

# STEPPERONLINE<sup>®</sup>

User Manual

## BLD-550S

Brushless DC Motor Driver



©2023 All Rights Reserved

Address: 15-4, #799 Hushan Road, Jiangning, Nanjing, China

Tel: 0086-2587156578

Web: [www.omc-stepperonline.com](http://www.omc-stepperonline.com)

Sales: [sales@stepperonline.com](mailto:sales@stepperonline.com)

Support: [technical@stepperonline.com](mailto:technical@stepperonline.com)

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

## Introduction

BLD-550S motor driver is a closed-loop speed controller and employs IGBT and MOS power devices. It utilizes the Hall signals of the 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 at low speeds, it can always reach the maximum torque. The speed control range is from 150 to 20,000 rpm.

## 1. Features

- PID speed and current dual-loop regulator
- High performance at a low price
- 20kHz PWM frequency
- Electrical brake function to enable rapid motor response
- Overload factor greater than 2, enabling maximum torque at low speed
- Fault alarm functions for overvoltage, under-voltage, over-current, over-temperature, peak current, and Hall signals
- Compatible with Hallless drive, it can be used as a brushless Hallless drive alone

## 2. Specifications

### 2.1 Electrical Specification

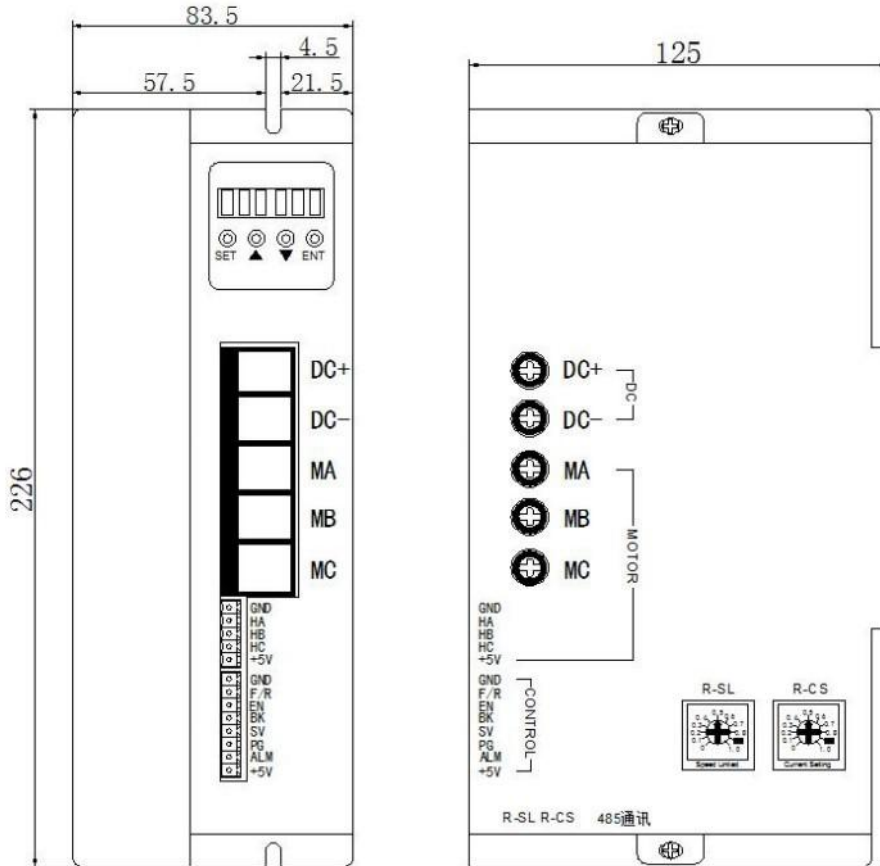
Parameters	BLD-550S			
Input voltage(VDC)	12	24	36	48
Continuous Output Current(A)	50	50	40	30
Rated Output Power(W)	600	1500	1500	1500
Peak Current(A)	75			

