HK SERIES
AC SERVO DRIVER
MANUAL BOOK

Declaration

The specifications and dimensions are subject to change without prior notice due to improvement or other reasons

Safety Caution

Before storage ,installation . distribution. operation . inspection or maintenance of the product, users must be familiar with and comply with the following important matters to ensure safe use of the product

Dangerous	Mis-operations may result in dangerous or personal injury
Improper	Operations may cause danger, personal injury. or device damage
Prohibited	Prohibited strictly. otherwise the device may be damaged or unavailable

1. APPLICATION

Dangerous

- Do not expose the product to water , corrosive gas, or flammable gas, otherwise it may cause electric shock or fire.
- Do not use the product in places with direct sunlight , dust, salt and metal power
- Do not use the product in places where water ,oil and medicine are dripping

2. Wiring

Dangerous

- Connect the ground terminal correctly. Poor grounding may cause electric shock or fire
- Do not connect the 220V driver power to the 380V power , otherwise the device may be damaged , electric shock or fire.
- Do not connect the output terminals of the U,V and W motors to the three phase power supply.otherwise , casualties or fire may occur
- Tighten the power supply and motor output terminals; otherwise, may occur fire
- Choose the wiring according to the wiring material , otherwise may occur fire

3. Operation

Attention

- When the mechanical equipment starts to operate ,the appropriate parameters must be set .If the value is not set properly mechanical equipment may lose control or break down
- Do not use the product in places with direct sunlight , dust. salt and metal powder.
- Do not expose the product to water, corrosive gas or flammable gas.
- Do not use the product in places where water , oil and medicine are dripping

4. Run

Prohibited

- When the motor is running , don't touch may rotating parts,otherwise it will cause casualties.
- Don't touch the driver or motor when the device is running. otherwise electric shock or bums may occur
- Don't move the cable when device is running ; otherwise personal injury or device damage may occur

5. Maintenance and inspection

Prohibited

- Don't touch the inside of the driver and its motor , otherwise it may cause electric shock
- Don't disassemble the drive panel when the power is on; otherwise electric shock may occur
- Don't touch the wiring terminals within 5 minutes after the power supply is off . otherwise , residual high voltage may cause electric shock
- Don't change the wiring when the power is on , otherwise it may cause electric shock
- Don't remove servo motor , otherwise will cause electric shock

6. Usage range

Attention

The products mentioned in this manual are for general industrial use. Don't use them on devices that may directly endanger human safety. such as nuclear power devices, aerospace equipment, life support equipment and various safety equipment . if need to use the above, please contact us

Catalogue

Chapter 1 Product inspection and installation

1. 1 Product Inspection

This product has done complete function test before sending Please check the following items carefully after receiving in order to prevent the product from being abnormal due to negligence during delivery .

- Check whether the servo driver and motor are the same as the ordered model
- Check the appearance of servo driver and motor for damage and scratches .
- Check whether the servo driver and servo motor have any other components loose . whether there are loose screws. whether the screws are not locked or fall off
- Check whether the rotor shaft of the servo motor can be rotated manually. The motor with brake cant rotate directly

If any of the above items are out of order or abnormal, please contact the dealer immediately

1. 2 Installation and Cable connection

- Installation in electrical control cabinet. The heating of the electrical control cabinet and the heat dissipation conditions in the control cabinet , the temperature around the servo driver will continue to rise ,so the long-term safe working temperature is below 40℃ in consideration of the cooling of the driver and the configuration in the control cabinet

- There is heating equipment near the servo driver. Under high temperature conditions, the service life of servo driver will be significantly shortened and faults will occur. Therefore, ensure that the ambient temperature of the servo driver is below 40℃ . under the conditions of thermal convection and thermal radiation. Ground the grounding terminals correctly. Poor grounding may cause electric shock or fire .

- There is vibration equipment near the servo driver

  Adopt various anti-shock measures to ensure that the servo driver is not affected by vibration . and ensure that it is below 0.5G (4.9m/S²)

- Corrosive gases , moisture, metal dust, water , and processing liquids may cause servo drivers to fail in harsh environment. Therefore you must ensure the working environment of the driver when installing .

- Interference equipment near the servo driver

- When there are interference devices near the servo driver , the power cord and control line of the servo driver will have a great interference effect, and the driver will act incorrectly. Noise filter and other interference measures can be added to ensure the normal work of the driver. Pay attention to the leakage current will increase after adding noise filter. In order to avoid this problem, isolation transformer can be used. Pay special attention to the control signals of the driver are easily interfered, and reasonable wiring and shielding measure should be taken.

1. 3 Installation Method

- The installation direction

The normal installation directly of the servo driver is vertical

- Fixed installation

During installation, tighten the two M5 fixing screws at the rear of the servo driver

- The installation space

Please refer to Figure 1.1 for the installation interval between servo drivers and other devices. Note that the surface of the figure is the minimum size .In order to ensure the service performance and life of the driver, please leave enough installation space as far as possible

- Heat dissipation

The servo driver adopts natural cooling mode. A cooling fan must be installed in the electrical cabinet to ensure that there is vertical wind to dissipate the heat for the servo driver radiator .

- Installation Precautions

when installing the electrical control cabinet, prevent dust or iron filing from entering the servo driver

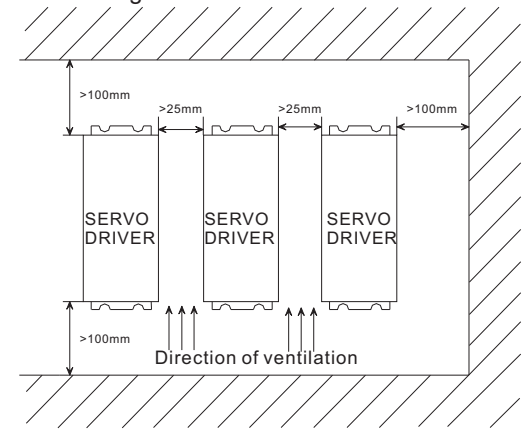


Figure 1.1 Servo driver installation diagram

1. 4 Servo motor installation

1. 4. 1 Installation Environment Conditions

- Working environment temperature: 0~40℃; humidity :below 80% (no condensation)
- Storage environment temperature:-40~50℃; storage humity: below 80%(no condensation)
- Vibration: below 0.5G
- A place with good ventilation and less moisture and dust
- No corrosive , ignition gas, oil and gas, cutting fluid , cutting powder , iron powder and other environment .
- Free from water vapor and direct sunlight

1. 4. 2 Installation Method

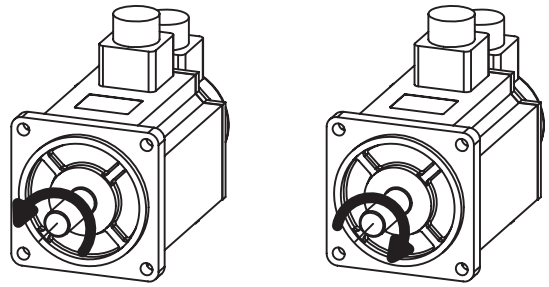
- Horizontal installation

  Horizontal installation : In order to avoid water, oil and other liquids flowing into the motor content from the outlet end of the motor , plz place the cable outlet below .

- Vertical installation : if the motor shaft is mounted upward and the reducer is attached ,should be paid attention to prevent the oil stains of the reducer from seeping into the motor through the motor shaft.
- The extension amount of the motor shaft should be sufficient . if the extension amount is insufficient , it will easily cause vibration when the motor is running
- Do not knock the motor with a hammer when installing or removing the motor .Otherwise the motor shaft and encoder may be damaged

1. 5 Definition of motor rotation direction

- The definition of motor rotation direction described in this manual: facing the extension of the motor axis, the clockwise rotation of the rotation of the rotating axis is positive (CCW), and the clockwise rotation of the rotating axis is reverse rotation (CW)



Forward rotation （CCW）　　Reversal （CW）

Figure 1. 2 definition of motor rotation direction

Chapter 2 Wiring

2. 1 Wiring specifications

- Cable diameter ：PE、R、S、T、U、V、W terminal cable diameter ≥1.5mm² (AWG14-16) ，r、t≥0.75mm²(AWG18)。
- Use pre-cord end terminals and ensure that the terminals are securel connected.
- It is recommended to use a three-phase isolation transformer power supply .

2. 2 Cabling Method

- For the input/output signal cables and encoder signal cables, use the recommended cables or similar shielded cables . The wiring length should be less than 3 meters for the input/output signal cables and less than 20 meters for the encoder signal cables. Connection according to the shortest distance , the shorter and the better , the main circuit wiring and signal line should be separated
- The grounding wire should be thick and strong , As a point grounding, the grounding terminal of the servo motor must be connected with grounding terminal PE of the servo driver
- In order to prevent interference from causing mis-operation , it is recommended to install a noise filter and pay attention to it
  1) The noise filter , servo driver and upper controller are installed as close as possible
  2) A surge suppressor must be installed in the coils of relays , electromagnetic contactor, breaks etc .
  3) The main circuit and signal line should not pass in the same pipe and should not be tied together
- In the vicinity of strong interference source (such as welding machine electric spark machine , etc), the use of isolation transformer on the input power supply can prevent interference caused by misoperation
- Install a fusible circuit breaker (NFB)to cut off the external power in case of driver failure
- Connect the cable shielding layer correctly

2. 3 Precautions

- The terminals of driver U, V , W must correspond to motor terminals U, V and W one by one . Note that the motor cant be reversed by exchanging three-phase terminals , which is completely different from asynchronous motors.
- Because the servo motor flows through high frequency switching current , the leakage current is relatively large . The motor ground terminal must be connected to the servo driver ground terminal PE and well grounded .
- Because the servo driver has large capacity of electrolytic capacitors there is still a high voltage in the internal circuit even if the power is cut off . After the power is cut off , wait at least 5 minutes before dis-connecting the driver and motor .
- After the power is switched on , the operator should keep a certain distance from the driver and motor
- If don't use any more , please cut off the power supply

2. 4 Standard Connection

2. 4. 1 Position control

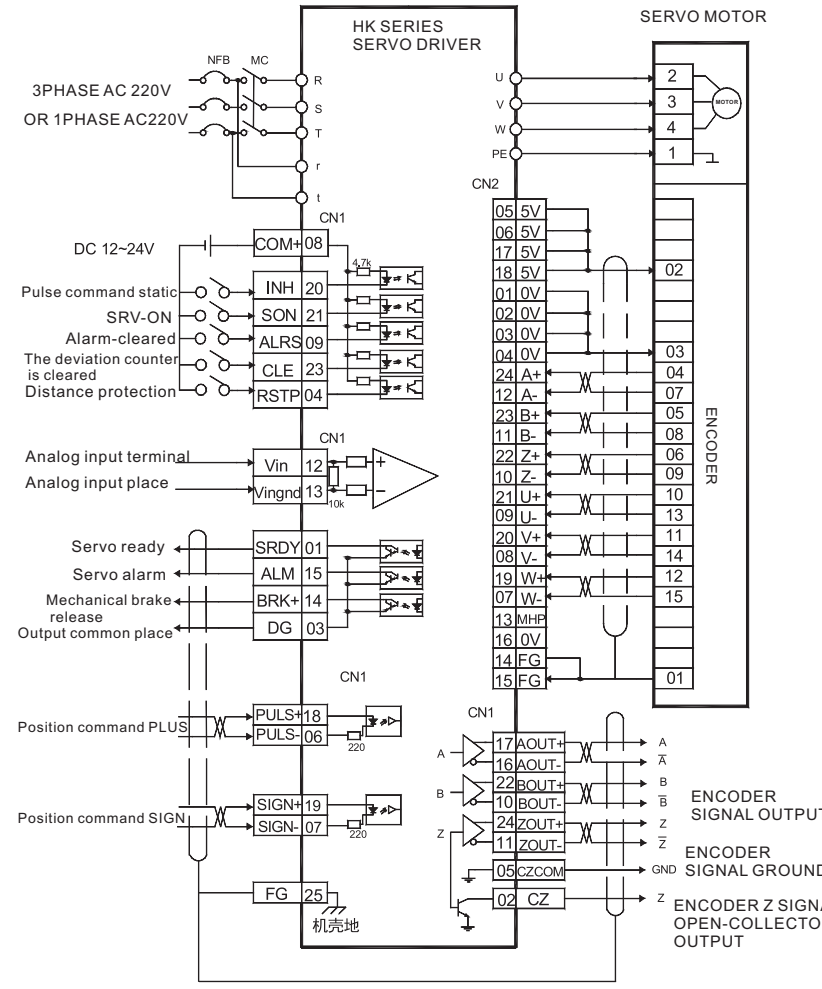


Figure 2.1 standard wiring for position/speed control

Chapter 3 Interface

3.1 HK Series servo driver power terminal TB

Terminal no.	Terminal marking	Signal name	Function
TB-1	PE	System Earthing	Earthing terminal
TB-2	R	Main circuit power input three-phase AC220V	Main loop power input terminal AC220V/50Hz Note: don't connect with the motor output terminal U/V/W
TB-3	S		
TB-4	T		
TB-5	U	Servo motor power output	The power output to the servo motor must be connected to the U/V/W terminal of the motor
TB-6	V		
TB-7	W		
TB-8	r	Control power input AC220V	The power input terminal of the control loop is AC220V 50Hz
TB-9	t		

3.2 Control signal input/output terminal CN1

Control mode ： P - Position control mode , S - Speed control mode , T - Torque control mode

Table 3.2 Control signal input/output terminal CN1

Terminal no.	Signal name	Marking	I/O	Mode	Function
CN1-08	input terminal power positive pole	COM+	Type1		input terminal power supply positive pole , used to drive input terminal photoelectric coupler DC12~24V,power supply≥100mA。
CN1-21	SRV-ON	SON	Type1		Servo enable input terminals. SON OFF : The driver shuts down, stops working , and the motor is in a free state. Note 1: The motor must be stationary when from SON OFFto SON ON. Note 2 : After SON ON is enabled , wait at least to secondsbefore entering the command. Note 3 : If internal enable is turned on , the SON signal is not detected.
CN1-09	A-CLR	ALRS	Type1		Alarm clears the input terminal. ALRS ON : clear system alarm ALRS OFF: Keep the system alert Note 1: For the alarm with fault code greater than 8 , it cant be cleared by this method . It needs to power off for maintenance and then power on again

Terminals no.	Signal name	Marking	I/O	Mode	Function
CN1-23	the deviation counter is cleared to zero	CLE	Type1	P	position control mode(PA4=0) position deviation counter to clear the input terminal. CLE ON :during position control, the position deviation counter is cleared
	speed selection 1	SC1	Type1	S	In speed control mode(PA =1), when selecting internal speed (No22=0), speed select 1 input terminal .In speed control mode, the combination of SC 1 and SC 2 are used to select different internal speeds.SC1 OFF,SC 2 OFF:internal spped 1; SC 1 ON , SC 2 OFF :internal speed 2; SC 1 OFF ,SC 2 ON: internal speed 3 ; SC 1 ON , SC 2 ON: internal speed 4
	ZEROSPD	ZEROSPD	Type1	S	In speed control mode (PA =1) , when the external analog speed is selected (PA22-1,the default value) ZEROSPD ON: No matter how much the analog input is. the forced speed instructionis zero ZEROSPD OFF: speed command is analog input value

