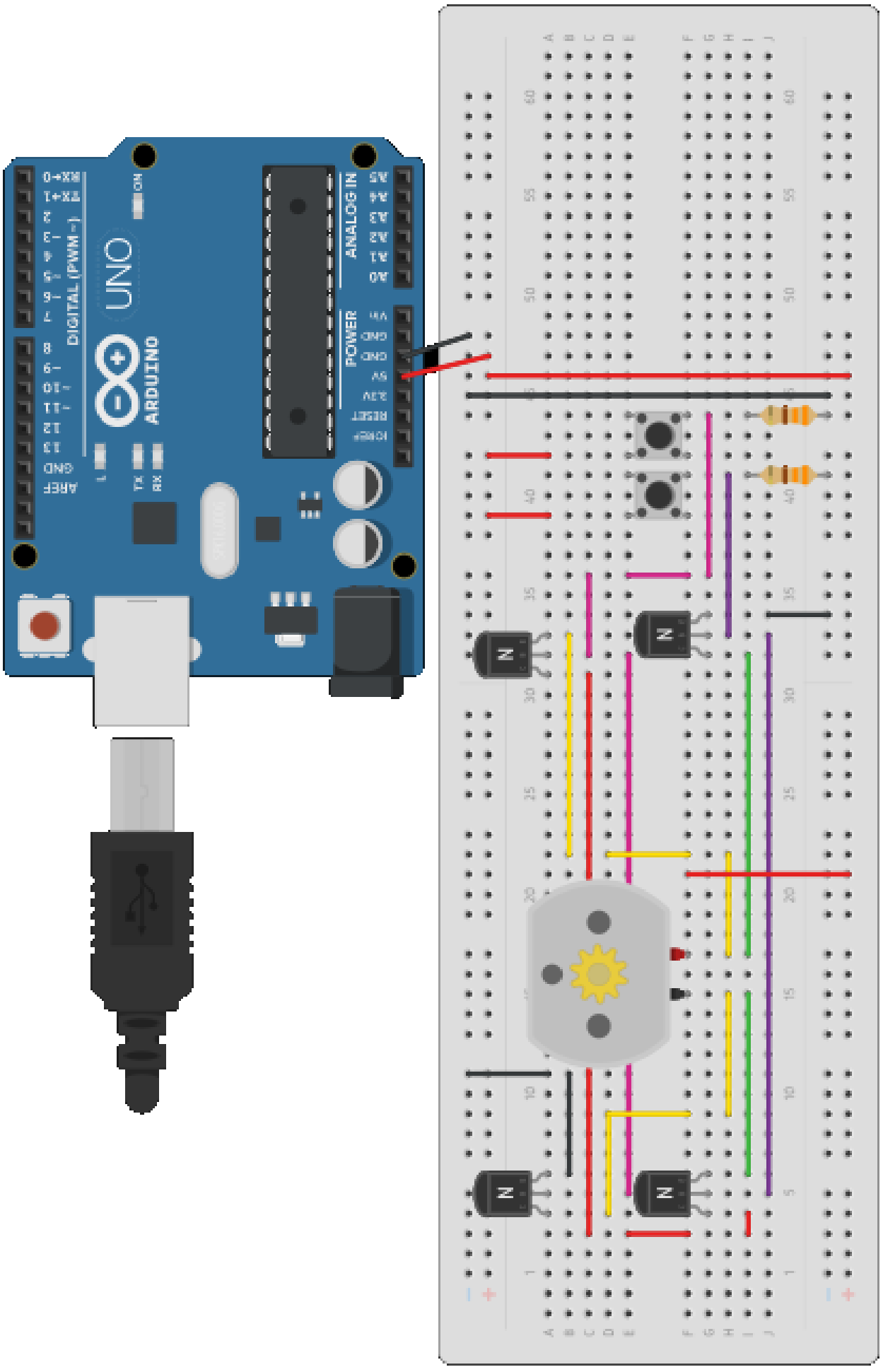
Schematic of a bipolar transistor hbridge circuit to drive a DC motor. Can you see the letter 'H'?

There are many different ways to draw the circuitry, but the above wiring diagram matches the model of most h-bridges.

