STEAM CLOWN™ PRODUCTIONS

DUAL H-BRIDGE MOTOR CONTROLLER - L298N

STEAM CLOWN™ & Squeaky Hinge PRODUCTIONS

OBJECTIVE, OVERVIEW & INTRODUCTION

- This presentation is a tutorial and setup guide for using the L298N Dual H Bridge Motor Controller
- 1. Student will be able to connect and use the L298N Controller
- 2. For additional information and reference material student can refer to STEAM Clowns Closet
- 3. A measure of success will be a spinning DC motor

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SEE APPENDIX A, FOR LICENSING & ATTRIBUTION INFORMATION

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CAN I GET A COPY OF THESE SLIDES? YES, PROBABLY…

Most presentation lecture slides can be found indexed on www.steamclown.org and maybe blogged about here on Jim The STEAM Clown's Blog, where you can search for the presentation title. While you are there, sign up for email updates

If you are on of my SVCTE Mechatronics Engineering Students, Look here on the SVCTE Mechatronics Engineering Blog: https://svctemechatronics.blogspot.com/

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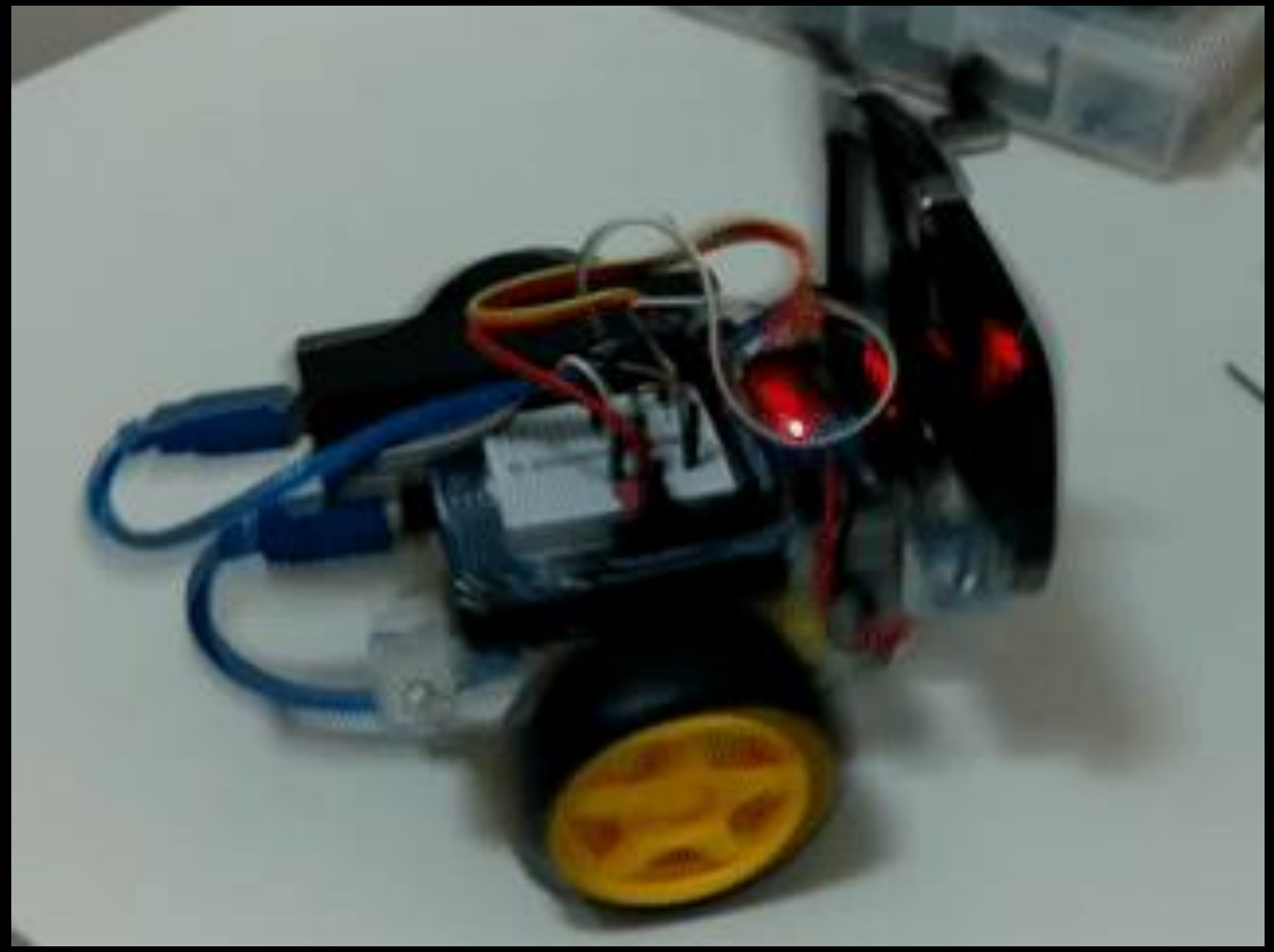
RESOURCES & MATERIALS NEEDED

- L298N Dual H Bridge Motor Controller
- Battery (7.9 – 12 volts)
- Arduino or Raspberry Pi

Control Stuff Like This...



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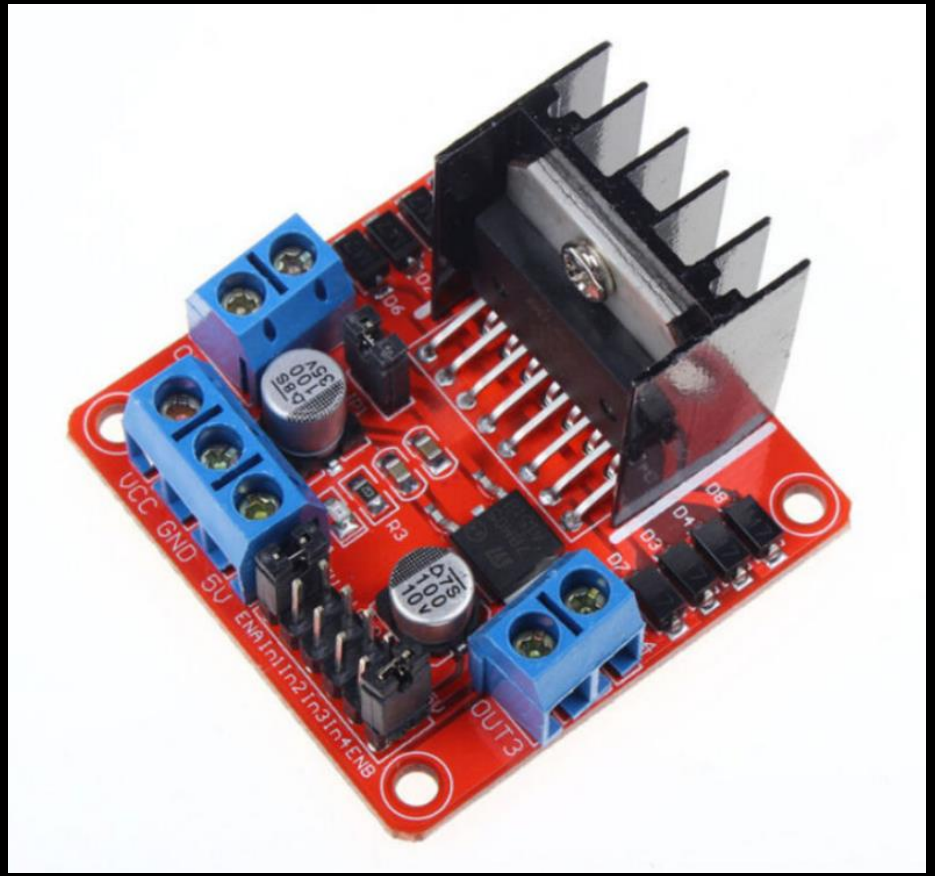
New Words or Concepts...

- H Bridge
- Motor Controller
- Differential Drive

L298N Dual H-Bridge Motor Controller

- H-Bridge on STEAM Clowns Closet
- YouTube - HOW TO: control DC Motors with Arduino + L298N
- Instructables - Arduino Modules - L298N Dual H-Bridge Motor Controller



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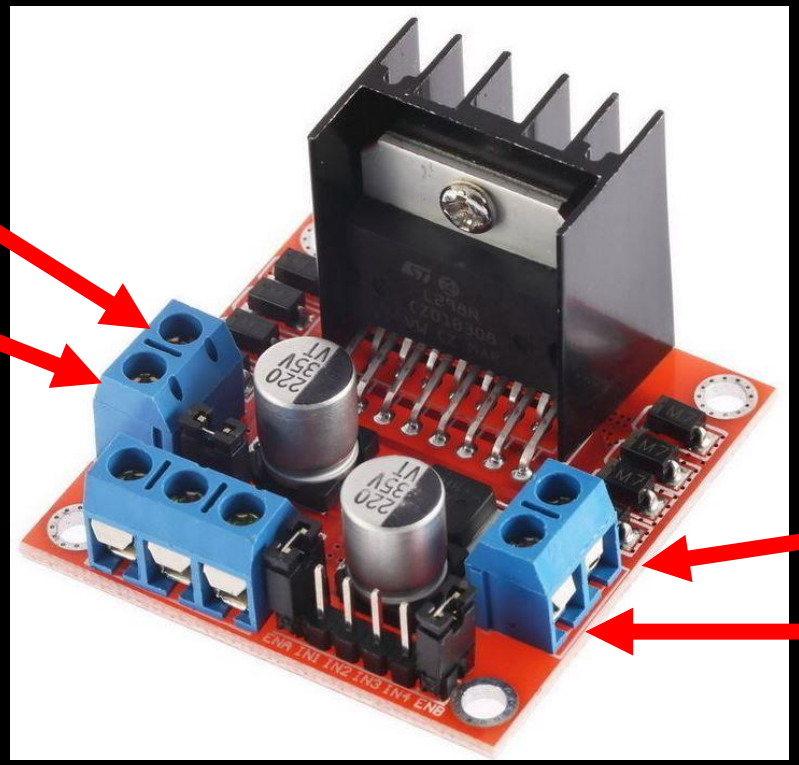
CONNECTING MOTORS