Terminals no.	Signal name	Marking	I/O	Mode	Function
CN1-20	PINH	INH	Type1	P	In position control mode （PA4=0), the control instruction pulse。 INH On：command pulse input is disabled ; INH OFF：the command pulse input is valid
	Speed selection 2	SC2	Type1	S	In the speed control mode (PA4=1),when selecting the internal speed （PA22 =0) ,the speed selects 2 input terminals .In the speed control mode,the combination of SC 1 and SC2 is used to select different internal speeds. SC1 OFF , SC2 OFF: internal speed 1 ; SC1 ON , SC2 OFF: internal speed 2 ; SC1 OFF , SC2 ON: internal speed 3 ; SC1 ON , SC2 ON: internal speed 4
CN1-01	Servo reay for output	SRDY	Type2	P,S	Servo ready output terminal SRDY ON:control power supply and main power supply are normal,the driver does not alarm,the servo is equipped with output ON (output conduction) ; SRDY OFF:the main power supply is not closed or driver has an alarm,the servo is ready to output (output cut-off)

Terminals no.	Signal name	Marking	I/O	Mode	Function
CN1-04	distance protection	RSTP	Type1	P,S	External overrange protect signal
CN1-15	servo alarm output	ALM	Type2	P,S	Servo ready output terminal ALM ON:servo driver no alarm servo alarm output ON (output conduction) ; ALM OFF: servo driver alarm, servo alarm output OFF （output cut-off）。
CN1-14	positioning completes the output (in position control mode)speed reaches output (speed control mode)	COIN	Type2	P,S	The output terminal is positioned.COIN ON: when the position deviation counter value is in the set positioning range, the positiong is completed and output ON (output conduction), otherwise output OFF(output cut-off). Speed reaches output terminal COIN ON:when the speed reaches or exceeds the set speed
CN1-14	机械制动器释放	BRK	Type2		This port can be used to controlthe brake when the motor has amechanical brake (power-off retainer) BRK ON: the brake is energized, the brake is invalid,the motor can run BRK OFF: brake cut-off, brake effective, motor is locked,cant run. Note 1 ：BRK function is controlled internally by the driver

Terminals no.	Signal name	Marking	I/O	Mode	Function
CN1-18	command pulse PLUS input	PULS+	Type3	P	External command pulse input terminal. Note 1: pulse input mode is set by parameter Pa14 ● PA 14=0. instruction pulse+ symbol mode(default state) ● PA 14=1,CCW/CW command pulse mode ● PA14=2, 2phase instruction pulse mode
CN1-06		PULS-			
CN1-19	command pulse SIGN input	SIGN+	Type3	P	
CN1-07		SIGN-			
CN1-12	analog input	VIN	Type4	S	External analog speed intruction input terminal, differential mode,input impedance10KΩ,input range -10V~+10V。
CN1-13	analog input	VINGND			Ground wire that simulates the input
CN1-17	Encoder A phase signal	AOUT+	Type5		● Encoder ABZ signal differential driver (26LS31output , equivalent RS422 ）； ● Non-isolation output (non-insulation)。
CN1-16		AOUT-			
CN1-22	Encoder B phase signal	BOUT+	Type5		
CN1-10		BOUT-			
CN1-24	Encoder Z phase signal	ZOUT+	Type5		
CN1-11		ZOUT-			

Terminals no.	Signal name	Marking	I/O	Mode	Function
CN1-02	Encoder Z phase collector open circuit output	CZ	Type6		● Encoder Z signal output by the open collector, encoder Z phase signal appears, (output conduction),otherwise output OFF(output cut-off) ● Encoder common ground wire ● In the upper computer, usually Z phase signal pulse is very narrow, so please use a high-speed photoelectric coupler to receive
CN1-05	Common terminal of Z phase output of encoder	GND			Encoder common ground wire
CN1-25	Shielding ground	FG			Shielding ground terminal

3.3 Encoder signal input terminal CN2

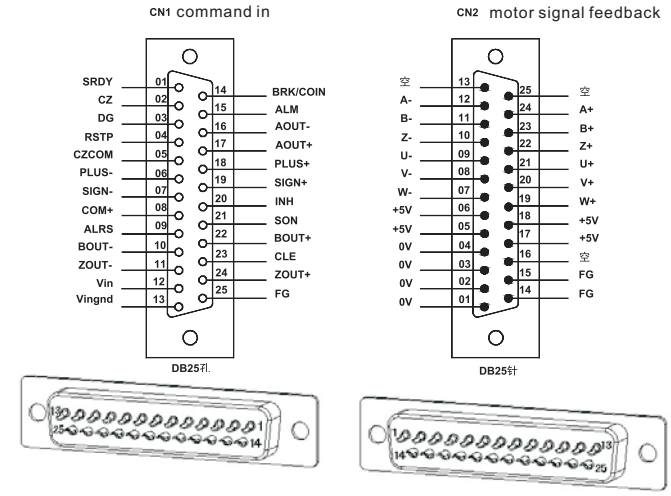
Table 3.3 Encoder signal input terminal CN2

Terminals no.	Signal name	Function		
		Marking	I/O	Description
CN2-05	5V power supply	+5V		Servo motor photoelectric encoder with +5V power supply and public place; if the cable length is long, connect multiple core wires in parallel to reduce the line voltage drop.
CN2-06				
CN2-17				
CN2-18				
CN2-01	power supply public place	0V		
CN2-02				
CN2-03				
CN2-04				
CN2-24	Encoder A+ input	A+	Type7	connect with photoelectric encoder A+
CN2-12	Encoder A- input	A-		connect with photoelectric encoder A-
CN2-23	Encoder B+ input	B+	Type7	connect with photoelectric encoder B+
CN2-11	Encoder B- input	B-		connect with photoelectric encoder B-
CN2-22	Encoder Z+ input	Z+	Type7	connect with photoelectric encoder Z+
CN2-10	Encoder Z- input	Z-		connect with photoelectric encoder Z-

Terminals no.	Signal name	Function		
		Marking	I/O	Description
CN2-21	Encoder U+ input	U+	Type7	connect with photoelectric encoder U+
CN2-09	Encoder U- input	U-		connect with photoelectric encoder U-
CN2-20	Encoder V+ input	V+	Type7	connect with photoelectric encoder V+
CN2-08	Encoder V- input	V-		connect with photoelectric encoder V-
CN2-19	Encoder W+ input	W+	Type7	connect with photoelectric encoder W+ 。
CN2-07	Encoder W- input	W-		connect with photoelectric encoder W-
CN2-15	Shielding ground	FG		Shielding ground terminal
CN2-14				
CN2-13				
CN2-16				
CN2-25				

3.4 Wiring terminal configuration

Figure 3.1shows the configuration of servo driver interface terminal Cn1 CN1 is a 36-core connector .Figure 3.2 shows the configuration diagram of servo driver interface terminal CN2,which is a 26- core connector.



CN 1 welding needle distribution CN 2 Welding needle distributon

Figure 3.1 Servo driver interface terminals

3.5 Type of the input/output interface

3.5.1 Switching value input interface

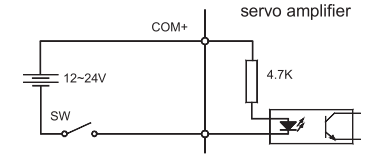
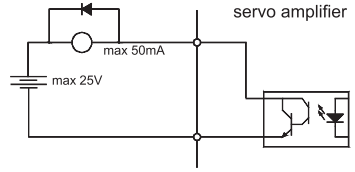


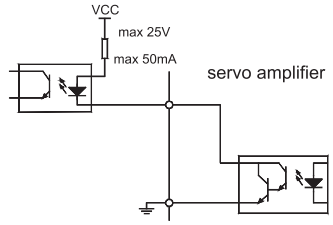
Figure 3.2 Type1 Switch input interface

- External power supply provided by the user DC12~24V, current≥100mA。
- Note : If the current mechanical connection is reversed, the servo driver will not work

3.5.2 Switching value output interface



A.Relay connection



B.Photoelectric coupler connection

Figure 3.3 switch output interface

- Output bit Darlington tube, connected with realy or photoelectric coupler
- The external power supply is provided by the user, but it must be noted that if the polarity of the power supply is reversed, the servo driver will be damaged
- The output is in the form of open collector , the maximum current is 50mA, and the maximum voltage of external power supply is 25V. Therefore , the load of the output signal of the switching quantity must meet this limit. If the limit is exceeded or the output is directly connected to the power supply , the servo driver will be damaged
- If the load is such that the relay is electrically loaded, the current diode must be connected in reverse parallel at both ends of the load. If the continuous diode is inversely connected ,the servo driver will be damaged.
- The output transistor is Darlington tube.When conducting,the voltage drop Vce between collector and emitter is about 1V, which cant meet the TTL low level requirements, so it cant be directly connected with TTL integrated circuit.

3.5.3 Pulse quantity input interface

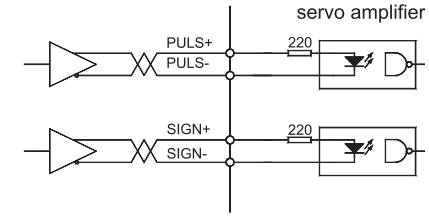


Figure 3.4 Type3 Differential driving mode of Type 3 pulse volume input interface

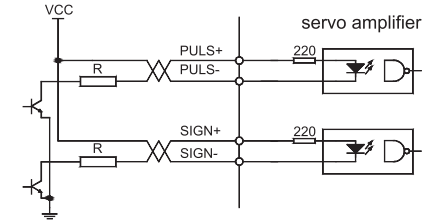


Figure 3.5 Type3 Single-ended driving mode of Type 3 pulse quantity input interface

- In order to transmit pulse volume data correctly, differential driver is recommended
- In differential driver mode ,use AM26LS31 , Mc3487 or similar Rs422 wire drivers
- Using single-end driver will reduce the frequency of action. According to the pulse input circuit , the driving current is 10~15mA, the maximum voltage of the external power supply is limited to 25V, and the value of resistance R is determined.Empirical data:VCC= 24V , R=1.3~2k ; VCC=12V , R=510~820Ω ; VCC=5V , R=82~120Ω Or dont connect
- when the single-ended driver mode is adopted, the external power supply is provided by the user.However, it must be noted that if the polarity of the power supply is reversed.Servo driver will be damaged

- See table 3.5 for the form of pulse input .Arrows represent counting edges.Table 3.6 shows the timing sequence and parameters of pulse input.when the 2 phase input form is used, the 4-octave pulse frequency is less than or equal to 500kHz。

Table 3.4 Pulse input form

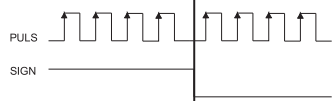
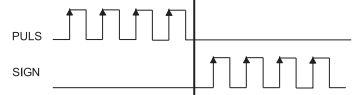
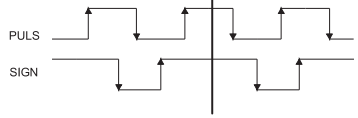
Impulse command form	CCW	CW	Parameter set value
Pulse-train sign			0 Command pulse +sign
CCW Pulse-train CW Pulse-train			1 CCW Pulse /CW Pulse
A Phase pulse-train B phase pulse-train			2 2 phase command pulse

Table 3.5 Timing parameters of pulse input

Parameter	Differential driver input	Single end driver input
t_{ck}	> 2μS	> 5μS
t_h	> 1μS	> 2.5μS
t_1	> 1μS	> 2.5μS
t_{rh}	> 0.2μS	> 0.3μS
t_{r1}	> 0.2μS	> 0.3μS
t_s	> 1μS	> 2.5μS
t_{qck}	> 8μS	> 10μS
t_{qh}	> 4μS	> 5μS
t_{q1}	> 4μS	> 5μS
t_{qrh}	> 0.2μS	> 0.3μS
t_{qr1}	> 0.2μS	> 0.3μS
t_{qs}	> 1μS	> 2.5μS

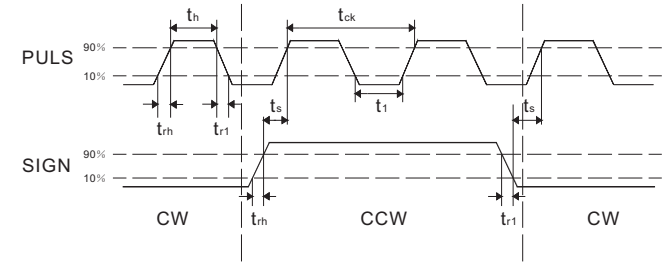


Figure 3.6 Timing diagram of pulse+symbol input interface (max pulse frequency 500kHz)

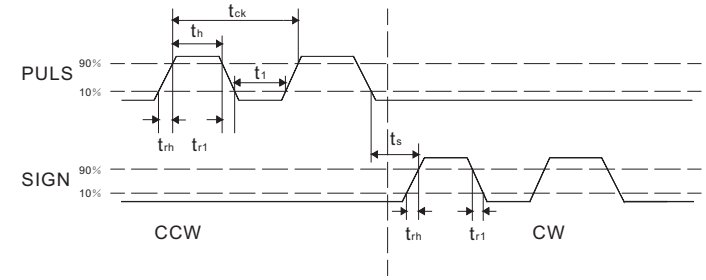


Figure 3.7 CCW Timing diagram of CCW pulse / CW pulse input interface (max pulse frequency 500kHz)

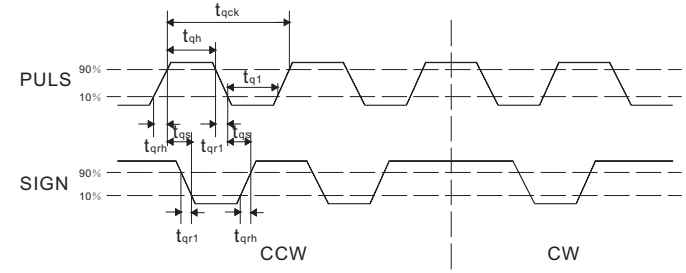


Figure 3.8 2Timing diagram of phase 2 command pulse input interface (max pulse frequency 125kHz)

3.5.4 Analog quantity input interface

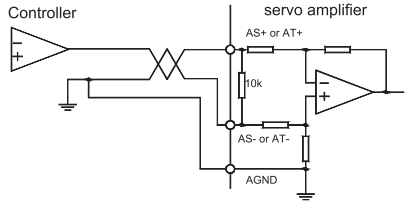


Figure 3.9a Analog differential input interface (Type4)

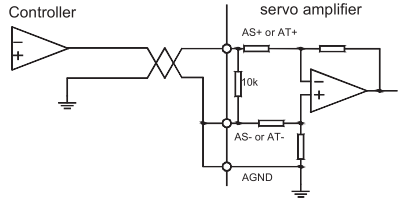


Figure 3.9b analog single-ended input interface (Type4)

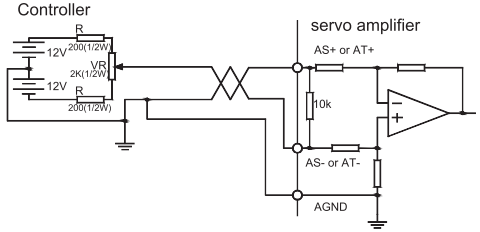


Figure 3.9c analog differential potentiometer input interface (Type4)

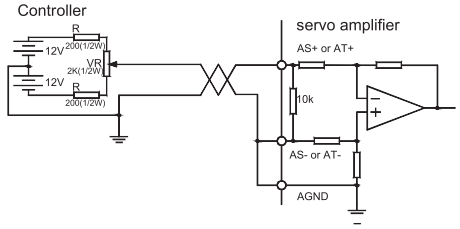


Figure 3.9d analog single-ended potentiometer input interface (Type4)

