User Manual for DC Brushless Driver

Version 1.0-1009

Please read this manual carefully before powering on the system.

BLDC-2408

(Rated Input Voltage: 24VDC)

I. Overview

This series of control drivers are closed-loop speed controllers that utilize high-power MOSFETs. They perform closed-loop speed control by frequency multiplication using signals from DC brushed motors. The control system includes a PID speed regulator, ensuring stable and reliable control, particularly achieving maximum torque at low speeds. The speed control range is 150~20000rpm.

II. Features

1. Dual-loop PID regulation for speed and current
2. Chopping frequency of 20KHZ
3. Overload capability greater than 2, with maximum torque always achieved at low speeds
4. Fault alarm functions for over-voltage, under-voltage, over-current, peak current, locked rotor, and over-temperature
5. Communication mode adopts the standard Modbus protocol, complying with the national standard GB/T 19582.1—2008. It uses RS485 two-wire serial communication with RTU transmission mode.

III. Electrical Specifications

Standard Input Voltage: 24VDC, with a minimum voltage not less than 11.5VDC and a maximum voltage not exceeding 31VDC.

Maximum Continuous Output Current: 8A.

IV. Terminal Interface Description

1. Power Input Terminal

Serial No.	Name	Function Definition
4	DC+	DC+ DC Positive Input +
5	DC-	DC- DC Negative Input -

2. Motor Input Terminals

Serial No.	Name	Function Definition
1	MC	Motor Phase C
2	MB	Motor Phase B
3	MA	Motor Phase A

3. Motor Hall input terminals.

1	+5V	Positive of Hall signal
2	HC	C-phase input terminal of Hall signal
3	HB	B-phase input terminal of Hall signal
4	HA	A-phase input terminal of Hall signal
5	GND	Negative of Hall signal

4. Control Signal Section

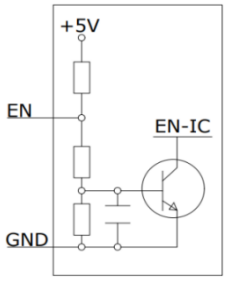
Serial Number	Name	Color	Function Definition	Serial Number	Name	Color	Function Definition
1	+5V	Red	+5V Power Output Port	5	SV	White	Analog Input
2	GND	Black	Signal Ground	6	F/R	Yellow	Forward/Reverse Control
3	EN	Green	Start/Stop	7	BK	Blue	Brake Control
4	PG	Brown	Motor Speed Pulse Output	8	ALM	Gray	Alarm Output

5.Explanation of Control Signal Input Terminals Usage

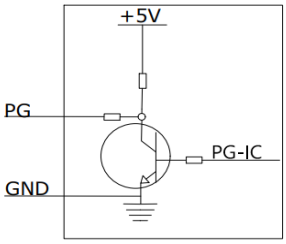
5.1 +5V: Speed Regulation Voltage Output. A potentiometer can be used to achieve continuous adjustment between SV and GND.

5.2 GND: Signal Ground

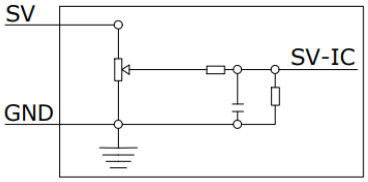
5.3 EN: Enable Control: When EN is connected to ground, the motor rotates; when EN is not connected, the motor does not rotate.



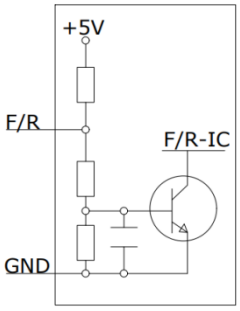
5.4 PG: Motor Speed Pulse Output: When the number of pole pairs is P, 3P pulses are output per revolution (for instance, when the rotational speed is 1000 RPM with 4 pole pairs, 12,000 pulses are output)



