External brushless motor driver manual

1. Features of External brushless motor driver

- Support voltage 18V~48V, rated maximum output current 10A；

- Support torque control (steady current), speed closed loop control (steady speed), all kinds of speed regulation methods;

- Support potentiometer, analog signal, logic level, switch amount, PWM, frequency, pulse, RS485 and many kinds of input signals；

- Support analog signal voltage range configuration and logic level voltage configuration, the analog signal can support 0~5/10V voltage range, logic level can support 0/5/12/24V voltage; support analog signal linearity adjustment and logic level threshold configuration;

- Support RS485 multi machine communication, support MODBUS-RTU communication protocol, facilitate a variety of controllers (such as PLC) communication control, support protection when communication error；

- Support acceleration and deceleration buffer time and acceleration and deceleration rate acceleration control, automatic acceleration and deceleration in the designated trip, and accurate positioning；

- Built in high power brake resistor provides 6A continuous braking current；

- Support motor phase sequence learning, Hall error protection；

- Support the motor cw/ccw over-travel inhibit, can be connected with two inhibit switches, respectively, to the forward and reverse inhibit;

- Support motor speed measurement, support motor blocking detection / blocking current set；

- Support fault alarm；

- All interfaces are ESD protected and can be adapted to complex site environments.

1.1 Product size

1.2 Technical parameter

| Item	Parameter	Note
Input voltage	18~48VDC	
Maximum output current	10A	
Maximum braking current	6A	
Hall sensor output voltage	5V	
Input/output signal voltage	5V	
Motor rated current range	0.5A~10A	
Load current range	0.5A~12A(not more than 1.5 times the rated current)	
Single ended analog signal input voltage range	0 ~ 5V	
Input frequency signal support range	0 ~ 10kHz	

2．Interface definition
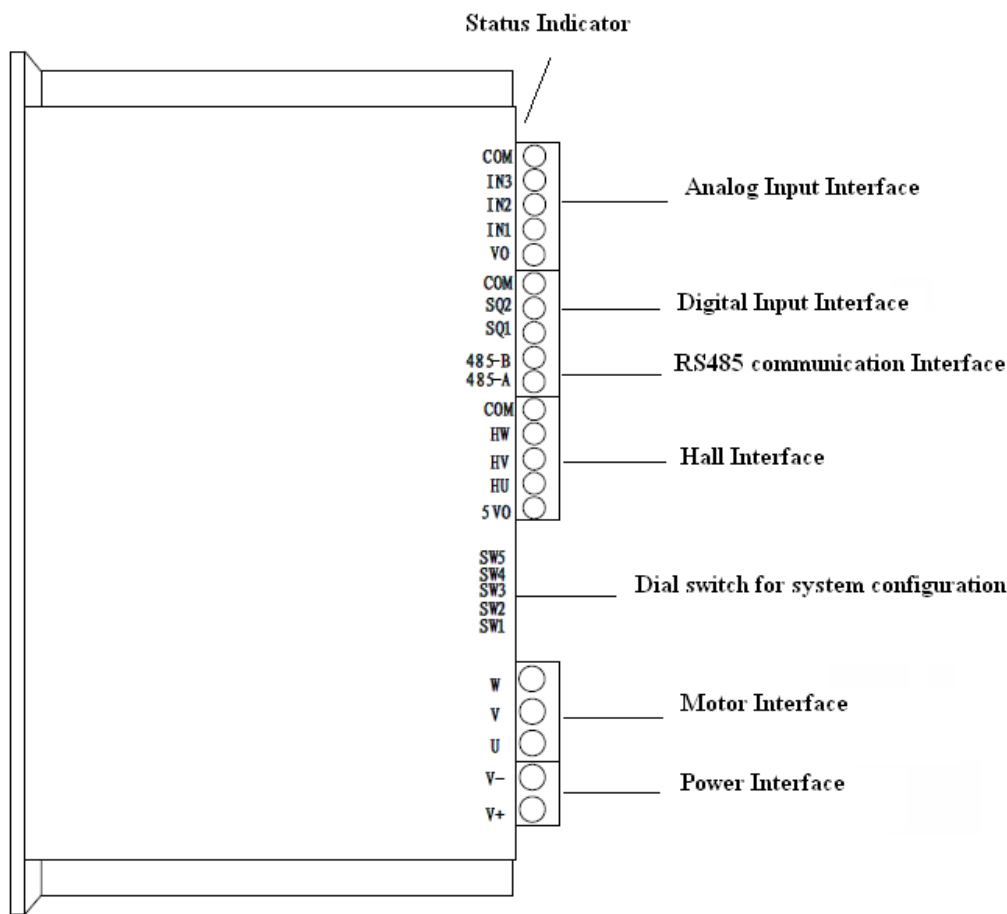
Figure 1 Driver interface definition

Note: The wiring of the power interface and the motor interface must not be put together, nor can they be put together with the input signal, the Hall signal, the limit, or the communication interface, otherwise it may damage the drive.