- The analog input interface is in differential mode. It can be connected in differential mode or single-ended mode depending on the connection method , The input impedance is 10kΩ.The input voltage ranges from -10~+10V。
- In the differential connection method , the analog ground wire and the input negative end are connected at the controller side, and the controller to the driver requires three wires.
- In the single-ended method, the analog ground wire and the input negative end are connected at the controller side, and the controller to the driver requires two wires .
- The differential connection method has better performance than the single end connection method, which can suppress the common mode interference
- The input voltage cant exceed -10V to +10V; otherwise driver may be damaged
- It is normal that the analog input interface has zero offset, which can be compensated by adjusting the parameter PA 45
- The analog interface is non-isolated (non-insulated)

3.5.5 Encoder signal output interface

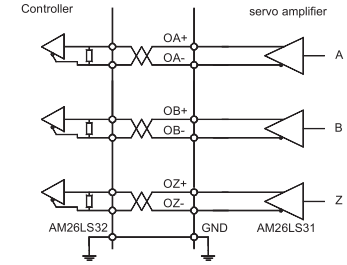


Figure 3.10a Output interface of photoelectric encoder (Type5)

- The encoder signal is output by differential driver (AM26LS31)
- The controller input can use AM26LS32 receiver, must be connected to the terminal resistance, about 330Ω
- The controller ground and the driver ground must be reliably grounded
- Non isolated output
- The input end of the controller can also be received by a photo-electric coupler, only must use a high-speed photoelectric coupler (such as 6N137)。

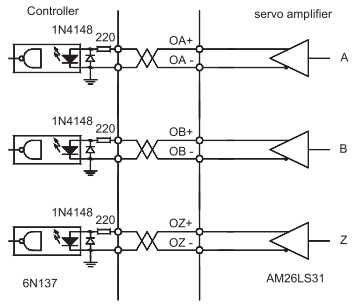


Figure 3.10b Output interface of photoelectric encoder (Type5)

3.5.6 Encoder Z signal collector open output interface

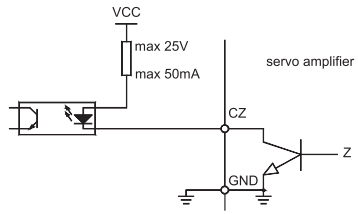


Figure 3.11 Output interface of photoelectric encoder (Type6)

- The Z phase signal of the encoder is output by the open collector. when the Z phase signal of the encoder appears, the output is ON (output conduction) , otherwise the output is OFF (output cut-off)
- Non-isolated output (non-insulated)。
- In the host computer, usually Z phase signal pulse is very narrow , so please use a high-speed photoelectric coupler to receive (such as 6N137)

3.5.7 Servo motor photoelectric encoder input interface

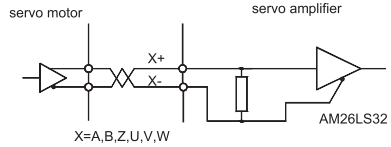


Figure 3.12 input interface of servo motor photoelectric encoder

Chapter 4 Parameters

4.1 List of parameter

The factory value 110ST-M04030 in the following table is used as an example .The parameter marked with "*" may be different in other models

Table 4.1 User Parameter list

No.	Description	Mode of application	Parameter scope	Factory default	Unit
0	Password	P,S	0~9999	315	
1	Model Code	P,S	0~51	30*	
2	Software Version (read only)	P,S	*	*	
3	Initial display state	S	0~21	0	
4	Control mode selection	P,S	0~6	0	
5	Velocity proportional gain	P,S	5~2000	150*	Hz
6	Velocity integration time constant	P,S	1~1000	20*	ms
7	Torque filter	P,S	20~500	100	%
8	Velocity detection filter	P,S	20~500	100	%
9	Position proportional gain	P	1~1000	40	1/s
10	Position feedforward gain	P	0~100	0	%
11	Position feedforward filter cut off frequency	P	0~1200	300	Hz
12	Position command pulse divider molecule	P	1~32767	1	
13	Denominator of position command pulse divider	P	1~32767	1	
14	Position command pulse input mode	P	0~2	0	

No.	Description	Mode of application	Parameter scope	Factory default	Unit
15	Position command pulse direction is reversed	P	0~1	0	
16	Range of positioning	P	0~30000	20	pulse
17	Position out of tolerance detection range	P	0~30000	400	X100pulse
18	Invalid position out of error	P	0~1	0	
19	Position command smoothing filter	P	0~30000	0	0.1ms
20	The driver forbid input is invalid	P,S	0~1	0	
21	JOG running speed	S	-3000~3000	120	r/min
22	Internal and external speed	S	0~2	1	
23	Max speed limit	P,S	0~4000	3600	r/min
24	Internal velocity 1	S	-3000~3000	0	r/min
25	Internal velocity 2	S	-3000~3000	100	r/min
26	Internal velocity 3	S	-3000~3000	300	r/min
27	Internal velocity 4	S	-3000~3000	-100	r/min
28	Reach the speed	S	0~3000	500	r/min
29	Analog torque command input	T	10~100	30	0.1V/100%
30	User torque overload alarm value	P,S,T	0~300	300	%
31	User torque overload alarm value	P,S,T	0~32767	0	ms
32	Control mode switching is allowed	P,S,T	0~1	0	
33	Analog torque command input	T	0~1	0	

No.	Description	Mode of application	Parameter scope	Factory default	Unit
34	Internal CCW torque limit	P,S,T	0~300	300*	%
35	Internal CW torque limit	P,S,T	-300~0	-300*	%
36	External CCW torque limit	P,S,T	0~300	100	%
37	External CW torque limit	P,S,T	-300~0	-100	%
38	Speed trial run,JOG operation torque limit	S	0~300	100	%
39	Analog torque command offset compensation	T	-2000~2000	0	
40	Acceleration time constant	S	1~10000	0	ms
41	Deceleration time constant	S	1~10000	0	ms
42	S-type acceleration and deceleration time constant	S	1~1000	0	ms
43	Analog speed command gain	S	10~3000	300	(r/min)/V
44	The direction of the analog speed command is reversed	S	0~1	100	
45	Analog speed command zero offset compensation	S	-5000~5000	0	
46	Analog speed command zero offset compensation	S	0~1000	300	Hz
47	Set the action of mechanical brake when motor stops	P,S,T	0~200	0	×10ms
48	Set the action of mechanical brake when the motor is running	P,S,T	0~200	50	×10ms
49	Speed of the mechanical brake when the motor is running	P,S,T	0~3000	100	r/min
50	Speed limit for torque control	T	0~5000	3600*	r/min
51	Dynamic electronic gear works	P	0~1	0	
52	The second position commands the pulse divider molecule	P	1~32767	1	

No.	Description	Mode of application	Parameter scope	Factory default	Unit
53	The low 4-bit input terminal forces the ON control word	P,S,T	0000~1111	0000	Binary
54	The high 4-bit input terminal forces the ON control word	P,S,T	0000~1111	0000	Binary
55	The low 4-bit input terminal takes the anti-control word	P,S,T	0000~1111	0000	Binary
56	The high 4-bit input terminal takes the anti-control word	P,S,T	0000~1111	0000	Binary
57	The output terminal takes the reverse control word	P,S,T	0000~1111	0000	Binary
58	Input terminal dejiter time constant	P,S,T	1~1000	16	0.1ms
59	Demo running	P,S	0~1	0	Binary

4.2 Description of Parameter

Table 4.2 Detailed description of user parameters

No.	Description	Function	Parameter scope
0	Password	● This parameter is used to prevent parameter modification. Generally if you need to set parameters , set this parameter to the required password and then set the parameters .after debugging, set this parameter to 0 to ensure that it will not be modified by mistake in the future. ● The password level corresponds to user parameters , system parameters and all parameter ● Change model code parameter (PA 1) the model code password must be used. otherwise passwords cant be changed ● User password : 315。 ● Model code password :385。	0~9999

No.	Description	Function	Parameter scope
1	Model code	● Corresponding to the same series of different power levels of drivers and motors ● The default value of the parameter varies with the model code .Ensure that this parameter is correct when you use the function to restore the default parameter ● When EEPROM alarm (NO .20) occurs, after it has been fixed. parameter must be reset and then the default parameters restored .Otherwise the driver may be abnormal or damaged ● Before modifying this parameter. set the password PA 0 to 385 ● The meanings of the parameters are described in section 9.4 ● For details about how to restore factory default parameters , refer to 7.13.1	1~51
2	Software versions	You can view the software version , but cant change	
3	初始显示状态	Select the display state of the display after the driver is powered on. 0: indicates the motor speed; 1: displays 5 digits lower than the current position; 2: displays 5 digits higher than the current position; 3:display position instruction (instruction pulse accumulation) is 5 bits lower; 4: display position command (instruction pulse accumulation)higher 5 bits; 5:indicates that the display position deviation is 5 digits lower; 6:display position deviation is 5 bits higher; 7: display motor torque; 8:display motor current; 9:display linear speed; 10:displays the control mode; 11:display position command pulse frequency; 12:display speed command; 13: display torque command; 14:shows the absolute position of the rotor in a turn; 15: display the input terminal status; 16:display the output terminal status; 17: display the encoder input signal; 18:display running status; 19:display alarm code; 20:Keep; 21:Keep。	0~20

No.	Description	Function	Parameter scope
4	control mode selection	● Can set the driver control mode by using this parameter 0:Position control mode; 1:Speed control mode; 2:Trial operation control mode; 3:JOG control mode; 4: Encoder zeroing mode; 5: open-loop operation (for testing motor and encoder) 6:Torque control mode。 ● Position control mode, speed command from the pulse input port ● Speed control mode , speed command from the input terminal input or analog input, there are parameters (internal and external speed command selection)(PA 22) to determine .when using internal speed , the combination of SC 1 and SC 2 is used to select different internal speed: SC1 OFF, SC2 OFF:internal speed1 SC1 ON, SC2 OFF:internal speed2 SC1 OFF, SC2 ON:internal speed3 SC1 ON, SC2 ON:internal speed4 ● Trial run control mode, speed command input from the key board used to test the driver and motor JOG control mode is also a point moving mode, after entering JOG operation, press [↑] and hold it . ● The motor will run at JOG speed. press [↓] and hold , the motor will run in reverse according to JOG speed, release the button, the motor will stop, keep zero speed, the encoder zeroing mode is used to adjust the zero of the coding disk of the motor before delivery	0~6
5	Velocity proportional gain	● Set the proportional gain of the speed loop regulator	5~2000Hz

No.	Description	Function	Parameter scope
		● the higher the setting value, the higher the gain and the higher the stiffness .The parameter value is determined according to the specific servo driver system model and load In general , the larger the load inertia, the larger the set value ● Under the condition that the system doesn't oscillate set it as large as possible	1~51
6	velocity integration time constant	● set the integral time constant of the speed loop regulator。 ● the smaller the set value is , the faster the integration speed is and the stronger the system resistance deviation is , that is the larger the stiffness is , but too small it is easy to produce overshoot	1~1000ms
7	torque filter	● set torque command filter characteristics ● To suppress the resonance generated by the torque ● the smaller the value , the lower the cut-off frequency ,and the smaller the vibration and noise generated by the motor , if the load inertia is large .the set point can be reduced appropriately .If the value is too small the response will be slow and oscillations may occur ● The higher the value , the higher the cutoff frequency and the faster the response, if higher torque response is required , the set point can be increased appropriately	20~500%
8	velocity detection filter	● Set torque command filter characteristic ● the smaller the value , the lower the cutoff frequency and the less noise the motor produces , if the load inertia is large , the set point can be reduced appropriately .if the value is too small , the response will be slow and oscillation may occur ● The larger the value , the higher the cut off frequency and the larger the velocity feedback response .If higher speed response is required,increase the set pint appropriately	20~500%

No.	Description	Function	Parameter scope
9	position proportional gain	● set the proportional gain of the position ring regulator ● The larger the setting value is , the higher the gain is , the larger the stiffness is,and the smaller the position lag is under the condition of the same frequency command pulse ● The parameter value is determined according to the specific servo driver system model and load	1~1000/s
10	position feed-forward gain	● set the feed-forward gain of the position loop ● when set to 100%, it means that the position lag is always 0 under any frequency of command pulses ● The feed-forward gain of the position increases , and the control system tells the response characteristic is improved ,but the position loop of the system is unstable and prone to oscillation ● The feed-forward gain of the position loop is usually 0 unless very high response characteristics are required	0~100%
11	position feed-forward filter cutoff frequency	● Set the low pass filter cut-off frequency of position loop feed-forward ● The function of this filter is to increase the stability of consistent position control	1~1200Hz

No.	Description	Function	Parameter scope
12	position command pulse divider molecule	● set the frequency of position command pulse (electronic gear) ● In the position control mode, by setting the parameters of PA 12 and PA 13 , it can be easily matched with various pulse sources to achieve the user's ideal control resolution ● P×G=N×C×4 P: the number of pulses of input command G:Electronic gear ratio; $G=\frac{\text{frequency division of molecular}}{\text{Dividing the denominator}}$ N:indicates the number of turns of the motor C:photoelectric encoder line C=2500。 ● Example : when the input command pulse is 6000,the servo motor rotates 1 turn $G=\frac{N\times C\times 4}{P}=\frac{1\times 2500\times 4}{6000}=\frac{5}{3}$ then PA 12 is set to 5, PA 13 is set to 3。 ● Then recommended range of electronic gear ratio is $\frac{1}{50}\leqslant G\leqslant 50$	1~32767
13	Denominator of position command pulse divider	See the parameters of PA12 。	1~32767

No.	Description	Function	Parameter scope
14	Position command pulse input method	● set the location command input form ● set the parameter to one of 3 input model: 0: pulse+symbol 1:CCW pulse / CW pulse； 2:two-phase quadrature pulse input ● CCW is views from the axial direction of the servo motor and rotated counterclockwise ,which is defined as forward direction ● CW is viewed from the axial direction of the servo motor,rotating clockwise,defined as reverse	0~2
15	position command pulse direction is reversed	set : 0: normal； 1:the direction of position instruction pulse is reversed。	0~1
16	Range of positioning completion	● set the position to complete the pulse range under the control of positioning ● This parameter provides a basics for the driver to determine if the position is complete in the position control mode. when the number of reputation pulses in the position deviation counter is less than or equal to the value of this parameter .The driver thinks that the positioning has been completed, and the signal COIN ON is completed , otherwise COIN OFF。 ● In the position control mode , the output positioning signal COIN is completed ,In the other control ode, the output speed reaches the signal SCMP.	0~30000 Pulse
17	Position out of tolerance detection range	● set the detection range of position out of position out of tolerance alarm ● In the position control mode , when the technical value of the position deviation counter exceeds this parameter ,the servo driver will give the position deviation alarm	0~30000× 100pulse

No.	Description	Function	Parameter scope
18	invalid position out of error	● Set to 0: position out of tolerance alarm detection is effective 1: position out of tolerance alarm detection is invalid , stop detection of position out of tolerance error	0~1
19	position command smoothing filter	● the command pulse is smoothed and filtered with exponential acceleration and deceleration, and the numerical value represents the time constant ● the filter will not lose the input pulse but will experience instruction delay phenomenon ● This filter is used for 1) the upper controller has no acceleration and deceleration functior 2) large frequency division and doubling of electronic gear（＞10); 3) the command frequency is low ● when the motor is running, it jumps and is not stable ● when set to 0 , the filter does not work	0~30000× 0.1ms
20	driver disable input is invalid	If the value is set to 0 , CCW and CW input are disabled. When the CCW driver disable switch (FSTP)is ON, the CCW driver allows when the CCW driver disable switch (FSTP)is OFF , the CCW direction remains 0 .The CW in the same way .if CCW and CW driver disable are OFF , a driver disable input error alarm will be generated 1: disable CCW、CW input. regardless of the status of the CCW and CW driver disable switch , the CCW and CW driver are allowed. At the same time , if CCW and CW driver prohibition are OFF, no driver prohibition error alarm will be generated	0~1

