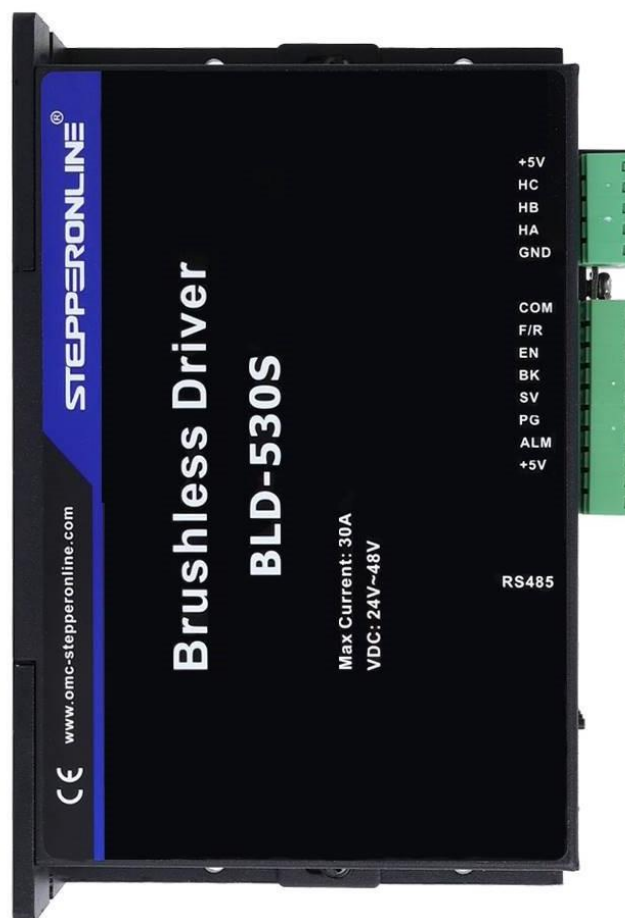




User Manual

BLD-530S

Brushless DC Motor Driver



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

Introduction

BLD-530S brushless motor driver is a small power driver independently developed by STEPPERONLINE to achieve the modern industrial automatic control. It mainly uses high-performance dedicated brushless DC motor driver chips, which have a series of advantages such as high integration, small size, comprehensive protection, simple and clear wiring, and high reliability. The driver is suitable for driving medium and small brushless DC motors with a rated power of 600W or below. It uses a new type of PWM technology, which enables the brushless motor to run at high speed, with low vibration, low noise, good stability, and high reliability.

1. Specifications

1.1 Electric Specification

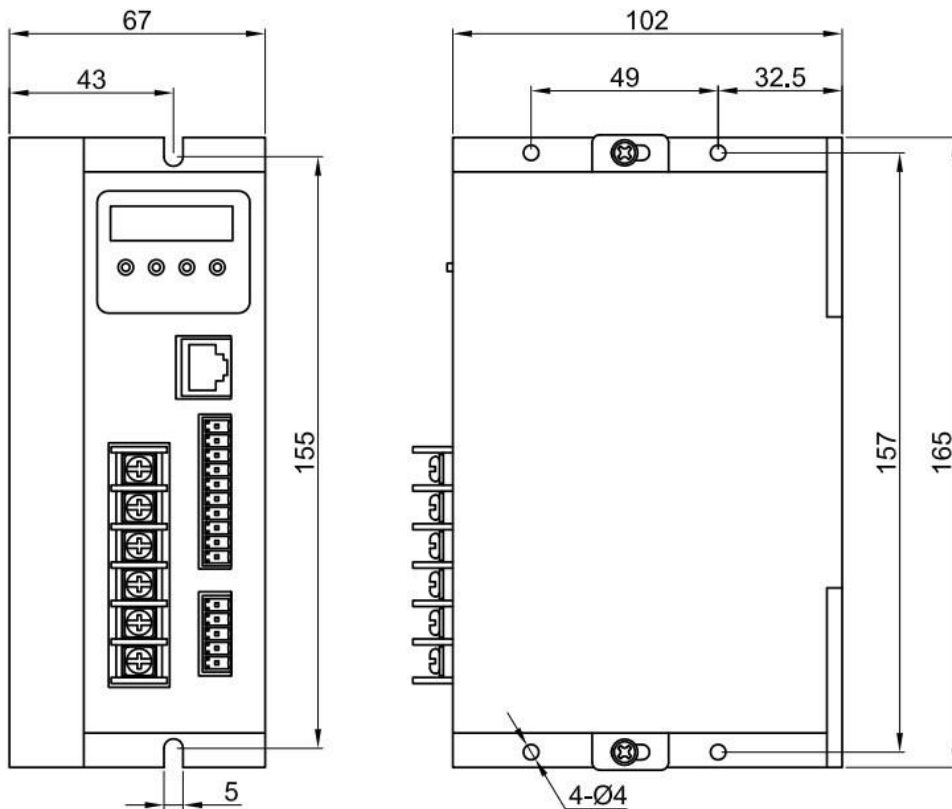
Parameters	BLD-530S			
Input voltage(VDC)	12	24	36	48
Continuous Output Current(A)	25	25	17	13
Rated Output Power(W)	300	600	600	600
Peak Current(A)	30			