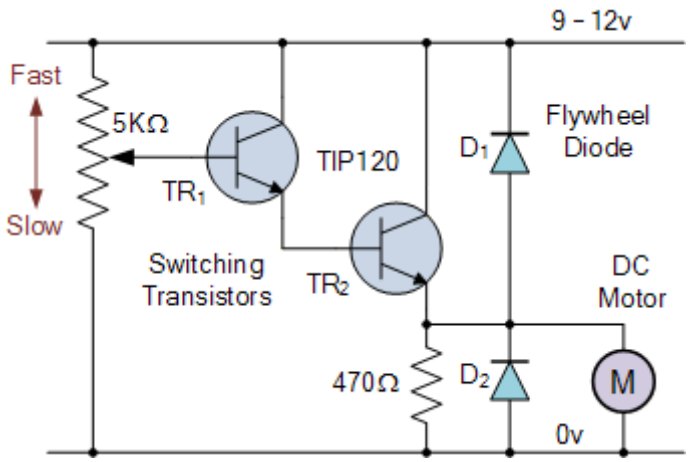
- **Q1, Q3**: These are NPN transistors. They connect the motor to ground (negative terminal of the battery).
- **Q2, Q4**: These are PNP transistors. They connect the motor to +2.2V to +9.6V (positive terminal of the battery).
- **R1-R4**: These resistors prevent too much current from passing through the base (labeled B) control pin of the transistor. The resistor value of 1 kilohm (1000 ohms) was chosen to provide enough current to fully turn on (saturate) the transistor. A higher resistance would waste less power, but might cause the motor to receive less power. A lower resistance would waste more power, but wouldn't likely provide better performance for motors running on consumer batteries.
- **D1-D4**: Diodes provide a safe path for the motor energy to be dispersed or returned to the battery when the motor is commanded to coast or stop. I notice many H-bridge circuits on the web lack these diodes. I suppose that's safe enough for light loads at low voltages, but without diodes, a motor voltage spike can force its way through the unprotected transistors, damaging or destroying them.
- **M1**: This is a direct-current (DC) motor. These are very common. You can find them in surplus stores online or in salvaged toys. The motor should have only two wires. Measure the resistance of the two motor wires using a multimeter. If the motor resistance is less than 5 ohms, then the transistor parts listed in this article are too weak to power the motor.


