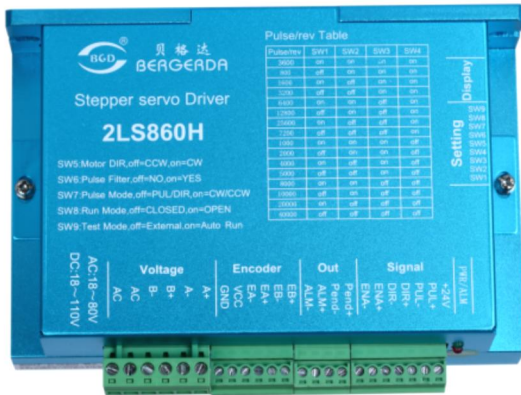


LS series

Closed-loop Stepping Driver

Manual(V1.2)



Hangzhou Bergerda Automation Technology Co., LTD

Read this manual carefully before

installing / debugging/ using the product

Thank you for choosing the LS series closed-loop stepping drive. Before use, please read this technical manual, which mainly including:

- * Closed-loop stepping drive inspection, installation and wiring steps.
- * Closed-loop stepping driver specifications
- * Operation steps, status display, abnormal alarms and handling of the panel.
- * Description of all parameters of the closed-loop stepper drive.
- * Trial operation and adjustment steps of the closed-loop stepping system.

In order to facilitate daily inspection, maintenance and understand the causes and countermeasures of abnormality, please keep this manual properly for reference at any time. Note: Please hand this manual to the end user to maximize the closed-loop stepper driver.

- Due to product improvements, the contents of this manual may be changed without prior notice.
- The company will not be liable for any changes to the product for personal, and the product warranty will be invalid.

When reading this user manual, please pay special attention to the following warning signs



Indicates that incorrect operation may cause catastrophic consequences - death or serious injury!—— Death or serious injury!



Indicates that incorrect operation may cause injury to the operator and damage to the equipment!



Indicates that improper use may damage the product and equipment!

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Chapter 1 Overview

1.1 Product introduction

2LS556A 2LS860H is a high-performance closed-loop step driver developed by Bergerda Company. It's based on the 32-bit ARM processing chip platform and is designed using the magnetic field orientation and high-speed weakening magnetic algorithm in the servo driver. It has an excellent performance.

The built-in vector control technology and servo adjustment function of the driver, combined with the feedback from the closed-loop motor encoder, enable the closed-loop stepping system to have the characteristics of low heat generation, no step loss and higher application speed, which can comprehensively improve the performance of the intelligent equipment system.

1.2 Features

- The new generation of 32-bit ARM technology, high cost performance, good stability, low noise, low vibration.
- 1 photoelectric isolation input interface to receive external control signals and realize the emergency stop function of the driver.
- 2 photoelectric isolation programmable output interface, output driver status and control signals.
- It has a Display interface and can be connected to a handheld closed-loop debugger for convenient debugging.
- When the step pulse stops for more than 200ms, the motor current is reduced by half.
- Current control is smooth, precise, and the motor generates little heat.
- Open-loop control can be selected through the dial switch.
- Voltage range: AC: 18-80V; DC: 18-100V.

1.3 Application field

It is mainly used in welding machines, dispensing machines, wire stripping machines, marking machines, engraving machines, electronic assembly equipment, stage lighting, robots and medical equipment, laser equipment, plotters and other automation equipment.

1.4 Product naming rules

2 LS 8 60 H
① ② ③ ④ ⑤

- ① 2 is two phases and 3 is three phase;
- ② Digital step, NS is open loop, LS is closed loop;
- ③ Maximum input AC, 80V power supply voltage;
- ④ Maximum output current 6A;
- ⑤ A is low voltage type; H is high voltage type.

