BLDC MOTOR DRIVER

Manual V1.31

BLSD-D-02-H

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

Summary

BLSD-D-02-H BLDC motor driver is a closed-loop speed controller, which uses IGBT and MOS power, uses the Hall signal of the DC brushless motor to perform double-loop speed control, and has a PID speed regulator in the control link. The system control is stable and reliable.

It can always reach the maximum torque at low speed, and the speed control range is 150~10000rpm.

Features

➢ PID speed, current double loop regulator

➢ With best price performance ratio

➢ 20KHZ chopper frequency

➢ Electrical stop to ensure the quickly action

➢ Over load radio larger than 2, the torque can always reach the maximum at low speed.

➢ Fault alarm function with Over voltage, Under voltage, Over current, Over temperature, and Hall signal illegal.

Product Characteristic

Input voltage: **24**~48VDC. (Under the power<2000W)
Accelerate time constant(default) : 2 seconds
Motor stall protection time: 3 seconds, other can be customized

1. Terminal and Control Signal
   Control Terminal

No.	Terminal Name	Description
1	**COM**	COM terminal
2	**F/R**	CW/CCW terminal
3	**EN**	Stop/Start terminal
4	BR	Brake terminal
5	**SV**	Analogy signal input terminal
6	PG	Speed output terminal
7	ALARM	Alarm output terminal
8	**+5V**	**+5V** power output terminal

Hall Signal Terminal

No.	Name	Description
1	GND	Hall sensor Negative
2	HA	Hall sensor A phase
3	HB	Hall sensor B phase
4	HC	Hall sensor C phase
5	+5V	Hall sensor Positive

Motor Connection Terminal

No.	Name	Description
1	DC+	DC+
2	DC-	DC-
3	FG	Ground wire
3	MA(U)	Winding U phase(A)
4	MB(V)	Winding V phase(B)
5	MC(W)	Winding W phase(C)

3. Control Signal

No.	Terminal Name	Description
1	GND	Signal ground
2	F/R	CW/CCW terminal
3	EN	Stop/Start terminal
4	BK	Brake terminal
5	SV	Analogy signal input terminal
6	PG	Speed output terminal
7	ALM	Alarm output terminal
8	+5V	**+5V** power output terminal

GND: Signal ground

F/R: Forward and reverse control, reverse when connected to GND, forward if not connected, turn off EN when switching between forward and reverse.

EN: Enable control: EN connect to the ground, motor turn (online state), EN not connected, motor does not turn (offline state).

BK: Brake control: When it is not grounded and works normally, when it is grounded, the motor is electrically braked. When the load inertia is large, it should be used pulse width signal mode, control the brake by adjusting the pulse width amplitude.

SV: ADJ: External speed attenuation: can be attenuated from 0~100%, when the external speed command is connected to 6.25V, the potentiometer can be used to speed and test the motor.

PG: Motor speed pulse output: When the pole pair is P, 6P pulses per revolution (Open Collector input).