No.	Description	Function	Parameter scope
21	JOG running speed	Set the running speed of the JOG operation	-3000~3000 r/min
22	Internal and external speed command selection	set to 0: the speed command is take from internal speed; 1:the speed command is taken from an external analog input; 2:the direction of speed is controlled by input terminals FIL(CCW torque limit) and RIL (CW torque limit).FIL is effective for forward rotation and RIL is effective for reverse rotation. when both are effective or both are invalid , the speed is zero , in this mode , the external torque limit does not work	0~2
23	Max speed limit	● Set the max speed limit of servo motor ● the direction of rotation doesn't affect ● If the value exceeds the rated speed the actual max speed limit is the rated speed	0~3000 r/min
24	internal velocity 1	● set the internal velocity 1。 ● in the speed control mode , when SC1 OFF, SC2 OFF , select the internal speed 1 as the speed command	-3000~3000 r/min
25	internal velocity 2	● set the internal velocity 2。 ● in the speed control mode , when SC1 ON, SC2 OFF , select the internal speed 2 as the speed command	-3000~3000 r/min
26	internal velocity 3	● set the internal velocity 3。 ● in the speed control mode , when SC1 OFF, SC2 ON , select the internal speed 3 as the speed command	-3000~3000 r/min

No.	Description	Function	Parameter scope
27	internal velocity 4	● set the internal velocity 4。 ● in the speed control mode , when SC1 ON, SC2 ON , select the internal speed 4 as the speed command	-3000~3000 r/min
28	arrival speed	● set arrival speed ● in non-position control mode, if the click speed exceeds this setting values, SCMP is ON, otherwise SCMP OFF。 ● this parameter is not used in position control mode ● the direction of rotation doesn't affect。 ● it has hysteres is characteristic	0~3000 r/min
29	analog torque command input gain	● set the proportional relationship between the analog torque input voltage and the actual motor operation ● the unit of the setting 0.1V/100% ; ● The default value is 30, which corresponds to 3V/100% , that is ,the input voltage of 3V produces 100% of the rated torque	10~100 (0.1V/100%)
30	User torque overload alarm value	● set the user torque overload value, which is the percentage of the rated torque .The torque limit value is not divided into directions, and both the positive and negative directions are protected ● when PA31>0 , motor torque >PA30 time >PA 31 ,driver do alarm, alarm no is Err-29, motor stops. after alarm driver must be on power and clear the alarm	1~300
31	User torque overload alarm detection time	● User torque overload detection time, unit : milliseconds ● when set to 0 , the user torque overload alarm function is prohibited ● In general,the parameter is set to 0	0~32767

<table>
<tr><th>No.</th><th>Description</th><th>Function</th><th>Parameter scope</th></tr>
<tr><td>32</td><td>Control mode switching is allowed</td><td>0: The switchover is not allowed;
1: Switchover is allowed.ALRS(alarm clearing) input is used for switching,the original alarm clearing function is invalid
<table><tr><th>PA4</th><th>ALRS</th><th>control mode</th></tr><tr><td rowspan="2">0</td><td>OFF</td><td>position</td></tr><tr><td>ON</td><td>Speed</td></tr><tr><td rowspan="2">1</td><td>OFF</td><td>Speed</td></tr><tr><td>ON</td><td>Torque</td></tr><tr><td rowspan="2">6</td><td>OFF</td><td>Torque</td></tr><tr><td>ON</td><td>position</td></tr></table></td><td>0~1</td></tr>
<tr><td>33</td><td>Analog torque command input direction is inverted</td><td>● reverse polarity of torque input to analog quantity
● when set to 0 , the analog torque command is positive,the torque direction is CCW ; when set to 1,the analog speed command is positive , and the torque direction is CW</td><td>0~1</td></tr>
<tr><td>34</td><td>Internal CCW torque limit</td><td>● set the content torque limit value in CCW direction of servo motor.
● set the value as a percentage of the rated torque.For example,set the value as 200 if the value is 2 times the rated torque.
● this restriction is in effect at any time
● If the value exceeds the max over-load capacity allowed by the system ,the actual torque limit is the max overload capacity allowed by the system</td><td>0~300%</td></tr>
<tr><td>35</td><td>Internal CW torque limit</td><td>● set the internal torque limit value CW direction of servo motor.
● the value is the percentage of the rated torque .For example, if the value is 2 times of the rated torque, the value is -200
● this restriction is in effect at any time
● If the value exceeds the max over-load capacity allowed by the system ,the actual torque limit is the max overload capacity allowed by the system.</td><td>-300~0%</td></tr>
</table>

<table>
<tr><th>No.</th><th>Description</th><th>Function</th><th>Parameter scope</th></tr>
<tr><td>36</td><td>External CCW torque limit</td><td>● Set the external torque limit value CCW direction of the servo motor
● the setting value is the percentage of rated torque.For example , if it is set to 1 times the rated torque.the setting value is 100
● this limit is only valid if the CCW torque limit input terminal (FIL)is ON
● when limit is effective,the actual torque limit is the min value among the allowed max overload capacity.the internal CCW torque limit , and the external CCW torque limit</td><td>0~300%</td></tr>
<tr><td>37</td><td>External CW torque limit</td><td>● Set the external torque limit value CW direction of the servo motor
● the setting value is the percentage of rated torque.For example, if it is set to 1 times the rated torque. the setting value is -100
● this limit is only valid if the CW torque limit input terminal (RIL)is ON
● when limit is effective,the actual torque limit is the min value among the allowed max overload capacity.the internal CW torque limit , and the external CW torque limit</td><td>-300~0%</td></tr>
<tr><td>38</td><td>Speed trial run, JOG operation torque limit</td><td>● set the torque limit value in speed trial operation and JOG operation mode.
● independent of the direction of rotation, valid in both directions
● For example, if it is set to 1 times of the rated torque , the value is set to100
● Internal and external torque limits remain in effect</td><td>0~300%</td></tr>
<tr><td>39</td><td>Analog torque command zero offset compensation</td><td>zero offset compensation for analog torque input</td><td>-2000~2000</td></tr>
</table>

No.	Description	Function	Parameter scope
40	Acceleration time constant	● When the value is set, it represents the acceleration time of the motor from 0 to 1000r/min。 ● The acceleration and deceleration characteristics are linear ● Only for speed control mode, position control mode is invalid ● If the driver is used in combination with an external position ring, this parameter should be set to 0	1~1000ms
41	Deceleration time constant	● When the value is set, it represents the deceleration time of the motor from 1000 to 0 r/min ● The acceleration and deceleration characteristics are linear。 ● Only for speed control mode, position control mode is invalid ● If the driver is used in combination with an external position ring, this parameter should be set to 0	1~1000ms
42	S-type acceleration and deceleration time constant	Make the motor start and stop smoothly, set part time of S-type acceleration and deceleration curve	1~1000ms
43	Analog speed command input gain	Set the proportional relationship between the input voltage and the actual running speed of the motor	10~3000 r/min/V
44	Analog speed command direction is inverted	● Reverse polarity of the analog velocity input ● When set to 0, the analog speed command is positive, and the speed direction is CCW ● When set to 1, the analog speed command is positive, and the speed direction is CW	0~1
45	Analog speed command zero offset compensation	Zero offset compensation for analog velocity input	-5000~5000

No.	Description	Function	Parameter scope
46	Analog speed command filter	● Low pass filter for analog velocity ● The larger the setting is, the faster the response speed to the speed input analog is, and the greater the influence of signal noise is. If the setting is small, the slower the response speed, the smaller the signal noise impact	0~1000Hz
47	Set the action of mechanical brake when motor stops	● Define the delay time from mechanical brake action (output terminal BRK changes from ON to OFF) to motor current cut-off during motor shutdown。 ● This parameter should not be less than the mechanical known delay time (Tb) to avoid small motor displacement or workpiece drop ● See Figure 7.5 for the corresponding timing	0~200×10 ms
48	Set the action of mechanical brake when the motor is running	● Define the delay time from the motor current cutter mechanical braking action (output terminal BRK changes from ON to OFF) during motor operation ● This parameter is to slow down the motor from high speed rotation to low speed, and then make the mechanical brake action, to avoid damage to brake ● The actual action time is the time required for PA48 or the motor to slow down to the value of PA49, and the minimum value of the two is taken ● See Figure 7.6 for the corresponding timing	0~200×10 ms
49	Set the action of mechanical brake when the motor is running	● Define the delay time from the motor current cutter mechanical braking action (output terminal BRK changes from ON to OFF) during motor operation ● The actual action time is the time required for PA48 or the motor to slow down to the value of PA49, and the minimum value of the two is taken。 ● See Figure 7.5 for the corresponding timing	0~200×10 ms
50	Speed limit for torque control	● In torque control, motor running speed is limited within this parameter; ● Can prevent light load overspeed phenomenon。	0~200×10 ms

No.	Description	Function	Parameter scope
51	Dynamic electronic gear works	● Set to 0, the dynamic electronic gear is invalid, and the function of the input terminal INH is to command pulse disable. ● Set to 1, dynamic electronic gear is valid, and the function of input terminal INH is electronic gear switching. When INH terminal is OFF,the input electronic gear is No.12/No.13; When INH terminal is ON, the input electronic gear is No.54/No.13; By controlling the INH terminal,the proportion value of the electronic gear is changed.	0~1
52	The second position commands the pulse divider molecule	● Set the second position command pulse divider (electronic gear) ● When using dynamic electronic gear, the parameter PA51=1 must be set. In this case, the input terminal INH(command pulse forbidden) function will be transformed into the electronic gear switching input control terminal ● When the INH terminal is OFF, the input electronic gear is PA12/PA13. When the INH terminal is ON, the input electronic gear is PA52 /PA13. By controlling the INH terminal, the proportion value of the electronic gear is changed ● Note that the denominator of the first and second electronic gear is the same	1~32767
53	Low 4-bit input terminals force ON control word	● Force ON is valid inside the input terminal.For terminals that are not forced ON, you need to connect external cables to control ON/OFF. For terminals that are forced ON, you dont need to connect external cables ● It is represented by a 4-bit binary number. 0 indicates that the input terminal is not forced ON, and 1 indicates that the input terminal is forced ON. Input terminals represented by binary numbers are as follows: 3 2 1 0 RSTP FSTP ALRS SON SON: SRV-ON；ALRS : alarm clear FSTP :The CCW driver is disabled RSTP: The CW driver is disabled	0000~1111

No.	Description	Function	Parameter scope
54	The high 4-bit input terminal forces the ON control word	● Force ON is valid inside the input terminal .For terminals that are not forced ON,you need to connect external cables to control ON/OFF. For terminals that are forced ON, you do not need to connect external cables ● It is represented by a 4-bit binary number. 0 indicates that the input terminal is not forced ON, and 1 indicates that the input terminal is forced ON.Input terminals represented by binary numbers are as follows: 3 2 1 0 RIL FIL INH/SC2 CLE/SC1/ZEROSPD CLE/SC1/ZEROSPD: Deviation counter to clear zero/speed select 1 /zero speed box position； INH/SC2: Command pulse Disable/ Speed select 2 FIL : CCW torque limit； RIL : CW torque limit.	0000~1111
55	The low 4-bit input terminal takes the anti-control word	● Set the input terminal to be inverted. Do not take the opposite terminal, when the switch is closed, the switch is not valid when the switch is disconnected; The reverse terminal is invalid when the switch is closed and valid when the switch is disconnected ● It is represented by a 4-bit binary number, where 0 indicates that the input terminal is not inverted, and 1 indicates that the input terminal is inverted. Input terminals represented by binary numbers are as follows: 3 2 1 0 RSTP FSTP ALRS SON SON: SRV-ON； ALRS : alarm clear； FSTP :The CCW driver is disabled RSTP: The CW driver is disabled	0000~1111
56	The high 4-bit input terminal takes the anti-control word	● Set the input terminal to be inverted. Do not take the opposite terminal, when the switch is closed, the switch is not valid when the switch is disconnected; The reverse terminal is invalid when the switch is closed and valid when the switch is disconnected	0000~1111

<table>
<tr><th>No.</th><th>Description</th><th>Function</th><th>Parameter scope</th></tr>
<tr><td></td><td></td><td>● It is represented by a 4-bit binary number, where 0 indicates that the input terminal is not inverted, and 1 indicates that the input terminal is inverted. Input terminals represented by binary numbers are as follows:
<table><tr><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>RIL</td><td>FIL</td><td>INH/SC2</td><td>CLE/SC1/ZEROSPD</td></tr></table>CLE/SC1/ZEROSPD: Deviation counter to clear zero/speed select 1/zero speed box position;
INH/SC2: Command pulse Disable/ Speed select 2;
FIL：CCW torque limit;
RIL：CW torque limit。</td><td></td></tr>
<tr><td>57</td><td>输出端子取反控制字</td><td>● Set the output terminal to be inverted. Taking the opposite terminal, the definition of conduction and cutoff is exactly the opposite of the standard definition;
● It is represented by a 4-bit binary number, where 0 indicates that the output terminal is not inverted, and 1 indicates that the output terminal is inverted. The input terminals represented by binary numbers are as follows:
<table><tr><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>BRK</td><td>COIN</td><td>ALM</td><td>SRDY</td></tr></table>SRDY：SRV-ON；ALRS : alarm clear;
FSTP :The CCW driver is disabled;
BRK: brake release。</td><td>0000~1111
.
.
.</td></tr>
<tr><td>58</td><td>Io indicates the terminal dithering time constant</td><td>● Remove the jitter filter time from the input terminal;
● The smaller the value, the faster the terminal input response;
● The larger the value, the better the anti-interference performance of the terminal input, but the response becomes slower</td><td>1~1000×0.1 ms</td></tr>
<tr><td>59</td><td>Demo running</td><td>● Only for Test</td><td>0~1</td></tr>
</table>

Chapter 5 Protection function

5. 1 Alarm list

Table 5.1 List of alarms

Alarm code	Alarm name	Content
- -	Normal	
1	Overspeed	Servo motor speed exceeds the set value
2	Overvoltage of main circuit	The main circuit power supply voltage is too high
3	Main circuit undervoltage	The main circuit power supply voltage is too low .
4	Position error	The value of the position deviation counter exceeds the set value .
5	Motor overheating	Motor temperature is too high
6	Velocity amplifier saturation fault	The speed regulator was saturated for a long time
7	Drive forbidden exception	CCW and CW drivers are OFF
8	The position deviation counter overflowed	The absolute value of the position deviation counter exceeds 2^{30}
9	ENCODER ERROR	Encoder signal error
10	Control power supply undervoltage	Low control power supply
11	IPM module is faulty	The IMP intelligent module is faulty
12	Overcurrent	Excessive motor current
13	Overload	Servo drive and motor over load (instantaneous overheating)
14	Brake error	Brake circuit error
15	Encoder count error	Technical abnormality of encoder
16	Motor thermal over-load	Electrical calorific value exceeds set value (I^2t test)
17	Velocity response fault	The velocity error is too large for a long time
19	Warm Reset	The system is hot reset.
20	EEPROM fault	EEPROM fault

Alarm code	Alarm name	Content
21	U4 Error	U4 Error
22	Keep	
23	U6 Chip is faulty	U6 Chip or current sensor is faulty
29	User torque overload alarm	Motor load exceeds user set value and duration
30	The encoder Z pulse is lost	the encoder Z pulse is wrong
31	encoder UVW signal is incorrect	encoder UVW signal is incorrect or does not match the encoder
32	encoder UVW signal is illegally encoded	UVW signal has full high or full low level