1.2 Environment

Cooling	Radiator
Control Signal I/O	Full Isolation
Working Temperature	0~+45°C
Storage Temperature	-20~+85°C
Working & Storage Humidity	<85% (No Frosting)
Protection Functions	Over-current, over-speed, over-voltage, under-voltage, power supply abnormality control

1.3 Mechanical Specification

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



Dimension: 165x102x67mm

1.4 Safety Precautions

Do not measure or touch any components without housing while operating

This product is powered by a DC power supply.

Please confirm that the positive and negative poles of the power supply are correct before powering on.

Do not plug or unplug the connecting cable when the power is on, and no short-circuiting of the cable is allowed when the power is on, otherwise the product will be damaged.

Should check soleplate or change fuse 1minutes later after power off.

Operating without housing is forbidden

Make sure to connect the ground terminal, otherwise the brushless motor will working unsteadily

If the motor needs to change direction while it is running, it must first decelerate till stop, and then change direction.

The driver is a power device and it is important to maintain good heat dissipation and ventilation in the working environment.

Sudden damage while drives working, our company only renders the service and replace in guarantee. Personal injury and motor damage caused by the accident will invalidate the guarantee

This product is professional electrical equipment and should be installed, debugged, operated and maintained by professional and technical personnel. Improper use will cause electric shock, fire, explosion and other dangers.

2. Terminal and Signal

2.1 Control Interface

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

2.2 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

2.3 Motor Connection Terminal

No.	Name	Description
1	DC+	DC+
2	DC-	DC-
3	FG	For the Ground
4	U	BLDC winding U phase(A)
5	V	BLDC winding U phase(B)
6	W	BLDC winding U phase(C)

3. Function and Usage

3.1 Speed Control Modes

This driver offers two speed control modes that the user can choose from:

Internal Potentiometer Speed Control: Counterclockwise rotation of the potentiometer on the driver panel decreases the motor speed, while clockwise rotation increases the speed. When using external input speed control, the potentiometer must be set to the minimum position.

External input speed control can be achieved by connecting the two fixed ends of an external potentiometer (5K100K) to the COM and +5v terminals of the driver, and connecting the adjustable end to the SV terminal. Alternatively, analog voltage can be input to the SV terminal (relative to COM) through other control units such as PLC or microcontroller to achieve speed control. The input range for SV is DC 0V~5V, corresponding to a motor speed range of 0~rated speed.

Digital signal speed control can also be used by applying a pulse-width modulated (PWM) signal with an amplitude of 5V and a frequency of 1kHz~2kHz between SV and COM. The motor speed is linearly adjusted by the duty cycle of the PWM signal.

The R-SV potentiometer can be adjusted to attenuate the SV digital signal amplitude in a 01.0 ratio. Generally, R-SV is set to 1.0, and no attenuation is applied to the SV input digital signal.

When the speed control voltage is below 0.3V, the motor will stop.

3.2 Motor Operate/Stop Control (EN)

Motor on/off control (EN) can be achieved by controlling the on/off state of the EN terminal relative to COM. When the terminal is connected, the motor runs, and when it is disconnected, the motor stops. When using the on/off control terminal to stop the motor, the motor will naturally come to a stop, which depends on the load inertia.

3.3 Motor Rotation Direction Control (F/R)

Motor forward/reverse control (F/R) can be achieved by controlling the on/off state of the F/R terminal relative to COM. When F/R is not connected to COM, the motor rotates clockwise (facing the motor shaft), otherwise the motor rotates counterclockwise.

Attention: To avoid damaging the driver when changing the motor direction, the motor should be stopped before operating the change direction function.