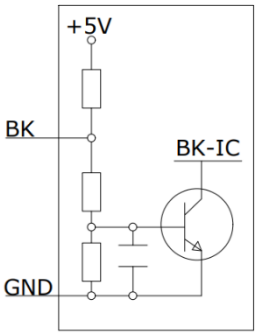
5.5 SV: Analog Voltage Input Terminal: It allows for attenuation from 0 to 100%. When an external speed command is connected to a 0-5V signal, this terminal can be used to adjust the speed for testing. The factory setting for the maximum rotational speed of the drive is 7000 RPM for a 2-pole motor, 3500 RPM for a 4-pole motor, and 2800 RPM for a 5-pole motor. To change the maximum rotational speed, you need to adjust the position of the jumper cap inside the PCB board to modify the maximum speed of the motor.



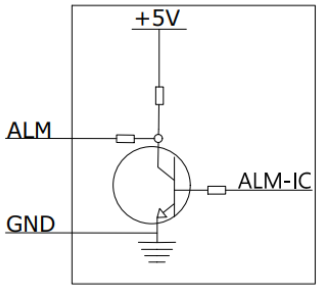
5.6 F/R: Forward/Reverse Control. Connect to GND for reverse rotation, and leave disconnected for forward rotation. When switching between forward and reverse rotation, EN should be turned off first.



5.7 BK: Brake Control: When not connected to ground, it operates normally. When connected to ground, the motor applies an electrical brake. When the load inertia is large, a pulse width signal should be used to control the braking effect by adjusting the pulse width amplitude.



5.8 ALM: Alarm Output: When the circuit is in an alarm state, this port outputs 0V; when there is no alarm, it outputs 5V.

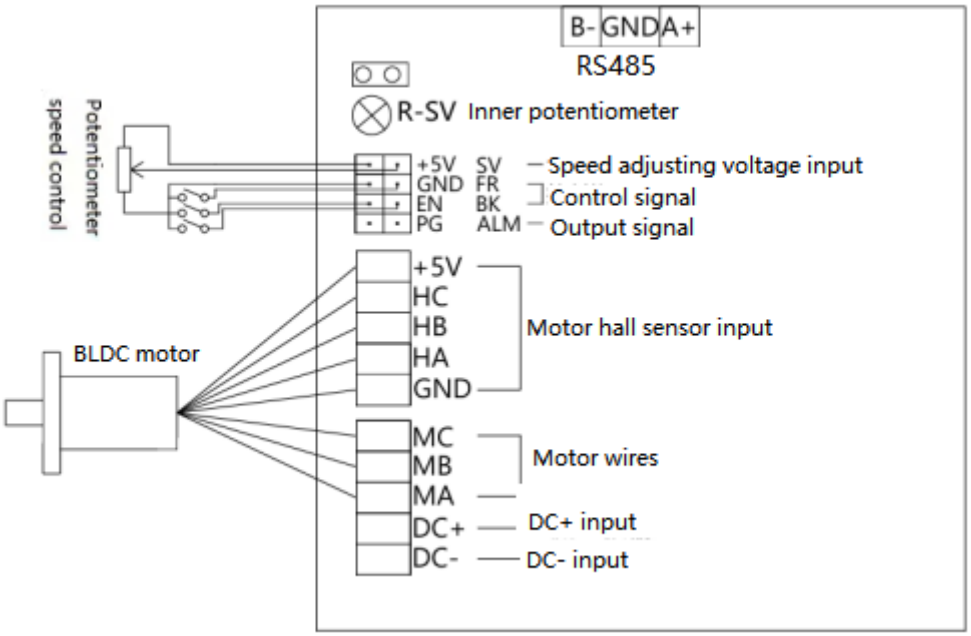


Built-in Speed Limit Potentiometer: Adjusts the motor speed gain, allowing speed regulation within a range of 0~100%.

