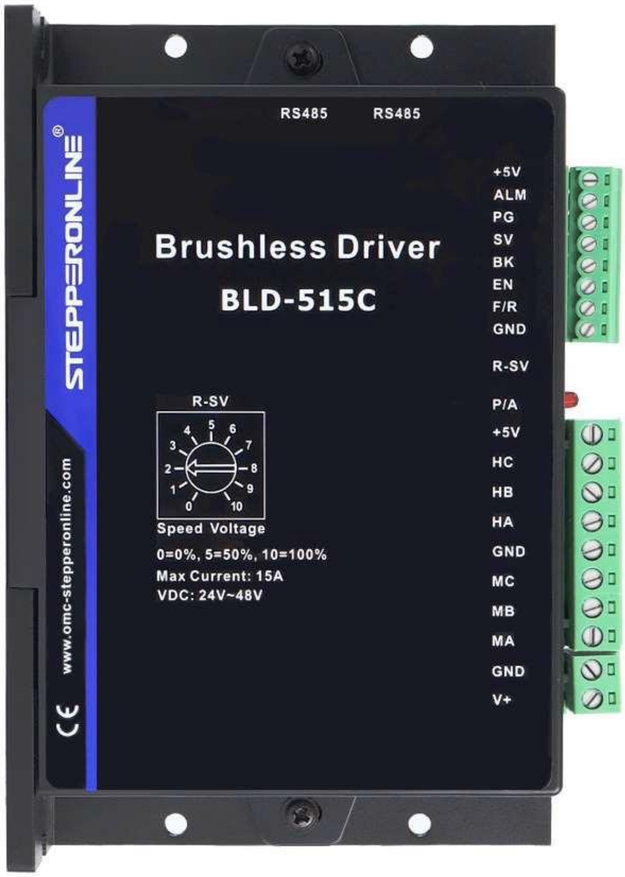
User Manual

BLD-515C

Brushless DC Motor Driver



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Read the operating instructions carefully before putting the driver into operation with power

Introduction

The BLDC driver is a closed-loop speed driver, which adopts the latest type of IGBT and MOS power devices. It uses the Hall signals of a DC brushless motor after frequency multiplication to achieve closed-loop speed control. The control loop has a PID speed regulator, making the system control stable and reliable, especially in low-speed conditions where maximum torque can always be achieved. The speed control range is from 150 to 10,000 rpm.

1. Features

- PID speed and current dual-loop controller
- High performance at a low price
- 20kHz chopping frequency
- Electrical braking function for fast motor response
- Overload factor greater than 2, with maximum torque achievable at low speeds
- Fault alarm function for over-voltage, under-voltage, over-current, over-temperature, and illegal Hall signal
- Compatible with both Hall and non-Hall sensors, with automatic identification. Non-Hall sensor mode is only suitable for special occasions where the load is relatively constant and start-up is not frequent, such as fans, water pumps, polishing equipment, etc.

2. Electrical Specifications

Parameters	**BLD-515C**			
Input voltage（VDC）	12	24	36	48
Continuous Output Current（A）	12.5	12.5	10	8.3
Rated Output Power（W）	150	300	360	400
Peak Current(A)	15			

3. Terminal and Signal

3.1 Power Input

No.	**Terminal Name**	**Description**
1	V+	12~48VDC input
2	GND	GND input

3.2 Motor Input

No.	Terminal Name	Description
1	MA	BLDC motor A phase
2	MB	BLDC motor B phase
3	MC	BLDC motor C phase
4	GND	GND
5	HA	Hall sensor A phase input
6	HB	Hall sensor B phase input
7	HC	Hall sensor C phase input
8	+5V	Hall signal power line

3.3 Control Signal

GND: Signal ground

F / R: For forward and reverse control, connect to GND for reverse and do not connect for forward. When switching between forward and reverse, the EN signal should be turned off first.

