

# Low Voltage DC Servo Drive

Manual 1.0-0927

## DSL806



# AKT

AKT AUTOMATION TECHNOLOGY

## Safety Precautions

Please read carefully before using in order to avoid the damage of the drive

### Open box to check

- ! If found any parts missing or found drives damaged, do not install them.
- ! The servo drive must be used with a matching servo motor.

### Installation

- ! Installed on a non-flammable metal frame to prevent intrusion of dust, corrosive gases, conductive objects, liquids and flammable materials, and maintain good heat dissipation conditions;
- ! When installing, be sure to tighten the mounting screws of the drive. The servo drive and servo motor should be protected from vibration and must not be subjected to impact.

### Wiring

- ! Please perform the wiring work by professional electrical engineers;
- ! Before wiring, please confirm that the input power is in the off state. Wiring and inspection must be performed after the power is cut off and the drive indicator is off to prevent electric shock;
- ! When plugging and unplugging the terminal of the drive, please make sure that the drive indicator is off;
- ! The grounding terminal PE must be reliably grounded through the left side of the drive;
- ! Please set the emergency stop circuit outside the controller;
- ! Do not connect the power input cable to the output U, V, W terminals;
- ! Tighten the output terminals with a suitable torque.

### Power on

⚠ Please confirm whether the main circuit input power supply and the rated working voltage of the drive are consistent; Do not test the drive for high voltage and insulation performance;

⚠ Do not connect the electromagnetic contactor or electromagnetic switch to the output circuit.

## **General**

DSL806 low voltage direct current servo drive is developed by high-performance processor, which provides users with a cost-effective servo control.

The solution is to ensure the stability and reliability of the system and to meet the most common application functions and performance.

Compared with stepping products, the servo drive has the advantage of low noise, low heating, high speed, constant torque output, no loss of step.

Compared with stepping servo products, this servo drive completely abandoned the inherent disadvantages of stepping products. Function, performance and reliability are better.

Compared with worldwide well known high-voltage servo, this drive has the similar performance with cheaper price and easy to use.

## **I. Basic Characteristics**

- Working voltage: 18V-60VDC;
- Output current: rated 8A, peak 24A;
- Rated speed: 3000RPM, supporting the highest 10000RPM;
- Compatible motor: 5W-600W low voltage servo motor, DC brushless motor with encoder or hollow cup motor.
- Control mode: external pulse, analog, RS232 communication control. For position, speed and torque mode;
- Parameter adjustment: RS232 communication, PC debugging software written, or

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handheld debugger.

- Abnormal protection: with under-voltage, over-voltage, overload, over-current, encoder abnormal functions. Alarm output function inside.