2.1 System configuration dial switch

Before using this drive, you should configure the motor current rating, the selection of the signal source and the mode of operation. By dialing the dial switch, the motor's rated current, signal source and mode of operation, and the station address under the 485 communication control mode can be configured in the digital / analog signal control mode.

In the configuration of motor rated current, the maximum load current of the motor is set. When the motor is overloaded or stalled, the driver will output the rated output current, effectively protect the motor; on the other hand, it can make the motor speed corresponding to the rated current more stable.

In the configuration of the signal source, the user can support different control signals. The driver can support input signals such as potentiometers, analog signals, switches, logic levels, and PWM/ frequency / pulse.

Through the configuration of the working mode, different speed regulating modes of the motor can be configured, or the motor phase sequence learning can be carried out. For the first use of the motor, the motor phase need to learn; by choosing speed regulating modes, the speed can meet the application requirements of different users; through the setting of motor travel, the user can make the motor rotating within a fixed trip of the range given by potentiometer, analog signal, frequency signal or PWM.

The system configuration dial switch is shown in figure 2.2. The switch is set to ON below and OFF above. From left to right is No. 1-5.
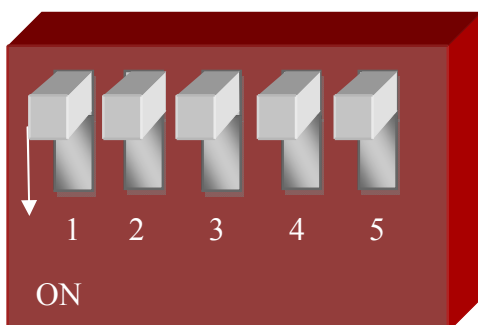

Figure 2.2. The system configuration dial switch

Note: when you use the dial switch for configuration parameters, please turn off the driver power, then configure, after that power up.

2.1.1 Dial switch function definition table in digital / analog signal control mode

Table 2.1 Digital / analog signal mode: dial switch function definition

Position 1-2	Position 3-4	Position 5
Configuration of motor rating current	Selection of signal source	Operation mode configuration

2.1.2 Configuration of motor rating current in digital / analog signal control mode

Table 2.2 Digital / analog signal mode: Configuration of motor rating current

Position 1	Position 2	Motor rating current
OFF	OFF	1.5A
OFF	ON	3A
ON	OFF	6A
ON	ON	10A

Note: the rated current of the motor should be set in accordance with the actual rated current of the motor, otherwise it may lead to unstable speed, slow response, burnt fuse and even more serious consequences. The actual rated current of the motor can be obtained by means of the nameplate of the motor or the motor data manual.

2.1.3 Selection of signal source in digital / analog signal control mode

Table 2.3 Digital / analog signal mode: Selection of signal source

Position 3	Position 4	Signal source
OFF	OFF	Potentiometers /PWM
OFF	ON	Frequency
ON	OFF	Motor phase sequence learning
ON	ON	Communication of RS485

2.1.4 Configuration of the working mode in digital / analog signal control mode

Table 2.4 Digital / analog signal mode: Configuration of the working mode

Position 5	Working mode
OFF	Torque control
ON	Speed closed loop control

2.2 Inhibit signal interface

Table 2.5 Inhibit signal interface logic

Inhibit triggered polarity	Direction of motor rotation	SQ1 state	SQ2 state	Inhibit function
Low level	CCW	Low level / Switch on	Arbitrary	Stop the motor
	CW	Arbitrary	Low level / Switch on	Stop the motor

2.3 Input signal interface

The definition of the input signal interface is shown in Figure 2.11. The function of each signal port is shown in table 2.6.

Table 2.6 Function of each signal port

Control mode	Function of signal port				
	VO	IN1	IN2	IN3	COM
Single potentiometer torque control Single potentiometer speed close loop control	potentio meter VCC power	Connect potentiometer to motor speed regulation	CCW enable signal, High: enable Low: disable	CW enable signal , High: enable Low: disable	potentiomet er power ground
Single potentiometer torque control Single potentiometer speed close loop control	potentio meter VCC power	Connect potentiometer to motor speed regulation	Enable signal High: enable Low: disable	Direction signal High: ccw Low: cw	potentiomet er power ground

2.4 Status indicator

When the driver green indicator is on, it means that the power is on and the drive is starting to function properly. When the red indicator flashes, the driver is in a fault state.

