

CL86C V2.0

Universal closed-loop stepper driver

User Manual

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[Please read this manual carefully before use to avoid damaging the drive]



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Shenzhen Leisai Intelligent Control Co., Ltd.
Leadshine Technology Co., Ltd.

1. Product Introduction

1. Overview

CL86C V2.0This is a new closed-loop stepper driver developed by Leadshine based on more than ten years of experience in stepper and servo R&D. It uses the latest dedicated motor control chip and closed-loop control technology to completely overcome the problem of step loss in open-loop stepper motors. At the same time, it can significantly improve the high-speed performance of the motor, reduce the heat generation of the motor and reduce the vibration of the motor, thereby improving the processing speed and accuracy of the machine and reducing the energy consumption of the machine. In addition, when the motor is continuously overloaded, the driver will output an alarm signal, and it has the same reliability as the AC servo system. Of course, the motor installation size is the same as the traditional86The series of stepper motors are fully compatible, and the traditional stepper drive solution is very easy to upgrade, and the cost is only equivalent to that of the traditional AC servo system.50%.

2. Technical Features

- With trapezoidal wave test function;
- The current can be set arbitrarily (0--8Awithin the range);
- Driveable86Series closed-loop stepper motors;
- Optocoupler isolated differential signal input;
- Impulse response frequency up to500KHZ;
- Segment settings (200~51200Inside);
- With over-current, over-voltage and tracking error protection;

3. Application areas

Suitable for various small and medium-sized automation equipment and instruments, such as engraving machines, wire stripping machines, marking machines, cutting machines, laser typesetting machines, plotters, CNC machine tools, automatic assembly equipment, etc. It works particularly well in equipment where users expect low noise and high speed.