Motor A
Motor A (-)
Motor A (+)

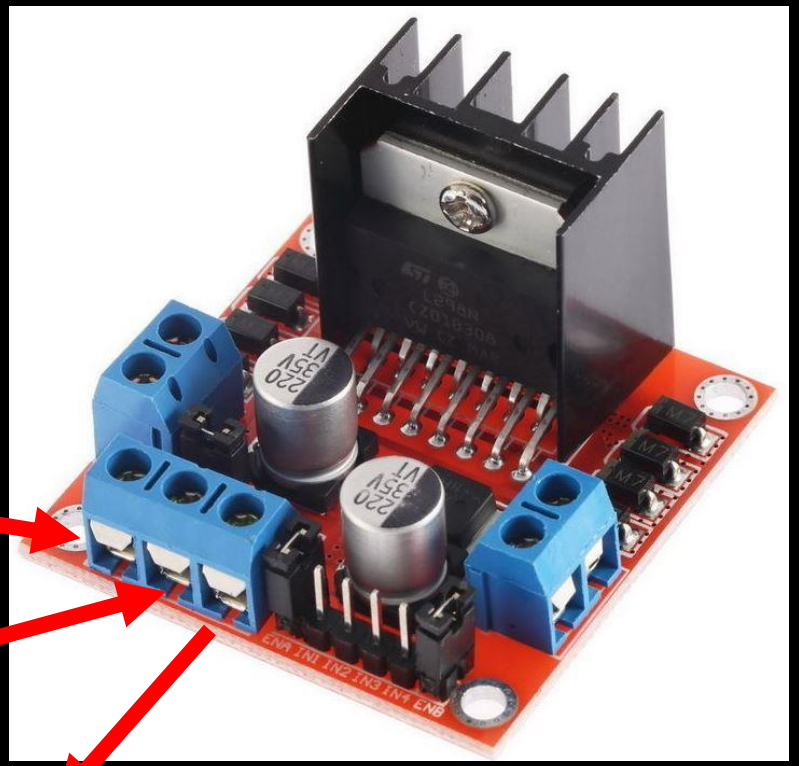


Motor B
Motor B (+)
Motor B (-)

POWERING THE MOTORS

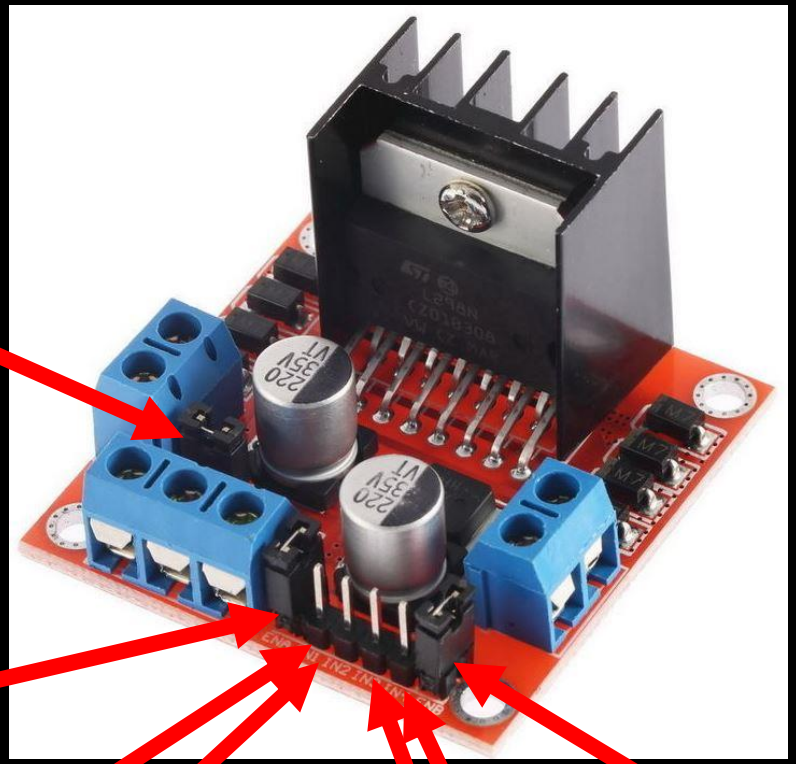
In most cases, the “12” volts will be a 9.6 v battery pack

“12” volts is just the motor power



CONTROLLING THE MOTORS – FULL SPEED

Don’t move Jumper



ENA
Enable A

IN1A
IN2A

IN4B
IN3B

ENB
Enable B

Pin	Forward	Backward	STOP	BAD
ENA	Jumper	Jumper	Jumper)	Jumper
IN1(A)	HIGH	LOW	LOW	HIGH
IN2(A)	LOW	HIGH	LOW	HIGH
IN3(B)	HIGH	LOW	LOW	HIGH
IN4(B)	LOW	HIGH	LOW	HIGH
ENB	Jumper	Jumper	Jumper	Jumper

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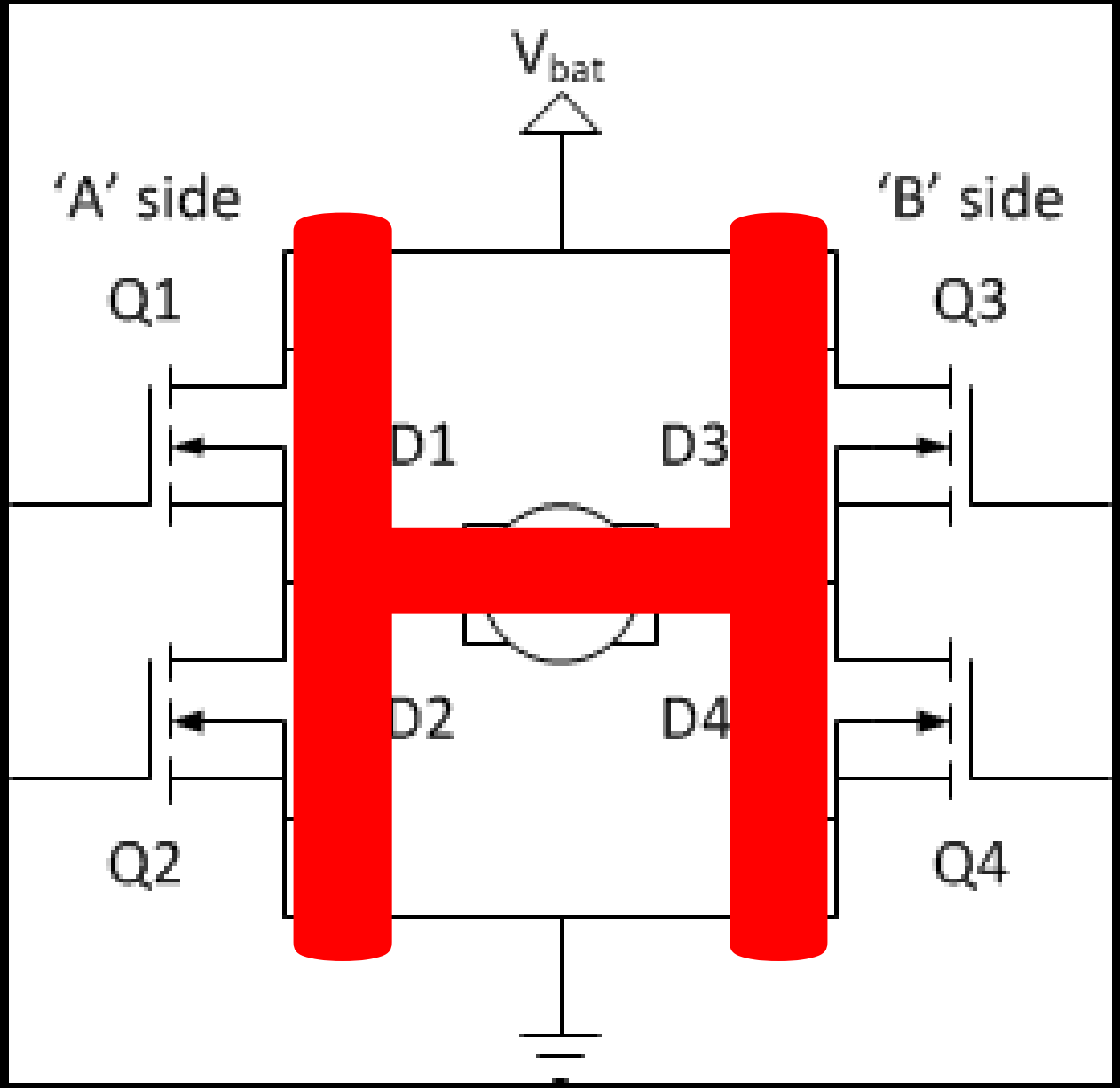
H-BRIDGE THE BASICS



Source - http://www.modularcircuits.com/blog/articles/h-bridge-secrets/h-bridges-the-basics/