5. 2 Alarm handling method

Table 5. 2 alarm handling methods

Alarm code	Alarm name	Running statues	Reason	Solution
1	over speed	when the control power is switched on	● Control circuit board fault ● Encoder failed	● Change servo driver ● Change servo motor
		During motor operation	the input command pulse frequency is too high	Set input command pulse correctly
			the acceleration/ deceleration time constant is too small and the time speed overshoot is too large	Increase the acceleration/ deceleration time constant
			the input electronic gear ratio is too large	set up correctly
			Encoder failed。	Change servo motor
			Encoder wire damaged。	Change encoder cable

Alarm code	Alarm name	Running statues	Reason	Solution
			the servo system is unstable , causing an overshoot	● Rest the relevant gain ● If the gain cant be set to a suitable value, the load moment of inertia ratio is reduced
		when the motor is just started	Load inertia is too large	● Reduce load inertia ● Switch to bigger drivers and motor
			Encoder zero error	● Change servo motor ● Please reset the zero of the encoder
			● motor U、V、W wrong connection 。 ● Encoder cable lead is connected wrong	Correct connection。
2	Over-voltage of main circuit	when the control power is switched on	Circuit board failure	Change servo driver
		when the main power supply is switched on	Excessively high power supply voltage; the power supply voltage waveform is abnormal	Check the power supply
		During motor operation	Brake resistance wiring is disconnected	Rewiring
			Brake transistor damage; internal brake resistance is damaged	Change servo motor
			Insufficient brake circuit capacity	● reduce the start and stop frequency ● Increase the accele-ration/deceleration time constant ● reduce the torque limit ● reduce load inertia ● Change to bigger drive and motor

Alarm code	Alarm name	Running status	Reason	Solution
3	Main circuit under voltage	when the main power supply is switched on	● circuit board failure ● power supply insurance damage ● the soft start circuit is faulty ● rectifier damage	change servo driver
			● power supply voltage low ● temporary power outage over 20ms	check the power supply
		During motor operation	● insufficient power supply capacity ● Instantaneous power down	check the power supply
			hear sink overheating	check the load
4	position error	when the control power is switched on	circuit board failure	change the servo driver
		switch on the main power supply and control line input command pulse , the motor does not rotate or reverse	motor U/V/W lead wire is incorrectly connected. encoder cable connected wrong	Normal connection。
			● zero change of encoder ● encoder failed	● reset the zero of the encoder ● change servo driver
		happened during motor run	the setting position out-of-tolerance detection range is too small	increase the range of position deviation detection
			Lack of torque。	●check the torque limit ● reduce load capacity ● switch to more powerful drivers and motors
			command pulse frequency is too high	reduce frequency
			zero change of encoder	reset the zero of the change encoder

Alarm code	Alarm name	Running status	Reason	Solution
5	motor over-heating	when the control power is switched on	circuit board failure	change servo driver
			● cable bolt ● internal temperature relay of the motor is damaged	● check the cable ● check the motor
		happened during motor run	motor over load	● reduce the load ● reduce the start and stop frequency ● reduce the torque limit。 ● decrease the relevant gain ● switch to more powerful drivers and motors
			internal motor fault	change servo motor。
6	velocity amplifier saturation fault	happened during motor run	the motor is mechanically stuck	check the mechanical part of the load
			the load is too large	● reduce the load ●change to bigger servo motor and driver。
7	driver forbidden exception		CCW、CW drivers forbid input terminals to be disconnected	check the cable connection
8	the position deviation counter over-flowed	.	● the motor is mechanically stuck ● the input command pulse is abnormal	● check the mechanical part of the load ● check command pulse ● check whether the motor pulses as instructed
9	encoder failed		wiring error of encoder	check the cable connection
			encoder damaged	change servo motor
			bad encoder cable	change encoder cable
			the encoder cable is too long , resulting in low encoder power supply voltage	shorten the cable, use multi-core parallel power supply
10	control power supply under-voltage		The input control power supply is low	check the control power supply

Alarm code	Alarm name	Running status	Reason	Solution
			● internal connector of the driver is faulty ● switching power supply is abnormal ● the chip damaged	● change driver ● check connector ● check the switching power supply
11	the IPM module is faulty	when the control power is switched on	circuit board failure	change servo driver
		happened during motor is running	● low supply voltage ● overheating。	● check servo driver ● power on reset ● change driver
			driver is short-circuited between U、V、W	check the cable connection
			imperfect earth	normal ground
			insulation damage of motor	change servo motor
			be disturbed	● add line filter ● stay away from interference sources
12	over-current		driver is short-circuited between U、V、W	check the cable connection
			imperfect earth。	normal ground
			insulation damage of motor	change servo motor
			driver damaged。	change driver
13	overload	when the control power is switched on	circuit board failure	change driver
		happened during motor is running	the torque exceeds the operation	● check the load ● reduce the start and stop frequency ● reduce the torque limit ● switch to more powerful driver and motor
			brake does not release	change driver

Alarm code	Alarm name	Running status	Reason	Solution
			the motor oscillates	● adjust the gain ● increase the acceleration /deceleration time constant ● reduce load inertia
			● U、V、W has a broken line ● wiring error of encoder	check the cable connection
14	brake failure	when the control power is switched on	circuit board failure	change servo driver
		happened during motor is running	brake resistance wiring is disconnected	rewiring
			● brake transistor damage。 ● internal brake resis-tance is damaged	change servo driver
			insufficient brake circuit capacity	● reduce the start and stop frequency ● increase the acceleration /deceleration time constant ● reduce the torque limit ● check the load ● switch to more powerful driver and motor。
			Main supply voltage too high。	check the main power
15	encoder count error		● encoder damaged ● the number of encoder lines is incorrect ● the encoder disc is damaged ● false Z-signal in encoder	change encoder
			encoder grounding error	check the cable connection
			imperfect earth	● correct grounding ● check whether the shield grounding cable is properly connected

Alarm code	Alarm name	Running status	Reason	Solution
16	motor thermal overload	when the control power is switched on	circuit board failure	change servo driver。
			parameter setting error	set relevant parameters correctly
		during motor operation	prolonged torque operation in excess of torque	●check the load ●reduce the start and stop frequency ●reduce the torque limit ●change to bigger power motor and driver
			poor mechanical transmission	check the mechanical part
19	thermal reduction		the input control power is unstable	check the control power supply
			be disturbed	● add line filter ● stay away from interference sources
20	EEPROM error		the chip or circuit board is damaged	● replace servo driver ● after repair, you must reset the driver model(parameter PA1) and then restore the default parameter
21	U4 faulty		the chip or circuit board is damaged	replace servo driver
23	the U6 chip is faulty		● the chip or circuit board is damaged ● power sensor damage	replace servo driver
29	user torque overload alarm		●parameter PA30、PA31 are unreasonable ●unexpected heavy load occurred	● change parameter ● maintenance machinery

Alarm code	Alarm name	Running status	Reason	Solution
30	the encoder Z pulse is lost		● Z-pulse is nonexistent ● cable is bad ● improper cable shielding ● the shielding ground wire should connect properly ● encoder connector error	● change encoder ● check the encoder circuit
31	the encoder UVW signal is illegally encoder		● the encoder U/V/W signal is damaged。 ● the encoder Z signal is damaged ● bad cable ● improper cable shielding ● the shielding ground wire should connect properly ● encoder connector error	● change encoder ● check the encoder circuit

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Chapter 6 Display and keyboard operation

The panel is composed of 6LED digital tube displays and 4 buttons ▲、▼、◄、↵ , which are used to display various state of the system and set parameters.The operation is hierachical , the key ◄ 、↵ indicates the backward and forward level , the ley ↵ has the meaning of entering and determining : the key ◄ indicates the of exit and cancellation, the key ▲ ▼ indicated as increase or decrease serial numbers or decrease values. if the key is pressed ▲ 、▼ and held , it will have the repeating effect , and the longer the longer the holding time ,the higher the repeating rate

If the six digital tubes or the decimal point on the rightmost digital tube flashes, and alarm is reported .The POWER indicator is on , indicating that main POWER supply is energized , and the RUN indicator is on , indicating that the motor is running

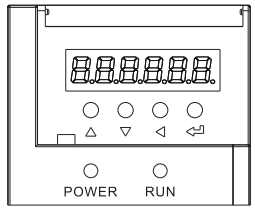


Figure 6.0 panel

6.1 The first layer

The first layer is used to select the operation mode , total 7 ways. with the key ▲ 、▼ to change the mode , the key ↵ into the selected mode of the second layer , the key ◄ from the second layer back to the first layer .

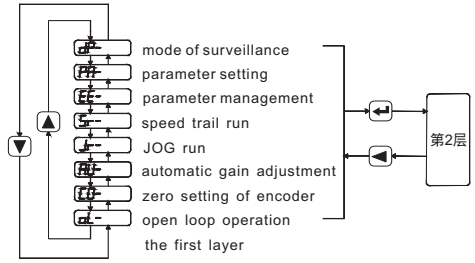


Figure 6.1 mode selection and operation

6.2 The second layer

6.2.1 monitoring methods

In layer 1 "dP-", and press the keys ↵ to enter the monitoring the user uses the key ▲ 、▼ to select the desired display mode, Press key ↵ gain , it will enter the specific dispaly state

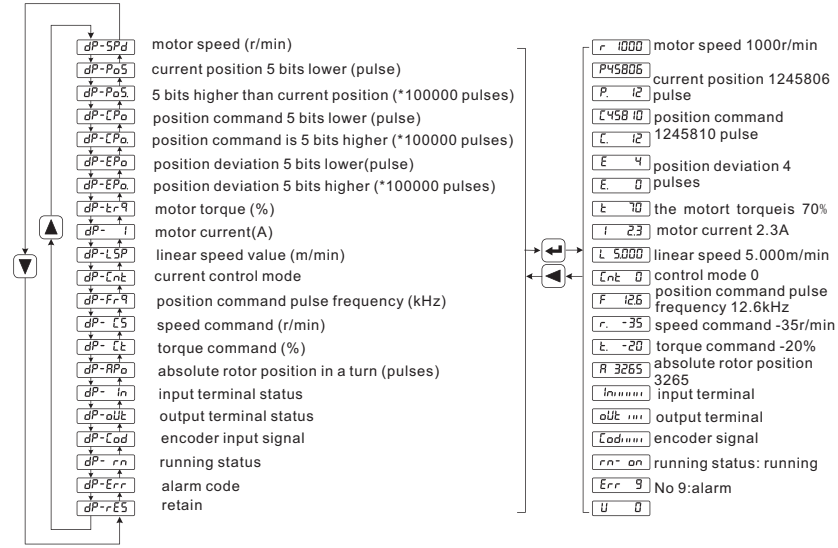


FIG.6.2 operation block diagram of monitoring mode

【 Note 1】the input pulse is the pulse amplified by the input electronic gear

【Note 2】the pulse volume unit is the internal pulse unit of the system, which is 10000 pulses/revolution in this system
the pulse volume is represented by high 5 bits+low 5 bits, and the calculation method is as follows:
pulse volume= high 5-bit value *10000+low 5-bit value

【Note 3】control mode：0-position control；1-speed control ； 2-speed test run ； 3-JOG operation ； 4-encoder is adjusted to zero；
5-open loop operation。

【Note 4】If the display value reaches 6 digits (such as display-12345), the prompt is not displayed

【Note 5】The position command pulse frequency is the actual pulse frequency before the input electronic gear amplification, the minimum unit is 0.1kHz , the positive number is displayed in the forward direction , and the negative number is displayed in the reverse direction.

【Note 6】represents the effective value of phase current , and the calculation method of current I is ：

$$I = \sqrt{\frac{1}{3}(I_U^2 + I_V^2 + I_W^2)}$$

【Note 7】the absolute position of the rotor in a revolution represents the position of the rotor relative to the nail in a revolution , the value ranges from 0 to 9999 and is independent of the electronic gear ratio

【Note 8】the input terminal display is shown in Figure 6.3 , the output terminal display is shown in Figure 6.4 ,and encoder signal display is shown in Figure 6.5

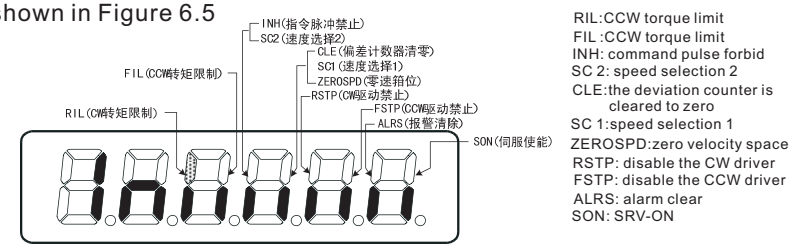


Figure 6.3 display of input terminals
（lit strokes indicate On，otherwise is OFF）

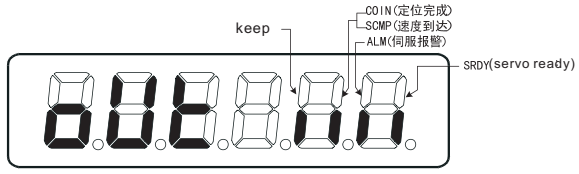


Figure 6.4 output terminal display（lit strokes indicate ON,otherwise is OFF）

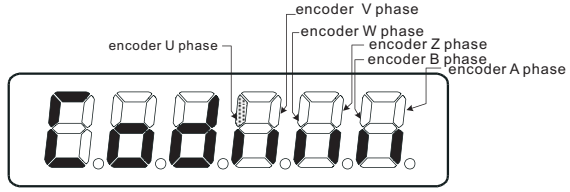


Figure 6.5 encoder signal display
（lit strokes indicate ON，Otherwise is OFF）

【Note 9】the running status is ：

“cn- oFF”：Main circuit is not charged and the servo system is not running;

“cn- CH”：Main circuit has been charged , the servo four-way is not running (the servo is not enabled or there is an alarm)

“cn- on”：Main circuit is power-on , servo system is running

【Note **10**】If the alarm displays “Err --”， it indicates that the alarm is normal and there is no alarm

6.2.2 Parameter settings

Select “PA-” in layer 1 and press the ↵ button to enter the parameter setting mode. Press the ▲、▼ key to select a parameter number . press the ↵ button to display the value of the parameter , Use ▲ ▼ key to modify the parameter value , Press the ▲ or ▼ one time , the parameter value to increase or decrease 1 . press and keep ▲ or ▼ keys, parameters to increase or decrease . the parameter value is modified , the most the right side of the LED digital tube decimal point light , press the ↵ key determined modified value effectivvely , the decimal point on the right LED digital tube is extinguished at this time , the value will be immediately reflected in the control after modification After that . press the ▲ or ▼ key to continue to modify the parameters After modification , press the button to return to the parameter selection state after modification .If you are not satisfied with the value being modified , dont press the ↵ button to confirm , can press the◀button to cancel , the parameter return to the original value , and return to the parameter selection stae

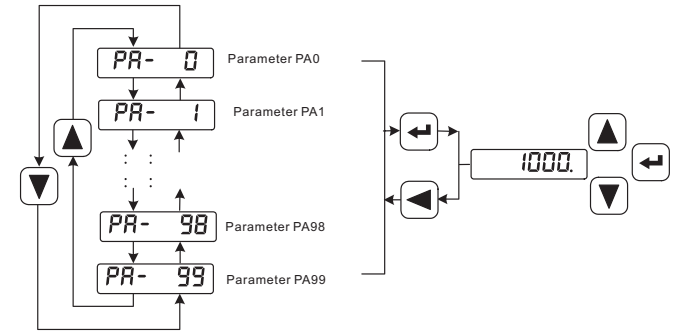


Figure 6.6 Operation block diagram of parameter setting

6.2.3 Parameter Management

Parameter management mainly deals with the operation between the parameter table and EEPROM. In layer 1 , select “EE-”,and press the ↵ button to enter the parameter management mode.First , you need to select the operation mode.There are five modes , use▲、▼to select. Take “ Parameter write ” as an example , select “ EE-SEt ”, and then press ↵ key and hold for more than 3 seconds , and display shows “StArt”, indicates that the parameter is being written to the EEPROM after about 1 to 2 seconds , if the write operation succeeds . the display shows“F in ISH”, If the write operation fails , the display shows “Error” Press ◀ again to return to the operation mode selection state.