## II. Applicable fields

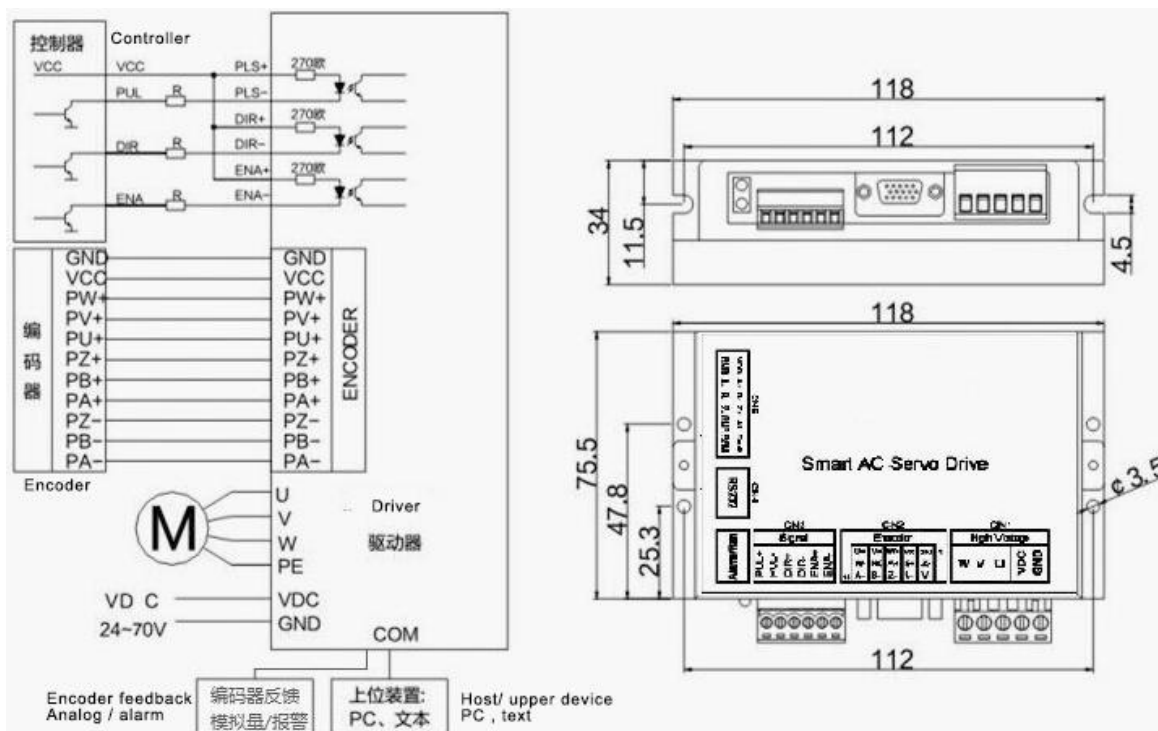
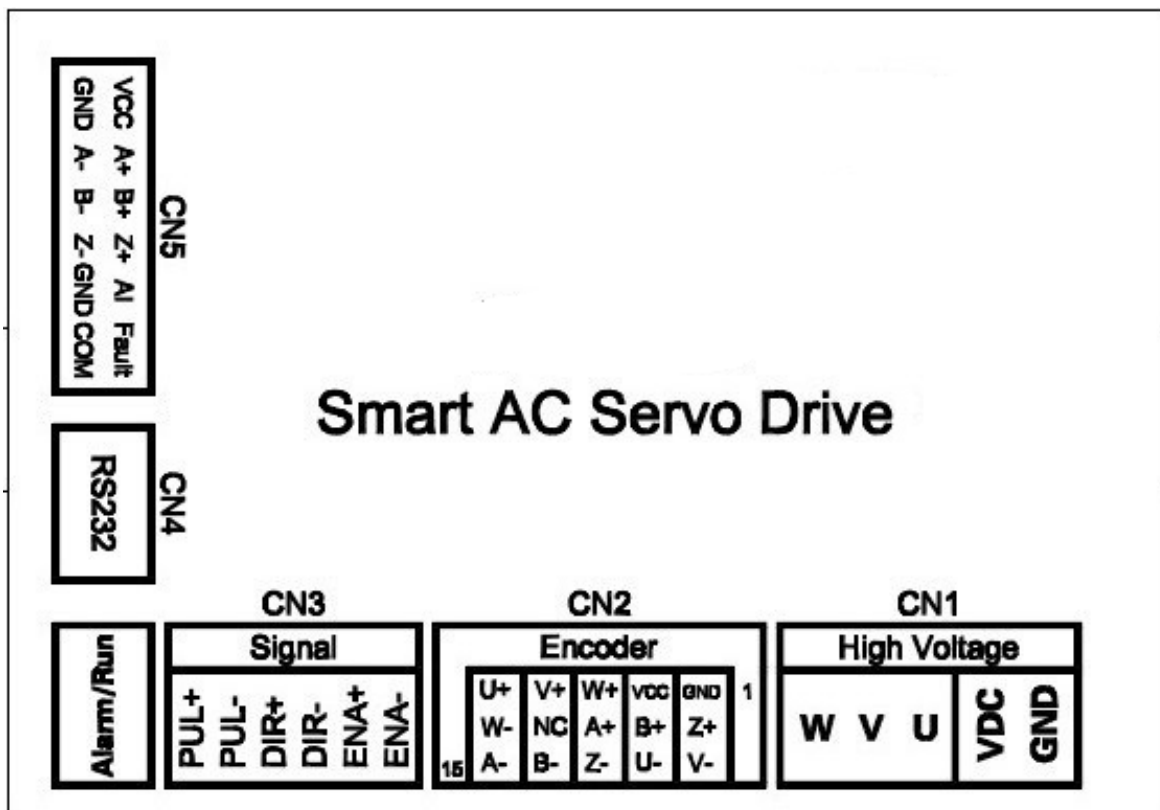
All kinds of electronic processing equipment, production line transmission equipment, medical equipment, instruments and meters, precision testing equipment, channel or gate control, AGV/RGV, Cartesian robot, servo length positioning, garage block control, and equipment, Feeding equipment, auxiliary motion equipment, grabbing and handling machinery, jet printers, photo machines, households and office automation devices.

## III. Technical indicators

Using FOC field oriented control technology and SVPWM space vector modulation algorithm. The parameters for the motor can be easily modified to fit various specifications of the motor, built-in electronic gear, graphical debugging and monitoring software. Customization is available according to the user's functional required. Simple control functions can be integrated.