EN: Enable control: EN grounded, motor turns (online state), EN not connected, motor does not turn (offline state).

BK: When working normally without grounding, the motor's electrical brake is activated when grounded. When the inertia of the load is large, a pulse width modulation signal should be used to adjust the brake effect by adjusting the pulse width amplitude.

SV: Analog voltage input: can attenuate from 0 to 100%. When an external speed command is applied from 0 to 5V, the speed of the machine can be adjusted through this port. The driver's factory-set maximum speed is 7000rpm for 2 poles (3500rpm for 4 poles). To change the maximum speed or adjust the linearity of the motor speed, it is necessary to modify the driver's maximum speed through an external parameter setting board.

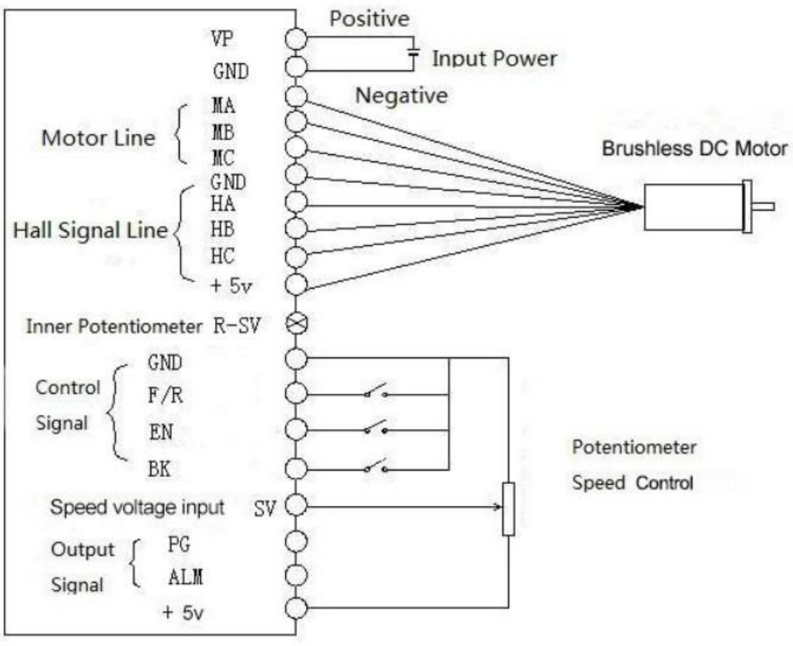
PG: Motor speed pulse output: When the number of pole pairs is P, P pulses are output per revolution (OC gate input).

ALM: Alarm output: When the circuit is in an alarm state, the output is a low level (OC gate output).

+5V: Speed-regulating voltage output, can be continuously adjusted using a potentiometer connected between SV and GND.

Built in speed limit potentiometer: Adjusts the motor speed again and can adjust the speed within the range of 0 to 100%.