ALM: Alarm output: When the circuit is in the alarm state, the output is low (Open Collector output).
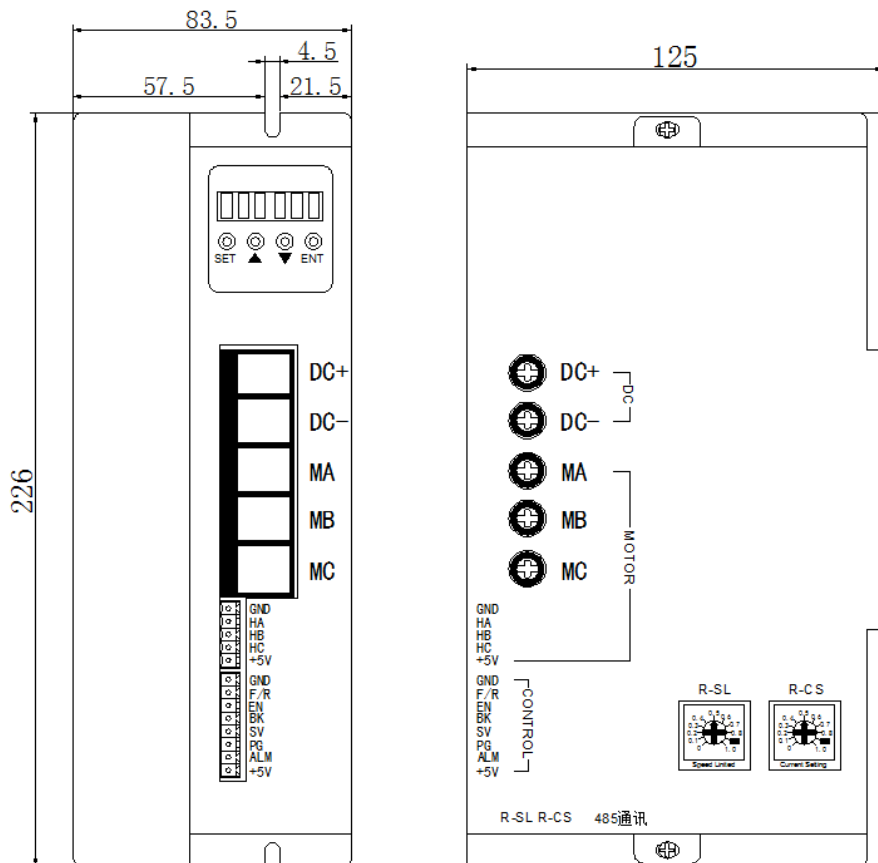
+5V: Speed regulation voltage output, the potentiometer can be continuously adjusted at SV and GND.

Dial code switch: Adjust the motor speed gain and the speed range from 0 to 100%.

Connection Diagram of motor and driver
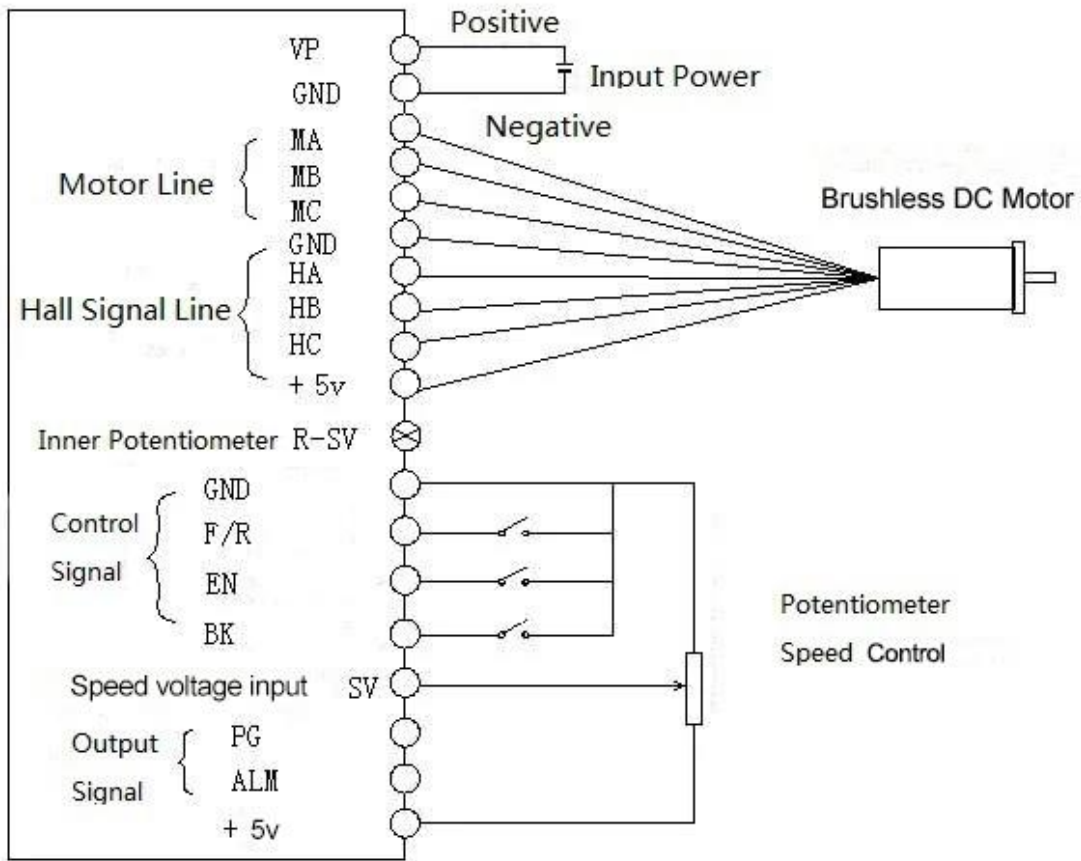
4. Mounting Dimension

