

## Brushed DC Motor Controller Using Rotary Encoder, Arduino Compatible Hardware

This DC Motor controller provides direction and speed control of brushed DC Motor using Rotary Encoder. This is Arduino compatible hardware that consists of LMD18201 DC motor driver chip, Atmega328 microcontroller, Rotary Encoder, L317 regulator, and other components. Hardware offers easy control of brushed DC motor up to 3A with speed, direction, and brake control. The encoder includes a tactile switch, which can be used to control the ON/OFF or Direction of the motor and the encoder helps to set the speed.

### Learn more about Rotary Encoder

<https://www.seeedstudio.com/blog/2020/01/19/rotary-encoders-how-it-works-how-to-use-with-arduino/>

<https://playground.arduino.cc/Main/RotaryEncoders/>

A rotary encoder is a type of position sensor which is used for determining the angular position of a rotating shaft. It generates two pulses, according to the rotational movement, these two pulses determine the direction of the shaft and angular position, this encoder is also included with a mechanical switch. Switch and encoder help to control the DC motor speed and direction.

The project can be described in 3 parts, Atmega328 Microcontroller, LMD18201 DC Motor H-bridge, and Rotary Encoder. This board can control DC motor up to 48V DC and continued current up to 3A, peak current 6A.

### Arduino Code

It is Arduino-compatible hardware and a new Atmega328 chip requires bootloader programming and Arduino code upload. Follow the link below for more info on programming and boot-loader burning.

**Credits:** This is modified Arduino Code, Original Author of the code <https://www.brainy-bits.com/>

<https://www.arduino.cc/en/Tutorial/BuiltInExamples/ArduinoToBreadboard>

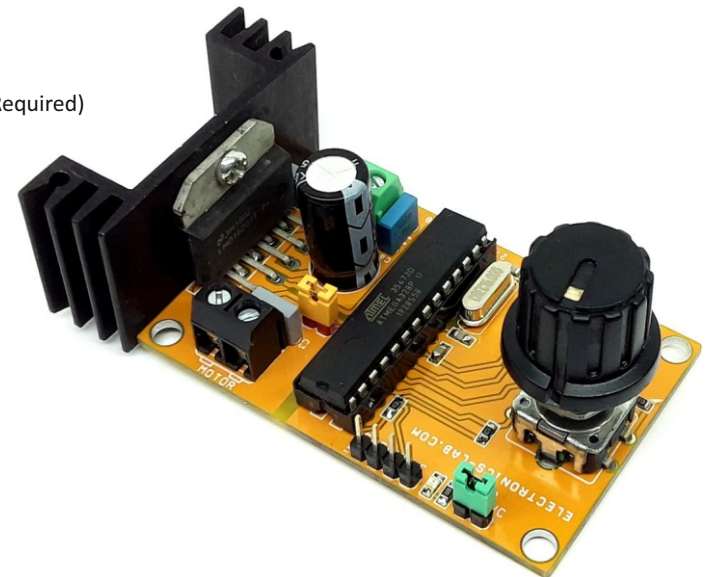
Arduino Example code provided to test the board, with this code user will be able to test the hardware. Code may be modified as per requirement.

### Arduino Pins Vs LMD18201 Motor Driver Pins

- Arduino Digital D5>>PWM Pin LMD18201,
- Arduino Digital Pin D11 >> Direction Pin LMD18201,
- Arduino Analog Pin A1 >> Brake Pin LMD18201 (Close the jumper J1 for Normal Operations If Brake Function Not Required)
- Arduino Digital Pin D2 >> Encoder Channel A- Pin Pulled Up using R7-10K
- Arduino Digital Pin D3>> Encoder Channel B- Pin Pulled Up using R8-10K
- Arduino Digital Pin D4>> Tactile Switch of Encoder – Pulled Up using R9-10K

### Features

- Operating Power Supply 12V to 24V DC (For Motor 25V to 48V Power Refer the Note)
- Motor Load 3Amps
- D1 Power LED
- Encoder with Switch = Motor Direction CW/CCW and Speed Control
- PWM Duty Cycle Adjustable 0 to 100% (Frequency 975Hz)
- Onboard L317 Regulator provides 5V to Atmega328
- PCB Dimensions 66.83 x 41.91 mm