Chapter 2 Performance indicators and motor specifications

2.1 Electrical characteristics

Parameter	2LS 556A-42		2LS 556A	
	Minimum value	Typical value	Maximum value	unit
Continuous output current	0.6	-	5.6	A
Input supply voltage	18	24	48	VDC
Pulse input voltage	5		24	V

Parameter	2LS860H			
	Minimum value	Typical value	Maximum value	unit
Continuous output current	1.2	-	7.2	A
Input supply voltage	18	48	80	VDC
Pulse input voltage	5		24	V

2.2 Usage environment

Cooling-down method	Heat sink cooling		
Usage environment	Usage occasion	Try to stay away from other heating equipment, avoid dust, oil mist, corrosive gases, strong vibration places, flammable gases and conductive dust are prohibited	

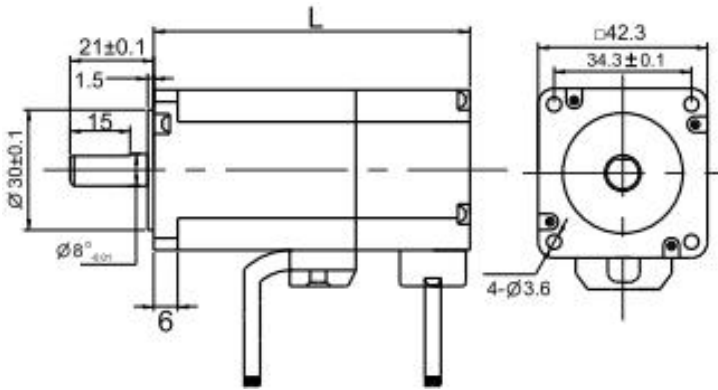
	Temperature	0°C ~55°C (no frost)
	Humidity	90%RH
	Vibration	Less than 0.5G(4.9m/s ²) 10Hz-60Hz (non-continuous operation)
Storage and transportation	Temperature	0°C ~55°C (no frost)
	Humidity	90%RH
Levels of protection	IP54	

2.3 Adapter motor

Closed loop driver model	Adapted motor
2LS556A -42	42BG04-EC
	42BG06-EC
2LS556A	57BG10-EC
	57BG20-EC
	60BG30-EC
2LS860H	86BG40-EC
	86BG80-EC
	86BG120-EC

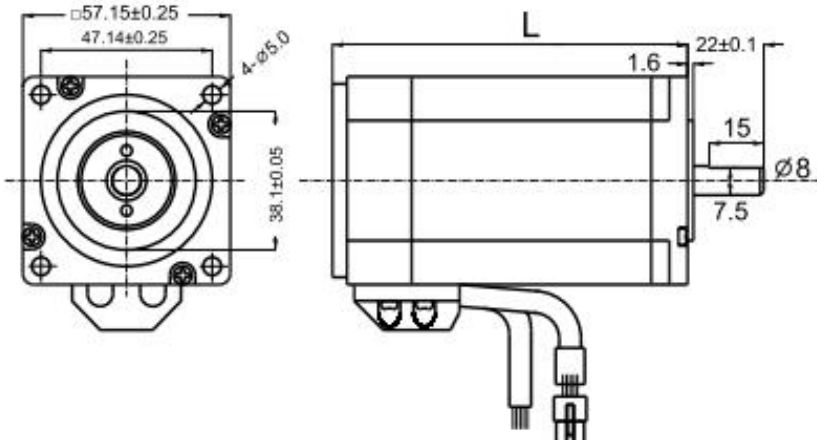
2.4 Dimensional drawing and wiring of the motor

1) 42 Series motor size (mm)



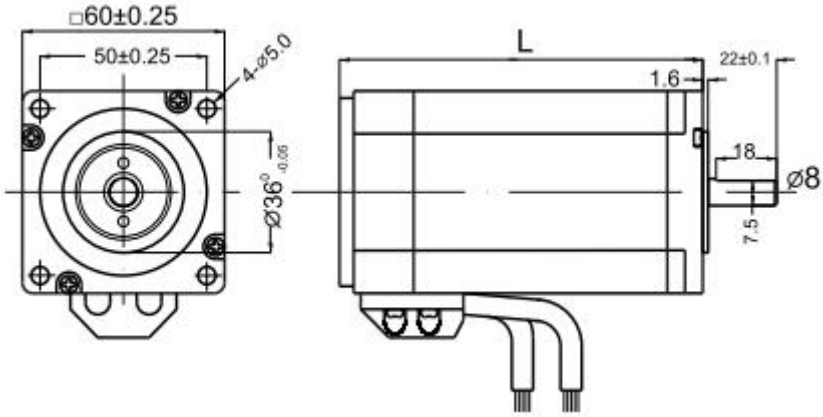
A+	A-	B+	B-
Black	Green	Red	Blue

2) 57 Series motor size (mm)