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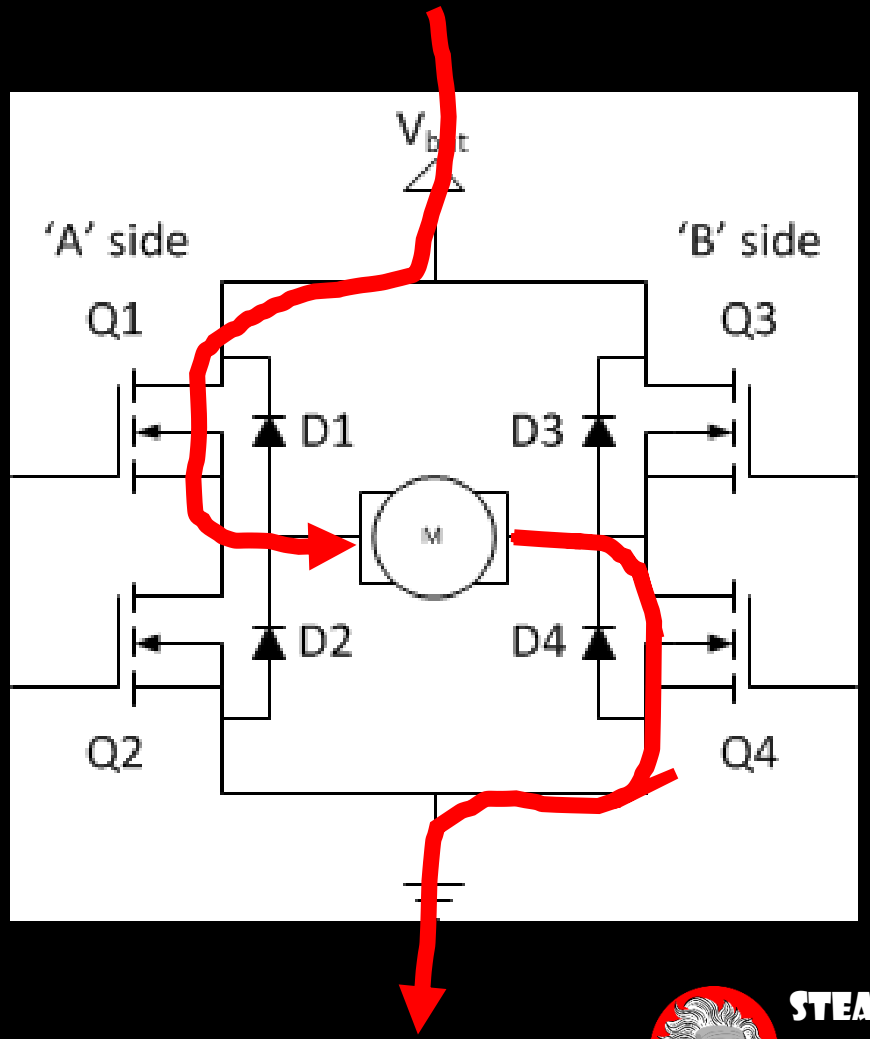
H-BRIDGE CIRCUIT

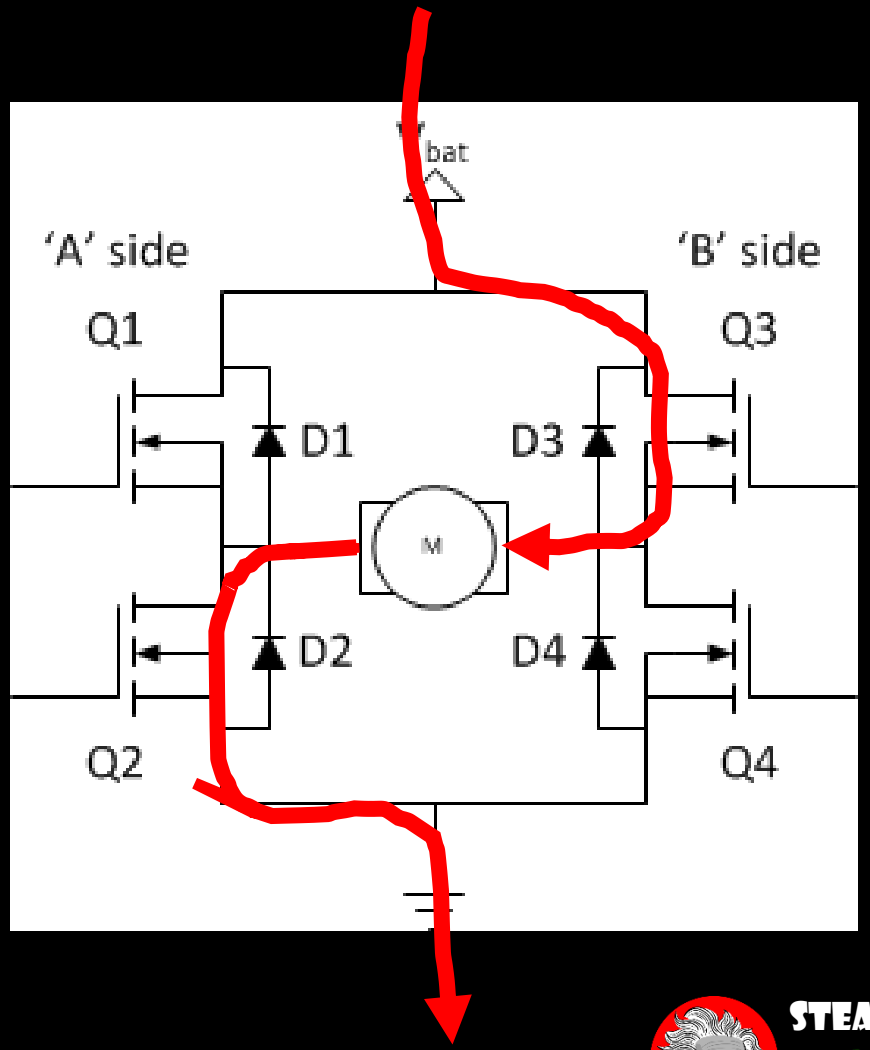
- if Q1 and Q4 are turned on
  - The left lead of the motor will be connected to the power supply
  - The right lead is connected to ground.
  - Current starts flowing through the motor which energizes the motor in (let's say) the Clockwise direction and the motor shaft starts spinning



Source - http://www.modularcircuits.com/blog/articles/h-bridge-secrets/h-bridges-the-basics/

H-BRIDGE CIRCUIT

- if Q3 and Q2 are turned on
  - The left lead of the motor will be connected to the power supply
  - The right lead is connected to ground.
  - Current starts flowing through the motor which energizes the motor in (let's say) the CounterClockwise direction and the motor shaft starts spinning



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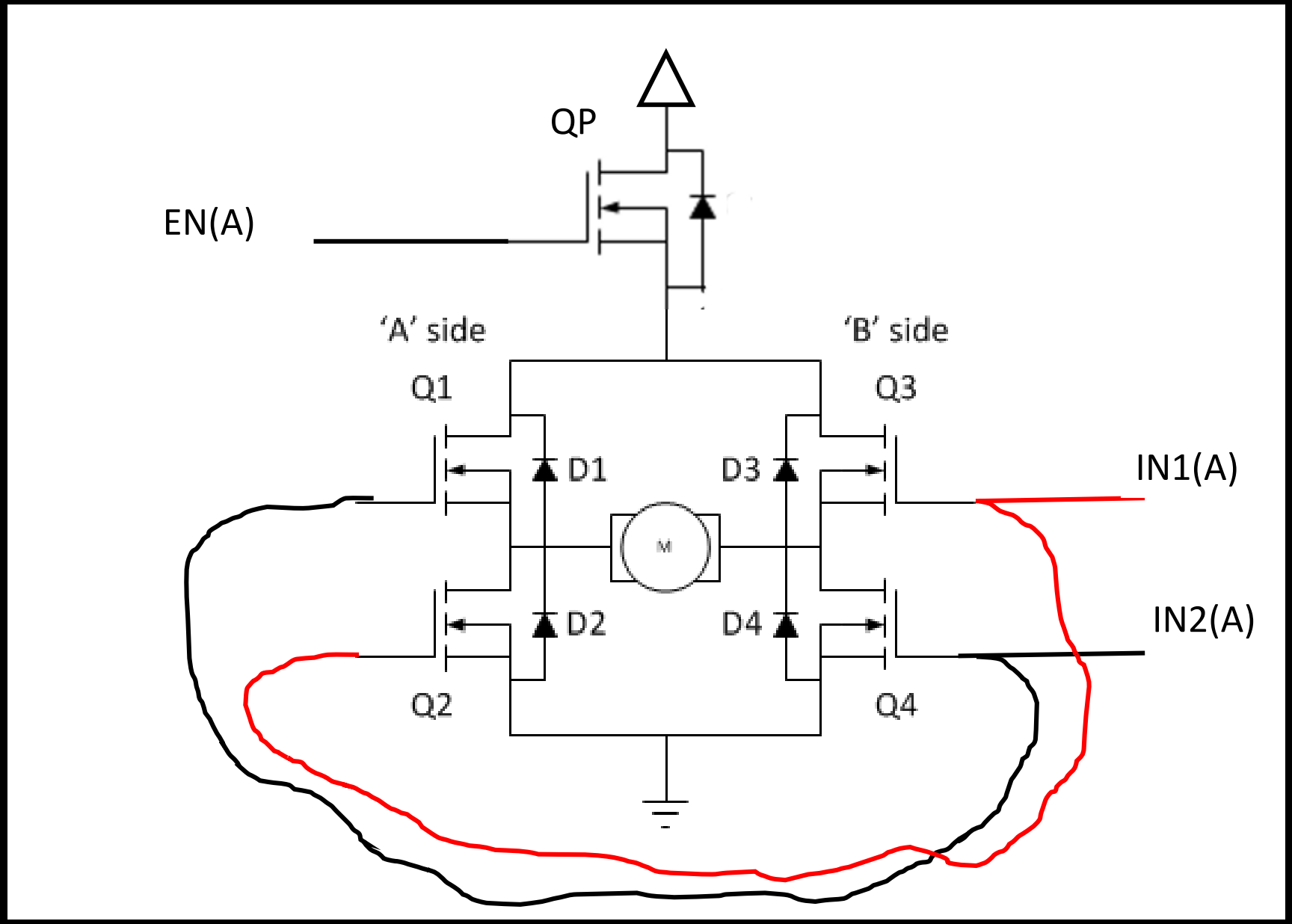
H-BRIDGE CIRCUIT