3.4 Brake the Motor to Stop (BREAK)

By controlling the connection and disconnection of terminals BK and COM, the motor can be controlled to brake and stop. When terminals BK and COM are disconnected, the motor runs, and when they are connected, the motor quickly brakes to a stop. The braking time is dependent on the load inertia of the user system. However, because braking has an impact on both electrical and mechanical systems, natural stopping should be used unless special stopping requirements are needed.

3.5 Speed Signal Output (PG)

The port is an OC output (30V/10mA max) that outputs a speed pulse. You can connect with a resistance (3K ohm~10K ohm) between signal and input power to get the pulse signal. The port will output a fixed pulse width (50 us) negative pulse string that is proportional to the frequency of the motor's rotation. The number of output pulses per revolution of the motor is $3 \times N$, where N is the number of poles of the motor. For example, a four-pole motor with two pairs of poles will output six pulses per revolution. When the motor speed is 500 rpm, the output pulse of the PG terminal is 3000.

3.6 Alarm Output (ALM)

The driver alarm output is an OC output (30V/10mA max). You can connect a resistance (3K ohm ~10K ohm) with the input power to get the alarm signal. When the alarm is triggered, the port is connected to COM (low level), and the driver stops working and enters an alarm state.

3.7 Driver Failure

When over-voltage or over-current occurs inside the driver, the driver will enter protection mode, automatically stop working, and the motor will stop. The digital display on the driver will show Err-x. To clear the alarm, the enable terminal (EN) needs to be reset (i.e., disconnected from COM) or power needs to be disconnected. If this fault occurs, please check the motor wiring.

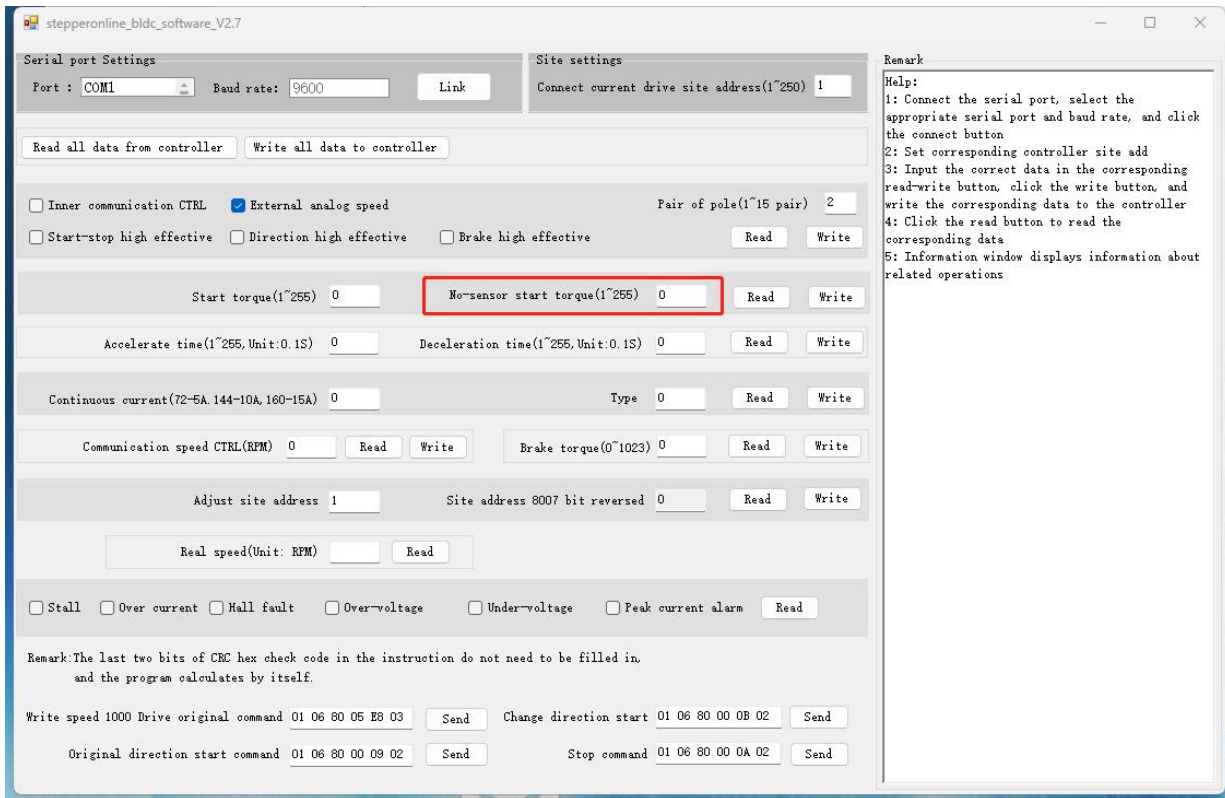
3.8 Sensorless control mode

STEPPERONLINE drivers can be used for sensorless brushless motors.