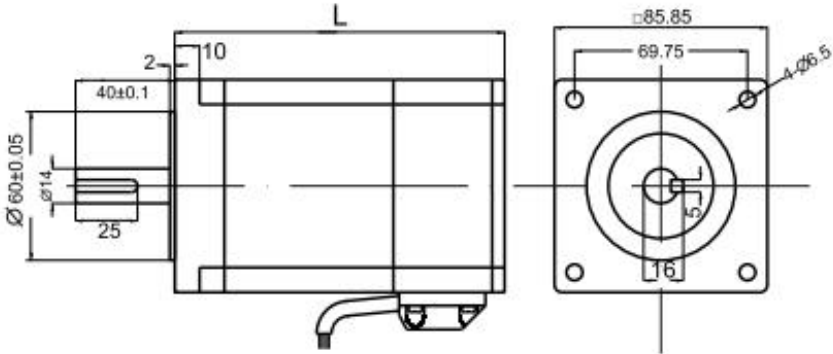
A+	A-	B+	B-
Black	Green	Red	Blue

3) 60 series motor size (mm)



A+	A-	B+	B-
Black	Green	Red	Blue

4) 86 Series motor size (mm)



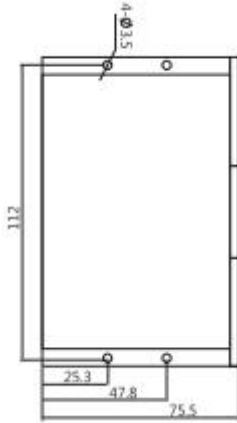
A+	A-	B+	B-
Black	Green	Red	Blue

2.4 Motor specifications

Model	Step angle (°)	Holding torque N.M	Rated current A	Phase inductance mH	Phase resistance Ohm	Rotor inertia (g.cm ²)	Body length (L) mm
42BG04-EC	1.8	0.48	2.0	2.9	1.35	77	68
42BG06-EC	1.8	0.72	2.0	4.0	1.75	110	80
57BG10-EC	1.8	1.0	2.8	1.2	0.8	260	73
57BG20-EC	1.8	2.0	4.0	1.8	0.8	460	97
60BG30-EC	1.8	3.0	5.0	1.8	0.45	690	108
86BG40-EC	1.8	4.0	6.0	3.5	0.8	1400	98
86BG80-EC	1.8	8.0	6.0	5.2	0.95	2800	136
86BG120-EC	1.8	12.0	6.0	8.6	0.73	4000	172

Chapter 3 Installation

3.1 2LS556A Installation dimensions

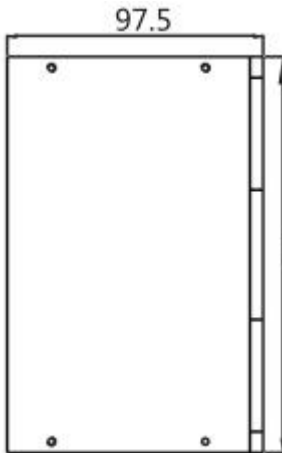


Front installation

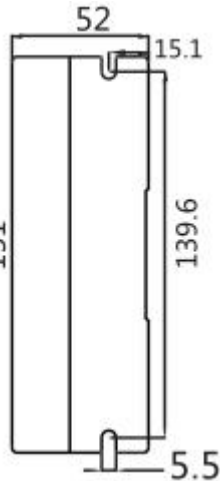


Side installation

3.2 2LS860H Installation dimensions



Front installation



Side installation

3.3 Installation method

When several drivers are installed in the control cabinet, please note that sufficient space must be reserved for adequate heat dissipation, In addition, an additional cooling fan must be installed to keep the peripheral temperature of the stepper driver below 55°C.