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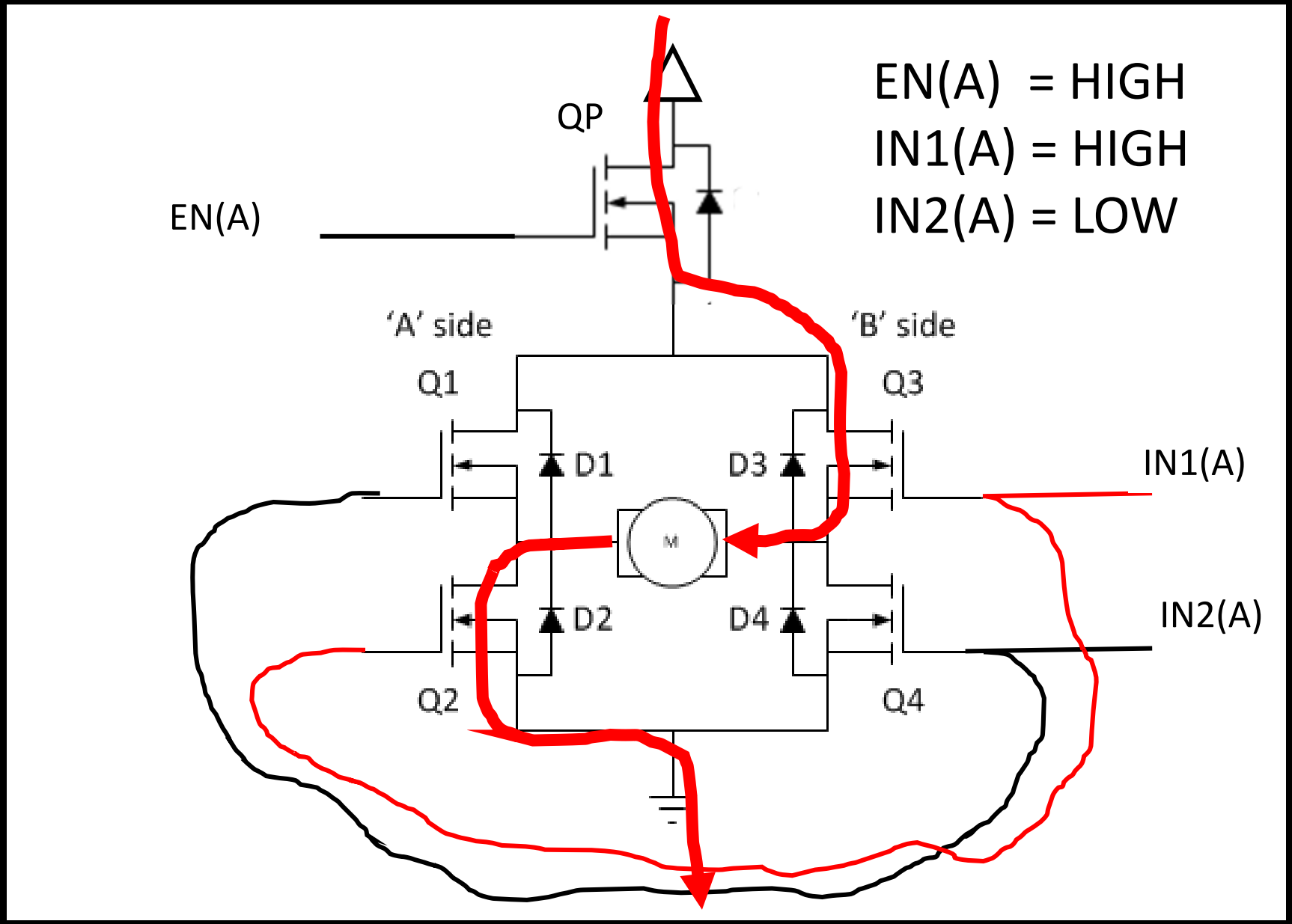
H-BRIDGE CIRCUIT



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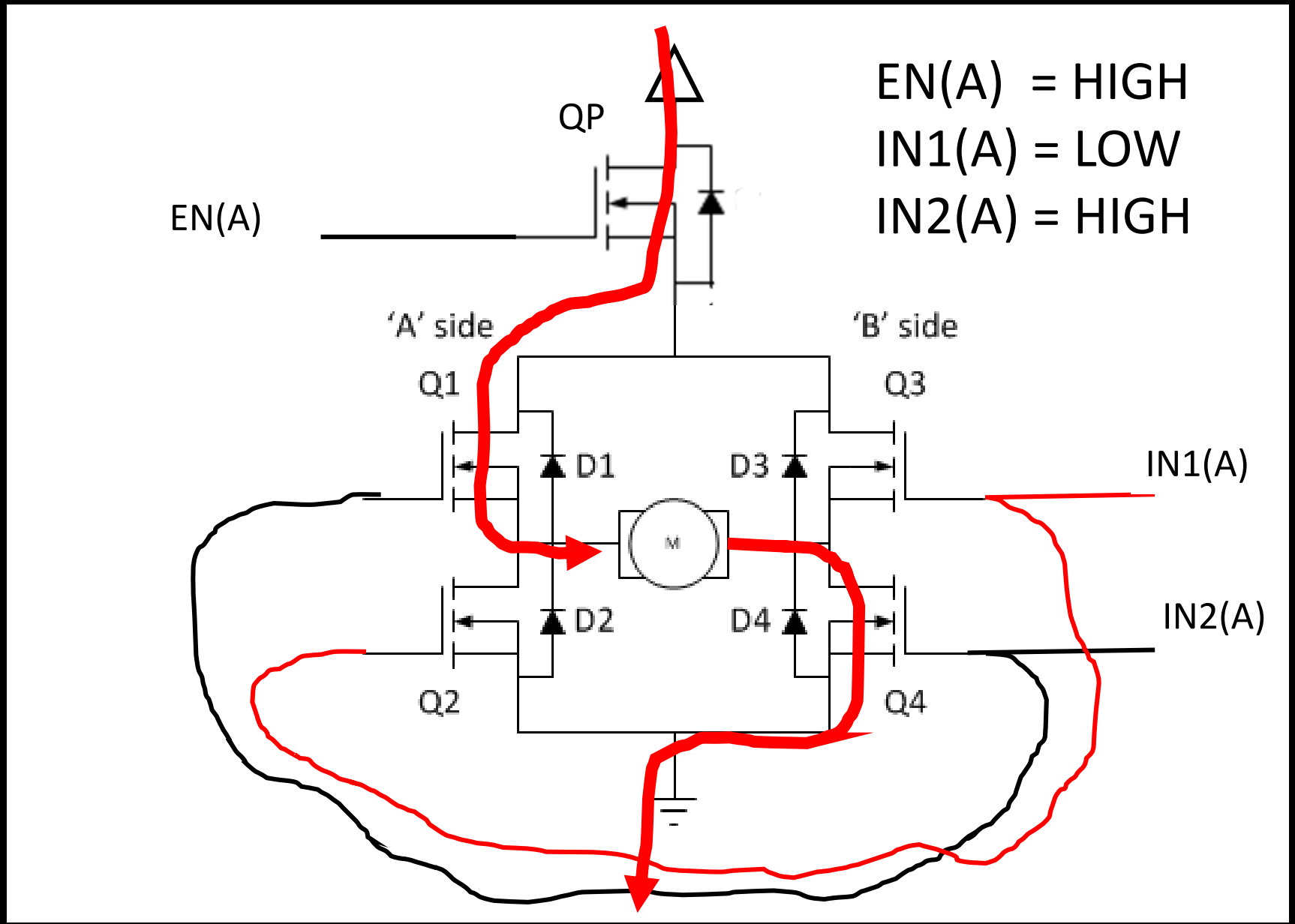
H-BRIDGE CIRCUIT



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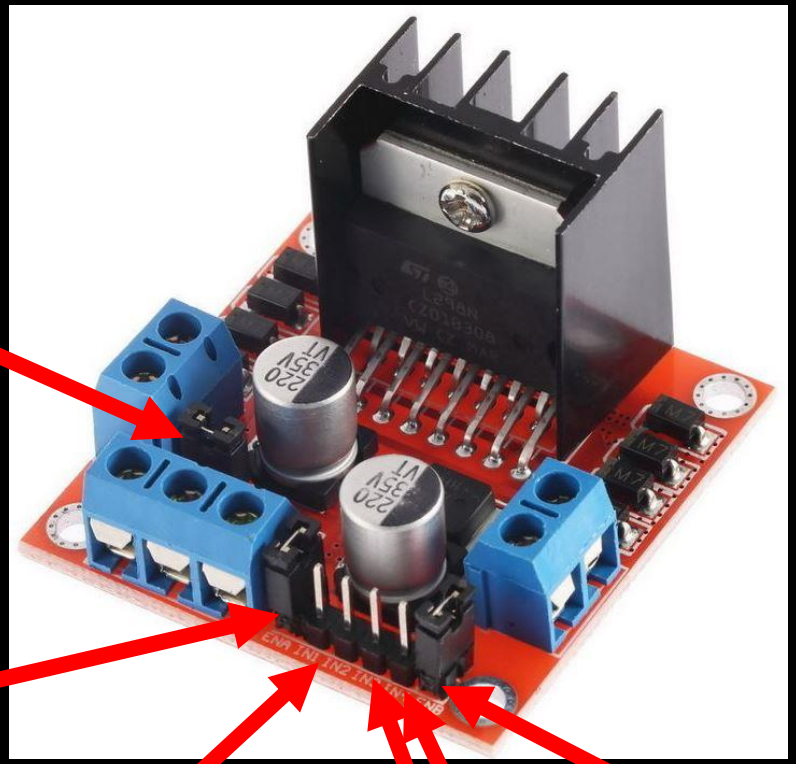
CONTROLLING THE MOTORS – PWM SPEED