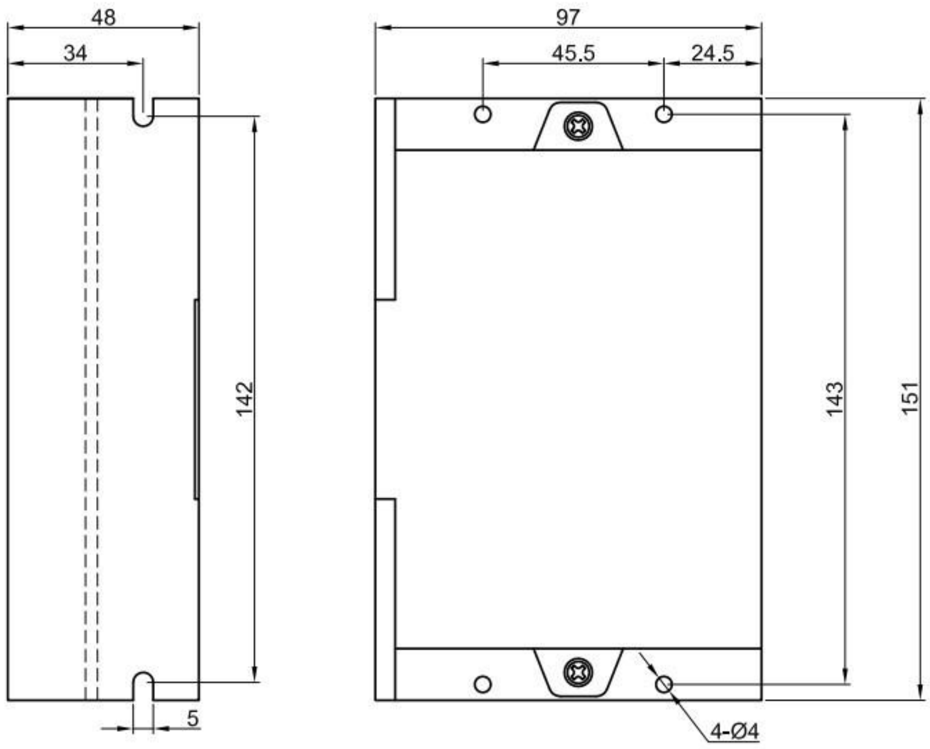
3.4 Connection Diagram of Motor and Driver



Note: If external potentiometer speed control is not required, SV and +5V can be directly shorted, and then controlled by shorting GND and EN for start/stop.

3.5 Mechanical Specifications

(Unit: mm [1inch=25.4mm])



4. The Driver Usage Steps

4.1 Connect the motor wires, Hall effective sensor wires, and power supply wires correctly. Incorrect wiring can potentially damage the motor and driver.

4.2 When using the built-in potentiometer for speed control, connect the EN to GND signal ground, connect the SV port to +5V, and use the built-in potentiometer R-SV for speed adjustment.

4.3 When using an external potentiometer for speed control, adjust the R-SV to a position of 1.0, while grounding the EN. Connect the wiper of the external potentiometer to the SV port of the driver, and connect the other two terminals to the GND and +5V ports.

4.4 Power on and operate the motor. At this point, the motor is in closed-loop maximum speed state. Adjust the external potentiometer to the required speed.