When installing, please stand the drive vertically, with the front facing forward and the top facing up to facilitate heat dissipation.

During assembly, care should be taken to prevent drilling chips and other foreign objects from falling into the driver.

Please use M4 screws to fix it when installing.

Please install it with the M4 screws.

When there is a vibration source nearby (punch machine), if it cannot be avoided, please use a vibration absorber or install an anti-vibration rubber gasket.

Chapter 4 Electrical connection of driver terminals

4.1 Connect power

- Connect the driver and power supply, AC 18-80V, DC 18-110V;
- Ensure reliable connection between the driver base and to the earth

through the grounding screws.

4.2 Connect motor

If the motor you are using is a Bergerda Brand stepping motor, please connect the power line labels to the A +, A-, B +, B- ports of the driver in sequence; the encoder line terminals (already connected before the factory) and connect driver Encoder port.

4.3 Port definition

4.3.1 the status indicator light

Color	Name	Function
Green	Power light	Flashes green, the driver is working normally
		Green light is always on, not enabled
Red	Alarm Light	Over current, the red light flashes once alternately
		the encode cable is not connected or connected wrong , the red light will flashes twice alternately.
		The position is out of tolerance and the red light flashes three times alternately.
		The ADC hardware goes wrong, and the red lights flashes five times alternately.

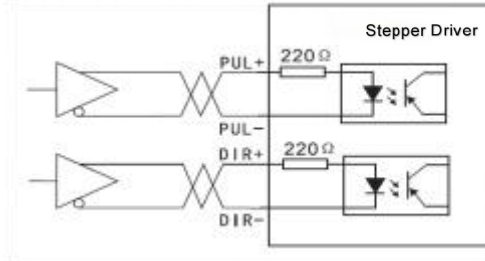
4.4 Control signal input / output definition

Pin	Signal name	Mark	I/O	Function
1	External public power supply	+24V	input	24 pulse signal, no serial resistor
2	Command pulse signal +5V	PUL+	input	External pulse command input terminal: Note: sw7 sets the pulse input mode; off = command pulse + symbol mode; on = ccw / cw command pulse mode.
3		PUL-	input	
4	Command direction signal +5V	DIR+	input	
5		DIR-	input	
6	Enable signal	ENA+	input	Driver enable input terminal, the default is son on : allows the driver to work.
7		ENA-	input	
1	Output port 1	Pend+	output	The system default is: in-position signal; Pend + and Pend- are the positive and negative ends of the in-position output signal
2		Pend-	output	
3	Output port 2	ALM+	output	The system default is: alarm output; ALM + and ALM- are the positive and negative ends of the alarm output signal.
4		ALM-	output	

4.5 Pulse signal input interface circuit

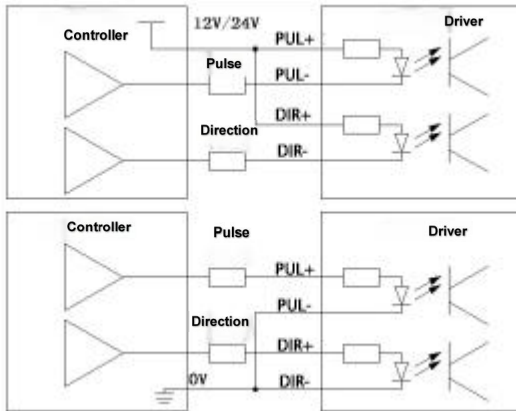
In order to correctly transmit pulse data, it is recommended to use differential driving mode; AM26LS31, MC3487 or similar RS422 line driver as

shown in below:

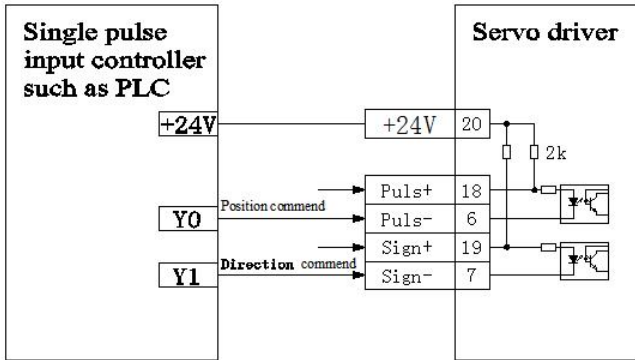


Using single-ended drive mode will reduce the operating frequency.