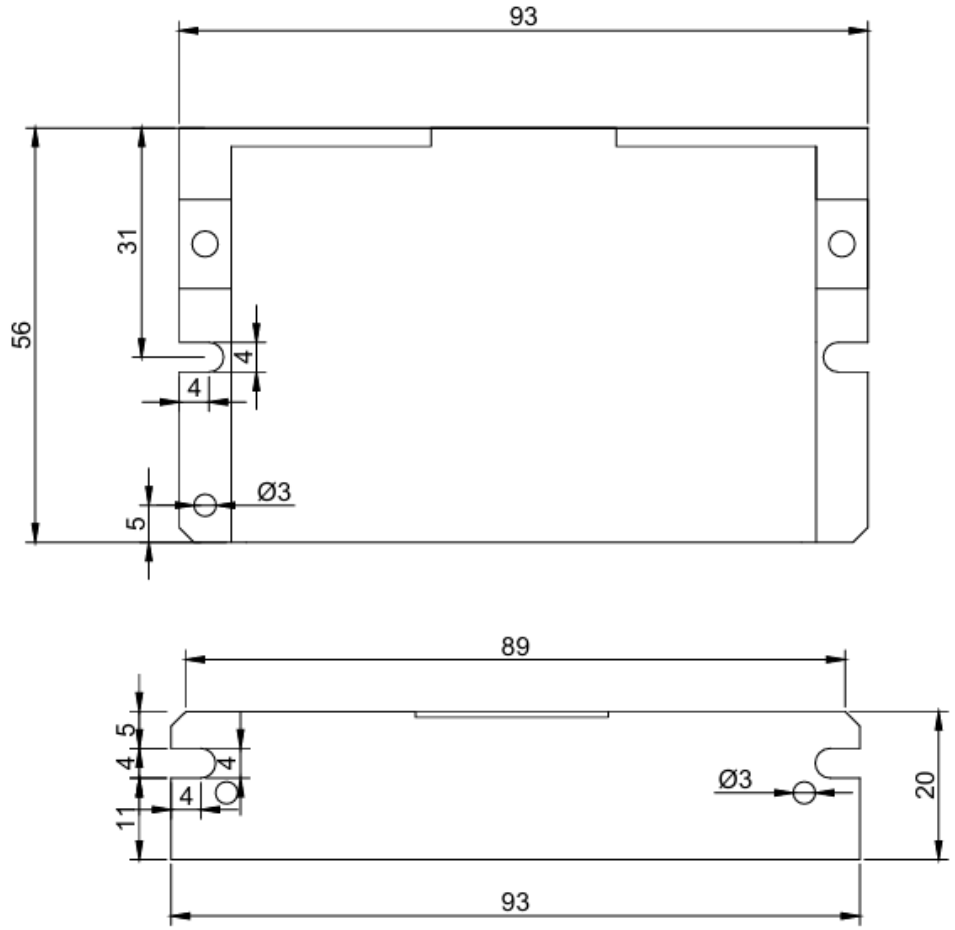
Red Indicator Light: Stays on continuously after power-on and flashes during an alarm. Different flashing frequencies correspond to different alarm states.

Green Indicator Light: Stays on continuously during operation.

V. Wiring Diagram for Drive and Motor



VI. Mechanical Installation



单位:mm

VII. Functions and Operation

1. Speed Regulation Method

To adjust the speed externally, connect the two fixed terminals of an external potentiometer to the GND and +5V terminals of the drive, respectively, and connect the adjustment terminal to the SV terminal. This allows for speed regulation using an external potentiometer (10K~50K). Alternatively, speed regulation can be achieved by inputting an analog voltage to the SV terminal (relative to GND) through other control units (such as PLCs, micro-controllers, etc.). The acceptable range for the SV terminal is DC 0V to +5V, corresponding to a motor speed of 0 to the rated speed.

2. Motor Run/Stop Control (EN)

Controlling the motor's operation and stoppage can be done by controlling the connection and

disconnection of the terminal EN relative to GND. When the terminal is connected, the motor runs; otherwise, it stops. When the motor is stopped using the run/stop terminal, it stops naturally, and its movement pattern is related to the load inertia.

3. Motor Forward/Reverse Control (F/R)

The direction of motor rotation can be controlled by controlling the connection and disconnection of the terminal F/R with the terminal GND. When F/R is not connected to GND, the motor rotates clockwise (facing the motor shaft); otherwise, it rotates counterclockwise.