Don’t move Jumper



ENA
Enable A

IN1A
IN2A

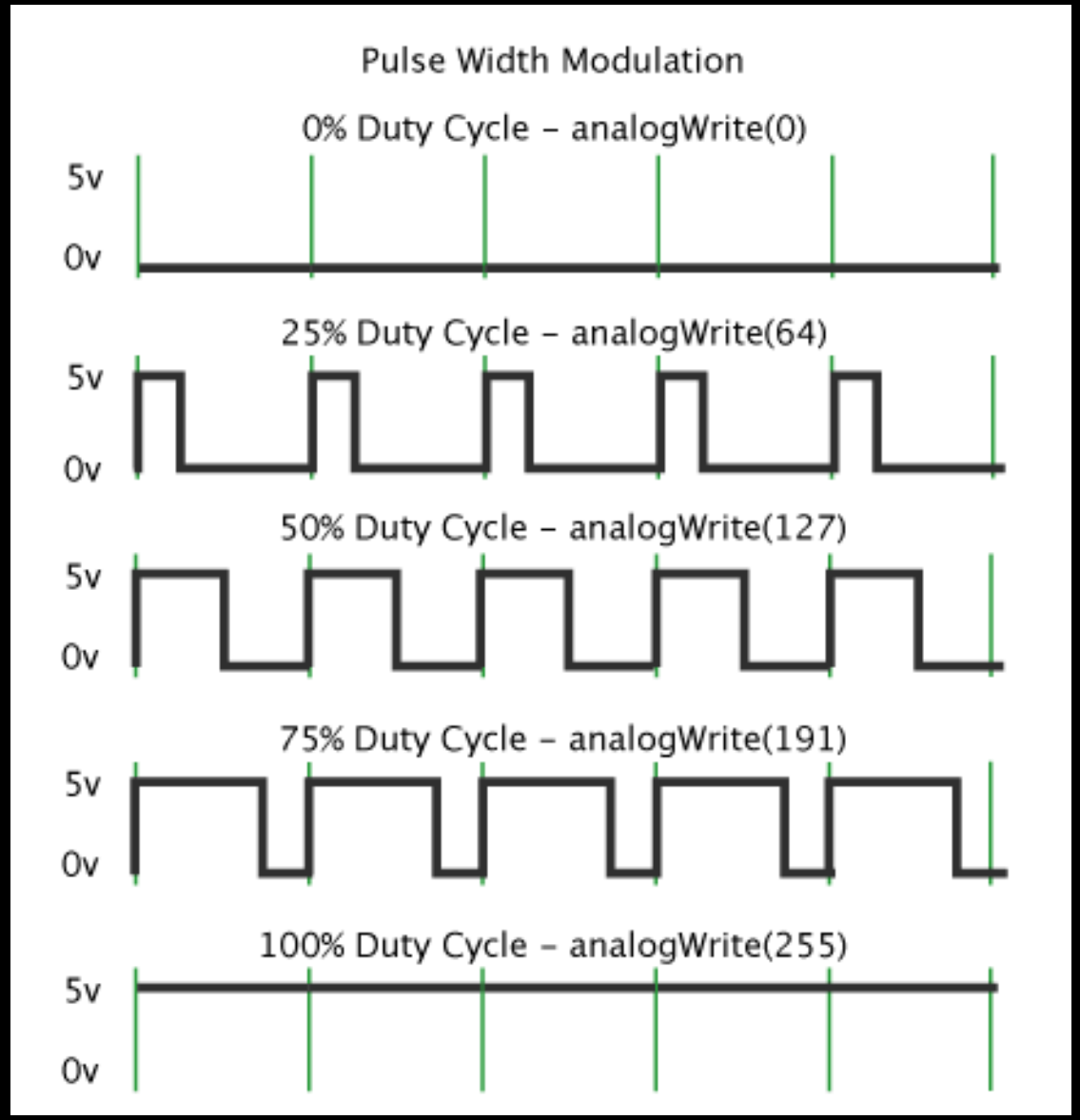
IN4B
IN3B

ENB
Enable B

Pin	Forward	Backward	STOP	BAD
ENA	Jumper	Jumper	Jumper)	Jumper
IN1(A)	***PWM***	LOW	LOW	**HIGH**
IN2(A)	LOW	***PWM***	LOW	**HIGH**
IN3(B)	***PWM***	LOW	LOW	**HIGH**
IN4(B)	LOW	***PWM***	LOW	**HIGH**
ENB	Jumper	Jumper	Jumper	Jumper

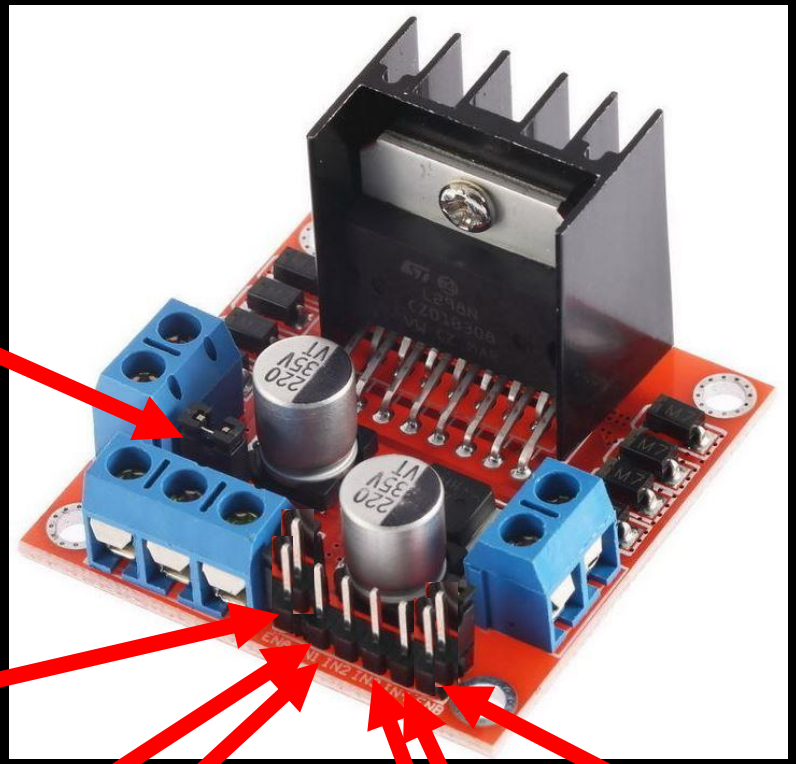
PWM

- While the signal can only be high (usually 5V) or low (ground) at any time, we can change the proportion of time the signal is high compared to when it is low over a consistent time interval
- https://learn.sparkfun.com/tutorials/pulse-width-modulation



CONTROLLING THE MOTORS – PWM SPEED

Don’t move Jumper



ENA
Enable A

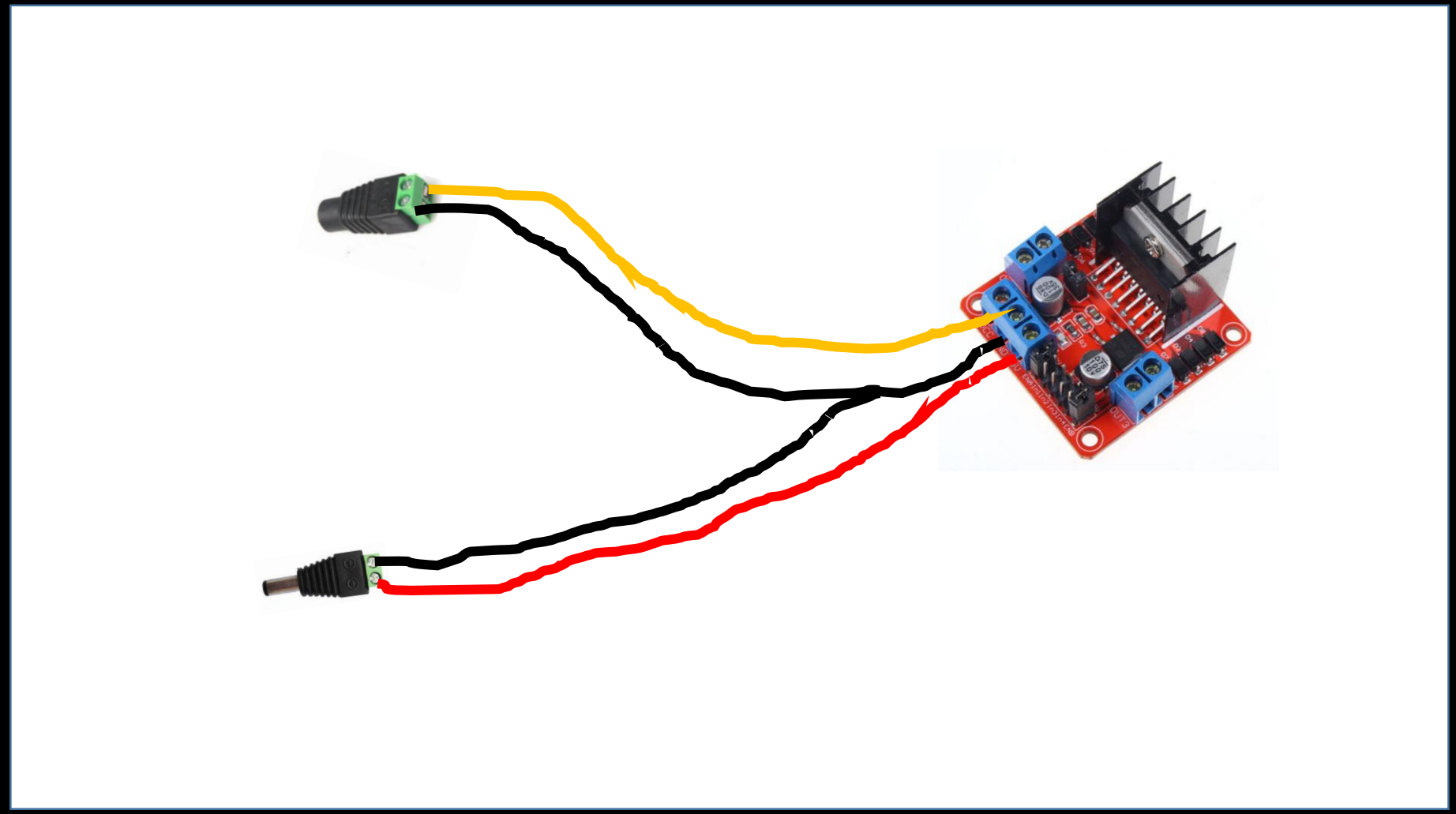
IN1A
IN2A

IN4B
IN3B

ENB
Enable B

Pin	Forward	Backward	STOP	BAD
ENA	***PWM***	***PWM***	***PWM=0***	***PWM***
IN1(A)	**HIGH**	LOW	LOW	**HIGH**
IN2(A)	LOW	**HIGH**	LOW	**HIGH**
IN3(B)	**HIGH**	LOW	LOW	**HIGH**
IN4(B)	LOW	**HIGH**	LOW	**HIGH**
ENB	***PWM***	***PWM***	Jumper	Jumper