- EE-SEt Parameter write : Indicates the parameter area of the HILL EEPROM in the parameter table .The user modifies the parameters, only the parameter values in the parameter table are changes, and the next power on will be restored to the original value.If you want to permanently change the parameter values , you need to perform a parameter writing operation , which writes the parameters in the parameter table to the parameter area of the EEPROM.The modified parameters will be used later when power is on.

- EE- rd Parameter read: Indicates that the west lake office in the parameter table.This process is performed automatically on power-on and starts with the same parameter values in the parameter table as in the EEPROM parameter field.However , if the user modifies the parameters , the parameter values in the parameter table will be changed.When the user is not satified with the modified parameters or the parameters are adjusted out of order , the user can perform the parameter area of the EEPROM into the parameter table again and reply the parameter that has just been powered on.

- EE-dEF Restoring default values:The default values of all parameters are read into the parameter table and written into the parameter area of the EEPROM.The default values will be used in the next power-on. This operation can be used to restore all parameters to their factory defaults if the user cannt work properly due to the confusion of parameters.Different driver and motor models have different default parameter values .Before restoring default parameters ,ensure that the model code (Parameter Pa1) is correct .For details , see section 8.4

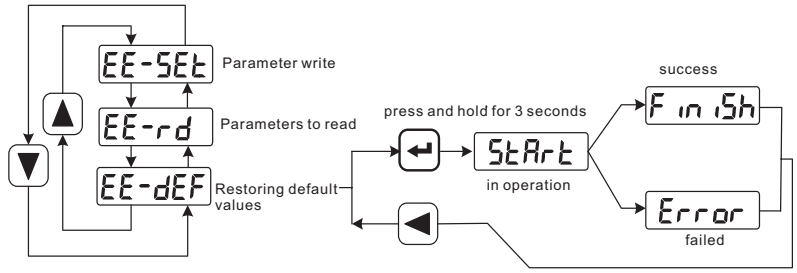


Figure 6.7 Parameter management and operation

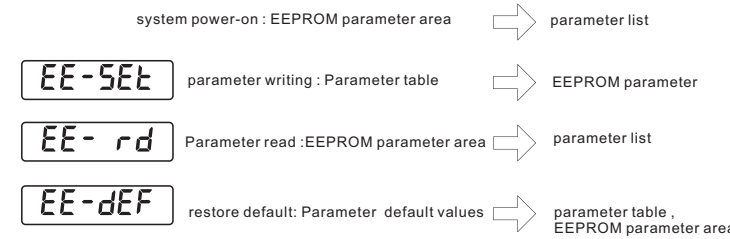


Figure 6.8 operation meaning of parameter management

6.2.4 Speed trial run

Select "Sr-" in layer 1 and press the ↵ button to enter the trial mode.The prompt" S ",and the unit of value is R/min.The system is in the speed control mode, and the speed command is provided by the key the speed command is provided by the key .The speed command can be changed by the ▲ ▼ and the motor runs at the given speed

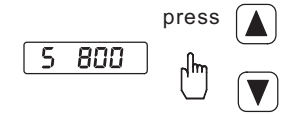


Figure 6.9 Operation block diagram of speed test run

6.2.5 JOG Running

Select "Jr-" in layer 1 and press the ↵ button to enter JOG mode .Thats the dot mode. The JOG running prompt is " J ", and the unit of value is r/min .The system is in the speed control mode,and the speed command is provided by the key . after entering JOG operation .Press the ▲ button and hold , the motor runs at JOG speed , release the button , the motor stops , maintain zero speed ; press the ▼ key and hold , the motor will run in the opposite direction of JOG steering , JOG speed is set with parameter PA21

Figure 6.10 JOG operation block diagram

6.2.6 The analog quantity is automatically reset to zero

After using this operation . the driver automatically detects the speed analog zero offset (or torque analog zero offset) . writes the zero offset value to PA45(or PA39), and saves it to the EEPROM .select " AU- "in layer 1 and press the ↵ key to enter the zeroing mode.
After the automatic zeroing , the user can continue to modify PA45(or PA39) and adjust the zeroing manually.

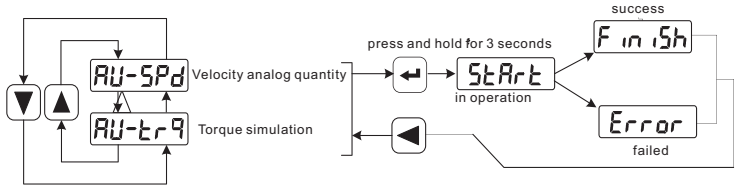


Figure 6.11 Operation block diagram of automatic zeroing of analog quantity

Chapter 7 Runs

7.1 Ground connection

The servo driver and motor should be reliably grounded .To avoid electric shock , the protective grounding terminal of the servo driver should always be connected to the protective grounding of the control box.Since the servo driver uses PWM technology to supply power to the servo motor through the power tube , the driver and connection line may be affected by switcing noise .In order to meet the EMC standards , the ground line is as thick as possible and the ground resistance is as small as possible .

7.2 Operation time sequence

7.2.1 Power switching sequence

1. Connect the power supply

2. The power supply R and T of the control circuit are connected at the same time or before the power supply of the main circuit . If only the control circuit is powered on . the servo is ready to signal（SRDY）OFF。

3. After the power supply of the main circuit is connected , the servo ready signal （SRDY）ON will be delayed for about 1.5 seconds .At this time , the servo enable (SON)signal can be accepted .The base circuit is closed and the motor is in free state when the servo enable is detected invalid or there is an alarm .

4. When the servo enable is connected together with the power supply, the base circuit will be connected in about 1.5 seconds . Frequent switching on and off the power supply may damage the soft start circuit and the good braking circuit .It is best to limit the frequency of switching on and off to 5 times per hour and less than 30 times per day.If the driver or motor is overheating, after the fault is removed . it will take 30 minutes to cool down before it can be switched on again

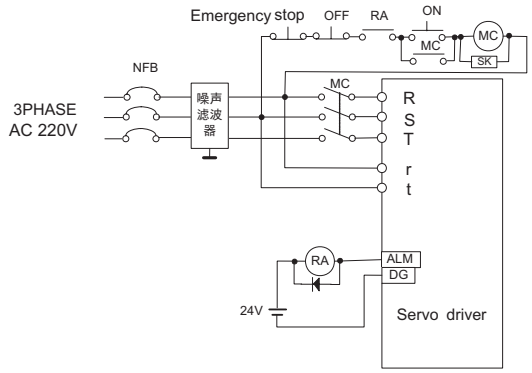


Figure 7.1 power supply wiring diagram

7.2.2 Sequence diagram

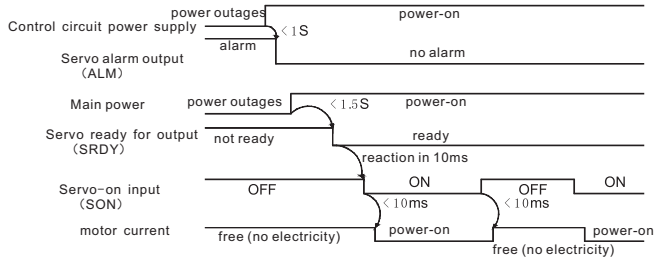


Figure 7.2 Sequence diagram of power connection

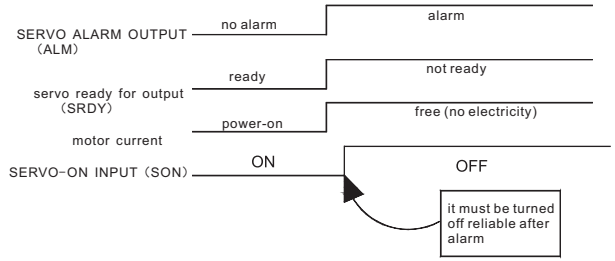


图 7.3 报警时序图

7.3 Use of mechanical brake

Mechanical brakes (hold brakes) are used to lock the vertical or tilting table connected to the motor to prevent the table from falling when the servo tube is lost.To achieve this function. you need to buy a motor with a holding brake .Brakes should only be used to hold the table and should never be used to slow down or stop the machine.

Figure 7.4 shows the wiring diagram of the brake , which is controlled using the mechanical release signal BRK from the actuator .Note that the brake power supply should be probided by the user and have sufficient capacity.It is recommended to install a SURGE absorber to suppress the surge voltage caused by the relay on/off action.The commission can also be used as a surge absorber , pay attention to will cause a little brake delay.

Figure 7.5 shows that action sequence of the mechianical brake after the motor stops stable under normal circumstances .at this time , the motor continues to be energized to maintain its position . After the brake is released and stabilized for a period of time (the time is determined by the parameter Pa47), the power supply of the motor is withdrawn.

Figure 7. 6 shows that when the motor is running at a speed greater than 30r/min, the motor current is cut off and the brake continues to be released . After a delay of some time , the brake will work . this is to slow down the motor from high speed rotation to low speed, and the make the mechanical brake action. to avoid damage to the brake , the delay time the time requred for parameter PA48 or motor speed to reach the value of parameter PA49 , and the minimum value of the two is taken

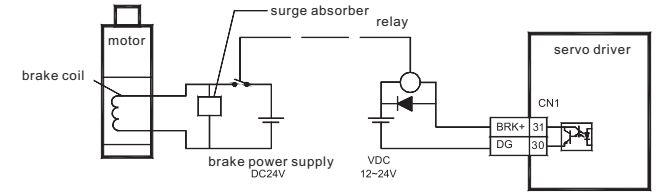


Figure 7.4wiring diagram of mechanical brake

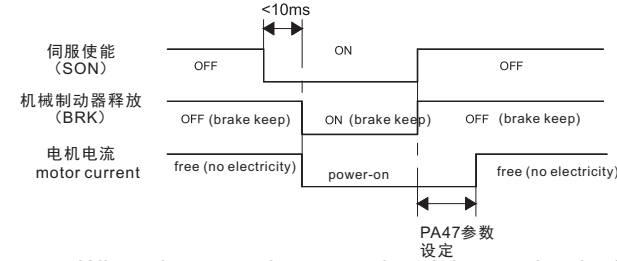


Figure 7.5 When the motor is stopped and the mechanical brake is actuated （motor speed ＜30r/min）

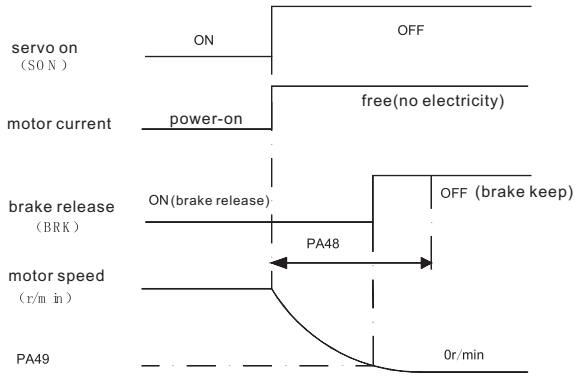


Figure 7.6 action sequence of mechanical brake during motor operation

7.4 Cautions

For the occasion of high frequency of start and stop, its necessary to confirm in advance whether it is within the frequency range of operation. The allowable frequency range varies with motor type , capacity , load inertia and motor speed.Firstly. set the acceleration and deceration time to prevent excessive regenerative energy (in the position control mode, set the acceleration and deceleration time of the controller output pulse in the moring or set the driver parameter PA19; in speed control mode, set driver parameters PA40 and PA41) .Under the condition that the load inertia is m times the inertia of the motor , the allowable start-stop frequency of the servo motor is as follows:

load inertia multiple	allowable start-stop frequency
m≤3	＞100 times /min, acceleration and deceleration time 60 ms or less
m≤5	60~100 times/min, acceleration and deceleration time 150ms or less
m＞5	＜60 times/min , acceleration and deceleration time more than 150 ms

If the requirements are not met, the method of reducing the internal torque limit (parameter PA34 , PA35) and reducing the maxmum motor speed (parameter PA23)can be adopted .

The allowable start-stop frequency of the servo motor varies with load conditions, running time and other overvoltage of the main circuit or abnormal braking may often occur during deceleration , which can be handled by the following methods;

1 Reduce the internal torque limit (parameter PA 34 , PA 35)

2.Reduce the best motor speed (parameter PA 23);

3.Install additional regeneration device

The servo driver is equipped with the power supply of the encoder.In order to ensure the normal operation of the encoder , the output voltage must be maintained at 5V±5%.When the user uses a very long cable, it may cause voltage loss. In this case , please use a mult-core power supply to the encoder to reduce the voltage drop on the cable

7.5 Trial Run

7.5. 1 Pre-run check

After installation and wiring , check the following items before starting the machine

- Is the connection correct?Especially R/S/T and U/V/W ,is there any loosening phenomenon?
- Is the input voltage correct ?
- Is there short circuit or ground in the motor connection cable ?
- Is the encoder cable connected correctly

7.5. 2 Power trial run

1.Before powering on

- motor no load, dont load the motor shaft.
- due to the impact of motor acceleration and deceleration, the the motor must be fixed.

2.Wiring

- wiring according to Figure 7.7 , main circuit terminal , three-phase AC220V terminals R,S,T;
- The control voltage terminals R and T are connected to single-phase AC220V;
- The encoder signal connector CN 2 is connected well with the servo motor;
- The control signal connector CN 1 is connected as shown

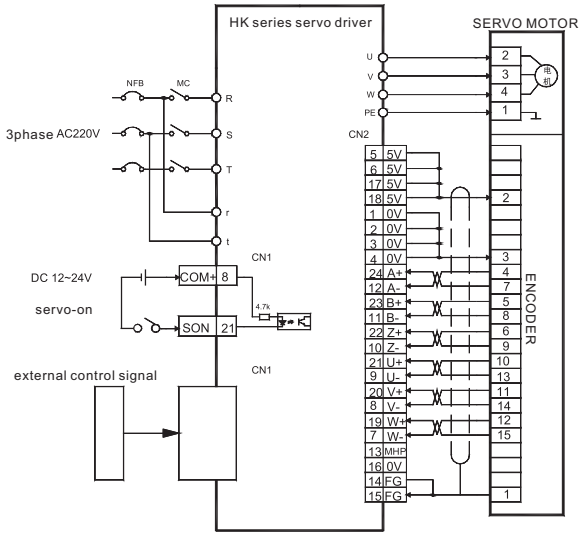


Figure 7.7commissioning wiring diagram

3. JOG Operation

- Switch on the power supply of the control circuit (the power supply of the main circuit is not connected. for the time being) , and the display of the driver is lit ,If there is an alarm,please check connection.