- Repeat tracking error:  $\pm 1$ pulse;
- Speed control accuracy:  $\pm 1$ RPM;
- Receiving frequency range: 1MHZ;
- Maximum speed support: 10000RPM;
- Minimum speed support: 1RPM;
- Positioning accuracy support: 1/10000;
- Maximum no-load acceleration: 200RPM/ms;
- Suitable motor: 24V/36V/48V/60V low voltage servo motor, brushless DC motor with encoder or hollow Cup motor.

### IV. Interface identification



#### 4.1 Power /Motor Connector CN1

Item	Mark	Description	Note
1	VDC	Input Power +	DC 18V-60V
2	GND	Input Power -	
3	U	U phase	Must be connected to the motor as indicated
4	V	V phase	
5	W	W phase	

Figure 4-1

#### 4.2 Encoder Connector CN2

Item	Mark	Description	Item	Mark	Note
1	GND	Output Power Ground	7	B+	Encoder B phase positive input
2	VCC	Output Power +5V	8	A+	Encoder A phase positive input
3	W+	Encoder W phase positive input	13	Z-	Encoder Z phase negative input
4	V+	Encoder V phase positive input	14	B-	Encoder B phase negative input

5	U+	Encoder U phase positive input	15	A-	Encoder A phase negative input
6	Z+	Encoder Z phase positive input			

Figure 4-2

### 4.3 Control Connector CN3

Item	Mark	Description	Note
1	PUL+	Phase positive input	Pulse signal: pulse rising edge is effective. 4-5v at high level, 0-0.5v at low level, Pulse width should be greater than 1.6us, If you use 12V or 24V, you must connect 1.5-2.2K resistors in series.
2	PUL-	Phase negative input	
3	DIR+	Direction positive input	Direction signal: input between DIR+ and DIR- Reverse at high level, and vice versa. The direction signal should be established at least 5us before the pulse signal. 4-5V at high level and 0-0.5V at low level. If you use 12V or 24V, you must connect 1.5-2.2K resistors in series.
4	DIR-	Direction negative input	

5	ENA+	Enable positive input	<p>Enable signal: This signal is used to enable or disable the servo motor. When the high level between ENA+ and ENA-, the drive will cut off the motor power, leaving the motor in a free state and not responding to the pulse.</p> <p>Enable the motor when the low level between ENA+ and ENA-, If you use 12V or 24V, you must connect 1.5-2.2K resistors in series.</p>
6	ENA-	Enable negative input	

Figure 4-3

**4.4 Communication Interface CN4**

Terminals No.	Description	Note
2	RXD	Connect to Computer serial port TXD
5	TXD	Connect to Computer serial port RXD
6	+5V	Drive external +5V output, maximum 100mA
3	GND	Signal ground

Figure 4-4

**4.5 Expansion interface CN5**



Item	Mark	Description	Note
1	VCC	Output power +5V	Drive external +5V output, maximum 100mA
2	GND	Output power ground	
3	A+	Differential output A+	Encoder feedback output, consistent with the encoder input line number
4	A-	Differential output A-	
5	B+	Differential output B+	
6	B-	Differential output B-	
7	Z+	Differential output Z+	
8	Z-	Differential output Z-	
9	AI	Analog input	0-5V, 0-2.5 REV, 2.5-5V FWD
10	GND	Output power ground	
11	Fault	Open set alarm output	Above 5V, it needs to be connected in series with 2K resistors.
12	COM	Open set output common port	Connect controller common port

Figure 4-5

## V: Control Mode

### 5.1 Basic control

This drive provides three basic operating modes: position, speed and torque. Using a single control mode, all operating modes and instructions are listed below.

Control mode selection	Control source selection	Note
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Position control mode	External pulse input	The drive accepts a position command to control the motor to the target position. The position command is input by the terminal, and the signal type is pulse + direction
	PC digital input	Relative position: The drive enable start time is mechanical zero point, each time the PC digital value inputted, the motor rotates the target distance.  Absolute position: The drive enable start time is mechanical zero point, each time the PC digital value inputted, the motor is referenced to the mechanical zero point and is rotated to the target position.
	External analog input	When the external analog input is 0~+5V, the motor rotates in absolute position mode -16384~+16384 pulses
Speed control mode	PC digital input	Input range: -10000RPM~+10000RPM
	External analog input	When the external analog input is 0~+5V, the motor runs at -12000RPM~+12000RPM.
Torque control mode	PC digital input	The input range is -7500~+7500. The corresponding output current is 24A. When the input is positive value, it corresponds to the positive torque, the negative value corresponds to the reverse torque.
	External analog input	When the external analog input is 0~+5V, the corresponding digital torque range is: -16384~+16384. Drive internal limit to a maximum of 7500

Figure 5-1

## 5.2 Communication Control

In addition to the basic control methods described above, the drive also provides RS232 communication control. When selecting the communication control mode, whether you select any of the control modes, the control source must select the PC digital input, then transmit data according to the communication format and drive. The following are some specific instructions for communication control.