POWER HARNESS



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LAB TIME - SPIN A MOTOR

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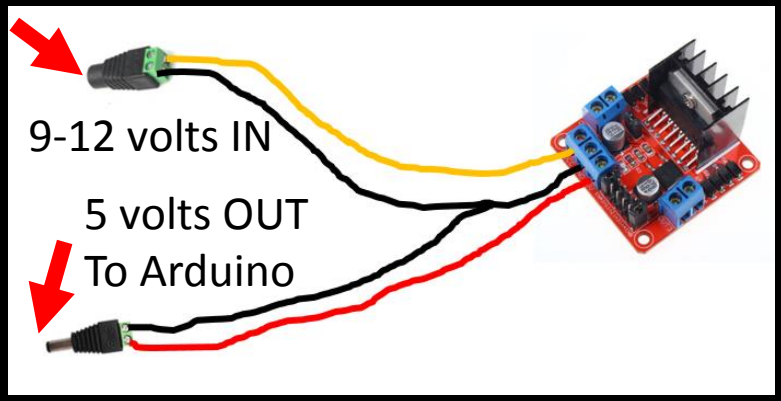
Connecting Power

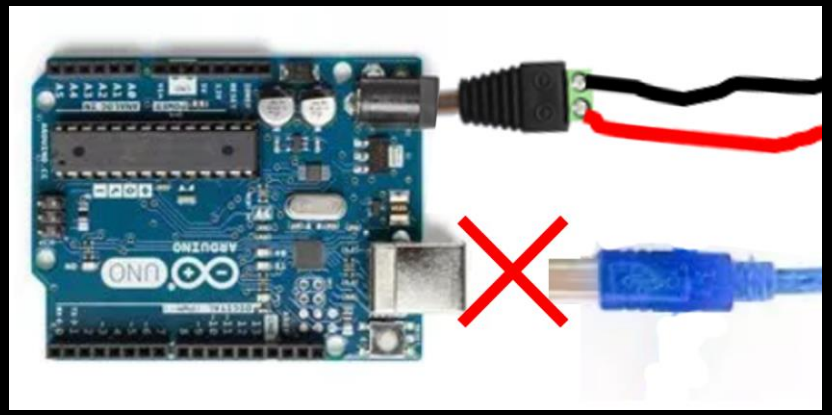


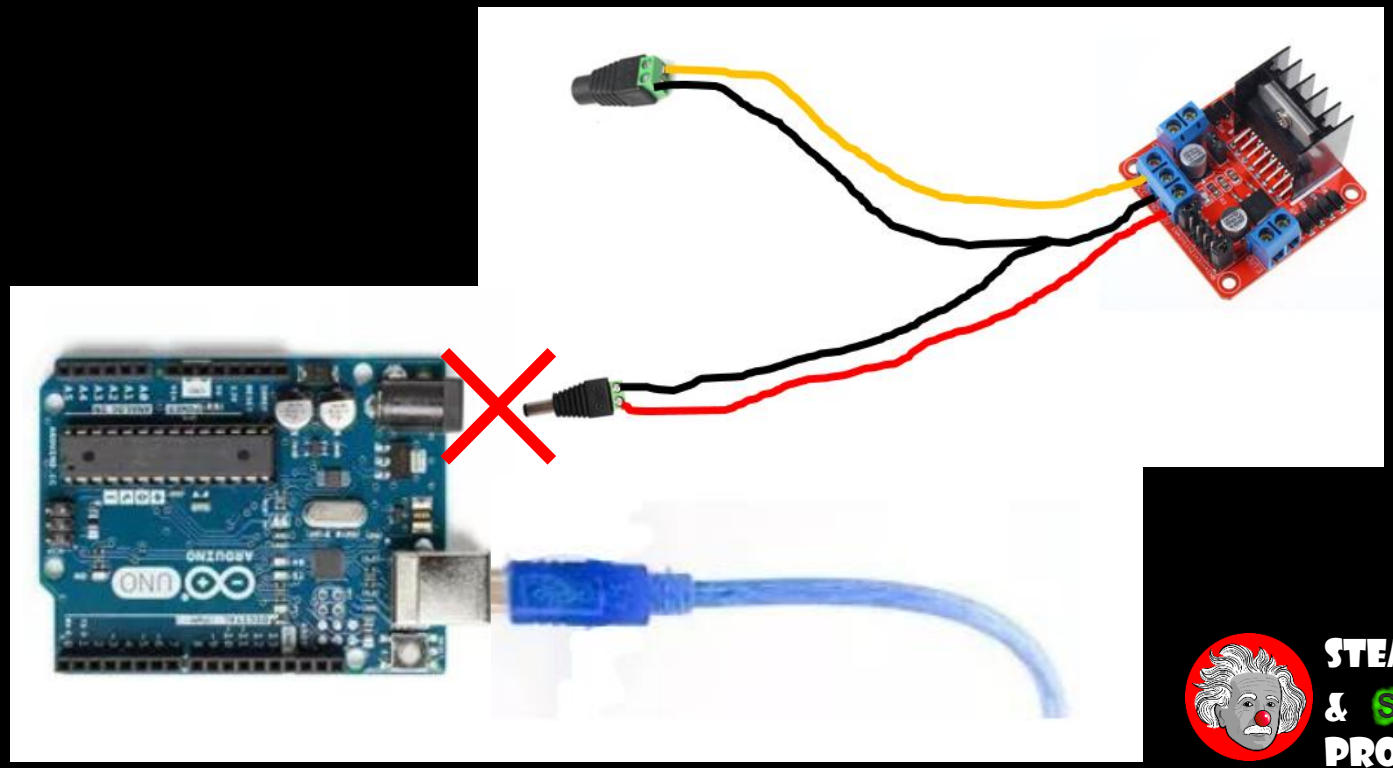
- Create a Motor Harness
- Use a 9-12 volt power supply
  - Where the 9 volt connects to the power harness
  - And the harness 5 volts connects to the Arduino

- See Instructions a few slides down…

DON'T CONNECT USB AND 5V AT THE SAME TIME

- Please don't connect the computer USB power and the Power harness 5 volts at the same time





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Lab Time – Go Get Some Code to Test With

- Open a new Arduino sketch and copy the dcMotorTest_01 from Github
  - Save it on your local drive as dcMotorTest_01
- You can also copy and save dcMotorTest_02
- Compile and upload
  - Open a Console window to see it printing it's status
  - Why is the motor not spinning? The code says it is…
- Disconnect the USB port and connect the Power Harness

MOTOR CONTROL PINS

```
// General Pins and Variables
  int boardLED=13;

// Motor Control Pins and Variables
  byte motorSpeed=0;  // change this (0-255) to control the speed
// Left Motor
  const int leftDirControl1 = 2;
  const int leftDirControl2 = 3;
  const int leftSpeedControlPin = 4;
```

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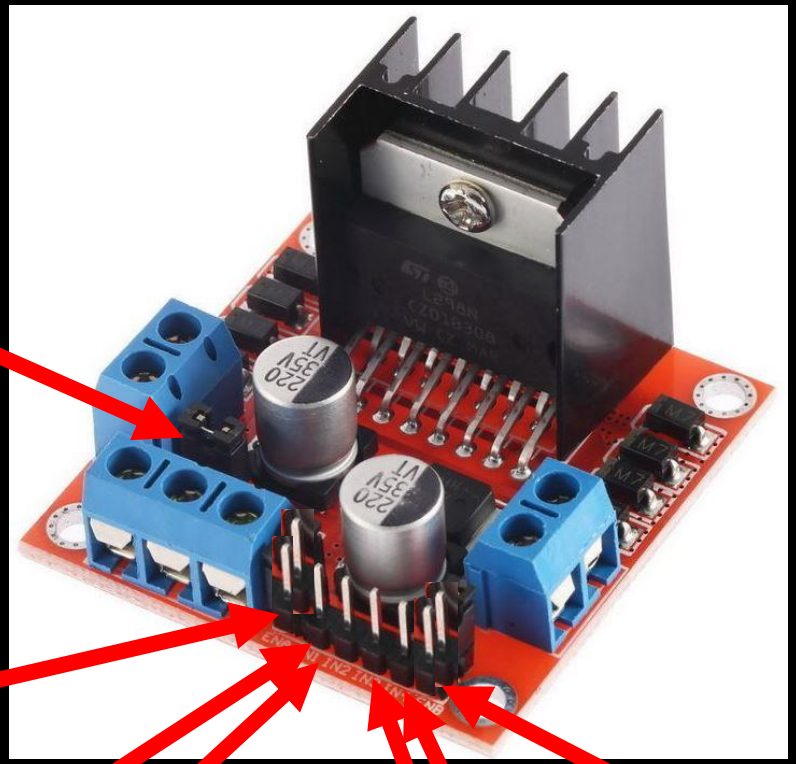
CONTROLLING THE MOTORS – PWM SPEED

Don’t move Jumper



ENA
Enable A

IN1A
IN2A

IN4B
IN3B

ENB
Enable B

Pin	Forward	Backward	STOP	BAD
ENA	***PWM***	***PWM***	***PWM=0***	***PWM***
IN1(A)	**HIGH**	LOW	LOW	**HIGH**
IN2(A)	LOW	**HIGH**	LOW	**HIGH**
IN3(B)	**HIGH**	LOW	LOW	**HIGH**
IN4(B)	LOW	**HIGH**	LOW	**HIGH**
ENB	***PWM***	***PWM***	Jumper	Jumper