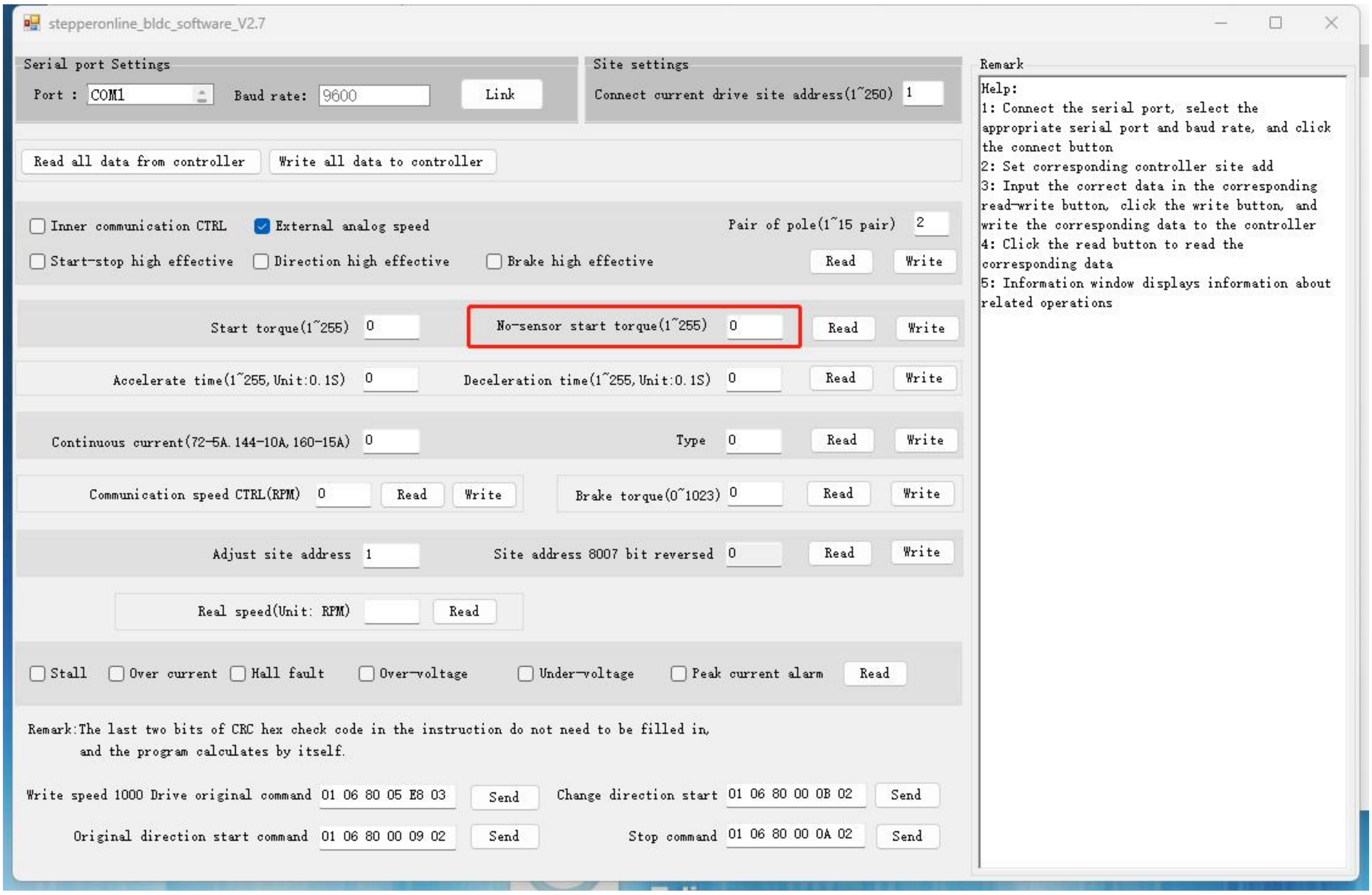
4.5 Sensorless control mode

STEPPERONLINE drivers can be used for sensorless brushless motors.

But it should be noted that since our brushless driver is mainly used for our brushless motor with sensors, its built-in program is also used for motors with sensors.

Although our brushless driver can be used for sensorless brushless motors, the program of the driver is not fully compatible and can only be used in simple scenarios. Our brushless drives are not recommended if the motor needs to be started and stopped frequently.

When using a brushless driver to drive a sensorless motor, it is necessary to use software to set the sensorless starting torque according to the parameters of the motor.



stepperonline_bldc_software_V2.7

Serial port Settings
Port : COM1 Baud rate: 9600

Site settings
Connect current drive site address(1~250) 1

☐ Inner communication CTRL ☑ External analog speed
Pair of pole(1~15 pair) 2
☐ Start-stop high effective ☐ Direction high effective ☐ Brake high effective

Start torque(1~255) 0
No-sensor start torque(1~255) 0

Accelerate time(1~255, Unit:0.1S) 0
Deceleration time(1~255, Unit:0.1S) 0

Continuous current(72-5A. 144-10A, 160-15A) 0
Type 0

Communication speed CTRL(RPM) 0
Brake torque(0~1023) 0

Adjust site address 1
Site address 8007 bit reversed 0

Real speed(Unit: RPM)

☐ Stall ☐ Over current ☐ Hall fault ☐ Over-voltage ☐ Under-voltage ☐ Peak current alarm

Remark:The last two bits of CRC hex check code in the instruction do not need to be filled in, and the program calculates by itself.