2. Electrical, mechanical and environmental indicators

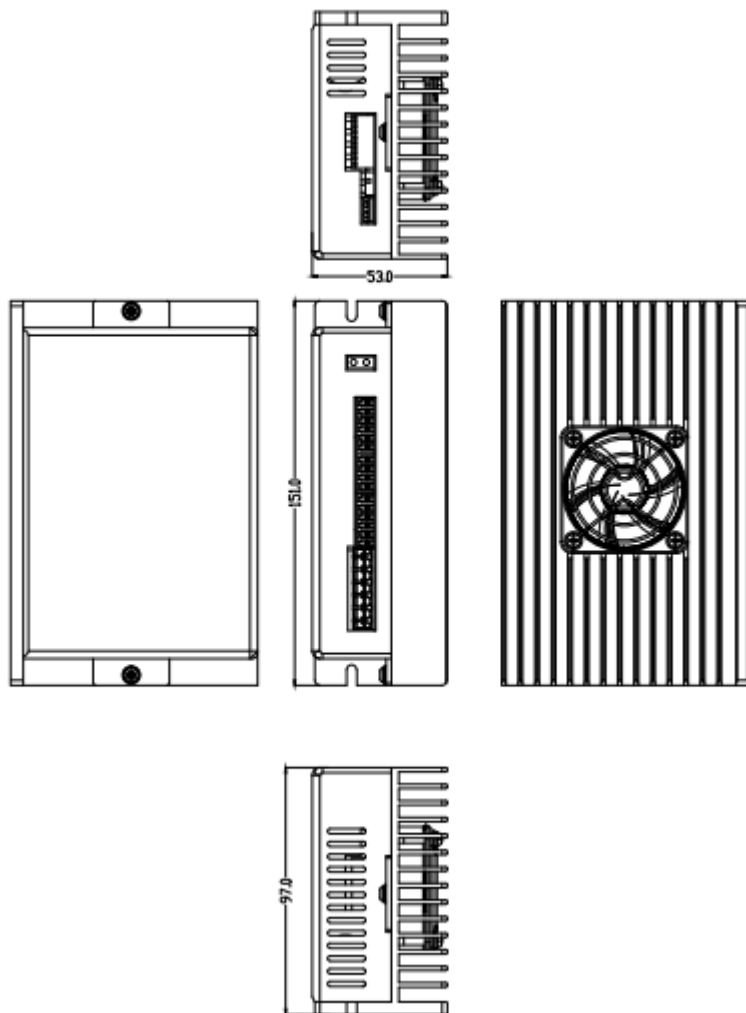
1. Electrical indicators

Ginseng number	CL86C V2.0			
	Minimum	Typical values	Maximum	unit
Continuous output current	4	-	8	A
Input power voltage	20	-	70	VAC
	30	-	90	VDC
Logic input current	7	10	20	mA
High-speed pulse input pulse frequency (Duty Cycle50%)	0	-	500	kHz
Signal input voltage range	5	-	twenty four	Vdc
Logic output load current	-	-	100	mA

2. Operating environment and parameters

Cooling method	Natural cooling or external radiator	
Usage Environment	Use occasions	Try to avoid dust, oil mist and corrosive gas
	temperature	0℃—50℃
	humidity	40-90%RH
	shock	10~55Hz/0.15mm
Storage temperature	- 20℃—65℃	
Heavy quantity	about600gram	

3. Mechanical Installation Dimensions (CL86C V2.0)



4. Enhance heat dissipation

(1) The reliable operating temperature of the driver is usually 60°C, the motor operating temperature is 80°C; (2) When installing the driver, please install it upright on its side to create strong air convection on the radiator surface;

If necessary, install a fan near the drive to force heat dissipation and ensure that the drive operates within a reliable operating temperature range.

3. Driver interface and wiring introduction

1. Interface definition

1) Motor and power input ports

Serial number	symbol	name	illustrate
1	A+	APhase motor winding +	
2	A-	APhase motor windings -	
3	B+	BPhase motor winding +	
4	B-	BPhase motor windings -	
5	AC	Input AC power	
6	AC	Input AC power	

2) Encoder signal input port

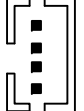
Serial number	symbol	name	illustrate
1	EB+	Motor encoderBPositive input	
2	EB-	Motor encoderBNegative input	
3	EA+	Motor encoderAPositive input	
4	EA-	Motor encoderANegative input	
5	VCC	Encoder power supply	+5V
6	EGND	Encoder power ground	0V

3) Control signal port

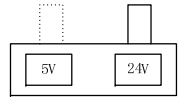
Serial number	symbol	name	illustrate
1	PUL+	Pulse positive input	Use the dial to select 5V or 24V Note: The signal is 24V. When the dial selects 5V, the input optocoupler will be damaged.
2	PUL-	Pulse negative input	
3	DIR+	Direction positive input	
4	DIR-	Direction negative input	
5	ENA+	Enable positive input	5-24V compatible Under the effective level, ENA+ catches 5V. ENA+ catches GND when the motor is in the power-off free state, the drive does not respond to pulses.
6	ENA-	Enable negative input	When this function is not needed, enable just leave the signal floating.
7	BRK+ (PEND+)	Brake signal positive output	Select in-position or brake function by dialing Yes, the default brake output. Maximum pull-up 30VDC, 100mA
8	BRK- (PEND-)	Brake signal negative output	
9	ALM+	Alarm signal positive output	Maximum pull-up 30VDC, 100mA
10	ALM-	Alarm signal negative output	

4) RS232 Communication port

RS232 The interface pin arrangement definition is shown in the figure below:

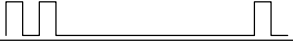
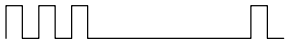
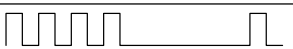
Graphic	Pins	name	Interface Description
	1	+5V	5V power supply positive terminal (50mA)
	2	TxD	RS232 transmitter
	3	GND	Power ground
	4	RxD	RS232 Receiver

5) Pulse and direction level selection dial

Graphic	Function	describe
	5V	The pulse and direction input level is 5V
	24V	The pulse direction input level is 24V (default)