Function	Data address(A1)	Data up 8 bits (A2)	Data low 8 bits (A3)	Data checksum (A1+A2+A3)	Note
Motor start	0x00	0x00	0x01	0x01	Write motor enable
Motor stop	0x00	0x00	0x00	0x00	Write motor disable
Speed mode selection ---PC digital input	0x02	0x00	0xc4	0xc6	Control mode given command source selection
Position mode selection -- External pulse input	0x02	0x00	0xc0	0xc2	Control mode given command source selection
Position mode selection --PC digital input	0x02	0x00	0xd0	0xd2	Control mode given command source selection
Speed proportional gain	0x40			Take low 8 bits (A1+A2+A3)	It is recommended to make the changes based on the factory default parameters according to the actual situation.
Speed integral gain	0x41			Take low 8 bits (A1+A2+A3)	

Speed differential gain	0x42			Take low 8 bits (A1+A2+A3)	
Position proportional gain	0x1a			Take low 8 bits (A1+A2+A3)	
Position differential gain	0x1b			Take low 8 bits (A1+A2+A3)	
Position feed forward gain	0x1c			Take low 8 bits (A1+A2+A3)	
Speed mode (available when PC digital input)-- acceleration and deceleration speed setting	0x0a	acceleration	deceleration	Take low 8 bits (A1+A2+A3)	Actual speed=( acceleration and deceleration speed/250)*6000
Speed mode --PC digital input -- speed given	0x06			Take low 8 bits (A1+A2+A3)	Set digital 16384 corresponding to the actual speed 6000RPM
Position debugging mode The position is given a up 16 bit --PC-- position	0x50			Take low 8 bits (A1+A2+A3)	Up 16 bits of the 32-bit data input

Position debugging mode The position is given a low 16 bit --PC-- position	0x05			Take low 8 bits (A1+A2+A3)	Low 16 bits of 32-bit data input
Find Z signal, mechanical origin	0x53	0x00	0x00	0x53	
Absolute position/relative position switch control in position mode	0x52	0x00	0x00	0x52	Absolute position
	0x52	0x00	0x01	0x53	Relative position
Speed limit value in position mode (The actual speed at the given position under the position command)	0x1d			Take low 8 bits (A1+A2+A3)	Set digital 16384 corresponding to the actual speed 6000RPM

Speed limit value in position mode: In the position mode PC input acceleration/deceleration setting parameter, "Acceleration/Deceleration" set to maximum will be the leading role, otherwise it will affect the final speed limit value. For example, in the host computer debugging software, input "Acceleration: 255 / Deceleration: 255" in the position mode PC input acceleration/deceleration setting, then submit the input. After the input is completed, the final speed value for the limit is the value assigned to the address of register 0x1d.

Read monitoring parameters	Sending 0x80 0x00 0x80 directly, drive will return the corresponding monitoring information				
Failure state	0x80	0x00	Status_word	Take low 8 bits (A1+A2+A3)	Status_word is customized parameters
	<p>The fault information corresponding to each bit of Status_word is as follows (highly effective) :</p> <p>Status_ov_i = Status_word^1; over current</p> <p>Status_ov_u = Status_word^2; over voltage</p> <p>Status_err_enc = Status_word^3; encoder error</p> <p>Status_ov_q = Status_word^5; under voltage</p> <p>Status_ov_load = Status_word^6; over load</p>				
Busbar voltage	0xe1			Take low 8 bit (A1+A2+A3)	(Deviation 2V)
Output current	0xe2			Take low 8 bit (A1+A2+A3)	The actual current will reduced by 100 times
Output speed	0xe4			Take low 8 bit (A1+A2+A3)	Returned digital 16384 corresponding to the actual speed 6000RPM
Position give up 16 bits	0xe6			Take low 8 bit (A1+A2+A3)	If the position is given as 32-bit data, the actual value is recombined according to the up 16 bits and the low 16 bits.
Position give low 16 bits	0xe7			Take low 8 bit (A1+A2+A3)	
Position feedback up 16 bits	0xe8			Take low 8 bit (A1+A2+A3)	If the position feedback is 32-bit data, the actual value is recombined according to the up 16 bits and the low 16 bits.
Position feedback low 16 bits	0xe9			Take low 8 bit (A1+A2+A3)	

Figure 5-2

**Detailed description of the communication control instructions:**

(1) The data command format received by the controller is: address + data up 8 bits + data low 8 bits + data checksum

(take the low 8 bits value of the summary of first three data) If the host computer sends correctly in this format, the drive will immediately return the two addresses of the command to the host computer, which indicates that the drive has successfully received the command. For example: the host computer sends: 0x09 0x32 0x32 0x6d, the drive returns to the host: 0x09 0x09, at this point, it means the drive has been finished receiving. (Note: There must be more than 1ms delay between each data instruction, otherwise the data is prone to error).