4. Drive Faults

When an over voltage or over current occurs inside the drive, it enters a protection state and automatically stops working. The motor stops, and the red light on the drive flashes. To restore normal operation, simply reset the enable terminal (i.e., disconnect EN from GND). Alternatively, power off to remove the alarm from the drive. If this fault occurs, please check the motor wiring or motor load.

The following table lists the codes for the number of red light flashes:

(Note: The actual table of red light flash codes is not provided in the given information, so it is not included in the translation.)：

Red Light Flashes Once: Motor Stall Alarm
Red Light Flashes Twice: Over current Alarm
The red light flashes three times: indicating a motor Hall sensor failure.
Red Light Flashes Four Times: Under-voltage Alarm of Power Supply
Red Light Flashes Five Times: Over-voltage Alarm of Power Supply
Red Light Flashes Six Times: Peak Current Alarm

Red Light Flashes Seven Times: 85°C Temperature Alarm

Register Address	Register Value Range	Unit	Function Code	Function Description	Default Value
0X0056	0-4000	RPM	0X06	Motor Speed Setting	5DC HEX =1500rpm
0X0066	0		0X06	Motor Stop	00 HEX
0X0066	1		0X06	Motor Forward Rotation	00 HEX
0X0066	2		0X06	Motor Reverse Rotation	00 HEX
0X0066	3		0X06	Motor Brake Stop	00 HEX
0X0076	0		0X06	Fault Code Reset	00 HEX
0X00A6	1-240(DEC)=1-F0(HEX)		0X06	Drive Address	01 HEX
0X00D6	1-255(DEC)=1-FF(HEX)		0X06	Starting Torque No-Sensor Initial Speed	18 HEX 04 HEX
0X00E6	1-255(DEC)=1-FF(HEX)	0.1S write 10(0A)=1S	0X06	Acceleration Time	00 HEX First Byte
0X00E6	1-255(DEC)=1-FF(HEX)	0.1S write 10(0A)=1S	0X06	Motor Deceleration Time	00 HEX Second Byte
0X00F6	00H=4800 01H=9600 02H=14400 03H=19200 04H=38400 05H=56000 06H=57600 07H=115200 08H=128000 09H=230400 10H=256000 If it exceeds		0X06	Drive Baud Rate Switching	01 HEX

	10H,the baud rate will be unified to 9600				
0X0116	1-250		0X06	Motor Pole Pair Number	05 HEX
0X0126	1-32		0X06	Maximum Continuous Protection Current	2D HEX 8.5A Alarm Value
0X0136	0-1		0X06	Internal/External Mode On/Off	01 for Internal Mode 00 for External Mode
0X005F			0X03	Motor Actual Speed	
0X0066			0X03	Motor Operating Status 0 - Stop 1 - Forward Rotation 2 - Reverse Rotation 3 - Brake Stop 0-	00

0X0076			0X03	Fault Codes: 1 - Over current 2 - Over temperature 3 - Over voltage 4 - Under voltage 5 - Sensor Abnormality 6 - Over speed 8 - Stall (Motor Blocked) 9 - Peak Current	00
0X0086			0X03	Overcurrent Time Protection Factor (0.1)	1E HEX
0X00A6			0X03	Drive Address	
0X00B6			0X03	Motor Actual Current	
0X00D6	1-255 DEC =1-FF (HEX)		0X03	Starting Torque No-Sensor Initial Speed	
0X00E6			0X03	Acceleration and Deceleration Time	
0X00F6			0X03	Drive Baud Rate Switching	
0X0116			0X03	Motor Pole Pair Number	
0X0126			0X03	Maximum Continuous Protection Current	
0X00C6			0X03	Motor Actual Voltage	

0x80FF	55AA		0X06	Save Parameters	Please Write (or Input) in Stopped State

VI. Communication Mode:

The communication mode adopts the standard Modbus protocol, conforming to the national standard GB/T 19582.1—2008. It uses RS485 two-wire serial link communication, with a conventional 3-pin 2.54mm wiring port (A+, GND, B-) terminal, making serial connection extremely convenient. The transmission mode is RTU, the verification mode is CRC, and the CRC start word is FFFFH. The data mode is 8-bit asynchronous serial, with 1 stop bit, no parity bit, and supports communication rates ranging from 4800 to 256000.