Method 1: Method 1: Determine the value of the resistor R according to the conditions of pulse input circuit, driving current 10~25mA, and limiting the maximum voltage of the external power supply to 24V. Empirical data: VCC = 24 V, R=1.3~2k; VCC = 12 V, R=510~820 Ω. The external power supply is provided by the user, but it must be noted that if the power supply polarity is reversed, the servo driver unit will be damaged. The details are as follows:



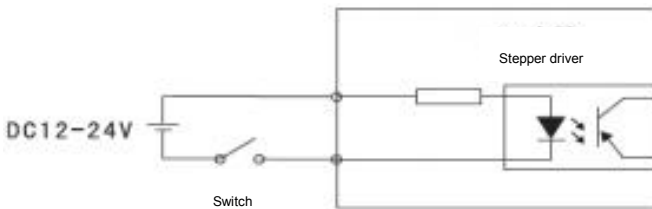
Method 2: Instead of connecting serial resistance, use the function of driving internal resistance to achieve. The wiring method is as shown below:



4.6 Schematic diagram of the digital input and output signal interface

4.6.1 Schematic diagram of the digital input and output signal interface

Digital input interface circuitS can be controlled by relay or open collector transistor circuits. The power supply is provided by the user, DC12~24V, current ≥ 100 mA; Note; if the current polarity is reversed, the stepping driver will not work. Input signals X0-X2 can refer to this connection method:

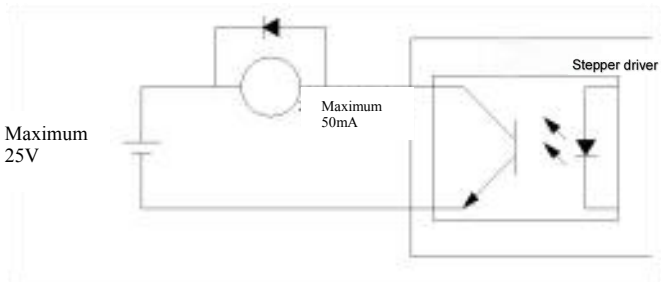


When the input signal is connected with 12V / 24V, the signal is ON input and valid. It can be judged by checking the status monitoring. When

the input point ON, the corresponding digital tube bar will be extinguished. Enter OFF, the corresponding digital tube bar will light up. Reasonable application of this display content facilitates debugging and maintenance of the input signal of the step driver.

4.6.2 Digital output signal interface schematic diagram


When using an external power supply, please pay attention to the polarity of the power supply. Reverse polarity will cause damage to the driver. The digital output is open-collector mode, the maximum external voltage is 24V, and the maximum current is 10 mA. In terms of load, when using inductive loads such as relays, a diode needs to be added in parallel with the inductive load. If the polarity of the diode is reversed, the driver will be damaged. The status of the output signal can be observed through status monitoring.





Chapter 5 Operation and Display


5.1 Closed-loop debugger keyboard operation



The closed-loop debugger panel consists of 6 LED digital tube displays and 4 buttons, which are used to display various statuses, setting parameters, etc. The key functions are as follows:

: The serial number, value increases, or the option moves forward.

: The serial number or value decreases, or the option goes back.

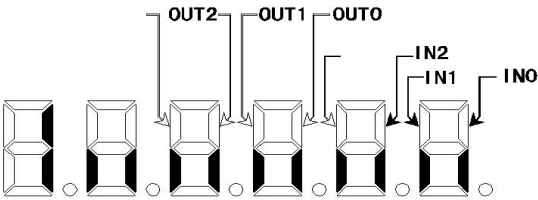
: Return to the previous operation menu, or cancel the operation.