MOTOR CONTROL SETUP

```
void setup() {
  // initialize serial communication @ 9600 baud:
  Serial.begin(9600);

  //Define L298N Dual H-Bridge Motor Controller Pins
  pinMode(leftDirControl1,OUTPUT);
  pinMode(leftDirControl2,OUTPUT);
  pinMode(leftSpeedControlPin,OUTPUT);

  // Stop All Motors
  motorSpeed = 0;
  analogWrite(leftSpeedControlPin, motorSpeed);  //Sets speed via PWM
  digitalWrite(leftDirControl1, LOW);
  digitalWrite(leftDirControl2, LOW);
  delay(1000);
}
```

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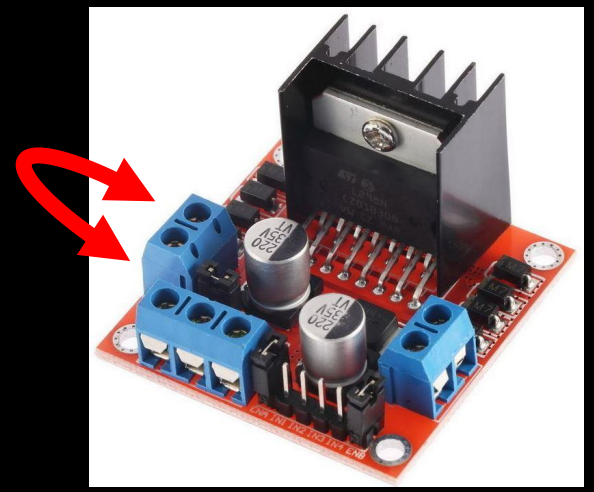
MOTOR CONTROL LOOP

```
void loop() {
    // turn on left motor in a Clockwise motion
   motorSpeed = 140;        //Sets speed variable via PWM = 140;
   analogWrite(leftSpeedControlPin, motorSpeed); //Sets speed via PWM
   digitalWrite(leftDirControl1, LOW);
   digitalWrite(leftDirControl2, HIGH);
   Serial.print("Clockwise with a speed of ");
   Serial.println(motorSpeed);
   delay(2000);

   // Stop All Motors
   motorSpeed = 0;
   analogWrite(leftSpeedControlPin, motorSpeed); //Sets speed  via PWM
   digitalWrite(leftDirControl1, LOW);
   digitalWrite(leftDirControl2, LOW);
   Serial.println("All Motors STOPPED");
   delay(1000);
}
```

Is your motor spinning? The right way?

- If your motor is spinning Clockwise when you tell it to spin clockwise, great…
- If not, what can you do?
  - Best option is to switch the motor wires
  - What else could you do?



LAB

- What is the difference between dcMotorTest_01 and dcMotorTest_02 ?
- What is the “stall” speed of your motor?
  - Stall speed is the slowest you can set the speed and still have your motor turn
  - dcMotorTest has the speed set at 140. what is the slowest speed that your motor will run? Hint: 100 is probably to slow

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POWER HARNESS

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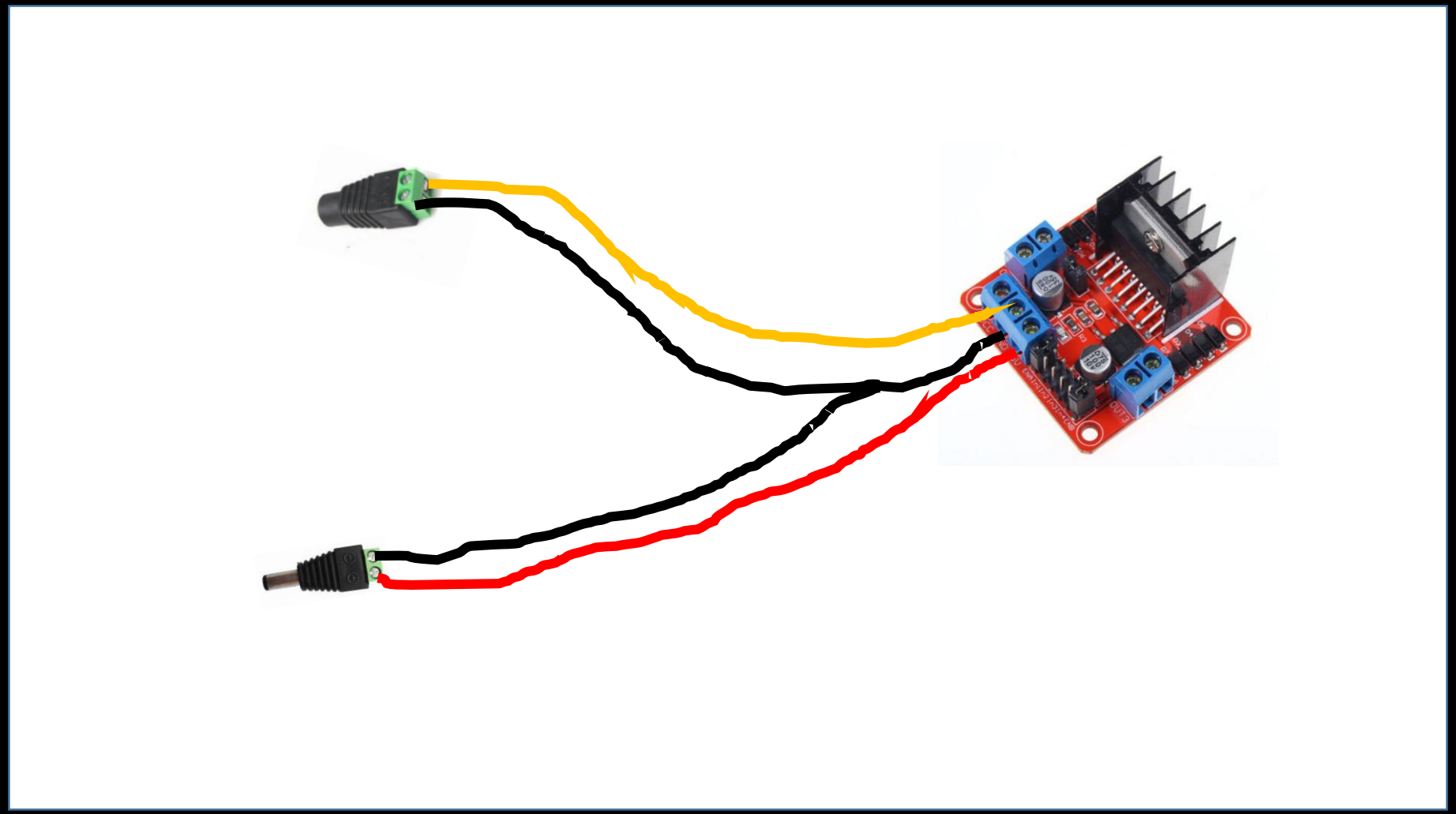
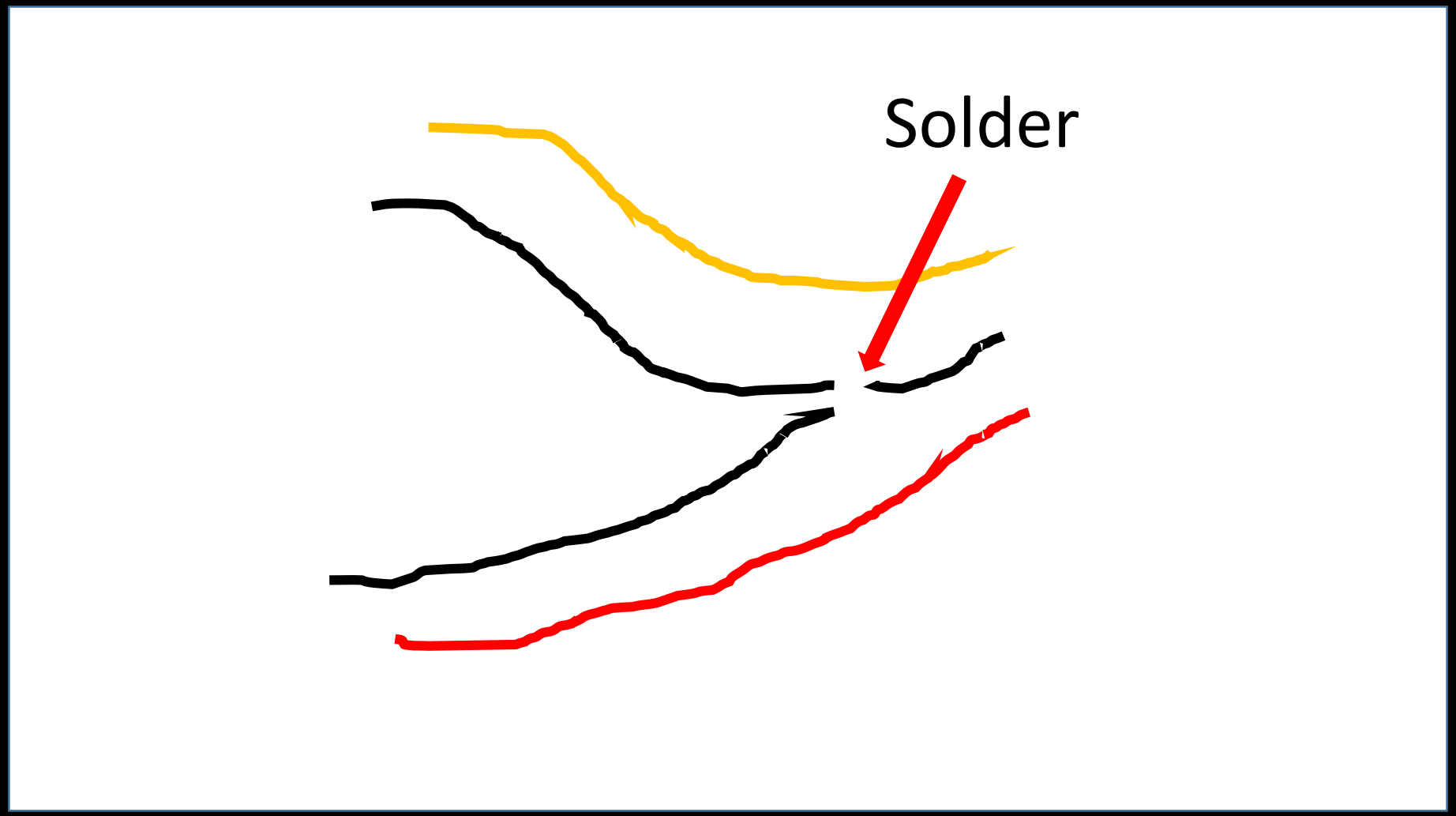
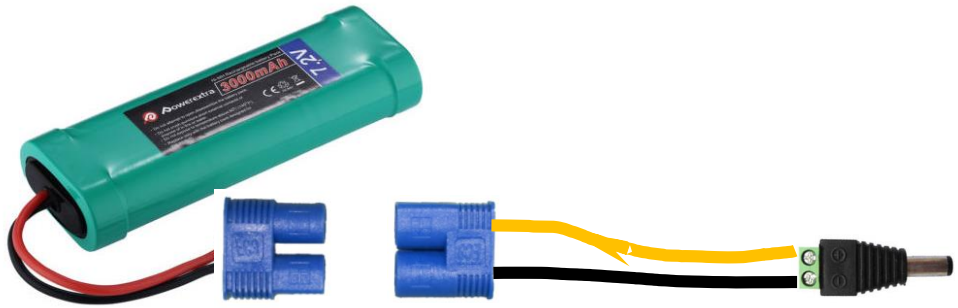
POWER HARNESS