5. Function and Usage

Choose any of the below speed command：

Build-in potentiometer: Speed reduced while CCW potentiometer, otherwise speed increased. Set the potentiometer at minimum while use the external speed command.

External potentiometer: Connect on the GND and +5V of the drives, speed can be adjusted on external potentiometer ((5K~100K) when connect SV terminal. Input simulate voltage through other control command (e.x. PLC, SCM etc.) to SV terminal to achieve the speed adjust as well (relative GND). The range of the SV terminal is DC OV~+5V, the relevant motor speed is 0~rated speed.

External digital signal speed regulation: Add 5V between SV and GND, speed can be adjusted by PWM control between the 1KHz~2KHz, motor speed is influenced by duty.   At this time, by adjusting the R-SV potentiometer, SV digital signal amplitude can be 0~1.0 ratio attenuation processing. Generally, adjust R-SV to 1.0, SV input digital signal without attenuation processing.

Motor running/stop control (EN)

Control the brushless motor to run or stop by controlling the terminal "EN" and "GND" connecting. The motor will running when we connect the terminal "EN" to "GND"; if shut down, the motor will stop, and the stopping time will decided by the motor inertia and load adding on the motor.

Motor rotation direction control（F/R)

Control the motor rotation direction by controlling the terminal "F/R" and "GND" connecting. When shut off terminal "F/R" to terminal "GND", the motor will run at CW (view from motor output side), and when connect on, the motor will run at another direction. For avoiding to damage the driver, please stop the motor running and then change the motor rotation direction.

Brake the motor to stop(BK)

Motor stop can be controlled by connect BK and GND terminal. When shut off the BK and GND terminal, motor running, otherwise motor will fast stop. Motor stopping time is decided by the motor inertia and load adding on the motor. If it is unnecessary to fast stop the motor, please don't use this function since it has some electrical and mechanical impact on the motor and controller.

Speed signal output(PG)

The speed pulse output port is OC, output 30V/10mA max. You can connect with a resistance (3K ohm ~10K ohm) between signal and input power to get the pulse signal, this port will output serial pulses which has fixed extent (it is 50uS). This output pulse from every rotation of motor is 3 x N, "N" means the total pole number of the magnet.For example, 2 pair of poles,means 4 poles motor, 12 pulses per turning, when the motor speed is 500rpm, the pulses out from the PG is 6000.

Alarm output

The alarm output port is OC, output 30V/10mA max. You can connect with a resistance (3K ohm ~10K ohm) between signal and input power to get the alarm signal. When alarm, this port and the GND is connecting (Low voltage), and the controller will stop working and keep in alarm status.

Driver failure

Drivers enter to protection status while inner overload or over current, drivers and motor will stop automatic, the blue led will flashed on the driver. The alarm can be released by reset the enable terminal (shut off EN and GND) or switched off. Please check the motor connection wires when failure.

6. **Display and keyboard**
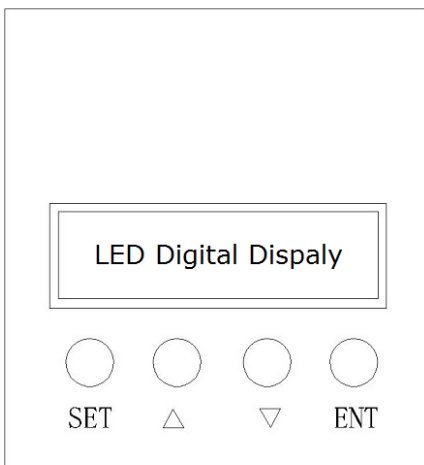
Display and Keyboard Operation

Remark: "SET" : Start/Stop, (backspace)

"△" : "+" , Plus 1

"▽" : "-" , Minus 1

"ENT" : "ENTER"   (Recall setting parameter)

6.1　Parameter Setting Sequence

Please insure that the motor is under the stop situation when set the parameter. That is, in the case of panel mode, the motor is in the stop state or an external port mode, the motor is enabled to disconnect.