: Enter the next level of operation menu, or enter to confirm..














Note:   IF keep pressing, the operation will be repeated , and the longer the hold time, the faster the repetition rate will be.

*** 6-bit LED digital tube displays various status and data of the system, the decimal point display of all digital tubes or the rightmost digital tube flashes, indicating that an alarm has occurred..


*** The operation is performed according to the two-layer operation menu.The first layer is the function menu under each operation mode. The interface displays the following table:



display status	Show meaning
r	Motor speed
I	Motor current
C	Command pulse
E	Encode position
D	Position deviation
D .	Position deviation after Acceleration or deceleration
IO	<p>Input / output display, 3 in puts are displayed from right to left, in0:son in1:direction in2:plus 3 outputs :out0 out1 out2</p> 
EE-OP	Press Enter to restore the default values, which will take some time
PA0-PA31	Displays and modify various parameters

5.2 Parameter setting

Select the required parameters in "PA0-PA31" in layer 1, press the  key, display the value of the parameter, use the  and  key to modify the parameter value. Press  or  key once, the parameter increase or decrease by 1, press and hold  or  key, the parameter can continuously increase or decrease. When the parameter value is modified, the decimal point of the rightmost LED digital tube lights up. Press  key to confirm that the modified value is valid and save the parameters. At this time, the decimal point of the right LED digital tube goes out and the modified value will be reflected in the control immediately. After that press  or  key can continue to modify the parameters, modify the  key back to the parameter selection state. If you are not satisfied with the value being modified, do not press the  key to confirm, you can press the  key to cancel. The parameter will be restored to the original value, and return to the parameter selection state.

5.3 Parameter management

Parameter management mainly handles the operations between memory and EEPROM, Select "EE-OP" in the first layer and press the  key enter the

parameter management mode. Then press the  key and hold it for more than 2 seconds. If the restore to default operation is successful, the display displays "FInISH", and if failed, "ERR". Press the  key again to return to the operation mode selection state.

Chapter 6 Parameters

6.1 Detailed list of the functional meaning of each parameter, taking 2LS860H as an example

Parameter number	Name	Function	Factory default
0	Maximum current value	Set the maximum output current of the driver in 0.1A.	7.2
1	low load current ratio	Set the ratio of the operating current to maximum current at low load; When the load can be driven, setting it lower will help reduce the heat generated by the motor.	50
2	Invert signal of input port	The input signal is and inverted to match the input signal level.	0
3	Invert the output port signal	1: Logic inversion of output port 1 2: Logic inversion of output port 2	0
4	Output port 1 function definition	0: Alarm 1: Brake 2: Positioning completed	2
5	Output port 2 function definition	Refer to PA4.	0
6	Positioning completion range setting	When the position deviation is lower than this setting value, the positioning completion signal is output.	20
7	Encode Type	The number of pulses per encoder revolution.	1000

8	Position out of tolerance alarm set up	When the position deviation is higher than this set value, the driver outputs a position out-of-tolerance alarm, which is only used in closed loop.	4000
9	Pulse command smoothing filter	When the input pulse frequency is low, the setting is larger can make the motor run more smoothly.	500
10	Driver proportional gain	1, the larger the setting value, the higher the gain, the greater the stiffness; 2, the larger the load inertia, the larger the setting value.	80
11	Driver proportional integral	1, the larger the setting value, the faster the integration speed, and the greater the stiffness; 2, the larger the load inertia, the smaller the setting value.	15
12	Acceleration and deceleration	The setting value must be greater than $V^2 / 100000$.	0
13	Half or full current selection	If SW8=ON model ,the motor quiescent current 0: Full rated 1: half rated	1
14	Off enable delay time	After turning off the enable, delay the brake time to ensure that the motor is braked after excitation.	100
15	Motor power line phase modulation	After the motor power is phase-modulated, normal control can be achieved without changing the encoder phase sequence.	0