### Power Supply

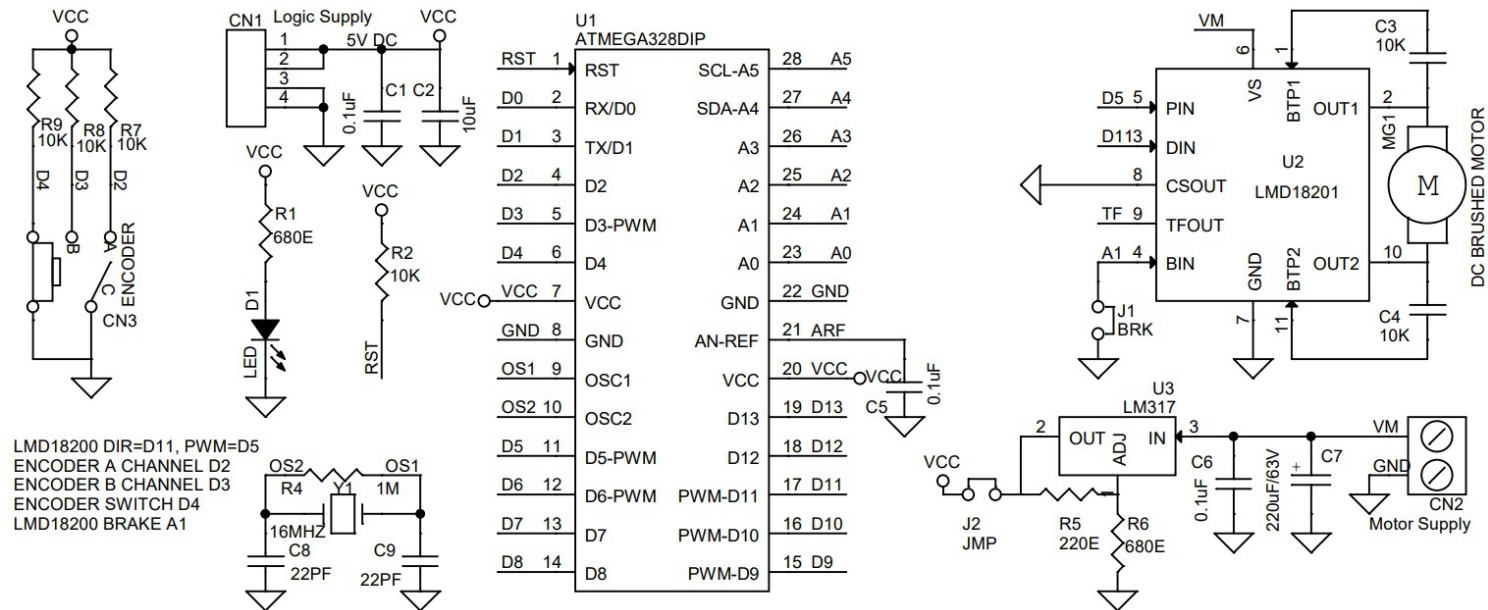
Motor 12 to 24V can work with a single supply, apply 12 to 24V at CN2, close Jumper J2. To drive a higher voltage motor, the circuit requires 2 separate power supplies, for logic and motor, in this case, open the jumper J2, use CN2 to apply motor supply 25V to 48V, and CN1 7V to 24V logic supply.

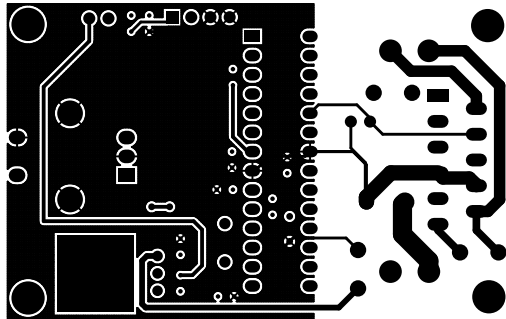
### Heat-sink

Large Size heatsink with fan recommended on LMD18201 chip if motor is running on full power 3Amps.