1. In standby condition, press "ENTER" to call out the system parameters, press "ENTER" again, it will call out the parameter value.
2. Press "△"or "▽"to the parameter number. Press "SET" to return to standby mode if there is no value need to change.
3. Press "ENTER" to show the parameter setting value. Press "SET" to return to standby mode if there is no need to change value.
4. Press"△"or "▽" to change the value demanded.
5. Press "ENTER" to save the changes, then press "SET" to return to standby mode.

Note: At setting mode, it will return to display interface if there is no press within one minute.

6.2 Working mode

Motor works at two modes. One is the panel mode, the other is external terminal control. The motor runs as the setting, LED digital display shows the speed of motor. Under the panel mode, Press "SET" to start/stop the motor, long press "△"or "▽" to acceleration or deceleration speed, press "ENTER" to insure and know the running speed. The motor runs as setting speed.

6.3 Protect mode

While Motor operates abnormally, display will show Err×

(1) Err-01: motor stall
(2) Err-02: over current
(3) Err-04: hall fault
(4) Err-05: motor stall and hall fault
(5) Err-08: under-voltage
(6) Err-10: over-voltage
(7) Err-20: peak current alarm
(8) Err-40: temperature alarm

6.4 Drives parameter setting:

P00X：Operating Parameter					
Function Code	**Function Name**	**Setting Range**	**Unit**	**Default value**	**Change**
P000	Control mode	00 non inductive external control mode 18 non inductive mode panel control and 485 communication control mode 40 forced sensing external control mode 58 inductive mode panel control mode and 485 communication control mode		40 forced sensing external control mode	
P001	Pair of Pole	1~255	Pairs	2	O
P002	Rated Speed	1~65535 (external port mode effective)	RPM	3000	O
P003	Display mode	00: speed display		00	O
P004	starting torque	1~255		16	O
P005	Initial speed w/o sensor start	1~255		04	O
P006	Acceleration time	1~255	0.1S	0	O
P007	Deceleration time	1~255	0.1S	0	O

P008	Current setting	1~255		44	
P009	Temperature alarm setting	1~255		34	
P010	Panel speed setting	1~65535 only external port mode effective	RPM	2000	
P011	Brake force	0-1023		1023	
P012	Site address	0~250		1	
P013	Reserved				
P014	Current adjusting parameter	0-FF	Hexa deci mal	3A	
P015	Reserve				
P016	Reserve				

7. System Usage

Connect on the wires of the motor and driver (motor winding wires, Hall wires and power lines) strictly as request. It can not achieve the CW and CCW through changing the wires connection like asynchronous motor. The motor will run abnormality with the wrong wires connection, like brushless motor will shake much or heat quickly (the temperature will up to 80 degree in seconds to 2 min.),and will damage the motor and driver.

Please run the motor while connect the power supply, Hall wires and drive power supply. Firstly set the potentiometer to the minimum, press the start switch, increase the motor potentiometer a little, the motor should run. If the motor does not run, or shaking, maybe did the wrong wires connection, please recheck the brushless motor wires till the motor running normally.

8. Communication Mode

This communication model is used standard Mod bus protocol, implement national standards GB/T 19582.1 - 2008. It is using RS485 two-wire serial link communication, Physical interface uses two 3.81mm spacing 3 core Phoenix terminals, serial connection is very convenient. Transmission mode is RTU, testing mode is CRC, CRC start word is FFFFH. Data mode is 8 bit asynchronous serial, 1 is stop bit, without invalid bit. Currently there is only one communication speed 9600bps,