16	Reserve	Reserve	175
17	Enabled state set up	0:The enable signal is off, and the motor shaft is in free rotation. 1:The enable signal is On, and the motor shaft is in free rotation.	1
18	Reserve	Reserve	3
19	Reserve	Reserve	0
20	Alarm records	Most recent alarm record.	0
21	Alarm records	The penultimate alarm record.	0
22	Alarm records	The third to last alarm is recorded.	1
23	Alarm records	The fourth to last alarm was recorded.	0
24	Alarm records	The fifth to last alarm record.	1
25	Alarm records	The sixth to last alarm was recorded.	0
26	Alarm records	The seventh to last alarm was recorded.	0
27	Alarm records	The eighth to last alarm record.	0
28	Reserve	Reserve	0
29	Reserve	Reserve	0
30	software version	Used by the manufacturer.	108
31	motor code	42BG04-EC: 4 42BG06-EC: 3 57BG20-EC: 0 86BG80-EC: 6	6

Chapter 7 Debugging and operation

7.1 Special notes for debugging:

- 1) 2LS556A Stepping driver, power supply connected to DC: 18-48V.
- 2) 2LS860H Stepping driver, power supply connected to DC: 18-100V, or AC: 18-80V.
- 3) The order of motor power lines A+, A-, B+, B- cannot be reversed;
- 4) The above part is the connection method of driver. If it is connected incorrectly, it may cause burnout, motor failure, alarm, etc. Please check carefully whether the connection is incorrect or reversed

7.2 Trial operation

After the power line and the encoder are connected, select on the SW9 DIP switch, and the motor will automatically transmit forward and reverse at 20 PRM, which can be used to test whether the motor, driver and wiring are correct.

7.3 Handheld closed-loop display

The handheld closed-loop display is used to observe the working parameter information of the closed-loop stepper system and modify the parameters. For operation methods, please refer to Chapter 5 Operation and Display. The handheld closed-loop display is as shown below:



Closed-loop debugger



Debugger connecting line

Chapter 8: Alarm and solution

8.1 Alarm list and solution methods

LED state	Driver name	Cause	Solution
1 Red	Over current	Damage motor insulation	Replace the motor
		There is a short circuit in the motor winding	Replace the motor
		Acceleration and deceleration time is too short	Increase the acceleration and deceleration time of the host computer
		Current surge	Decrease the parameter PA0
		Driver protection action	Replace the driver
2 Red	Encode error	Encoder wire is connected reversely	Check and wire it correctly
		Encoder cable not connected	Check and connect correctly
		Motor power wire connected reversely	Check or the parameter PA15
3 Red	Position error	When the operation is executed and the motor does not rotate at any angle, an alarm will be issued immediately.	<ol style="list-style-type: none"> 1. Confirm whether the phase sequence of the motor power line is correct 2. Confirm whether the input pulse frequency is too high
		Alarm during rotation	Confirm the input pulse frequency and width

		Alarm during rotation	Set the parameter PA8 even larger
		Alarm during rotation	Increase the setting value of parameter PA10
		Alarm during rotation	Replacement of high torque stepping motor
5 Red	ADC hardware error	Driver protection action	Replace the driver

Appendix B1: Product after-sales service instructions

According to the correct use method, this product can have a long service life. If it is used improperly, or the environment is harsh beyond the allowable range. This product will malfunction. The standard warranty period of this product is 18 months. If it breaks down due to improper use or exceeds 18 months, it will be repaired for a fee. Please note the following regarding maintenance services:

- 1) The product label is an important certificate of maintenance, do not tear or damage at will. Otherwise, no warranty will be void;
- 2) The warranty period is 18 months from the date of purchase. If proof of purchase cannot be provided, the warranty period will be 19 months from the factory date on the product label;
- 3) If you need maintenance services, please contact each office or dealer;
- 4) During product maintenance and transportation, please package it well to prevent secondary damage.

The following situations are not covered by the warranty:

- * Due to the incorrect use, such as the wrong power supply, self-disassembly, modification, water ingress, oil ingress, etc

Damage caused by the factors;

- * Damage caused by natural disasters, such as lightning, earthquake, etc.

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