(2) When the position debug mode is selected and the host machine sends the control command through the serial port, the setting sequence is: set the drive to position debugging mode (send 0x02 0x00 0xd0 0xd2) → set the speed limit value in position mode → motor start (0x00 0x00 0x01 0x01) → position given up 16 bits → The position is given by the low 16 bits. If the position debug mode has been determined and the motor has been started, it will not need to be sent repeatedly when it is sent next time.

(3) If all parameters have been set when the drive is debugging parameters, such as acceleration and deceleration, control mode, speed limit (the factory has set a suitable value). At this time, it is only necessary to set the motor to start, and then send the position. Step: Motor start (0x00 0x00 0x01 0x01) → position is given up 16 bits → position is given low 16 bits.

(4) The input length given by the position is a 32-bit data, which must be decomposed to a up 16 bits and a low 16 bits when transmitted.

Moreover, the 16-bit data is also need to be decomposed into up 8 bits and low 8 bits. The data splitting will be done by the data format generator in the file. The user only needs to input the data to be sent, it can be automatically split into the format used for communication.

(5) Use of the data format generator. For example, set the acceleration and deceleration to 50 and place it in the 16-bit data generation box: Address: 09 Acceleration input 50, Deceleration input 50 then display. At this time, the data format is generated 0x09 0x32 0x32 0x6d and then the host computer can send this command to set the acceleration and deceleration in the position debugging mode.

(6) Set the 32-bit position reference command. The 32-bit data corresponds to the number of pulses. For example, when the numerator value and denominator value are both set to 1 in the electronic gear, and the encoder lines is 2500, the number of pulses required per one revolution of the motor is 10000.

When the position reference is written as 10000, the drive starts at the mechanical zero point and the motor rotates once. When 100000 is written, the motor rotates 10 revolutions. If 0 is written again, the motor rotates to the position just when starting.

(7) Regarding the position mode, whether the transmission position command is an absolute position or a relative position. When the send command is 0X52 0X00 0X00 0X52, the send position is the absolute position. When the send command is 0X52 0X00 0X01 0X53, the position is the relative position.

(8) In position mode, the maximum stable speed limit of the motor output is determined by VLimit (provided that the acceleration/deceleration in position mode has been set to a maximum value of 255). The send command is (0x1d set value up 8 bits set value low 8 bit checksum) where the set value corresponds to the limit speed = (requires set limit speed / 6000) \* 16384 , the obtained data is rounded off. For example, if the motor requires 3000 RPM, the set value is 8192. If 1RPM is required, the set value is 3 (rounded).

(9) About the problem of finding the origin of the mechanical Z signal, after the parameter configuration is completed, after sending the origin operation (0x53 0x00 0x00 0x53). And after sending the motor start (0x00 0x00 0x01 0x01), the motor will rotate slowly until the Z signal origin is found, and then it will not move.

(10) About monitoring commands. Send the monitoring command is (0x80 0x00 0x80), after receiving the command, the drive returns the following data: fault information, busbar voltage, output current (which has been amplified by 100 times, the actual display current needs to be divided by 100. For example, the received value is 123. It means the current is 1.23A), output speed (output speed is digital, the conversion relationship is: actual speed = (digital speed / 16384) \* 6000), the current position given value up 16 bit, the current position given value low 16 bits, the current position feedback value up 16 bits, and the current position feedback value low 16 bits. Please refer to the above table for the corresponding relationship. The format returned is four data per frame.

**The format is: Address Data up 8 bits Data low 8 bits Checksum (takes the low 8 bits).**

## VI. The use of the host computer debugging software

The drive provides easy-to-use debugging software, all parameters can be written to the inside of the drive through the debug software, while monitoring the status of the drive. The following details will show the use of the software.

### 6.1 Serial Port Operation

After opening the software, there is a serial port setting in the file drop-down list. Select the serial port number of the PC, and the other ones are as default like the picture below. After setting, apply the settings and open the serial port. The first time the software is opened, the parameters of the drive are read out by default. If the user needs to load the parameters that have been stored and modified, the stored parameter file can be opened from the software.





Figure 6-1

## 6.2 Basic parameter settings

Pulse direction reference selection (this option is only valid when the position mode external pulse input):

When forward rotation is selected, the input signal is:

- pulse + direction (high level), at this time the drive is rotating forward.
- pulse + direction (low level), at this time the the drive is rotating reversed.

When reverse is selected, the input signal is:

- pulse + direction (low level), at this time the drive is rotating forward.
- pulse + direction (high level), at this time the drive is rotating reversed.