5) Status Indicator

It is the power indicator light. When the driver is powered on, the power indicator light is green. When the driver is powered off, the power indicator light is off. It is a fault indicator light. When a fault occurs, the indicator light flashes for 5 seconds for a periodic flashing; when the fault is cleared by the user, the indicator light is normally off. The flashing frequency is 2Hz, and the brightness is 200ms. The number of flashes per second represents different fault information, and the specific relationship is shown in the following table:

Serial number	Number of flashes	Fault Flickering waveform	Fault Description
1	1		Overcurrent fault
2	2		Overvoltage fault
3	3		Op amp error
4	4		Axis lock error
5	5		EEPROM mistake
6	6		Auto-tuning error
7	7		Tracking error exceeds tolerance

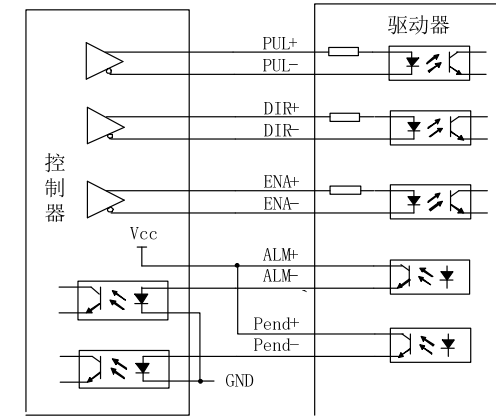
When a fault occurs in the drive, the drive will stop and prompt the corresponding fault code. The user needs to turn off the power and then turn it on again to clear the fault. When a fault occurs in the drive, the drive will queue and save the latest fault in the drive's EEPROM. Inside, the drive saves up to 10 of the latest historical failures. Users can PC The corresponding fault code can be read on the computer and text display.

Troubleshooting method:

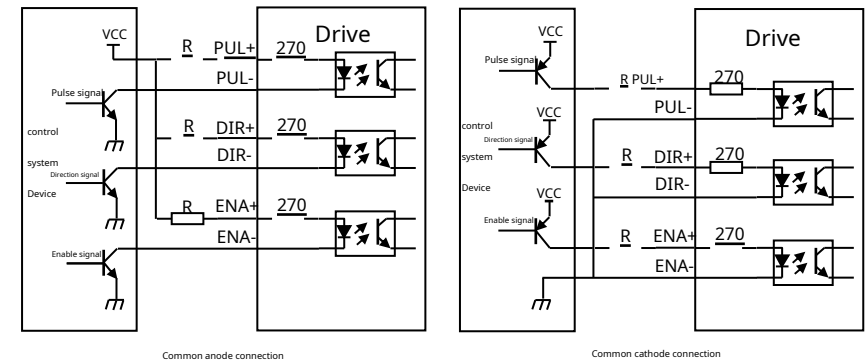
Phenomenon	question	Solution
greenledNot bright	No power	Check whether the drive power cable is connected correctly.
redledFlash1Second-rate	Overcurrent	Disconnect the motor winding wire from the drive and restart the drive. If there is no alarm, please check whether there is any abnormality in the motor and motor power line; Disconnect the motor winding wire from the drive and restart the drive. If the drive still alarms, the drive is damaged;
redledFlash2Second-rate	Overvoltage	Restart the drive; If the alarm persists after restarting the drive, check whether the power supply voltage is too high.
redledFlash3Second-rate	Op amp error	Restart the drive; If the alarm persists after restarting the drive, the drive hardware may be faulty.
redledFlash4Second-rate	Axis lock error	Check whether the motor power line is broken.
redledFlash5Second-rate	Storage Error	useRS232Connect the debug port to the host computer and restore the drive to factory settings; If the factory reset alarm persists, the drive hardware may be faulty.
redledFlash6Second-rate	Motor parameter auto-tuning error	Restart the drive; If the alarm still exists after restarting the drive, use the host computer to turn off the auto-tuning function.
redledFlash7Second-rate	Tracking error exceeds tolerance	Check whether the "Motor Resolution" in the parameter list is set correctly; Check the wiring between the motor and the driver to see if the phase sequence is wrong (motorA+VA-, B+VB-Must and driveA+VA-, B+VB-Strictly correspond); Check whether the encoder line is broken; The acceleration time is appropriately extended; Check if the motor is blocked.
Motor rotation direction is wrong	Motor direction setting error	DialSW5Status setting error
The motor does not rotate	No pulse signal	Check whether the pulse signal wiring is connected correctly.
The motor only rotates in one direction	Wrong pulse mode selection	examineSW7Is the pulse mode set correctly?
change	No directional signal	Check whether the direction signal line is connected correctly.