Write speed 1000 Drive original command 01 06 80 05 E8 03
Change direction start 01 06 80 00 0B 02
Original direction start command 01 06 80 00 09 02
Stop command 01 06 80 00 0A 02

Remark
Help:
1: Connect the serial port, select the appropriate serial port and baud rate, and click the connect button
2: Set corresponding controller site add
3: Input the correct data in the corresponding read-write button, click the write button, and write the corresponding data to the controller
4: Click the read button to read the corresponding data
5: Information window displays information about related operations

5. Communication Method

The communication mode uses the standard Modbus protocol, which complies with the national standard GB/T 19582.1-2008. It uses a serial communication based on RS485 two-wire system, and the physical interface adopts a conventional 3-pin 2.54 wiring terminal (A+, GND, B-) which is very easy to connect in series. The transmission mode is RTU, and the verification mode is CRC, with a CRC initial word of FFFFH. The data mode is 8-bit asynchronous serial with 1 stop bit and no verification bit. It supports multiple communication rates (see parameter table for details).

Function codes 03H support multiple register reads, and 06H supports single register writes. Site address:

00: broadcast address

1-250: user address

251-255: special address, not available to users

No.	485 Address	CAN address	Parameter Name	Setting Range	Default	Unit	Remark
00	$8000	1000H	Driver type Low half word	0x0192			Read-only device identification
01	$8001	1000H	Driver type High half character	0x0004			Read-only device identification
02	$8002	1008H	Driver name Low half word	0x5354			Read-only device identification
03	$8003	1008H	Driver name High half word	0x3032			Read-only device identification
04	$8004	1009H	Hardware version, Low half word	0x2E30			Read-only device identification
05	$8005	1009H	Hardware version high half a word	0x5630			Read-only device identification

06	$8006	100AH	Software version, Low half word	0x2E30			Read-only device identification
07	$8007	100AH	Software version High half word	0x5630			Read-only device identification
08	$8008	1018H	Device ID Low half word	0x02d9			Read-only device identification
09	$8009	1018H	Device ID high half word	0x0000			Read-only device identification
10	$800A	1018H	Product code is as low as half a word	0x0000			Read-only device identification
11	$800B	1018H	Product code high half a word	0x0000			Read-only device identification
12	$800C	1018H	Modified version lower half word	0x0000			Read-only device identification
13	$800D	1018H	Modified version high half word	0x0000			Read-only device identification
14	$800E	1018H	Serial number, low half word	0x0000			Read-only device identification
15	$800F	1018H	Serial number, low half word	0x0000			Read-only device identification
16	$8100	1005H	Synchronize the address low half word	0x0080			Read and write variable
17	$8101	1005H	Synchronize the address high half word	0x0000			Read and write variable
18	$8102	1006H	First byte: Site address Second byte: reserved	0-250	1		Read and write variable
19	$8103	1006H	The mailing address is about half a word high	0x0000			Read and write variable
20	$8104	1007	Communication frequency	1000			Read and write variable
21	$8105	1017H	The CAN heartbeat time	0X0			Read and write variable
22	$8106	6100	First byte: the control status bit The second byte: the working mode bit	The first byte: Bit 0: start stop EN (1: start, 0: stop) Bit 1: Direction FR (1: reverse, 0: forward) Bit 2: Brake BK (1: enable brake, 0: no	First byte: 00H 2nd byte: 04H		Read and write variable