- Switch on the main circuit according to the following table

Parameter No .	Meaning	Parameter values	Factory default value
PA4	control mode selection	3	0
PA20	driver disable input is invalid	1	0

- After confirming that there is no alarm or any abnormal situation, make the servo enable（SON）ON， and the RUN indicator light will be lit .At this time , the motor will be excited and in the state of zero speed
- The speed trial operation prompt is "J 0" ,and the value unit is r/min.The system is in the speed control mode,and speed control mode and the speed command is provided by the key.Press the key ▲ and hold the motor will run at JOG speed , release the key, the motor will stop and keep zero speed, press the key ▼ and hold, the motor will run in the opposite direction of JOG speed , release the key , the motor will stop and keep zero speed.JOG speed is set by parameter PA 21,and 120r/min is missing

- If its inconevenient to enable the external control (SON) , you can set the parameter PA 53 to 0001,and the Q forced servo enable(SON) ON is effective.External cables are not required to control the SON.

4.Manual speed control operation

- Switch on the power supply of the control circuit (the power supply of the main circuit is not connected for the time being), and light the monitor regularly .If there is an alarm , please check the connection.

Set the parameter values according to the following table

Parameter No	Meaning	Parameter values	Factory default value
PA4	control mode selection	2	0
PA20	driver disable input is invalid	1	0

- After confirming that there is no alarm or any abnormal situation make the servo enable (SON)ON, and the RUN indicator light will be lit.At this time , the motor will be excited and in the state of zero speed.

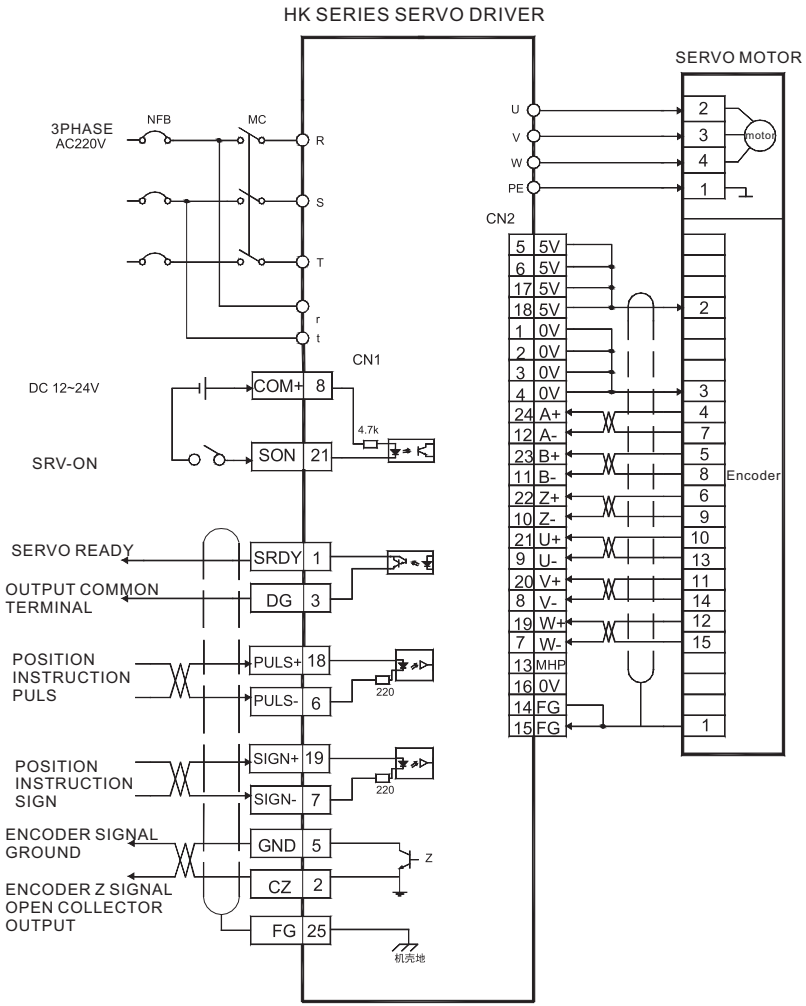
- Enter the speed trial operation state by pressing the key.The prompt for speed trial operation is "S 0 ", and the value unit is r/min.The system is in the speed control mode, and the speed command is provided by pressing the key.Press the keys ▲ ▼ to change the speed instruction, and the motor should run at the given speed .

- If its inconvenient to enable to external control servo (SON), you can set PA 53 to 0001 to enable the forced servo (SON)ON and dont need external cable control.

7.6 Simple wiring operation in position control mode

1.Wiring

- Wiring according to Figure 7.8,main circuit terminal, 3phase AC 220V terminals R,S,T
- The control voltage terminals r and t are connected to 1 phase AC 220V
- The encoder signal connector CN 2 is connected well with the servo motor
- The control signal connector CN 1 is connected as shown



Picture 7.8 Wiring diagram of position control mode

2. Operation

- Switch on the power supply of the control circuit and the main power supply . the display has a display . and the power indicator light is on
- Set the parameter values according to the following table

Parameter No.	Meaning	Parameter values	Factory default value
PA4	Control mode selection	0	0
PA12	Electronic gear molecule	User settings	1
PA13	Electronic gear denominator	User settings	1
PA19	Position command smoothing filter	0	0
PA20	Driver disable input is invalid	1	0

- If there is no alarm or any abnormal situation , make the servo enable (SON) and RUN indicator light on ;Send low frequency pulse signal from the controller to the driver to make motor run at low speed

3.Electronic gear setting

- The encoder installed in the is 10000 pulses / revolution , and arbitrary pulse equivalents can be obtained by setting the electronic gear parameters PA12 and Pa13 . Note: You can give the numerator and denominator any value to get any ratio , but it is best not to go beyond 1/50-50

Table 7-1 Relationship between the number of input pulses and the number of rotating turns

Input pulse number	The number of rotations of the motor	Electronic gear molecule PA12	Electronic gear denominator PA13
Pules	$\frac{\text{Pules} \times \text{PA12}}{10000 \times \text{PA13}}$	PA12	PA13
10000	1	1	1
5000	1	2	1
3000	1	10	3
800	1	25	2
20000	1	1	2
1000	2/3	20	3
4000	3	30	4

Table 7-2 Relationship between input pulse frequency and rotation speed

Input pulse frequency (Hz)	Motor speed (r/min)	Electronic gear molecule PA12	Electronic gear denominator PA13
Frequency	$\frac{\text{Frequency} \times 60 \times \text{PA12}}{10000 \times \text{PA13}}$	PA12	PA13
300k	1800	1	1
500k	3000	1	1
100k	1200	2	1
100k	1800	3	1
50k	1000	10	3
200k	800	2	3
100k	300	1	2

7.7 Speed control mode for simple wiring operation

1.Wiring

- Wiring according to Figure 7.9 main circuit terminal , three-phase AC220V terminal R , S ,T .
- The control voltage terminals R and T are connected to single-phase AC 220V
- The encoder signal connector Cn2 is connected well with the servo motor .
- The control signal connector Cn1 is connected as shown
- If only for speed control , don't need to connect the encoder output signal ; if the external controller is the position controller, the encoder output signal needs to be connected

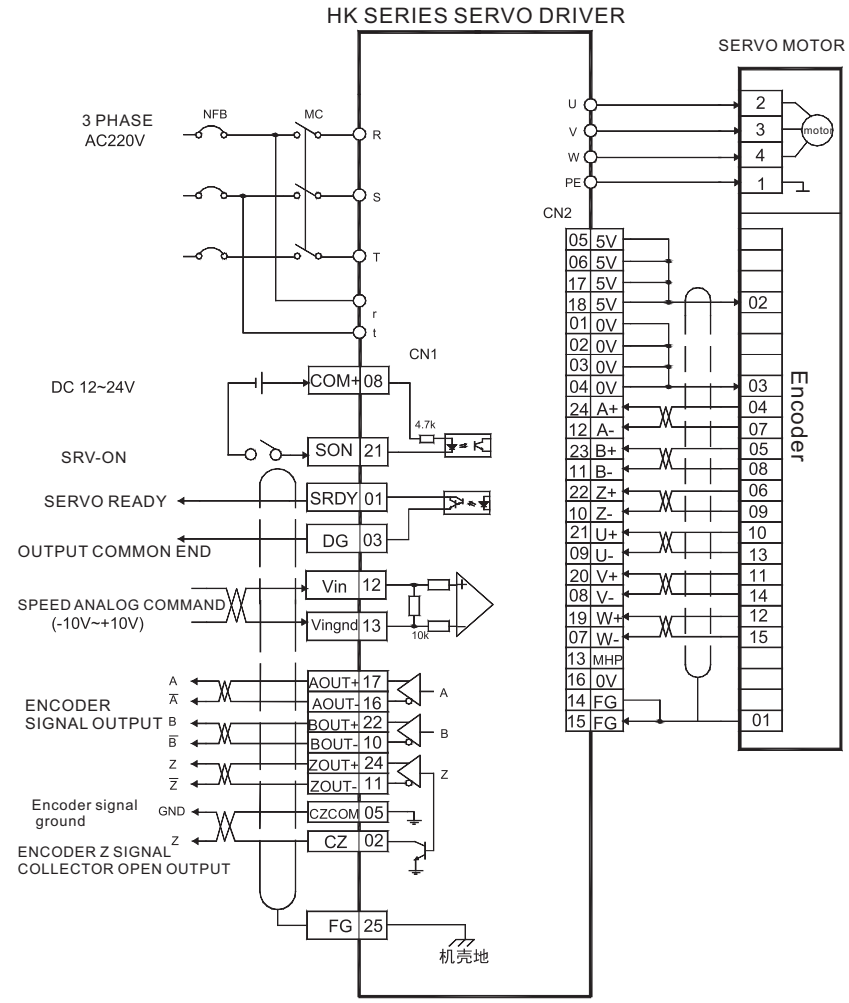


Figure 7. 9 Simple wiring diagram for speed control mode

2.Operation

- Connect the control circuit POWER supply and the main power display has a display , the power indicator light is on

Parameter No	Meaning	Parameter values	Factory default value
PA4	Control mode selection	1	0
PA20	Driver disable input is invalid	1	0
PA22	Internal and external speed common selection	1	1
PA40	Acceleration time constant	0	0
PA41	Deceleration time constant	0	0
PA43	Analog speed command gain	Set as requires	300
PA44	Analog speed command direction reversal	0	0
PA45	Analog speed command bias compensation	0	0

- When there are no alarms and any abnormal conditions , the servo enable (SON) is ON and RUN indicator is on
- Add an adjustable DC voltage to the analog speed input port, and gradually increase the specific voltage from 0 to ensure that the motor speed changes accordingly with the command; when negative voltage is applied , the motor shall rotate reversely.
- The zero speed clamp switch ZEROSPD is closed and the motor shall stop and remain at zero speed.
- If the given analog voltage is zero-speed voltage (0V),the motor may run at a low speed due to the zero-bias voltage of the upper controller and driver, and the parameter PA45 can be adjusted to compensate the zero-bias to make the motor at zero speed.
- Adjust the parameters PA43, PA44 to change the input gain and direction

7.8 Dynamic electronic gear use

The function of dynamic electronic gear is to dynamically change the proportion of electronic gear by input control signals during the determination of system operation .The function: the upper computer maximum output pulse frequency is low, when the electronic gear ratio is set large , the position resolution is low, but maximum speed is high In order to obtain a higher position resolution and a higher max speed for reuse, the ratio of two gears is set , which is dynamically switched through the control signal output by the upper computer

For example, in the application of CNC machine tools, set the first electronic gear proportion is small ,the second electronic gear proportion is large, in the cutting process , the speed is generally not very high ,the host computer output control signal to choose the first electronic gear proportion , can get a higher position resolution ;when moving fast , the upper computer output control signal chooses the second electronic gear ratio, and the higher moving speed can be obtained.

7.8.1 Brief connection for wiring

- Wiring according to figure 7.10 main circuit terminal , three-phase AC220V terminals R/S/T
- The control voltage terminals r and t are connected to single-phase AC220V
- Encoder signal connector Cn2 is connected with the motor
- The control signal connector Cn1 is connected as shown

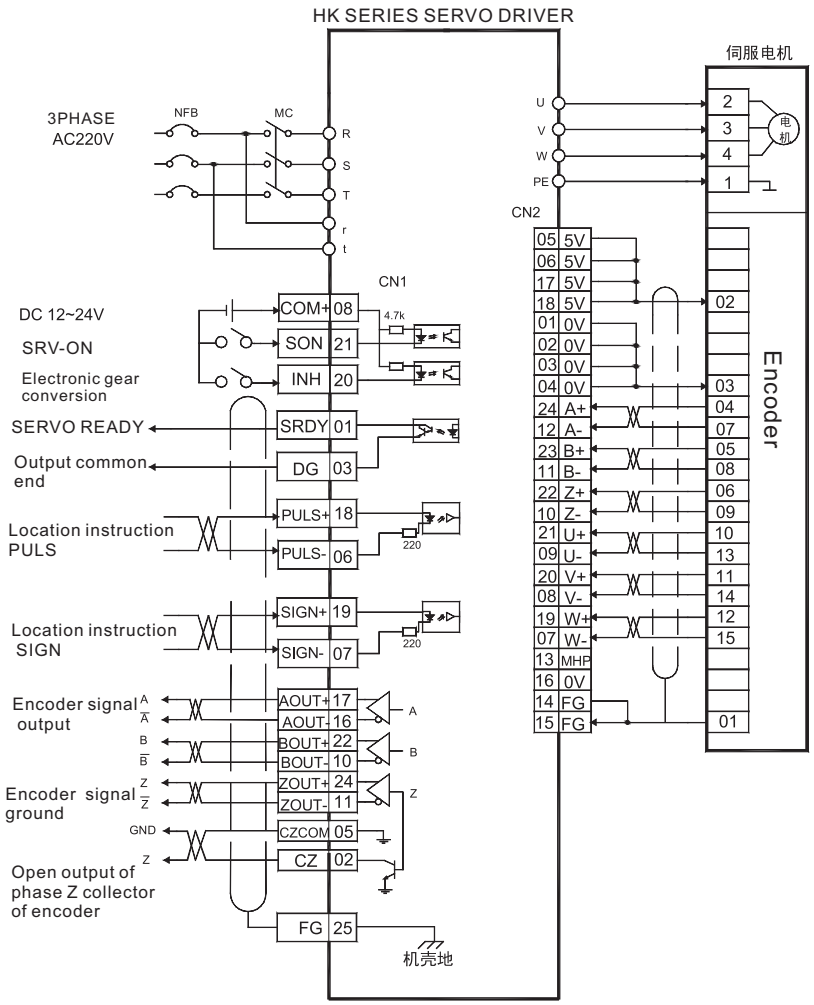


Figure 7.10 Wiring diagram of dynamic electronic gear

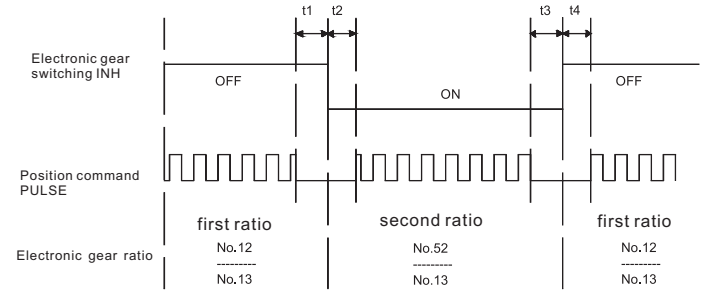
7.9.2 Operation

- Set the parameter values according to the following table.