No.	address	name	Setting range	Default	unit	
00	$8000	First byte: control bit state Second byte: Hall angle and pair of poles	First byte： Bit0：EN Bit1：FR Bit2：BK Bit3：NW1 Bit4：NW Bit5：KHX Bit6：HR60 Bit7：KH Second byte： Bit0-7: pair of poles 1-255	00H 02H		
01	$8001	Maximum speed in analog adjustment	0-65535	3000	RPM	
02	$8002	First byte: start torque Second byte: start speed without sense start	1-255 1-255	10H 04H		
03	$8003	First byte: accelerate time Second byte: decelerate time	1-255	10 10	0.1s	
04	$8004	First byte: max. Current Second byte: temperature alarm point		35H 30H		
05	$8005	External speed setting	0-65535	2000	RPM	
06	$8006	Brake force	0-1023	1023		
07	$8007	First byte: site address Second byte: reserved	1-250	1 0		
08-0F		$8008-$800F	Segmental speed value			
10-17		$8010-$8017	reserved			
18	$8018	Real speed				

19	$8019	First byte: bus voltage Second byte: bus current					
1A	$801A	First byte: control port state Second: analog port value	Bit0：SW1 Bit1：SW2 Bit2：SW3 Bit3：SW4				
1B	$801B	First byte: fault state Second byte: motor running state	Bit0: stall Bit1: over current Bit2：hall abnormality Bit3：low bus voltage Bit4：over bus voltage Bit5:peak current alarm Bit6：temperature alarm Bit7：reserve				
1C		$801C-$801F	Reserve				
20		$8020 above illegal					

Site address 8000H-8017H   Read-write register

Site address 8018H-801FH   Read-only register

Other address is illegal

8000：first byte：

EN: when NW=0，0：external   EN low level effective   1：external   EN high level effective

　　when NW=1，0：EN   ineffective   1：EN   effective

FR: when NW=0，0：external FR   low level effective   1：external FR   high level effective

　　when NW=1，0：FR   ineffective   1：FR   effective

BK: when NW=0，0：external BK   low level effective   1：external BK   high level effective

　　when NW=1，0：BK   ineffective   1：BK   effective

NW1：0：external control effective （EN,FR,BK） 1：internal effective

NW: 0: Speed external effective,   1:speed internal internal effective(under panel speed adjusting mode, PWN speed adjusting mode and segmental speed adjusting mode,   it must set to 1)

KHX: stall alarm under the open loop w/sense mode.   0: stall alarm   1: NO alarm

HR60： 0: 120° hall control   1: 60° hall control   temporarily not supported

KH：   0：closed loop control   1：open loop control

For example:

1. Write 1500 speed

01 06 80 05 DC 05 28 C8

2. Write 2 pair of poles EN start

01 06 80 00 19 02 2A 5B

3. Write EN stop

01 06 80 00 18 02 2B CB

4. Write brake

01 06 80 00 1D 02 28 9B

5. Checking the fault state

01 03 80 1b 00 01 DD CD

6. 01 06 80 00 19 02 2A 5B   EN start   2 pair of poles

7. 01 06 80 05 D0 07 AC 09   Write 2000

8. 01 06 80 05 E8 03 BE 0A   Write 1000

9. 01 60 80 00 18 02 2B CB   EN stop

10. 01 06 80 00 19 01 6A 5A   1 pair of pole EN start

The write message is explained as follows

Message	Explain
01	address
10	Function code
00 1B	Start address register
00 05	The numbers of register
0A	Total byte digits
02 58	Write the first register data
02 58	Write the second register data
00 F0	Write the third register data
00 03	Write the fourth register data
0D 40	Write the fifth register data
CD 83	CRC testing(from the address to the fifth register data)

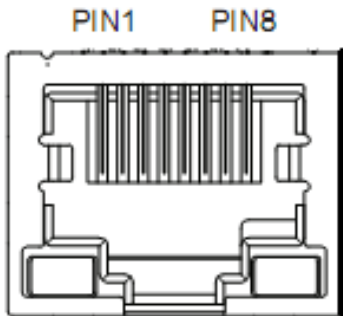The successful feedback message is explained as follows

message	01	10	00 1B	00 05	70 0D
explain	address	Function code	The start register address	The wrote register number	CRC testing code

9. Communication wires connection

RS-485 communication can be carried out by using the RJ45 cable connector

The RJ45 connector pins are defined as follows：

PIN1   PIN8

Pin	Description
8	GND
6	A+
3	B-