OFF
VOLTAGE SUPPLY
N
N
N
N


DIGITAL (PWM~)
UNO
ARDUINO
ON
TX
RX
POWER
ANALOG IN
N
N
N
N


UNO
ARDUINO
DIGITAL (PWM~)
ANALOG IN
POWER
ON
TX
RX
L

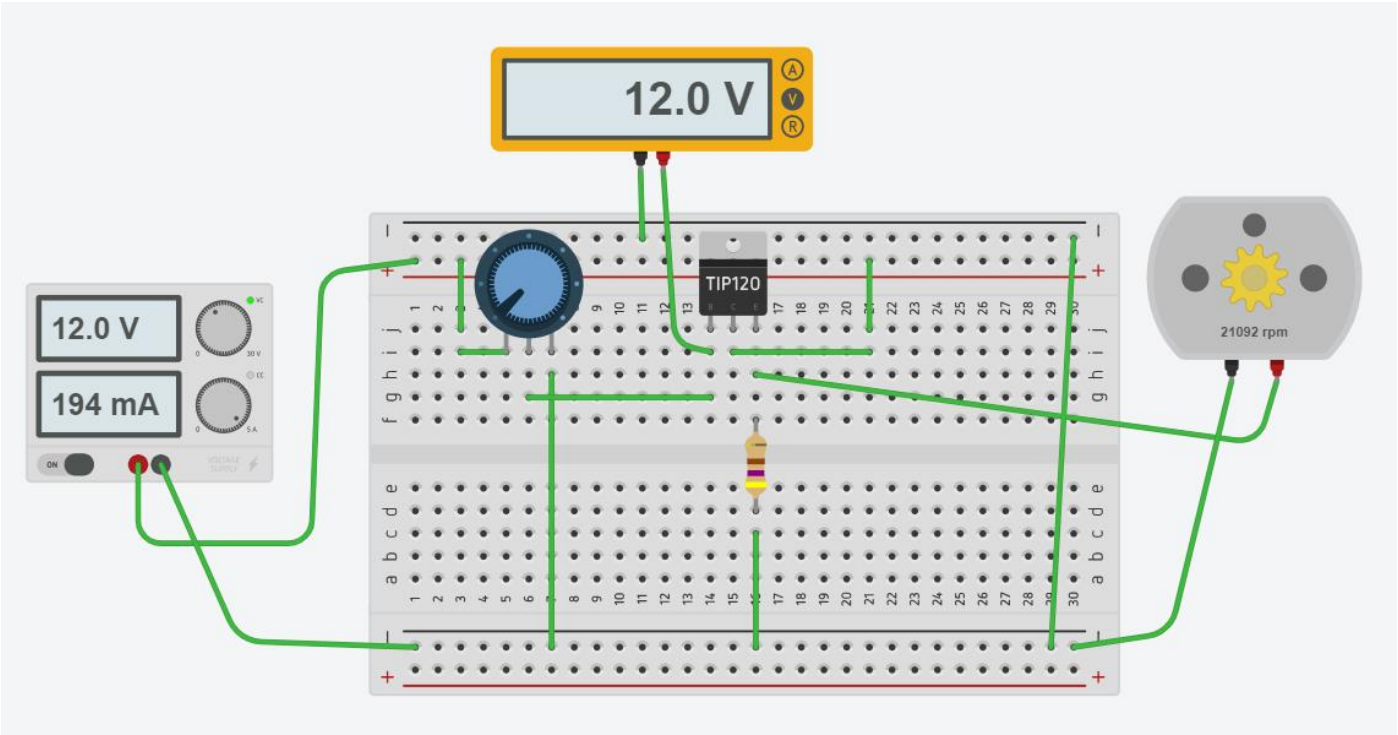
Motor Speed Control



The simple switching circuit above shows the circuit for a **Uni-directional** (one direction only) motor speed control circuit. As the rotational speed of a DC motor is proportional to the voltage across its terminals, we can regulate this terminal voltage using a transistor.

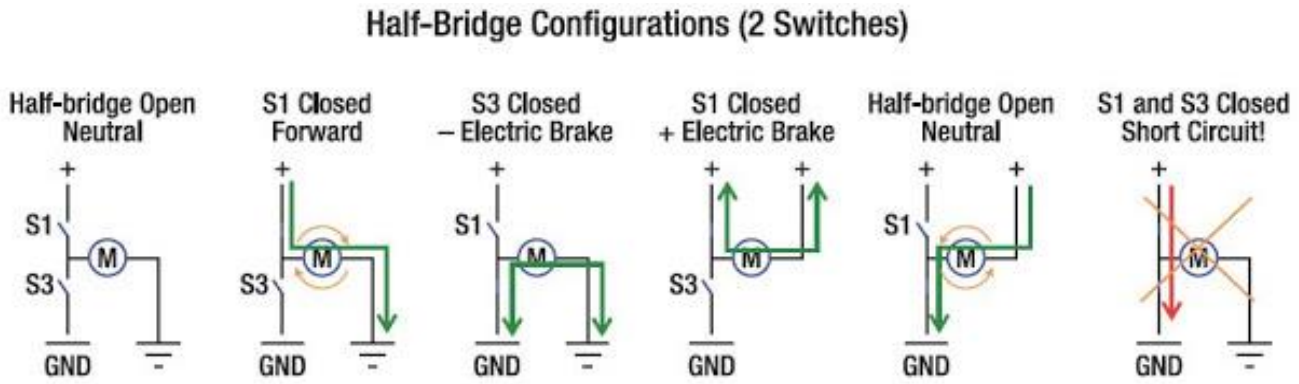
The two transistors are connected as a darlington pair to control the main armature current of the motor. A 5kΩ potentiometer is used to control the amount of base drive to the first pilot transistor TR_1, which in turn controls the main switching transistor, TR_2allowing the motor's DC voltage to be varied from zero to Vcc, in this example 9 to 12 volts.