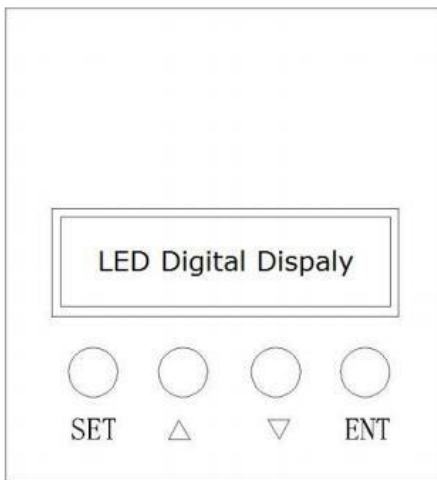
But it should be noted that since our brushless driver is mainly used for our brushless motor with sensors, its built-in program is also used for motors with sensors.

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.



4. Display and Keyboard Operation



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

"△": "+", Plus 1

"▽": "-", Minus 1

"ENT": "ENTER" (call out setting parameter)

4.1 System Parameter Setting

Please ensure that the motor is under the stop situation when setting 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.

4.1.1 In standby mode, press the "ENTER" key to call up the system parameters, and then press ENTER again to call up the setting value of the system parameters.

4.1.2 Use the "△" or "▽" keys to navigate to the parameter you want to modify. If you do not want to modify it, press the "SET" key to exit the setting and return to standby mode.

4.1.3 Press "ENTER" to see the parameter content. If you do not want to modify it, press the "SET" key to exit the setting and return to standby mode.

4.1.4 Use the "△" or "▽" keys to adjust the parameter value you want to modify.

4.1.5 Press the "ENTER" key to store the parameters and press the SET key to return to standby mode.

Note: In the setting state, if no key is pressed for one minute, it will automatically jump to the speed display interface.

4.2 Working Mode

There are two working modes for the driver, which can be set through the panel. One is the panel working mode, and the other is the external port working mode. The motor operates according to the set mode, and the digital display shows the motor's rotational speed. In panel working mode, press the SET key to start or stop the motor. Press and hold the △ and ▽ keys to increase or decrease the motor speed, and press the ENTER key to confirm the motor speed. The motor runs at the set speed.

4.3 Protect Mode

While Motor operates abnormally, display will show Errx:

Err-01	Stall
Err-02	Over Current
Err-04	Hall Fault
Err-05	Stall and Hall Fault
Err-08	Under-Voltage
Err-10	Over-Voltage
Err-20	Peak Current Alarm
Err-40	Temperature Alarm

4.4 Drives Parameter Setting

P00X:Operating Parameter					
Code	Name	Setting Range	Unit	Default Value	Change
P000	Control Mode	00 External port mode 18 Panel control mode 485 communication control mode		External Port Control Mode	
P001	Pair of Pole	1~255	Pair	2	o
P002	Rated Speed	1~65535 (external port mode effective)	RPM	3000	o
P003	Display mode	00: Speed Display		00	o
		01: PWM Speed Adjustment			
		02: Segmented speed control mode (when parameter P000 is set to 10)			
		80: Current Display			
P004	No sense 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	1~255		34	
P010	Panel Speed Setting	0~65535 Only external port mode effective	RPM	2000	
P011	Brake Force	0~1023		1023	
P012	Site Address	0~250		1	
P013	Sensored/ Sensorless Control	Odd numbers are sensed Even numbers are sensorless		255	
P014	Current Adjusting Parameter	0~FF	Hexadecimal	3A	
P015	Reserved				
P016	Velocity 1	0~65535	Hexadecimal	500	
P017	Velocity 2	0~65535	Hexadecimal	1000	
P018	Velocity 3	0~65535	Hexadecimal	2000	
P019	Velocity 4	0~65535	Hexadecimal	3000	
P020	Velocity 5	0~65535	Hexadecimal	4000	
P021	Velocity 6	0~65535	Hexadecimal	5000	
P022	Velocity 7	0~65535	Hexadecimal	6000	
P023	Velocity 8	0~65535	Hexadecimal	7000	
P024- P031		Reserved			

4.5 Explanation of Segmented Speed Control

4.5.1 Set the segmented speed control mode: Change the P-000 parameter to 10, change P-003 to 02, and connect EN to 0V.

4.5.2 DBLS-02S segmented speed control gear table: 0 represents 0V, 1 represents 5V, SV is suspended at 0V, and pins 1 and 2 are suspended at 5V.