### 2.2 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

**2.3 Mechanical Specification**

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



**Dimension: 226x125x83.5mm**

**2.4 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.

### 3. Terminal and Signal

#### 3.1 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

#### 3.2 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

#### 3.3 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)

#### 3.4 Control the 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

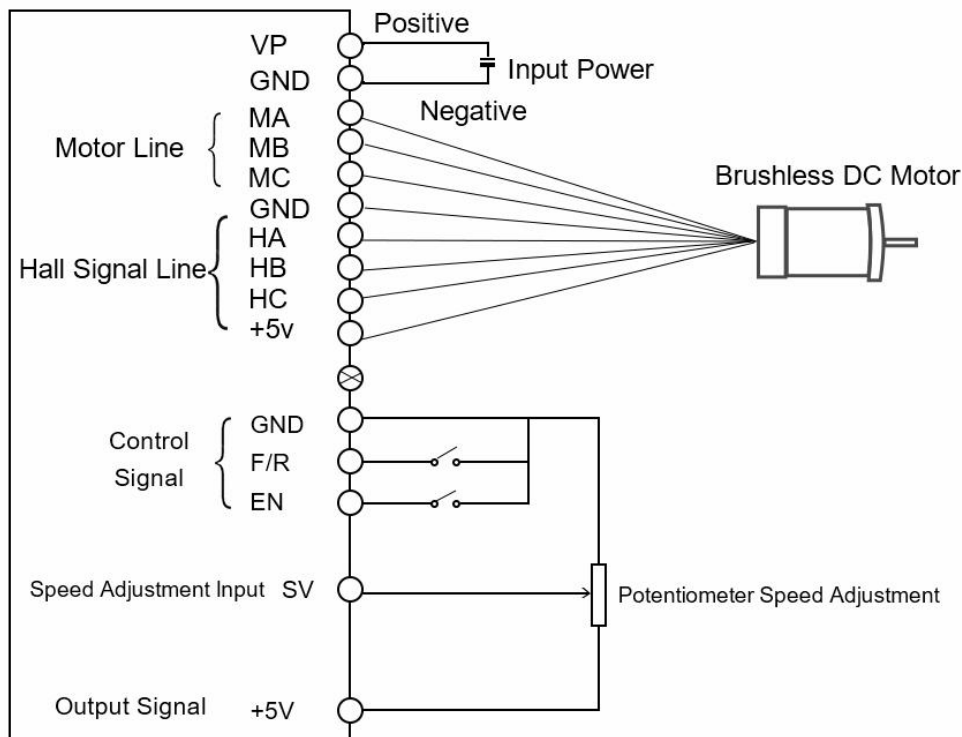
**F/R:** Forward/Reverse control. To reverse the motor, connect it to GND and do not connect it to switch it in the forward direction. When switching between forward and reverse, the EN should be turned off first.

**EN:** When EN is connected to GND, the motor rotates (online state). When EN is not connected, the motor does not rotate (offline state).

**SV:** External speed attenuation: It can be attenuated from 0 to 100%. When the external speed command is connected to 5V, the speed can be adjusted through this potentiometer.

**+5V:** Speed control voltage output, which can be continuously adjusted by the potentiometer on SV and GND.

**Wiring diagram of the driver and the brushless motor:**



**4. Functions and Usage**

**4.1 Speed Adjustment Method**

**4.1.1 Internal potentiometer speed regulation:** Rotate the potentiometer on the driver panel counterclockwise to reduce the motor speed, and clockwise to increase the speed.

When the user uses external input to adjust the speed, the potentiometer must be set to the minimum state. External input speed regulation Connect the two fixed terminals of the external potentiometer to the GND and +5v terminals of the driver respectively, and connect the adjustable terminal

Connect to the SV terminal to use an external potentiometer (5K~100K) to adjust the speed, or use other control units (such as PLC, single-chip microcomputer) to adjust the speed.

etc.) Input the analog voltage to the SV terminal to realize speed regulation (relative to GND), the acceptance range of the SV port is DC 0V~+5V, corresponding to The motor speed is 0~rated speed.

**4.1.2 External digital signal speed regulation:** the amplitude of 5V can be applied between SV and GND, and the frequency is 1KHz~2KHz

The pulse width digital signal (PWM) is used for speed regulation, and the motor speed is linearly adjusted by its duty cycle. At this time, you can adjust the R-SV voltage

The potentiometer performs 0~1.0 ratio attenuation processing on the amplitude of the SV digital signal. Generally, the R-SV is adjusted to 1.0, and the SV input data Word signals are not attenuated.

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

**4.2 Motor Operate/Stop Control (EN)**

By controlling the on/off state of the EN terminal relative to GND, the operation and stop of the motor can be controlled. When the terminal is connected, the motor runs, and vice versa, the motor stops. When the motor is stopped by using the run/stop terminal, it will come to a natural stop, and its motion characteristics are related to the load inertia.

**4.3 Motor Rotation Direction Control (F/R)**

The direction of the motor can be controlled by connecting or disconnecting terminal F/R and terminal GND. When F/R is not connected to terminal GND, the motor runs clockwise (facing the motor shaft) and vice versa for counterclockwise rotation. Attention: To avoid damage to the driver when changing the motor direction, the motor should be stopped before the direction changing to avoid performing direction operations while the motor is running.