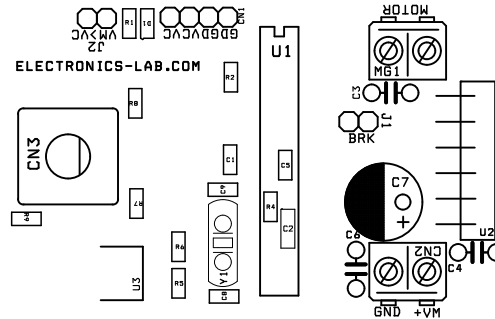
### LMD18201

The LMD18201 is a 3A H-Bridge designed for motion control applications. The device is built using a multi-technology process which combines bipolar and CMOS control circuitry with DMOS power devices on the same monolithic structure. The H-Bridge configuration is ideal for driving DC and stepper motors. The LMD18201 accommodates peak output currents up to 6A. Current sensing can be achieved via a small sense resistor connected in series with the power ground lead. For current sensing without disturbing the path of current to the load, the LMD18200 is recommended.

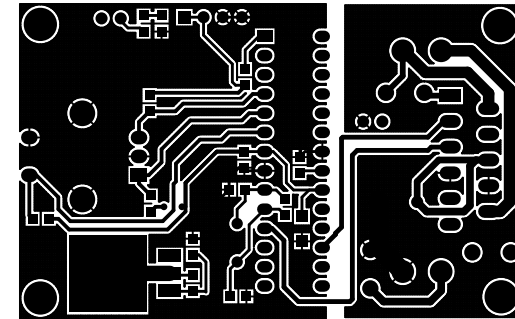




BOTTOM LAYER

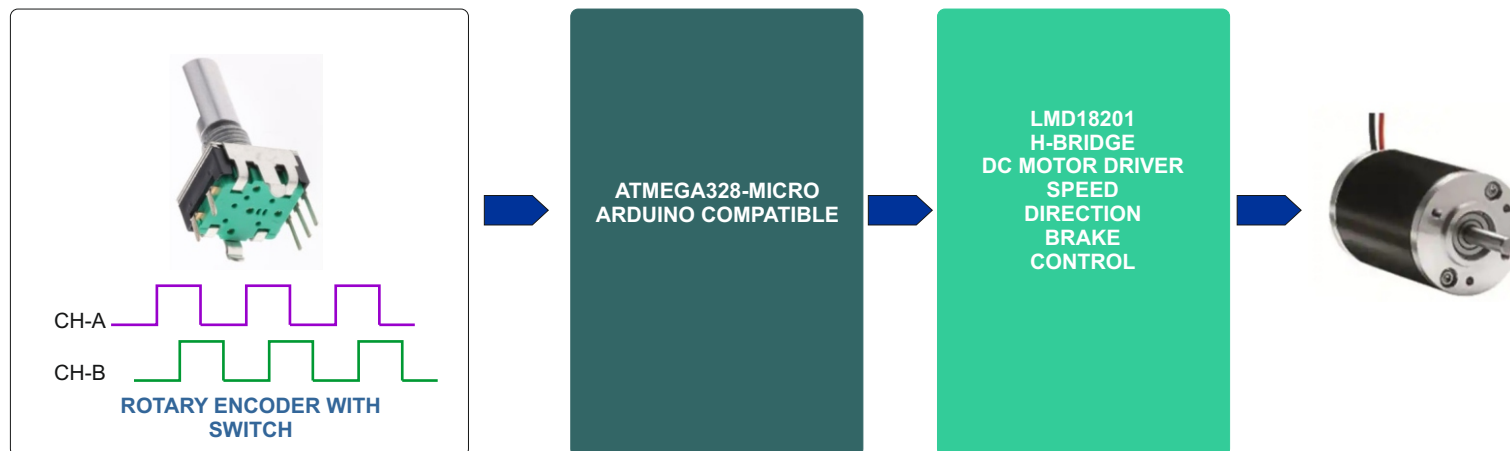


SILK SCREEN TOP



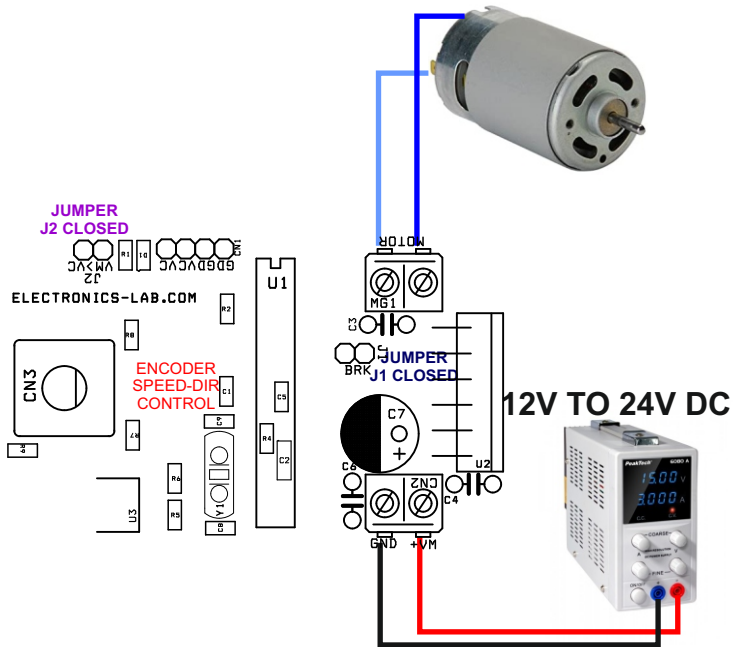
TOP LAYER

PCB DIMENSION 66.83MM X 41.91MM



BOM						
NO.	QNTY.	REF.	DESC	MANUFACTURER	SUPPLIER	SUPPLIER PART NO
1	1	CN1	4 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5317-ND
2	1	CN2	2 PIN SCREW TERMINAL PITCH 5.08MM	PHOENIX	DIGIKEY	277-1247-ND
3	2	C5,C6	0.1uF/50V SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