Overload factor: The setting parameter range is 0~300%, the default is 200%. This setting is the maximum current allowed to output of the drive. If exceeded the set overload time, it will stop and alarm.

Analog dead zone: The approved range of mechanical zero, zero speed, and zero torque when using analog control. For example, when set to 50, when the digital quantity sampled by AD is less than 50, the drive forced sample value will be 0.

Electronic gear:  $\text{actual position command} = \text{input pulse command} * (\text{numerator of the electronic gear ratio} / \text{denominator of the electronic gear ratio})$ .

The specific settings are shown in Figure 6-2-1, 6-2-2.

**过载设置**  
(30~300)

过载系数:  %

(100~32767)

过载时间:  mS

**模拟量设置**  
(0~1024)

模拟量死区:

**\*需重新上电方有效**

Figure 6-2-1

**伺服驱动运行参数设置**  
**\*写入即时生效**

**位置环 (0~32767)**

比例增益Kp:

微分增益Kd:

前馈增益Kf:

**速度环 (0~32767)**

比例增益Kp:

积分增益Ki:

微分增益Kd:

速度限制:  rpm  
**(1~8000) 位置模式下有效**

**电流环 (0~32767)**

比例增益Kp:

积分增益Ki:

Figure 6-2-2

### 6.3 Drive PI Parameter Settings

The parameters that the drive is now open are position loop PDF, speed loop PID. There is a great relationship between parameter adjustment and response. The actual working environment is subject to adjustment.

Under the default parameter setting, if the motor vibrates, reduce the value of the speed loop KpV and increase the value of the speed loop KI appropriately after vibrating situation. If the speed loop KpV is reduced, however the motor is still vibrated, and then reduce the KpP value of the position loop.

In the case of none vibration, slowly increase the KpV value of the speed loop while

reducing the KiV value of the speed loop. Under the condition of rigid demand, appropriately increasing the value of the speed loop KdV can reduce the vibration of the motor, and increasing the excessive KdV will cause high-frequency noise, please pay attention, if the above cannot reduce the vibration, properly reduce the Kpl value of the current loop. The PI parameter of the current loop is now encrypted. For modification, please contact the factory.

控制来源选择

模式选择:

外部脉冲输入模式正反转方向给定选择

正转       反转

电子齿轮 (0~65536) -- 位置模式有效

分子:

分母:  \*需重新上电方有效

位置模式PC输入加减速设定 (1~255)	速度模式PC输入加减速设定 (1~255)
加速度 <input type="text" value="1"/>	加速度 <input type="text" value="1"/>
减速度 <input type="text" value="1"/>	减速度 <input type="text" value="1"/>

Figure 6-3

#### 6.4 Mode Selection and PC Reference

The drive provides 7 control source options, users can select different control methods according to different needs. In the corresponding mode of PC digital input, the text area of the three modes is valid, but the acceleration and deceleration settings are valid only in the PC input mode.