POWER HARNESS



POWER HARNESS



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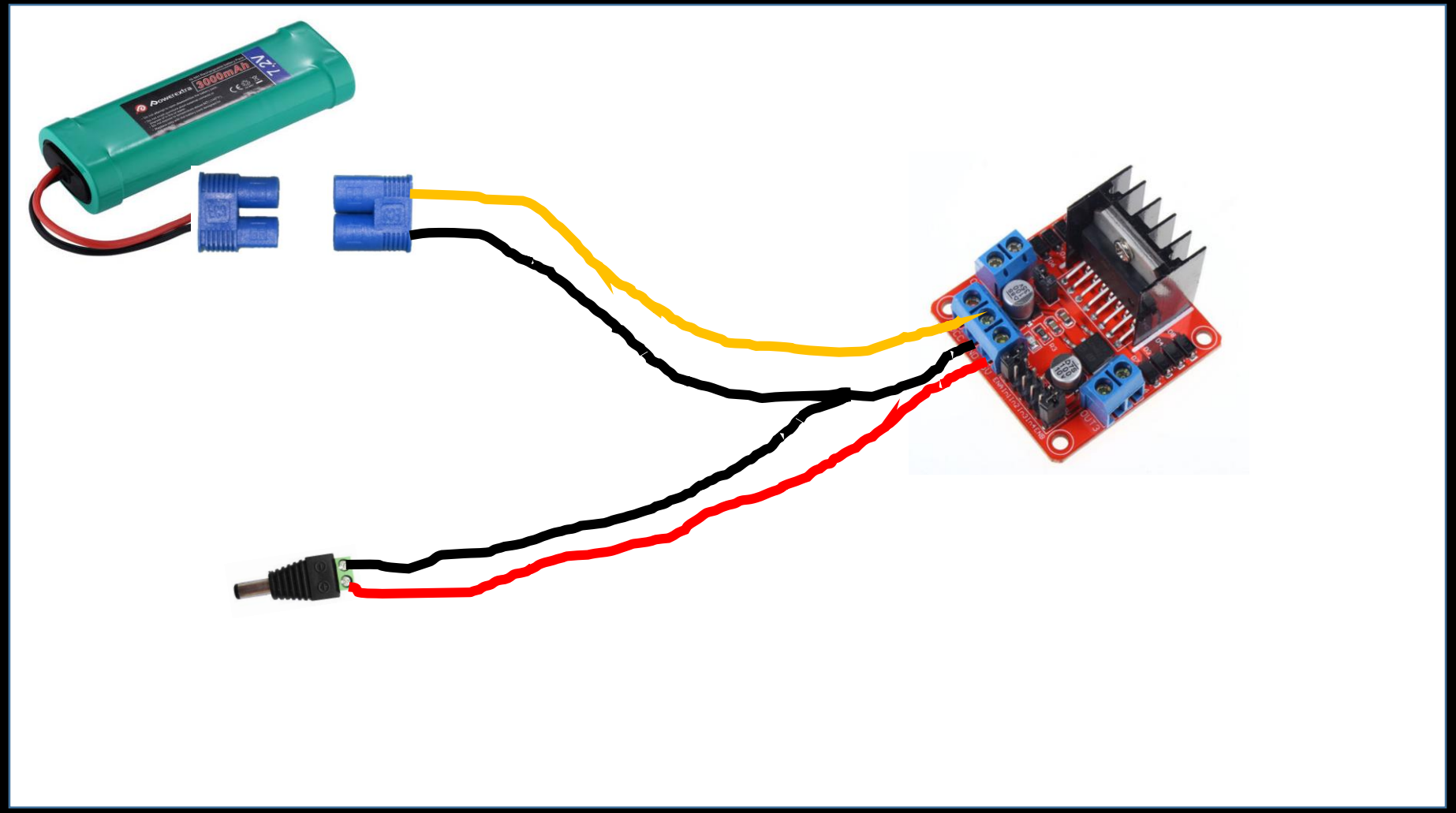
POWER HARNESS WHEN FIXED TO EQUIPMENT



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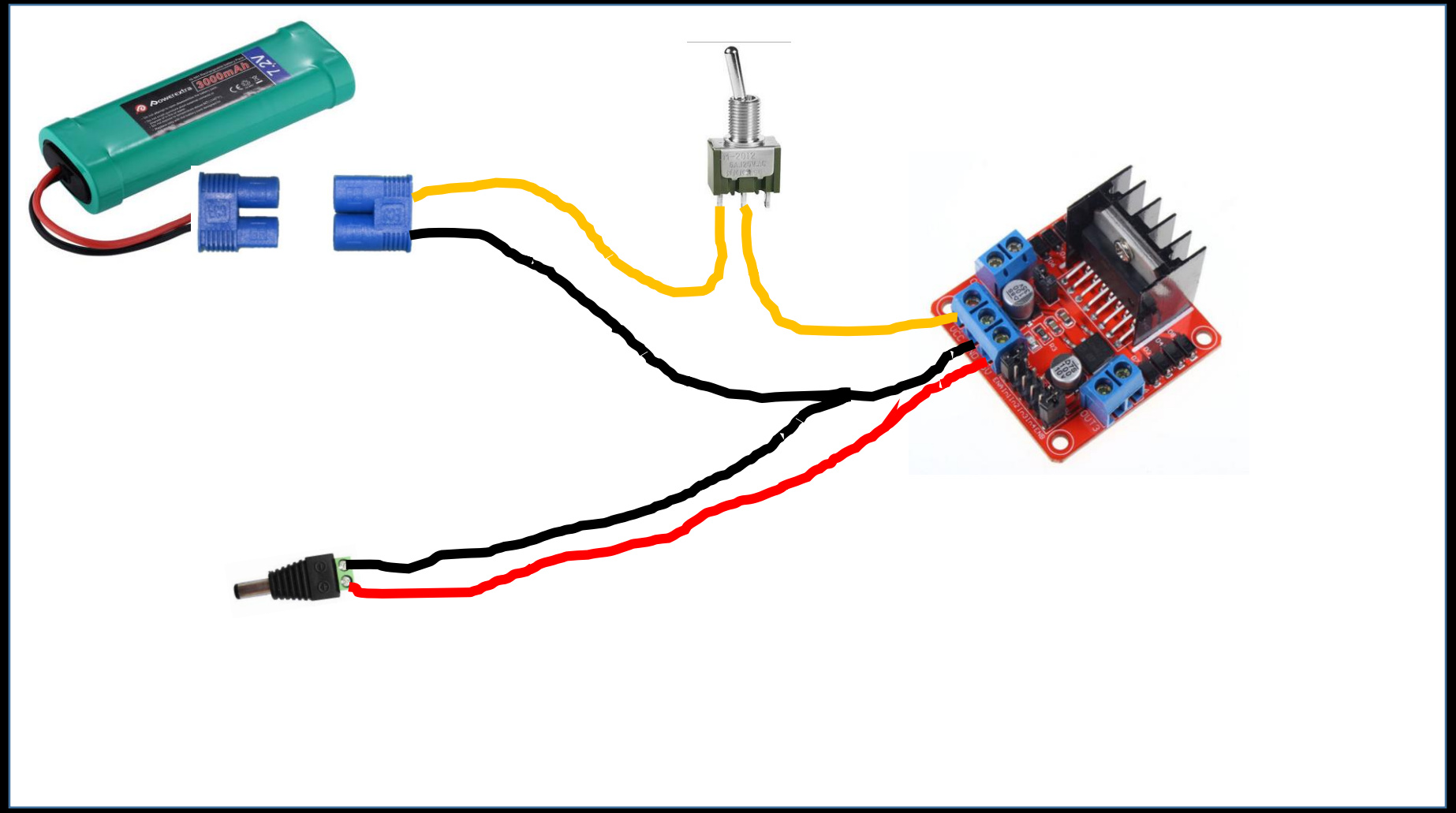
POWER HARNESS WITH POWER SWITCH



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REFERENCE SLIDES

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APPENDIX

Appendix A: License & Attribution

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Appendix B: Attribution for Sources Used

- http://www.modularcircuits.com/blog/articles/h-bridge-secrets/h-bridges-the-basics/
- For additional information and reference material student can refer to STEAM Clowns Closet
  - https://sites.google.com/view/steam-clowns-closet/motor-controller-l298n-dual-h-bridge-motor-controller
- https://learn.sparkfun.com/tutorials/pulse-width-modulation

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