**4.4 Braking Stop (BK)**

The braking stop of the motor can be controlled by the connection of control terminal BK to terminal GND. When control terminal BK is disconnected from terminal GND, the motor runs, when it is switched on the motor quickly brakes to a stop, braking stop is faster than natural stop, the specific stopping time is related to the load inertia of the user's system. Attention: As the brake stop has a bad impact on both the electrical and the mechanical, a natural stop should be used if there are no special stopping requirements.

**4.5 Motor Speed Signal Output (PG)**

The speed pulse output is a 5V pulse output, to obtain the signal a pull-up resistor of 3K ohm ~10K ohm should be connected to the power supply. The number of output pulses per revolution of the motor is 3 x N, N being the number of pairs of poles of the motor. For example: 2 pairs of poles, i.e. a four-pole motor, 6 pulses per revolution. When the motor speed is 500 rpm, the output pulse of the terminal PG is 3000.

**4.6 Alarm Output (ALM)**

Alarm output of the driver: this terminal is low during an alarm. To obtain a signal, a pull-up resistor of 3K ohm to 10K ohm should be connected to the power supply. When the alarm is on, this terminal is connected to GND (low level) and the driver stops itself and is in alarm.

**4.7 Driver Failure**

When there is over-voltage or over-current inside the drive, the drive will enter a protection state, automatically stop working, the motor will stop, and the blue light on the drive will go out. To clear the alarm, the enable terminal (that is, disconnecting EN and GND) or power must be disconnected. If this fault occurs, please check the motor wiring or motor load.

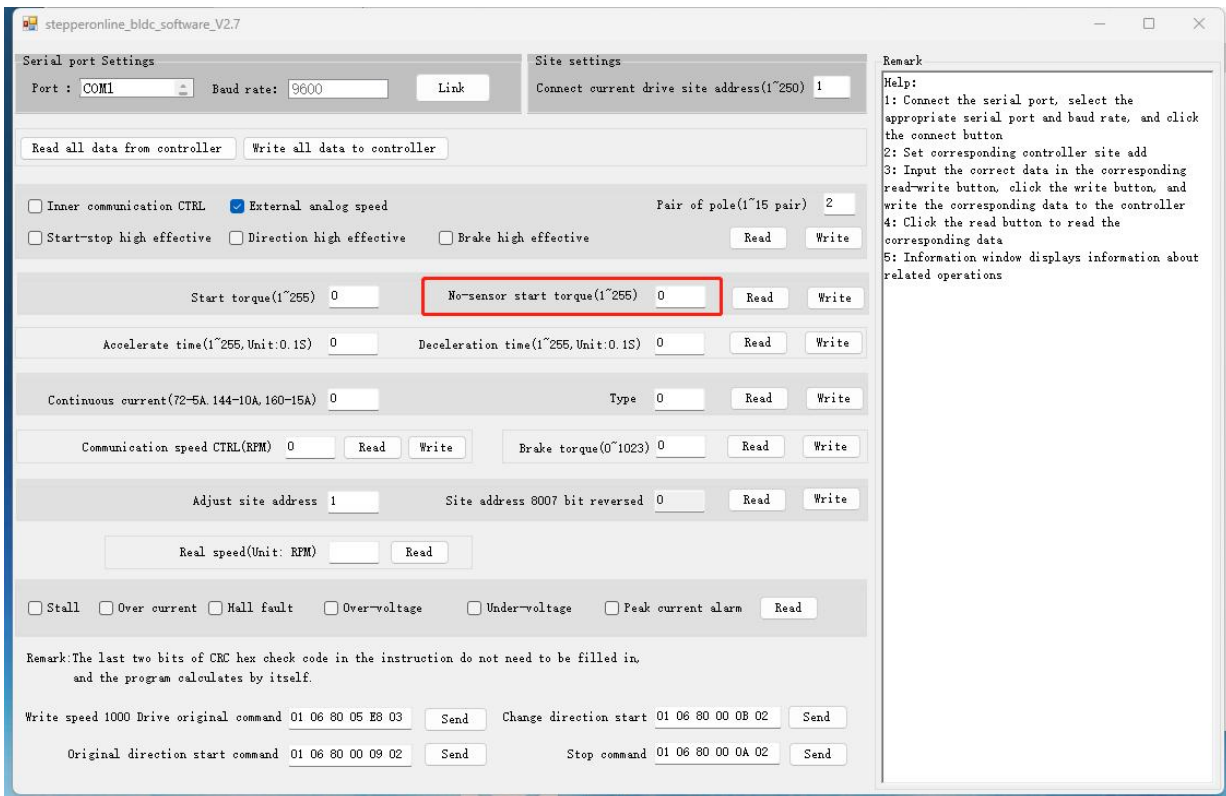
### 4.8 Sensorless control mode

STEPPERONLINE drivers can be used for sensorless brushless motors.