Function parameters support 03H for multiple register reads and 06H for single register writes.

Station Addresses:

00: Broadcast address

1-250: User addresses

251-255: Special addresses, not available for users

Note: After modifying the parameters in the stopped state, please write 55AA (HEX) to the 80FF register address for the system to save the modified parameters. Otherwise, the default parameters will be restored after power failure!

Save Command: 01 06 80 FF 55 AA

1. Write Examples:

Start	01	06	00	66	00	01	A8	12
Stop	01	06	00	66	00	00	69	D5
Reverse	01	06	00	66	00	02	E8	14
Brake	01	06	00	66	00	03	29	D4
Speed Setting 1000RPM	01	06	00	56	03	E8	69	64
Fault Reset	01	06	00	76	00	00	68	10

2. Read Examples:

2.1. Speed Query (3000RPM as an Example):

send out	01	03	00	5F	00	01	B4	18
return	01	03	02	0B	B8	B8	44	
0BB8H = 3000. The actual speed, or the motor's actual RPM, is calculated as 3000 * the pole pair number set in communication settings / the motor's actual pole pair number. For instance, if the settings match the motor's actual pole pair number, the actual speed is 3000RPM.								

2.2 Query Actual Current (3A as an Example):

send out	01	03	00	B6	00	01	65	EC
return	01	03	02	00	4D	B8	44	
4DH = 77 (hexadecimal 4D converts to decimal 77. With 25 units representing 1A, the actual current is 77/25 = 3A).								

2.3. Query Actual Voltage (23V example):

send out	01	03	00	C6	00	01	64	37
return	01	03	02	00	5D	79	BD	
5DH = 93 (hexadecimal 5D converts to decimal 93. Assuming a specific scaling factor or division, such as dividing by 4 in this case, the actual voltage is 93/4 = 23V).								

2.4. Query Motor Operating Status (Forward Rotation as an Example):

send out	01	03	00	66	00	01	64	15
return	01	03	02	00	01	79	84	
01H is the code for the motor's forward rotation.								

2.5. Query Drive Address:

send out	01	03	00	A6	00	01	64	29
return	01	03	02	00	01	79	84	
01H Represents Drive Address 01								

2.6. Query Faults

send out	01	03	00	76	00	01	65	D0
return	01	03	02	00	01	79	84	
01H is the Over current Alarm Code								

VII Maximum Speed Setting for Brushless Motors

The brushless drive has jumper caps inside to set the maximum speed for different motors. The details are as follows: Adding a jumper cap to positions 1, 2, 3, or 4 indicates a value of 1, while the absence of a jumper cap indicates a value of 0. To adjust the jumper caps, the outer casing needs to be disassembled.

Gear Position 1	Gear Position 2	Gear Position 3	Gear Position 4	2-Pole Speed (RPM)	4-Pole Speed (RPM)	5-Pole Speed (RPM)
1	0	0	0	1500	750	600
0	1	0	0	1600	1250	1000
1	1	0	0	2500	1080	1350
0	0	1	0	4500	2250	1800
1	0	1	0	5600	2800	2240
0	1	1	0	6250	3120	2500
1	1	1	0	Default Value 7000	Default Value 3500	Default Value 2800
0	0	0	1	8750	4370	3500
1	0	0	1	10000	5000	4000
0	1	0	1	11250	5620	4500
1	1	0	1	12500	62500	5000
0	0	1	1	15000	7500	6000
1	0	1	1	17500	8750	7000
0	1	1	1	20000	10000	8000
1	1	1	1	30000	15000	12000
0	0	0	0	Open-loop Mode	Open-loop Mode	Open-loop Mode