Optional flywheel diodes are connected across the switching transistor, TR_2 and the motor terminals for protection from any back emf generated by the motor as it rotates.



Circuitry of the H-bridge

2 Switch Bridge



The simplest of the H-bridge uses two switches, which provide a path to either the positive terminal or the negative terminal, due to which the motor is able to turn in either directions.

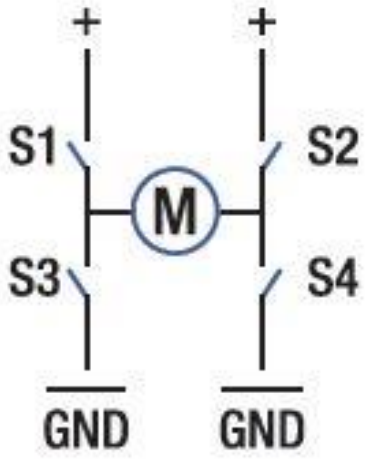
By using only one of the switches at a time, a short circuit is avoided.

The other terminal of the motor is permanently connected to the GND.(Ground 0V).

If both the terminals of the motor are connected to the positive or negative supply, we obtain a condition known as an Electric Brake.

4 Switch H-Bridge

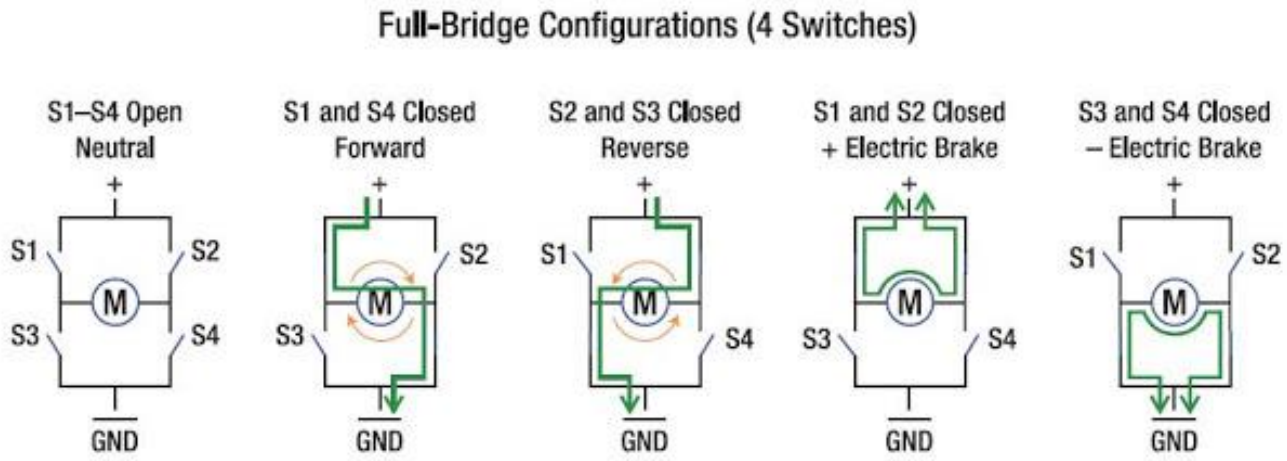
For the motor to spin, the battery current must flow from the Positive supply, through the Motor,