2. Control signal interface circuit diagram

CL86C V2.0The control signal input and output interface circuit diagram is shown in the figure.



Differential control signal interface wiring diagram



Single-ended control signal interface wiring diagram



Notice:CL86C V2.0The pulse and direction input levels are selected by dialing5Vor24V. when signal

Level is24VWhen the dial selects5VThe input optocoupler will be damaged.

In addition to the pulse and direction input ports, the enable and alarm clear signals are 5V~24V Compatible. For example:

the pulse and direction signal levels are 24V When the dial is turned to "24V" location, no external

resistance;

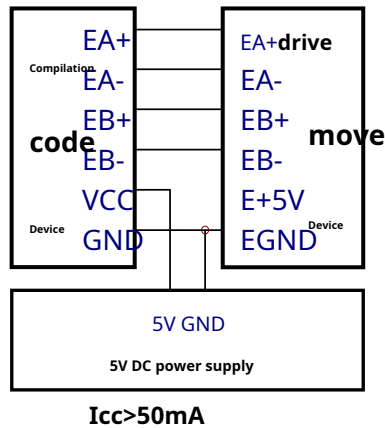
The pulse and direction signal levels are 5V When the dial is turned to "5V" No external resistor is required;

3. Control signal mode setting

Single or double pulse selection: The single pulse mode or double pulse mode can be set by dialing.

4. Encoder wiring

When the encoder requires current $I_{cc} < 50\text{mA}$, can be CL86C V2.0 Direct power supply, at this time should be EGND Connect to encoder ground. E+5V Connect encoder Vcc, encoder A+, A-, B+, B- The signal is connected to the driver in sequence EA+, EA-, EB+, EB- When the encoder requires current $I_{cc} > 50\text{mA}$ When 5V The specific wiring method for power supply is shown in the figure below. It is necessary to ensure that the encoder and driver share the same ground.



Wiring diagram when encoder is powered by external power supply

5. Serial port wiring

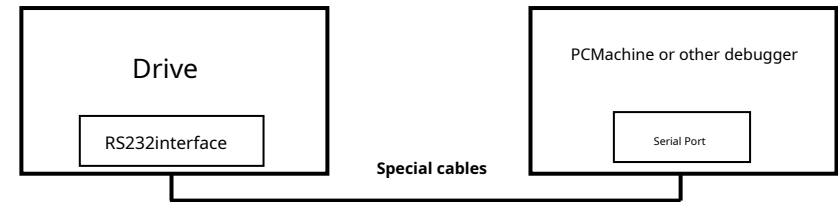


Figure 6 Parameter debugging wiring schematic



Notice:

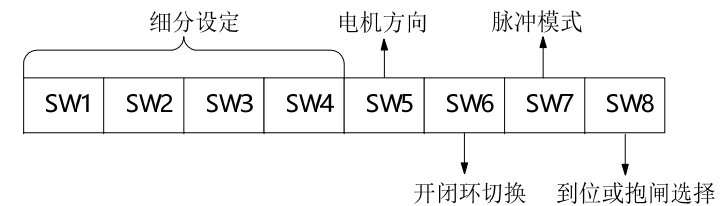
1. CL86C V2.0 and PC The cable connected to the machine must be a dedicated cable (provided randomly depending on the user's needs)

Please confirm before use to avoid damage.

2. CL86C V2.0 and PC When connecting the machine, you must ensure that the power supply is isolated power. If you are not sure, please use an isolation transformer to PC isolate to avoid damage PC machine.