				brake) The second byte: Bit 0: Control mode (1: internal, 0: external) Bit 1: speed way (1: internal, 0: external) Bit 2: feeling without feeling (1: feeling, 0: no feeling) Bit 3: open loop (1: open loop, 0: closed loop) Bit 4: Hall Angle (1:60 degrees, 0:120 degrees) Bit5: 0 Bit6: 0			
23	$8107	6101	First byte: the motor is extremely logarithmic The second byte: MODBUS Communication frequency	The first byte: 1~99 The second byte: (N + 1) * 600	The first byte: 2 Second byte: 0 FH		Read and write variable
24	$8108	6102	Analog maximum speed	The jumper cap corresponds	DACH		Read-only variable
25	$8109	6103	Starting torque	0-FFH	60H		Read and write variable
26	$810A	6104	No hall induction starting speed	0X1400			Read and write variable
27	$810B	Acceleration 6105: Deceleration 6106	Acceleration and deceleration settings	First byte: deceleration Second byte: Acceleration	The first byte: C8H The second byte: C8H	10/s	Read and write variable
28	$810C	6107	Current protection	IMAX=500			Read and write variable value
29	$810D	6108	brake force	0-FFFFH	700H		Read and write variable
30	$810E	6109	High voltage alarm point	0-FFFFH	258H	0.1V	Read and write variable
31	$810F	610A	Low voltage alarm point	0-FFFFH	50H	0.1V	Read and write variable
32	$8110	610B	Communication	0-FFFFH	5DCH(1500)	RPM	Read and write

			speed				variable
33	$8111	6200	Speed closed loop parameters	SPEED_P=0x100			Read and write variable
34	$8112	6201	Speed closed loop parameters	SPEED_I=0x200			Read and write variable
35	$8113	6202	Speed closed loop parameters	SPEED_D=0			Read and write variable
36	$8114	6203	Excursion factor	SPEED_C=0x50			Read and write variable
37	$8115	6204	The PWM output the minimum value	PWM_MIN=0x34			Read and write variable
38	$8116	6205	The PWM output is the maximum value	PWM_MAX=0x7FF			Read and write variable
+39	$8117	6206	Current closed loop parameters	IBH_P= 0			Read and write variable
40	$8118	6207	Current closed loop parameters	IBH_I= 200			Read and write variable
41	$8119	6208	Current closed loop parameters	IBH_D= 0			Read and write variable
42	$811A	6209	Current closed loop parameters	IBH_C= 200			Read and write variable
43	$811A, $811B	620A	Software speed max	CX_SPEED_MAX=300000			Read and write variable
44	$811C, $811D	620B	Software rotation speed minimum value	CX_SPEED_MIN=20			Read and write variable
45	$8200	6300	Motor working state	COMM_STATS=0			Read-only variable
		6301	Node state query times counter	COMM_STATS_JSQ=0			Read-only variable
46	$8201, $8202		Given the speed	SP_V=0			Read-only variable
47	$8203, $8204		Target speed	SPA_V=0			Read-only variable
48	$8205, $8206	6302	The actual speed	SPB_V=0			Read-only variable
49	$8207, $8208	6303	Motor running transition position	stat=0			Read-only variable
50	$8209	6304		VSP_AD=0			Read-only variable
51	$820A	6305	Voltage	VCC_AD=0			Read-only variable

52	$820B			IMAX_AD=0			Read-only variable
53	$820C	6306		KEY_AD=0			Read-only variable
54	$820D	6307		I_AD=0			Read-only variable
55	$820E	6308		ALM_V=0			Read-only variable

Note: After modifying the parameters, it is necessary to write FFFFH to the address 81FF in order for the system to save the modified parameters. Otherwise, default parameters will be restored after power loss.

485 communication example:

Set the internal control: 01 06 81 06 07 00 43 C7

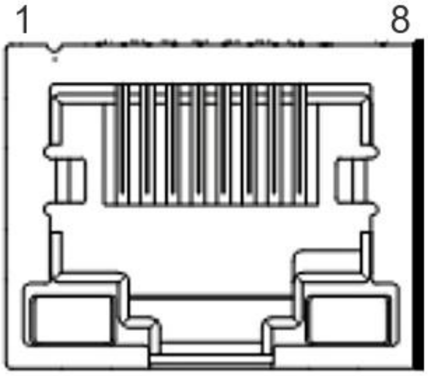
Set the internal control and start: 01 06 81 06 07 01 82 07