Table 2.7 red indicator flash for error

| Red indicator flash status	Error
Flash 1 time continuously	Driver overcurrent
Flash 2 times continuously	Drive overload
Flash 3 times continuously	The input voltage is below 18V
Flash 4 times continuously	The input voltage is higher than 48V
Flash 5 times continuously	The motor cable is out of contact or disconnected
Flash 6 times continuously	Hall connections are out of contact or disconnected
Flash 7 times continuously	Motor phase sequence learning failure

3. Use of digital / analog signal control mode

Before power up of the drive, first of all, motor rated current should be configured, then connected the motor to the driver and power up. If it is the first use of motor, you need to learn the motor phase sequence. Parameter configuration and control mode should be set in accordance with the relevant requirements: if you need to use the 485 communication configuration parameters, you should first set dial switch to choose 485 communication, set corresponding control mode, then connect the 485 communication.

Connection for potentiometer input
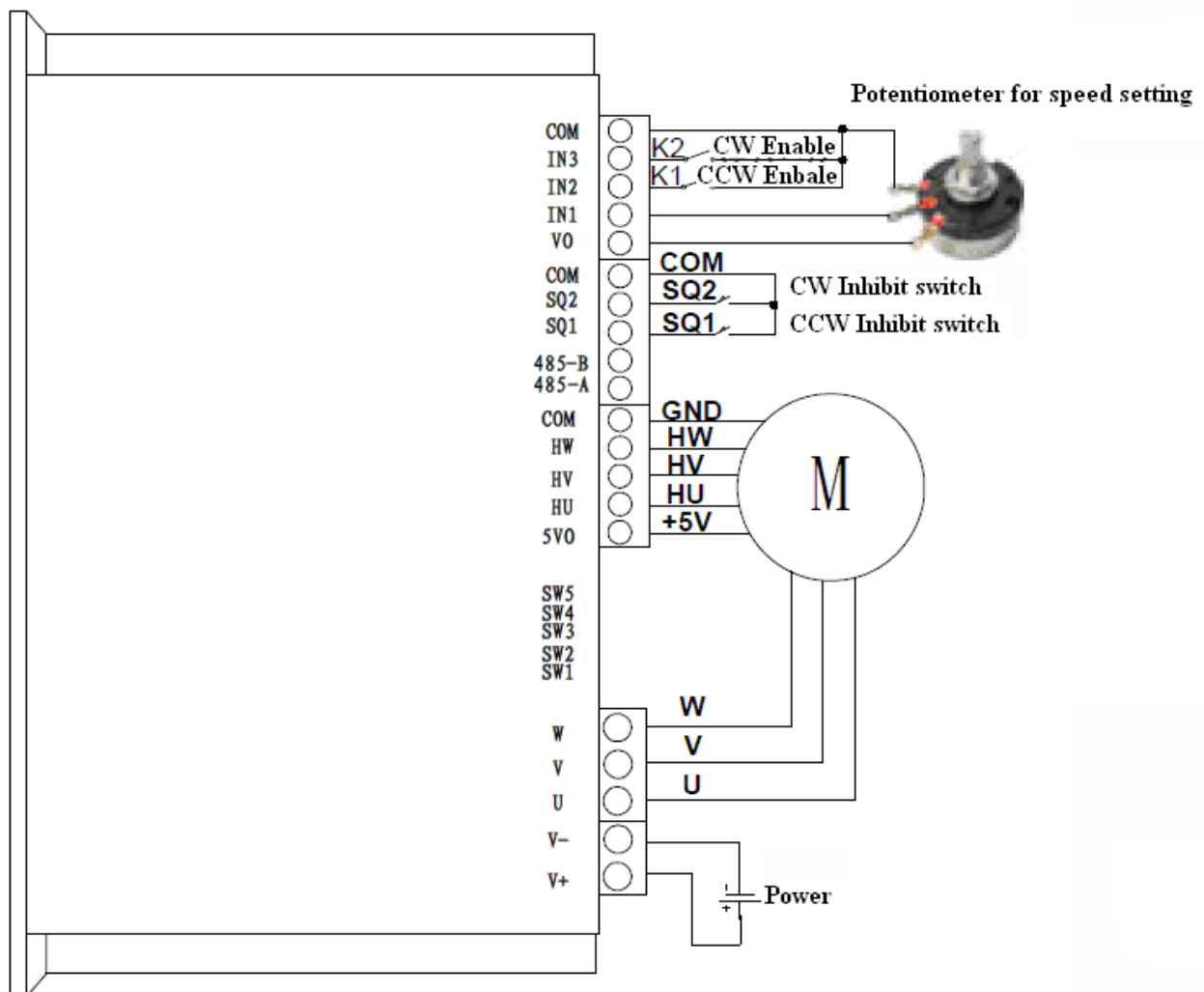
Dial switch status for potentiometer input
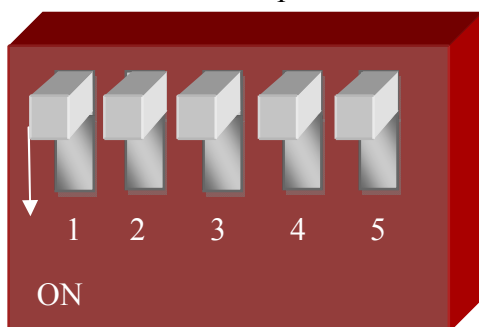
4. 485 communication connection and configuration