4. DIP switch setting

CL86C V2.0 Driver uses 8 DIP switches to set the subdivision accuracy, motor direction, open/closed loop mode, single/double pulse selection, and in-position or brake function. The detailed description is as follows:



Subdivision settings

Steps/lap	SW1	SW2	SW3	SW4
Default(1600)	on	on	on	on
800	off	on	on	on
1600	on	off	on	on
3200	off	off	on	on
6400	on	on	off	on

12800	off	on	off	on
25600	on	off	off	on
51200	off	off	off	on
1000	on	on	on	off
2000	off	on	on	off
4000	on	off	on	off
5000	off	off	on	off
8000	on	on	off	off
10000	off	on	off	off
20000	on	off	off	off
40,000	off	off	off	off

Note: The default subdivision table is 1600. The subdivision number can be set in this position through the debugging software.

SW5-SW8 are factory defaulted to off. The factory default subdivision is 1600.

1) SW5: Motor direction. SW5 = off, CW; SW5 = on, CCW. 2) SW6: Open/closed loop switching. SW6 = off, closed loop mode; SW6 = on, open loop mode. 3) SW7: Pulse mode. SW7 = off, pulse + direction; SW7 = on, dual pulse. 4) SW8: In-position or brake function selection. SW8 = off, brake; SW8 = on, in-position.

5. Driver parameter settings

CL86C V2.0The drive parameters can be set byPCOr handheld debugger and driverRS232The driver has a set of default factory configuration parameters that are optimal for the motor. The user only needs to adjust the internal subdivision number of the driver according to the specific usage. The specific adjustable parameters and functions are shown in the table below:

	Parameter name	Parameter range	default value	unit	Remark
Pr0.00	Command pulse number/revolution	200~51200	1600	P/R	- -
Pr0.01	Open-loop and closed-loop mode selection	0~10	2	- -	0-Open loop mode,2-Closed-loop power Corner mode;

Pr0.03	Motor running direction	0~1	1	- -	0-positive direction,1-reverse direction;
Pr0.04	Motor inductance	0~10000	1499	uH	Default value when auto-tuning is off
Pr0.05	Maximum tracking error	0~65535	4000	- -	Encoder pulse number
Pr1.00	Position loopKp	0~100	45	- -	- -
Pr1.01	Speed ringKI	0~100	0	- -	- -
Pr1.02	Speed ringKp	0~100	15	- -	- -
Pr2.00	instructionFIRPulse filter time	0~1024	15	0.1ms	- -
Pr2.01	Open loop to closed loop speed threshold	0~100	18	0.1r/s	- -
Pr2.02	Closed loop switches to open loop speed threshold	0~200	12	0.1r/s	- -
Pr2.03	Delay from open loop to closed loop	0~32767	5	ms	- -
Pr2.04	Delay from closed loop to open loop	0~32767	250	ms	- -
Pr2.05	Closed loop switches to open loop feedback speed Threshold	0~80	50	0.1r/s	- -
Pr2.07	Position loop integral cut-in delay	0~65535	2000	0.05ms	Speed ringKINot for0Valid at
Pr4.00	PendOutput valid level	0~1	1	- -	0-High resistance1-Low resistance
Pr4.19	Brake release delay	0~1500	250	1ms	- -
Pr4.20	Brake closing delay	0~1500	250	1ms	- -
Pr4.21	Brake closing speed threshold	0~500	10	0.1r/s	- -
Pr4.22	Fault detection selection	0~65535	65535	- -	bit1-Overcurrent,bit2-Very bad location,bit3-Op amp error, bit5-EEPROMmistake,bit6- Motor parameter identification error