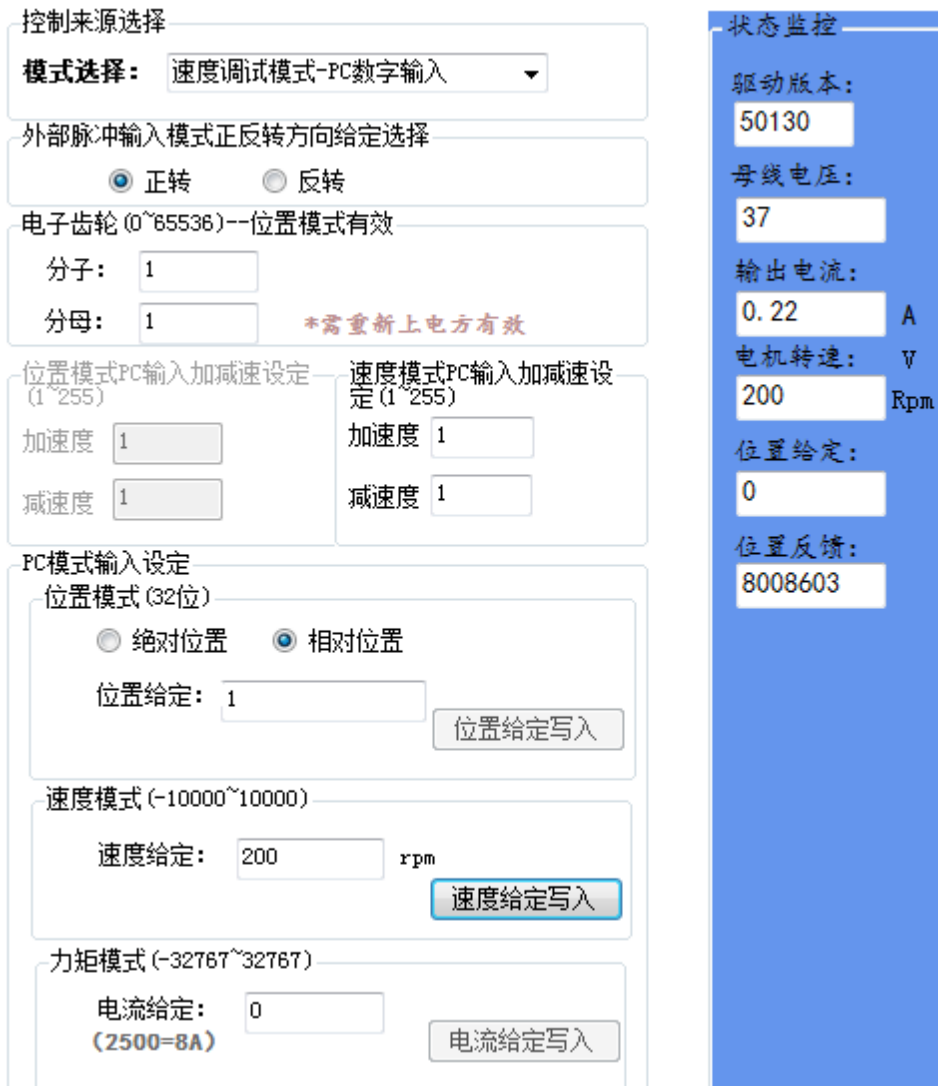


Figure 6-4 / Figure 6-5

## 6.5 Status Monitoring

The host computer software provides real-time monitoring of the bus voltage, output current, motor speed, position reference, and position feedback information. The specific status monitoring is shown in Figure 6-5.

## 6.6 Simple Oscilloscope

The debugging software provides periodic monitoring of U-phase digital current, V-phase digital current, current reference, current feedback, speed reference, speed feedback, position reference, and position feedback signal. At the same time, the current sample waveform or the load history waveform can be recorded

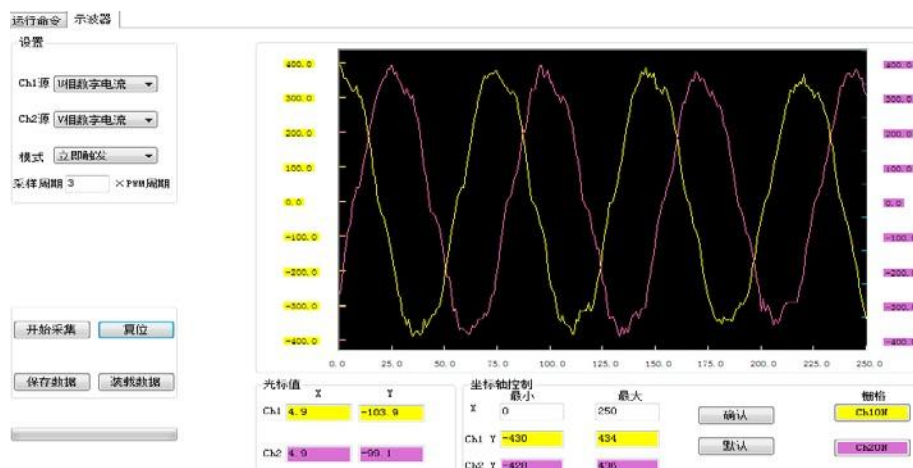


Figure 6-6

### 6.7 Setting of motor parameters

The motor parameters are fixed when the drive leaves the factory with the motor, and the user can not change them at will, otherwise the drive and equipment will be damaged.

Note: if you want to replace the motor, please confirm the parameters with the motor provider and drive manufacturer and write the relevant setting again. Motor related parameters are non-modifiable parameters after the drive is energized. After modification, it will be valid only after re-energized or the drive system reset.

Number of encoder lines: the resolution of the encoder corresponding to the motor nameplate;

Angle offset: the Angle offset value of the encoder Z signal corresponding to the motor U opposite to the electromotive force negative over zero;

Number of pole pairs: motor pole pairs.