The control of the motor operation can be achieved by 485 communication . The connection of communication control is shown in figure 4.57. With baud rate of 9600, master station (master station can be PLC, SCM or PC, etc.) connect the driver by two signal line in accordance with A-A, B-B way. The 485 master station can operates the register of the driver through the Modbus-RTU communication protocol to control the speed, direction and position of the motor. In the 485 communication control mode, the drive supports duty cycle speed control, speed closed-loop control and position closed loop control.
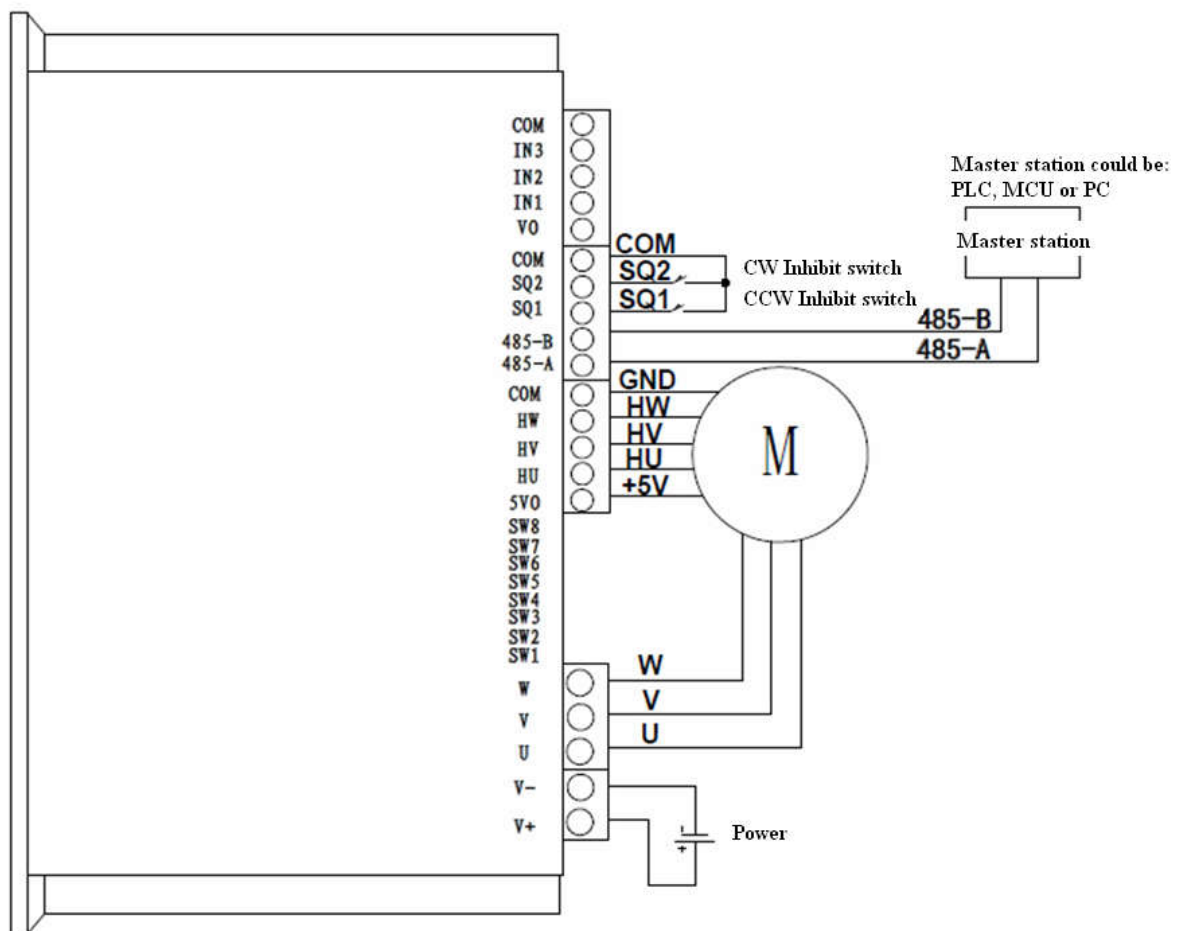
Dial switch status for RS485 communication
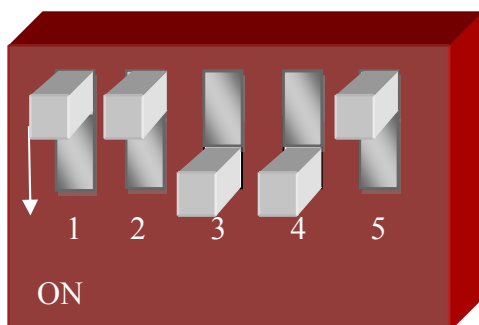
Frame format:

Byte	0	1	2	3	4	5	6	7
Content	First Byte	Data length	Axis Number	Command	Parameter	Data low byte	Data high byte	Check sum
		Bytes for checksum						

Note: 1、Send and receive in hex;

2、checksum is got by sum of byte1(Data length) to byte6(Data high byte),which could be adjusted according to user in the future.

First Byte: fixed to0x5A(temporary);

Data length: 0x08;

Axis number: fixed to 0x00(temporary);

Command ID table

Command ID	Meaning	Comment
0x00	READ_PARAM	Read speed
0x01	WRITE_PARAM	Write speed
0x02	READ_STATUS	Read status
0x03	WRITE_CMD	Write command
0x04	READ_MEMORY	Read record

Parameter: fixed to 0x00(temporary);

Data: two bytes, low byte in front, high byte in back;

Data low byte	Data high byte	Comment
When command ID is 0x03, data is for command		
0x00	0x00	disable
0x01	0x00	CCW enable
0x02	0x00	CW enable
0x03	0x00	Dynamic brake
0x04	0x00	Release dynamic brake
When command ID is 0x03, data is for speed setting		
0xD0	0x07	2000 RPM

0xE8	0x03	1000 RPM
0x00	0x00	0 RPM
When command ID is 0x03, data is for speed reading		
0xB8	0x0B	Current speed is 3000 RPM

Example for communication rs485:
1: normal flow
1. Start
    1)Write setting speed of 1000 RPM: 5A 08 00 01 00 E8 03 F4
    2)Release the bynamic brake if bynamic brake is enable: 5A 08 00 03 00 04 00 0F
    3)Write CCW enable command: 5A 08 00 03 00 01 00 0C

2. Now, the motor is rotating in CCW direction,
    1) if reading current speed is needed,
    send the message for reading speed: 5A 08 00 00 00 00 00 08
        driver will send back the current speed in hex: 03 E8
    2) if reading current state is needed,
    send the message for reading state:5A 08 00 02 00 00 00 0A
        driver will send back the current state in hex: 00 00

3. If setting speed needs to change to 4000 RPM, then send: 5A 08 00 01 00 A0 0F B8

4. If motor running direction needs to be changed, then send:5A 08 00 03 00 02 00 0D

5. Stop motr
    1) If stop with brake, is needed,then send: 5A 08 00 03 00 03 00 0E
    2) If stop without brake, then send: 5A 08 00 03 00 00 00 0B

    2: setting speed
Setting speed for 1000 RPM: 5A 08 00 01 00 E8 03 F4   (08+00+01+00+E8+03 = F4)
Setting speed for 2000 RPM: 5A 08 00 01 00 D0 07 E0
Setting speed for 3000 RPM: 5A 08 00 01 00 B8 0B CC
Setting speed for 4000 RPM: 5A 08 00 01 00 A0 0F B8
Setting speed for 5200 RPM: 5A 08 00 01 00 50 14 6D
Setting speed for 6400 RPM: 5A 08 00 01 00 00 19 22
Setting speed for 8500 RPM: 5A 08 00 01 00 34 21 9B
Setting speed for 10000 RPM:5A 08 00 01 00 10 27 40
CCW enable:5A 08 00 03 00 01 00 0C
CW enable: 5A 08 00 03 00 02 00 0D