Pr4.23	Enable clear fault selection (After turning on, the default falling edge effect)	0~1	1	--	0-Disable clear enable fault,1-Turn on clear enable fault;
Pr4.24	Position error setting when in position	0~100	8	Pluses	Encoder pulse number
Pr4.25	Position error software elimination when in place Jitter Delay	0~100	3	ms	--
Pr4.26	Zero speed threshold	0~500	10	0.1r/s	--
Pr4.30	Enable Control	0~1	1	--	0-High level,1-Low level;
Pr4.31	Fault output status	0~1	1	--	0-High resistance,1-Low resistance;
Pr5.00	Motor peak current	0~80	80	100mA	--
Pr5.01	Closed loop holding current percentage	0~100	50	%	--
Pr5.02	Open loop holding current percentage	0~100	50	%	--
Pr5.03	Power-on lock axis current percentage	0~100	100	%	--
Pr5.04	Axis lock duration	0~1500	200	1ms	--
Pr5.07	Power-on start time	1~30	8	100ms	Reduce the time it takes to power on and enable the motor Vibration;
Pr5.09	Automatic operation after power on	0~1	0	--	0-Disable automatic operation,1-allow Automatic operation;
Pr5.10	Maximum parking time	100~10000	1000	ms	--
Pr5.13	Current loop power-on auto-tuning	0~1	1	--	0-No self-tuning,1-Self-tuning;
Pr5.19	Pulse edge	0~1	0	--	0-rising edge,1-Falling edge
Pr5.30	ZShaft torque compensation direction	0~2	0	--	0-No compensation,1-Forward compensation, 2:Reverse compensation
Pr5.31	ZShaft torque compensation percentage	0~65535	0	--	
Pr6.00	Trial run speed	0~5000	60	RPM	

Pr6.01	Trial run time interval	10~10000	100	ms	
Pr6.02	Number of trial run cycles	0~30000	1	--	
Pr6.03	Trial run acceleration and deceleration	10~10000	200	--	
Pr6.10	Manufacturer customized parameters2	0~10	0	--	--
Pr7.01	Encoder resolution	200~20000	4000	--	default1000Line encoder,4 Frequency doubling;
Pr7.02	Back EMF coefficient	0~300	100	100mV/rps	--
Pr7.03	Current loop proportional gainP	0~3000	1500	--	Can read, write and save
Pr7.04	Current loop integral gainI	0~1000	300	--	Can read, write and save
Pr7.09	Overpressure threshold	0~200	190	V	--
Pr2.13	Low-speed vibration Motion inhibition parameter number	VBSOpen	0~1	0	0-closure;1-Open
Pr2.16		VBSSpeed limit Degree value	0~500	200	0.01r/s
Pr2.17		VBSLower speed limit Degree value	0~500	49	0.01r/s
Pr1.07	Medium speed section vibration Motion inhibition parameter number	Position loop filter Wave frequency	0~3000	3000	Hz
Pr1.08		Speed ring filter Wave frequency	0~3000	300	Hz
Pr2.21		Acceleration system number	0~5000	1000	r/° 2/A
Pr1.03	Performance parameters	Torque feedforward percentage	0~10000	50	%
Pr2.08	Command signal Low-frequency filtering	Command pulse IIRfilter band Width	0~3000	320	Hz



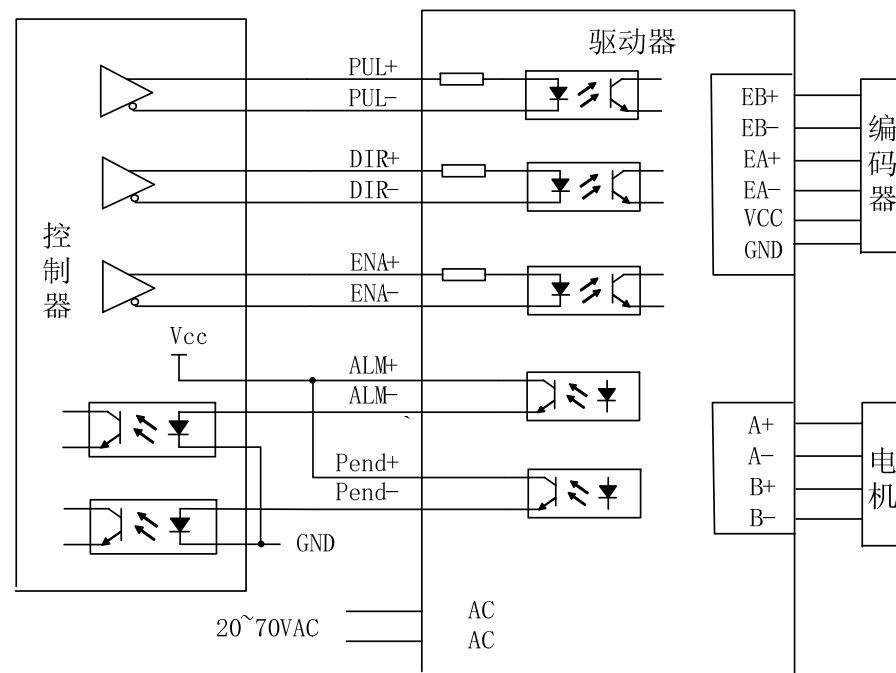
Notice:The factory default current loop, position loop and speed loop parameters of the driver are the best for the matching motor.