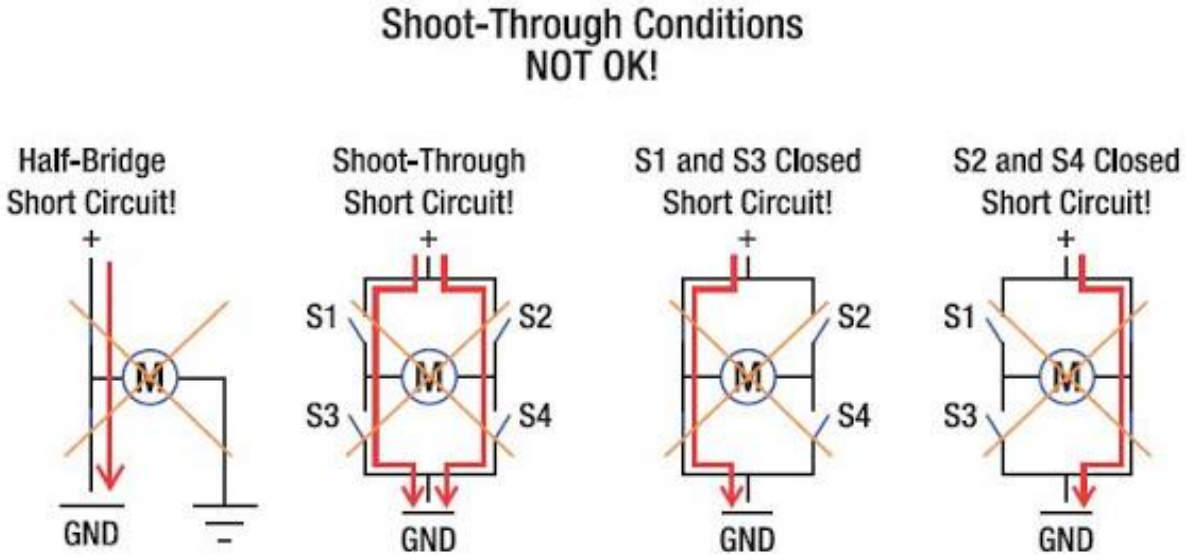
and to the Ground supply to complete the circuit. To make this happen we must open one switch from each side of the bridge, one Low-side and an opposite High-side—that means we can either turn on S1 and S4 to go Forward, or we can turn on S2 and S3 to go in Reverse.

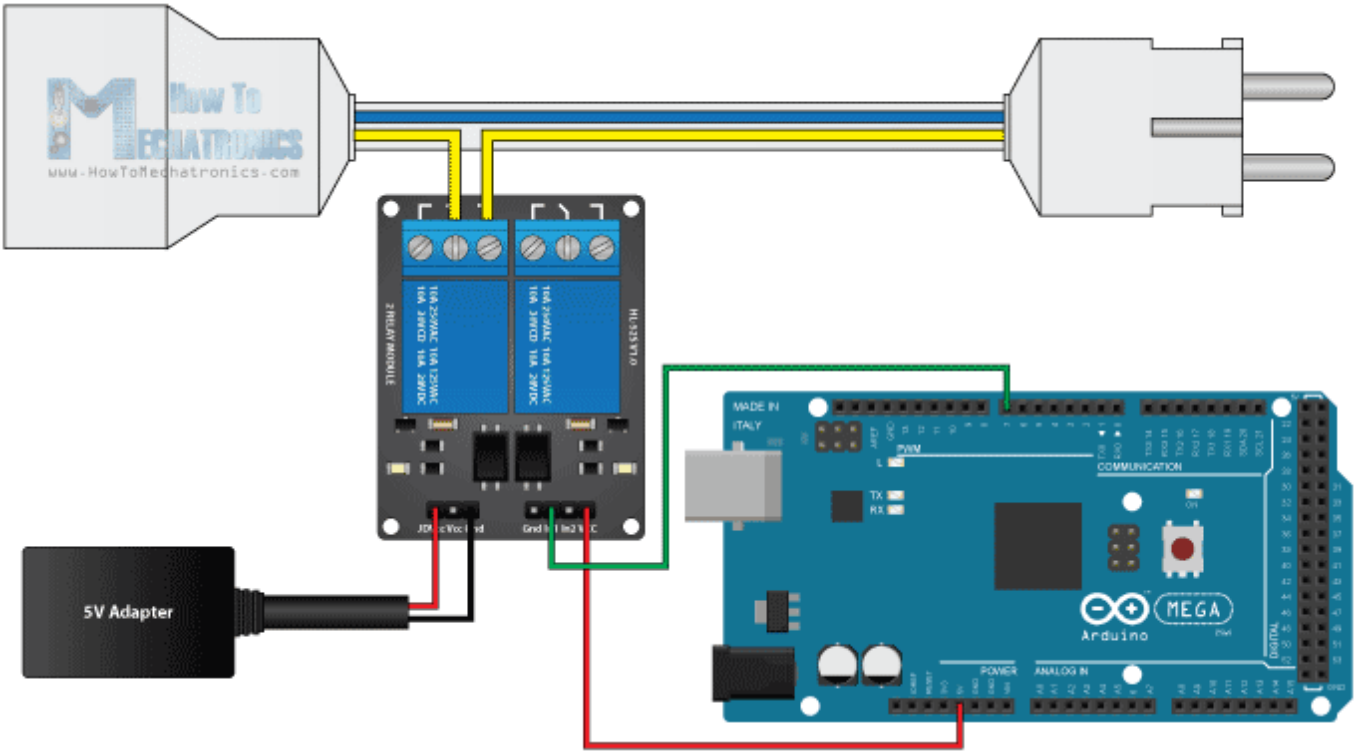
The direction of the current flow through the motor terminals determines the direction that the motor spins. We can manipulate the flow of the current by closing the two corresponding switches together to give us directional control of the motor. If all four switches are open (disconnected), the motor is coasting, meaning there is no path for the current to travel.