4	1	C2	10uF/6.3V SMD SIZE 1206	YAGEO/MURATA	DIGIKEY	
5	6	R2,R7,R8,R9	10K 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
6	1	C7	470uF/50V OR 63V	NICHICON	DIGIKEY	493-12789-3-ND
7	2	C8,C9	22PF/50V SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
8	1	D1	LED RED SMD SIZE 0805	LITEON INC	DIGIKEY	160-1427-1-ND
9	2	J1,J2	2 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	
10	1	J1,J2	JUMPER-SHUNT	SULINS	DIGIKEY	S9001-ND
11	1	MG1	2 PIN SCREW TERMINAL PITCH 5.08MM	PHOENIX	DIGIKEY	277-1247-ND
12	2	R1,R6	680E 1% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
13	1	R4	1M 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
14	1	R5	220E 1% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
15	1	CN3/SW1	ROTARY ENCODER EN11-HSM1BF20	TT ELECTRONICS	DIGIKEY	987-1398-ND
16	1	U1	ATMEGA328DIP	MICROCHIP	DIGIKEY	ATMEGA328-PU-ND
17	1	U2	LMD18201	TI	DIGIKEY	LMD18201T/NOPB-ND
18	1	U3	LM317	ON SEMI	DIGIKEY	LM317MDTRKGOSCT-ND
19	1	Y1	16MHZ	ECS INC	DIGIKEY	X1103-ND
20	2	C3,C4	0.01UF/63V	KEMET	DIGIKEY	399-5437-ND
21	1	C1	0.1UF/63V	EPCOS/TKD	DIGIKEY	495-2479-1-ND

### CONNECTIONS FOR MOTOR 12V TO 24V



### 7V TO 12V CONNECTIONS FOR MOTOR 25V TO 48V