Parameters, customers generally do not need to modify, they only need to select the motor subdivision number and the percentage of open and closed loop current

according to the needs of system control.

6. Typical application wiring diagram

Depend on CL86C V2.0The typical wiring diagram is shown in the figure. The power supply is within the recommended range. The higher the voltage, the better the high-speed performance.



How to use a motor with a brake

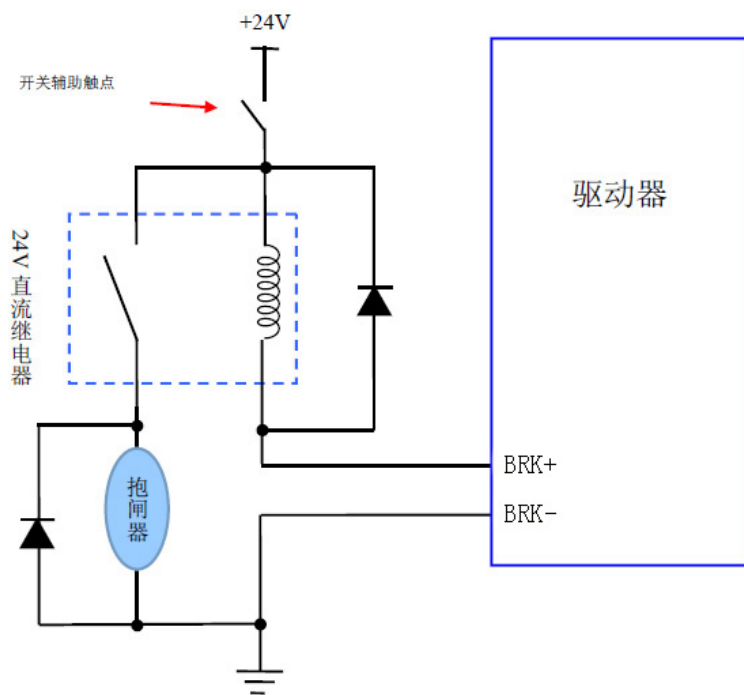
Notice:

1. Use the brake function, dial SW8 should be in OFF state.

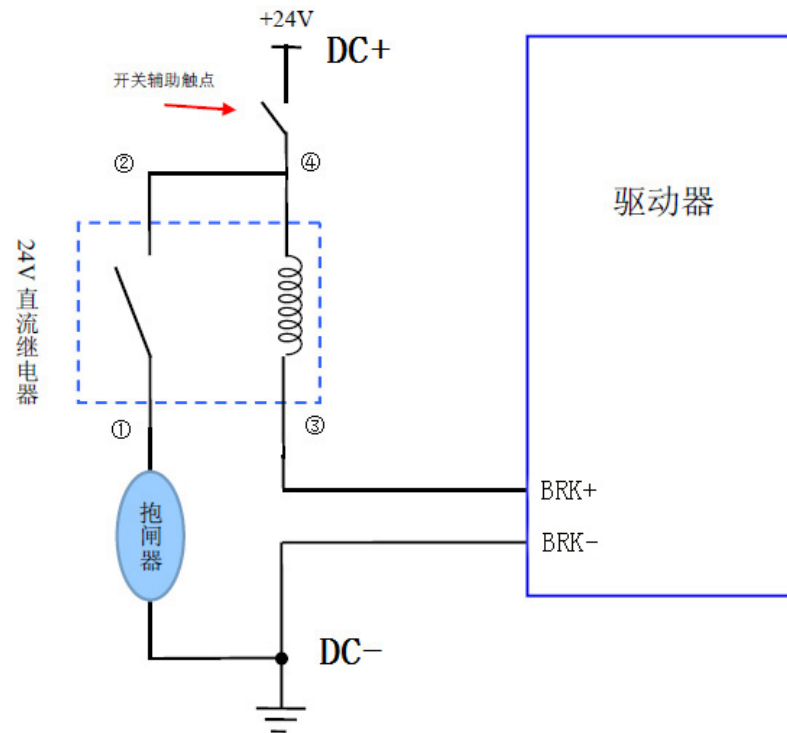
2. The motor brake must be controlled by the driver, otherwise unexpected situations such as motor runaway may occur. The

reference wiring of the relay is shown in the figure below. Since the brake coil and the relay coil are both inductive loads, it is recommended to add a diode. The diode model can be a common rectifier diode (such as: 1N4007). In addition, the polarity of the diode must not be reversed.

We recommend customers to use solid-state relays, which do not require diodes. Solid-state relays have the following advantages: fast response, no diodes required, and no sound when switching on and off. We recommend using "Kaiser" relays. KS1-10DD Model solid state relay.



Ordinary relay connected to brake motor



Solid-state relay connected to brake motor

1. Closed-loop stepper motor encoder lead colors and definitions

Pins	color	Signal	describe
1	yellow	EB+	encoderBChannel positive output
2	green	EB-	encoderBChannel negative output
3	black	EA+	encoderAChannel positive output
4	blue	EA-	encoderAChannel negative output
5	red	VCC	Encoder+5VPower input
6	White	GND	encoderGNDenter

2. Closed-loop stepper motor wire colors and definitions

Pins	color	Signal	describe
1	black	A+	APhase motor winding +
2	red	A-	APhase motor windings -
3	yellow	B+	BPhase motor winding +
4	blue	B-	BPhase motor windings -

Leadshine Product Warranty Terms

1One-year warranty

Leadshine provides a one-year warranty against defects in materials and workmanship for its products from the date of shipment. During the warranty period,

Leadshine provides free repair services for defective products.

2Not covered by warranty

- Improper wiring, such as reverse polarity of the power supply and plugging in or out while power is on
- Unauthorized modification of internal components
- Use beyond electrical and environmental requirements
- The ambient heat dissipation is too poor

3Maintenance process

If the product needs to be repaired, it will be handled according to the following process:

- (1) Before shipment, you need to call the customer service staff of Leadsun to obtain the return authorization number;
- (2) A written description must be enclosed with the goods, describing the fault phenomenon of the driver being returned for repair; the voltage, current, and operating

environment when the fault occurred; and the contact person's name, telephone number, and mailing address.

- (3) Send by prepaid postage to Makan South Road, Nanshan District, Shenzhen912nd Floor, Building 1, Leisai Intelligent Maintenance Department, Postal Code:

518052 Telephone:0755-86082091.

4Warranty Limitations

- The warranty coverage of Leadshine products is limited to the components and workmanship (i.e. consistency) of the products.
- Leadsun does not guarantee that its products are suitable for specific customer applications, as suitability depends on the technical requirements, operating conditions, and environment of the application. The company does not recommend the use of this product for clinical medical purposes.

5Maintenance Request

When returning for repair, please fill out the "Repair Report" truthfully (this form can be found atwww.leisai.comDownload orEmail:

tech@leisai.com)For the convenience of maintenance analysis. Mailing address: Macan South Road, Nanshan District, Shenzhen912nd Floor, Building 1,

Leisai Intelligent Maintenance Department, Postal Code:518052Telephone:0755-86082091.