Stop: 01 06 81 06 06 01 82 07

Write communication speed 1500: 01 06 81 10 05 DC A2 FA External control setting: 01 06 81 06 04 00 43 37

Communication baud rate 9600, pole number to 4: 01 06 81 07 0F 04 14 04

RS485 communication terminal definition:



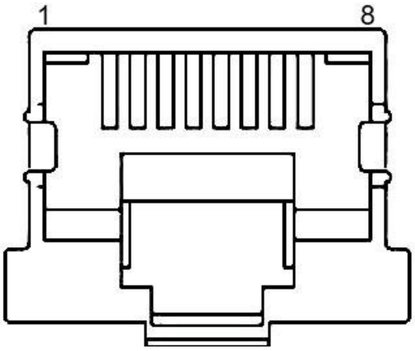
Pin	Function
3	B
6	A
8	COM

CAN communication example:

2Fh = write a byte
2Bh = write two bytes
27h= write three words
23h= write four bytes
60h= write successful response
80h= the abnormal response

40h= read
4Fh = read a corresponding byte
4Bh= read response to two bytes
47h= read response to three bytes
43h= read response for four bytes

CAN communication terminal definition:



Pin	Function
1	H
2	L
8	GND

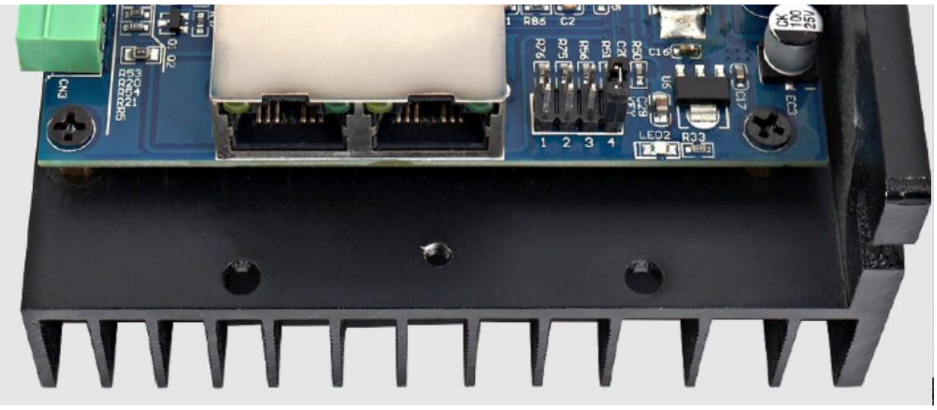
5.1 Driver Failure

When there is an overvoltage or overcurrent fault inside the driver, the driver enters the protection state, and then the driver will automatically stop working and the motor also stops. The red light on the driver starts to flash, and the number of flashes corresponds to different fault phenomena. As long as the enabling end will be reset (i.e. EN and GND disconnected) or power off, the driver can remove the alarm. Check the motor wiring or remove the load when this fault occurs.

No. of Red Light Flashes	Alarm
1	Stall
2	Over Current
3	Hall Fault
4	Under-Voltage
5	Over-Voltage

5.2 Speed Stage

The gear 1	The gear 2	The gear 3	The gear 4	2 pairs of poles speed(RPM)	4 pairs of poles speed(RPM)
1	0	0	0	1200	600
0	1	0	0	2000	1000
1	1	0	0	2700	1350
0	0	1	0	3600	1800
1	0	1	0	4480	2240
0	1	1	0	5000	2500
1	1	1	0	5600	2800
0	0	0	1	7000	3500
1	0	0	1	8000	4000
0	1	0	1	9000	4500
1	1	0	1	10000	5000
0	0	1	1	12000	6000
1	0	1	1	14000	7000
0	1	1	1	16000	8000
1	1	1	1	24000	12000
0	0	0	0	open loop	



In the picture, at 1,2,3,4 positions, add a jumper cap to indicate 1, and no jumper cap to indicate 0.