COM	SV	1Pin K1	2Pin K2	RPM
0	0	0	0	500
0	0	0	1	1000
0	0	1	0	2000
0	0	1	1	3000
0	1	0	0	4000
0	1	0	1	5000
0	1	1	0	6000
0	1	1	1	7000

5. System Usage

First, connect the motor and driver wires (motor winding wires, Hall signal wires, and power wires) strictly according to the requirements. Brushless motors cannot achieve forward and reverse rotation by changing the wiring like asynchronous motors. Incorrect wiring can cause abnormal motor operation or no operation at all. The main manifestations are that the brushless motor vibrates or heats up quickly (within tens of seconds to two minutes, and the temperature rises to 80 degrees), and it can damage the motor and driver.

After connecting the motor winding wires, Hall wires, and driver power wires, you can try to run it. First, adjust the potentiometer to the minimum, then press the start switch and slightly increase the motor potentiometer. The motor should run. If the motor does not run or vibrates, it may be due to the wrong phase sequence of the motor wires. Please recheck the order of the brushless motor leads until the motor can run normally. Then, stop the motor.

6. Communication Mode

The communication mode adopts the standard Modbus protocol, which complies with the national standard GB/T 19582.1-2008. It uses RS484 dual-line serial communication and the physical interface adopts two 3.81mm spaced 3-core Phoenix terminals, which is very convenient for serial connection. The transmission mode is RTU, the verification mode is CRC, and the CRC starting word is FFFFH. The data mode is 8-bit asynchronous serial, 2 stop bits, no parity, and supports multiple communication speeds (see parameter table for details).

Note: If communication mode is required to control the motor, it must be in internal speed control mode.

6.1 ModBus Communication Control Register Definition

No	Adress	Name	Setting Range	Default	Unit
00	\$8000	First byte: control bit state Second byte: Hall angle and motor poles	First byte: Bit0: EN Bit1: FR Bit2: BK Bit3: NW1 Bit4: NW Bit5: KHX Bit6: HR60 Bit7: KH Second byte: Bit0-7: Poles 1-255	00H 02H	
01	\$8001	Max. Speed in analog adjustment	0-65535	3000	Rpm
02	\$8002	First byte: start torque Second byte: start speed without sense start	1-255	10H	
03	\$8003	First byte: accelerate time Second byte: decelerate time	1-255	0 0	0.1s
04	\$8004	First byte: Max. current Second byte: temp alarm point		38H 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 byte: 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: High Bus Voltage Bit5: Peak Current Alarm Bit6: Temperature Alarm Bit7: Reserved		
1C		\$801C-\$801F	Reserved		
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: Control terminal external effective(EN,FR,BK) | 1: Internal effective |
| NW: | 0: Speed external effective | 1: Speed internal effective (under panel speed adjusting mode, PWN speed adjusting mode and segmental speed adjusting mode, it must set to1) |
| KH: | 0: Closed loop control | 1: Open loop control |
| KHX: | 0: Stall alarm | 1: No alarm |
- Stall alarm under the open loop w/ sense mode.
- | | | |
|-------|----------------------|---|
| HR60: | 0: 120° hall control | 1: 60° hall control (temporarily not supported) |
|-------|----------------------|---|

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 06 80 00 18 02 2B CB EN stop

10. 01 06 80 00 19 01 6A 5A 1 pair of poles 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)

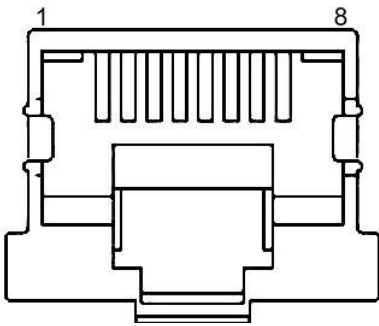
The successful feedback message is explained as follows:

Message	01	10	11 1B	00 05	70 0D
Explain	Address	Function Code	The start register address	The wrote Register number	CRC testing code

7. Communication Wires Connection

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

The RJ45 connector pins are defined as follows:



Pin	Function
8	COM
6	A
3	B