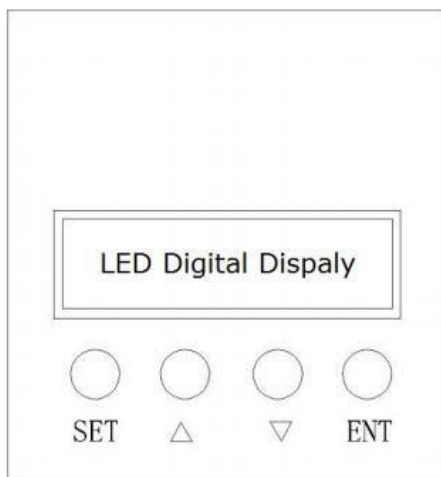
But it should be noted that since our brushless driver is mainly used for our brushless motor with sensors, its built-in program is also used for motors with sensors.

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.



## 5. Display and Keyboard Operation



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

"Δ": "+", Plus 1

"∇": "-", Minus 1

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

### 5.1 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.

**5.1.1** 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.

**5.1.2** Use the "Δ" 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.

**5.1.3** 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.

**5.1.4** Use the "Δ" or "∇" keys to adjust the parameter value you want to modify.

**5.1.5** 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.

### 5.2 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 Δ 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.

### 5.3 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

#### 5.4 Drives Parameter Setting

P00X:Operating Parameter					
Code	Name	Setting Range	Unit	Default Value	Change
P000	Control Mode Setting	00 Sensorless external control mode 18 Panel control mode and 485 communication control mode for sensorless mode 40 Forced sensored external control mode 58 Panel control mode and 485 communication control mode for sensored mode		00 External Port 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
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	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	Reserved				
P014	Current Adjusting Parameter	0~FF	Hexadecimal	3A	
P015	Reserved				
P016	Reserved				

## 6. 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.

## 7. Communication Node

This communication model 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	Parameter name	Setting range	Default	unit	Remark
00	\$8000	First byte: control bit state Second byte: Hall angle and number of pole pairs of motors	First byte: Bit0: EN Bit1: FR Bit2: BK Bit3: NW1 Bit4: NW Bit5: KH Bit6: HR60 Second byte: Bit0-7: number of pole pairs 1-255	00H       02H		
01	\$8001	The maximum rotational speed of analogue speed regulation	0-65535	3000	Rpm	
02	\$8002	First byte: start torque Second byte: sensorless start speed	1-255 1-255	10H 04H		
03	\$8003	First byte: acceleration time Second byte: deceleration time	1-255	10 10	0.1s	
04	\$8004	First byte: Maximum current		35H		144

		The second byte: temperature alarm point		30FH		corresponds to 13A 15 Have a feeling 16 No feeling
05	\$8005	External speed setting	0-65535	2000	RPM	
06	\$8006	Braking force	0-1023	1023		
07	\$8007	First byte: site address Second byte: reserve	1-250	1 0		
08-0F		\$8010-\$8017	Reserved			
10-17		\$8010-\$8017	Reserved			
18	\$8018	Actual motor speed				
19	\$8019	First byte: bus voltage The second byte: bus current				Invalid
1A	\$801A	First byte: control port status Second byte: the analog port value	Bit0: SW1 Bit1: SW2 Bit2: SW3 Bit3: SW4			Invalid
1B	\$801B	First byte: the fault status The 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: Reserved			
1C		\$801C-\$801F	Reserved			
20		Over \$8020 illegal				

Addresses 8000H—8017H are read and write registers

Addresses 8018H-801FH are read-only registers

Other addresses are 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: 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)

**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 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)

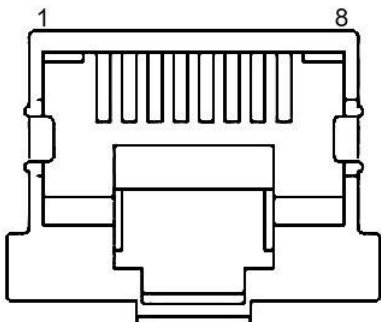
The successful feedback message is explained as follows:

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

## 8. Communication Wires Connection

RS-485 communication can be carried out through a regular 3-pin 2.54 wiring port.

The pin definitions of a regular 3-pin 2.54 wiring port are as follows:



Pin	Function
8	GND
6	A+
3	B-