Full Bridge Configurations



Shoot Through Configurations (NOT okay!)

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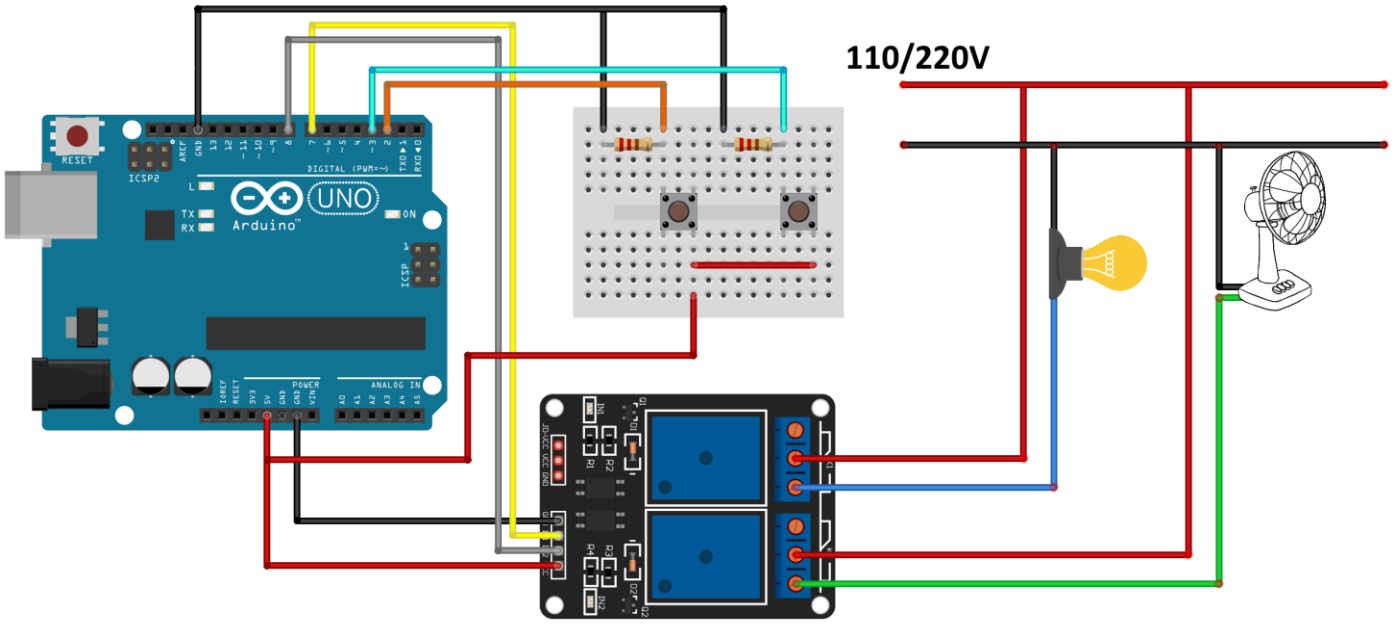
www.HowToMechatronics.com
5V Adapter
MADE IN ITALY
MEGA
Arduino


110/220V
UNO
Arduino