带权限参数设置

电机参数设置

编码器线数: 1250  
(0~3000)

角度偏移: 330  
(0~360°)

极对数: 4  
(0~255)

电机额定电流: 8000 mA

伺服使能设置

上电使能  
 ON  OFF

(100~32767)  
允许位置偏差范围: 10000 Count

(300~32767)  
允许位置偏差时间: 10000 mS

\*需重新上电方有效

输入密码

Figure 6-7 Password: 8888

## VII. Typical wiring of control signals

Figure 7-1 Wiring diagram of differential mode control signal interface

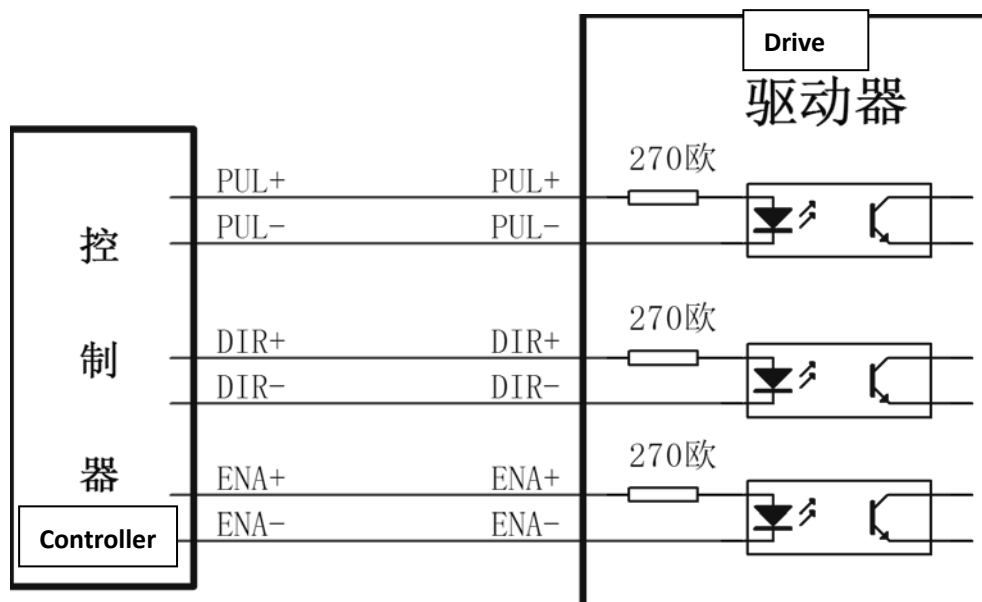
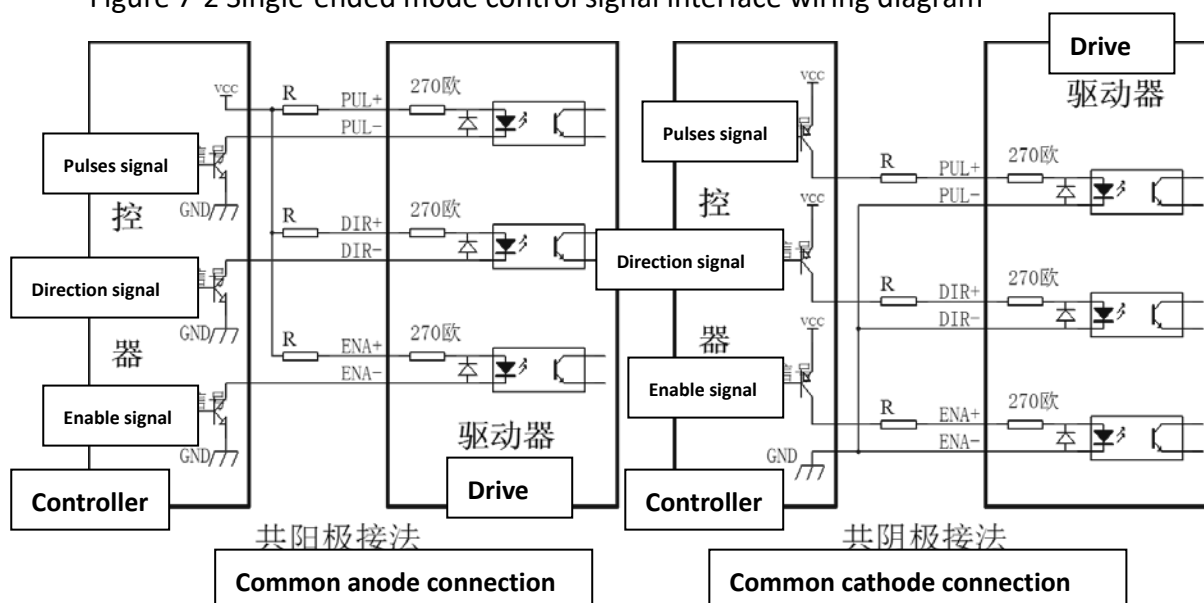


Figure 7-2 Single-ended mode control signal interface wiring diagram



**Special reminder:** When the control signal is 12V or 24V, an external current limiting resistor is required. 12V is connected to 1K resistor and 24V is connected to 2K resistor. Otherwise, long-term operation will damage the drive's opto-isolated device.