Parameter No.	Meaning	Parameter values	Factory default value
PA4	Control mode selection	0	0
PA20	Driver disable input is invalid	1	0
PA12	First electronic gear molecule	User settings	1
PA13	Electronic gear denominator	User settings	1
PA19	Position command smoothing filter	0	0
PA51	Dynamic electronic gear works	1	0
PA52	Second electronic gear molecule	User settings	1

Electronic gear switching is realized by controlling the input terminal INH . when the INH terminal is OFF, the input electronic gear is PA12/PA13 . When the INH terminal is ON, the input electronic gear is PA52/PA13

Note that when switching the electronic gear , the timing of FIG.7.11 must be met . At least 10ms before and after the change point of the input INH, no pulse should be sent .



t1,t2,t3,t4＞10ms

FIG 7.12 Timing of dynamic electronic gear switching

7.10 Unipolar analog voltage speed control

Set the parameter values according to the following table

Parameter No.	Meaning	Parameter values	Factory default value
PA4	Control mode selection	1	0
PA20	Diver disable input is invalid	1	0
PA22	Internal and external speed command selection	2	1
PA43	Analog speed command input gain	Set as required	300
PA44	Direction inversion of analog speed instruction	Set as required	0
PA45	Analog quantity speed instruction zero offset compensation	Set as required	0
PA46	Analog speed command filter	Set as required	300

The input analog range is 0~10V . when the SON is valid , the speed value is determined by the analog amount , and the direction is determined by the following

Parameter PA44	FIL（CCW torque limit）	RIL（CW torque limit）	Speed direction
0	ON	OFF	CCW
	OFF	ON	CW
	ON	ON	0
	OFF	OFF	0
1	ON	OFF	CW
	OFF	ON	CCW
	ON	ON	0
	OFF	OFF	0

7.11 Input terminal switching control mode

The input terminal switching control mode function uses the ON/OFF of one input terminal to switch the two control models in real time,The control mode can be switched between position/speed. speed/torque or torque/position

Add parameter PA32(control mode switching is allowed). When PA32 =0 , the control mode is not allowed to be switched by external input terminals, and the control mode is determined by parameter PA4.The function of “alarm clearing”terminal is to clear alarms .When PA32=1, the control mode can be switched from the external input terminal , According to the parameter value of PA4.the alarm clearing terminal can be used to switch the control mode between position/speed , speed /torque , and torque/position . In this case , the alarm clearing function of the input terminal is disabled.
“Position” control mode position command from external input pulse train; “Speed” the speed command of the control mode consists of two sources; when PA22=0 ,the speed command comes from the external speed, when PA22=1(default) , the speed command comes from the external speed analog input ; “Torque”control mode torque commmand from the external torque analog input

Parameter PA32	Parameter PA4	“Alarm cleared” ALRS input terminal	Control mode
0（缺省）	0（缺省）	Used to clear alarms	Position
	1	Used to clear alarms	Speed
	6	Used to clear alarms	Torque
1	0	OFF	Position
		ON	Speed
	1	OFF	Speed
		ON	Torque
	6	OFF	Torque
		ON	Position

7.12 User torque overload alarm function

In order to prevent the occurrence of unexpected events on some occasions , which may cause the motor to rise abnormally and damage some mechanical devices, the user torque overload alarm function is designed , When this function is effective , the driver system detects the motor torque. When the torque is found to be higher than the given parameter value and kept for a period of time . the driver will alarm with the alarm number of Err-20 , and the motor will stop.
When its necessary to use the user torque overload alarm function , set PA31>0 , and set Pa30 and Pa31 reasonably, so that it can alarm as soon as possible when accidents occur in the application, and no false alarm will occur under normal working conditions

The user torque overload alarm function (Err-29) and the overload alarm function (Err-13) are different, the user torque overload alarm function can be set by the user alarm parameters, while the overload alarm is set by the manufacturer , the user cant modify the parameters , no matter whether the user torque overload alarm function is valid or not , the over load alarm is always valid . In general , the user torque overload alarm function is set to forbidden (PA31=0)

7.13 Adjustment

7.13.1 Basic gain adjustment

- Speed control

1）[speed proportional gain]（ Parameter Pa5) set value, under the condition of no oscillation , try to set as large as possible.In general , the larger the load inertia , the large the set value of [Speed proportional gain] should be .

2）The set value of [Velocity integration time constant]（Parameter PA6) should be set as small as possible under the condition of no oscillation

- Position control

1）First, set appropriate [velocity proportional gain]and [velocity integration time constant] as above。

2）[Position feedforward gain]（Parameter PA10) is set to 0%.

3）The set value of [position feedforward gain]（Parameter PA9) should be st as large as possible within the stable range , if the [position proportional gain] is set too large , its easy to produce oscillations.

4) If the position tracking gender is required to be high , the [position feedforward gain] set point can be increased . However , if its too large , it will cause overshoot

Severity	[Position proportional gain]
Low rigidity	10~20/S
Middle rigidity	30~50/S
High rigidity	50~70/S

7.13.2 Adjusting basic parameters

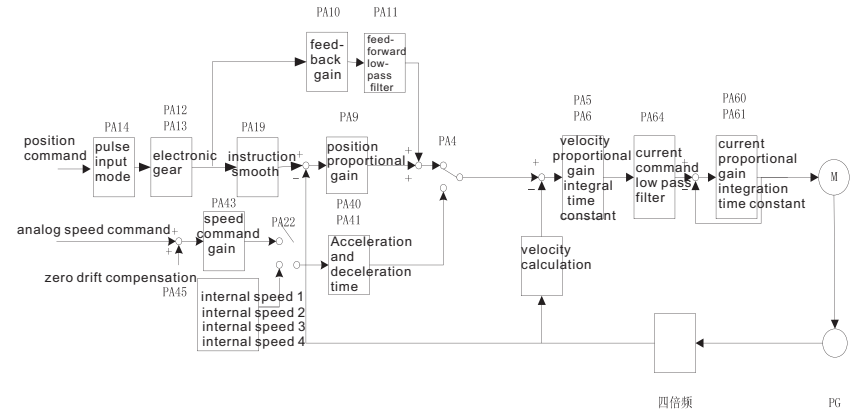


Figure 7.13 Adjustment of basic parameters

7.14 Questions

7.14.1 Restore default parameter

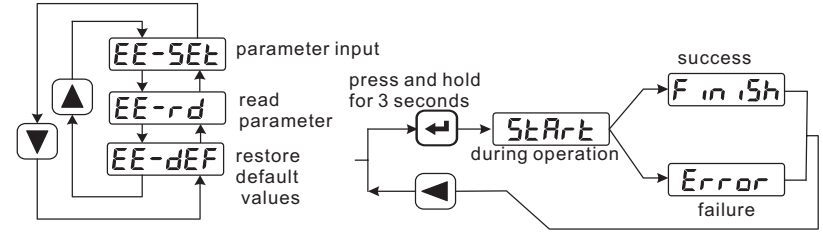


Figure 7.14 operation diagram of restoring default parameters

In the event of the following , use the restore default parameters(factory parameters) function: The parameters are scrambled and the system cant work properly . when saving the parameters, the system happens to be powered off .As a result , automatically restores the default parameters, but the model the system code (PA1)does not match the driver and motor .The driver needs to replace the original motor, the new motor and the original motor model is different , To restore default parameters perform the following steps: 1 . check the model of the driver and the model of the adapted motor , and find the model code according to Table 8.1 (for 30A driver) in section 8.4. Pay special attention to the model of the driver , otherwise the driver is damaged

Taking 30A driver ADAPTS 110ST-M06030 electricity as an example machine, the model code is 88 by looking up the table

2、Change password PA0 to 385 ；

3、Modify the model code PA1 parameter to the selected model code . In this example the PA1 parameter is 88 .the parameter value is displayed as “ 3A-88 ” ,the leading character is “ 3A ” . If the leading character is “ 2A ” , it indicates a 20A driver

4、Write the default parameter values to the EEPROM , Select “ EE- ” in layer 1 and press “ ↵ ” to enter the parameter management mode. First of all , you need to select the operation mode . There are three modes and use ▲▼ key to select them . Select “ EE-dEF”, Then press ↵ and hold it for more than 3 seconds . The display displays “StArt” indicating that the parameter is being written to EEPROM. After about 1 to 2 seconds, if the write operation is successful , Display of the display “ FinISH ” . If this fails , “ Error ” is displayed.

5、After the previous step is successful , power off the driver and power it on again.

7.14.2 Frequent Err-15、Err-30、Err-31、Err-32 alarm occur

These alarms indicate that these are problems with the photoelectric encoder and its connecting cable . which should be solved from the following aspects :

- Whether the connection cable and the plug are in poor connect
- The shielded cable connecting the cable is properly welded
- The ground PE terminal of the driver is properly connected
- The ground terminal of the motor and the ground PE terminal of the driver are properly connected .
- If the connection cable is too long , the voltage drop of the power supply on the cable may be too large .Use multiple wires to connect the 5V and 0V power supplies of the encoder .
- Don't share the same trough with the strong current cable . Try to change the wiring of the connecting cable . If the above measures don't work . Please contact with the seller

7.14.3 The power indicator fails to turn on

In the driver’s control power supply and strong power supply are normal conditions, the driver digital tube display. No alarm , and the panel of the strong electric indicator power light is not bright , the driver cant run

7.15 Related knowledge

7.15.1 Input an electronic gear

The unit impulse command can be input to the device through the electronic gear to make the transmission device move any distance. The impulse command generated by the upper controller does not need to consider the gear ratio of the transmission system, the reduction ratio or the number of motor encoder lines , The following table describes the electronic gear variables:

Variables	Variable declaration	Number value of this device
C	Number of encoder lines	2500
Pt	Encoder resolution （pulse/rev）	=4×C =4×2500 =10000（pulse/rev）
R	Ratio	R=B/A A：Motor rotation turns B：Rotation number of load shaft
ΔP	The amount of movement of a command pulse	
Pc	The number of command pulses for one rotation of	
Pitch	Ball screw pitch（mm）	
D	Roller diameter（mm）	

Computational formula

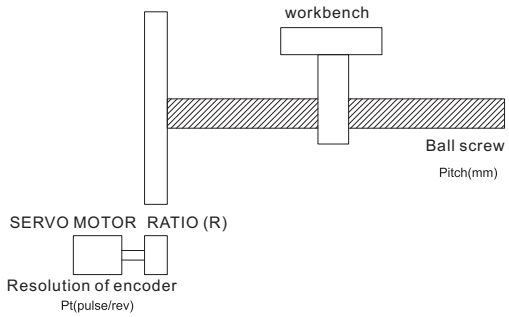
$$\text{gear ratio}\left(\frac{N}{M}\right)=\frac{\text{Encoder one-turn resolution (Pt)}}{\text{Number of command pulses for one rotation of load shaft (Pc)} \times \text{ratio (R)}}$$

and,

$$\text{Number of command pulses for one rotation of load shaft (Pc)}=\frac{\text{The amount of movement of the load shaft in one revolution}}{\text{A pluse instruction instructs the amount of movement (}\Delta\text{P)}}$$

Divide the following calculation results, and make both the numberator and denominator less than or equal to the integer value of 323767,and ensure that the ratio is within range of 1/50＜N/M＜200 , and write it into the parameter .

1、Electronic gear in ball screw application



For the ball screw load , there is

$$\text{electronic gear ratio } (\frac{N}{M}) = \frac{Pt}{Pc \times R}$$

And,

$$Pc = \frac{Pitch}{\Delta P}$$

For example : Its known that the number of encoder lines C=2500, the reduction ratio 1/1 , the Pitch =8mm , and the amount of movement of one pulse ΔP=0.001mm are used to calculate the electronic gear ratio. Computational procedure:

● Calculate the encoder resolution （Pt）

$$Pt=4\times C=4\times 2500=10000 \text{（pulse/rev）}$$

● Count the number of command pulses for one turn of the load shaft（Pc）

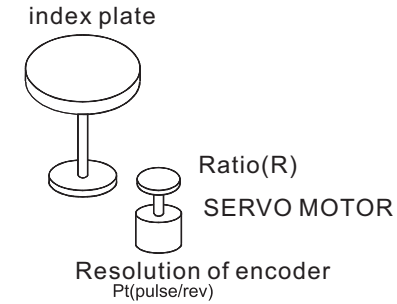
$$Pc = \frac{Pitch}{\Delta P} = \frac{8mm}{0.001mm} = 8000$$

● Calculate the electronic gear ratio

$$\text{electronic gear ratio } (\frac{N}{M}) = \frac{Pt}{Pc \times R} = \frac{10000}{8000\times(1/1)} = 8000$$

● Setting parameter (take the first molecule as an example)Numerator N=5, denominator M=4, set PA12=5 and PA13=4。

2、Application of electronic gear in indexing disk



For the ball screw load, there is :

$$\text{Electronic gear ratio } (\frac{N}{M}) = \frac{Pt}{Pc \times R}$$

and ,

$$Pc = \frac{360^\circ}{\Delta P}$$

For example: Its known that the number of encoder lines C=2500 lines the deceleration ratio 1/3, and the amount of one pulse movement ΔP =0.1° are used to calculate the electronic gear ratio。
Computational procedure：

● Calculate the encoder resolution （Pt）

$$Pt=4\times C=4\times 2500=10000 \text{（pulse/rev）}$$

● Count the number of command pulses for one turn of the load shaft（Pc）

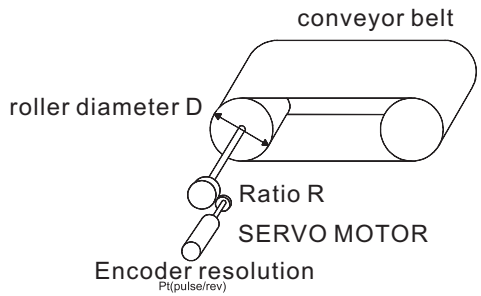
$$Pc = \frac{360^\circ}{\Delta P} = \frac{360^\circ}{0.1^\circ} = 3600$$

● Calculate the electronic gear ratio

$$\text{electronic gear ratio } (\frac{N}{M}) = \frac{Pt}{Pc \times R} = \frac{10000}{360\times(1/3)} = \frac{25}{3}$$

● Setting parameters(take the first molecule as an example)Numerator N=25, denominator M=3, Set PA12=25 and PA13=3。

3、Application of electronic gear in conveyor belt



For conveyor belt：

$$\text{electronic gear ratio } \left(\frac{N}{M}\right) = \frac{Pt}{Pc \times R}$$

and,

$$Pc = \frac{\pi D}{\Delta P}$$

For example : Its known that the number of encoder lines C=2500 lines, the ratio 1/10, roller diameter D=200mm, the amount of one pulse movement ΔP=0.01mm to calculate the electronic gear ratio Computational procedure :

- Calculate the encoder resolution （Pt）

$$Pt=4\times C=4\times 2500=10000 \text{（pulse/rev）}$$

- Count the number of command pulses for one turn of the load shaft（Pc）

$$Pc = \frac{\pi D}{\Delta P} = \frac{3.14\times 200}{0.01} = 62800$$

- Calculate the electronic gear ratio

$$\text{Electronic gear ratio } \left(\frac{N}{M}\right) = \frac{Pt}{Pc\times R} = \frac{10000}{62800\times(1/10)} = \frac{100000}{62800} = \frac{2500}{157}$$

- Setting parameters (taking the first molecule as an example)

Numerator N=2500, denominator M=157, set PA12=2500 and PA13=157。

4. The relationship between the number of motor turns and the electronic gear ratio

The relationship between the number of motor turns and the electronic gear ratio is as follows :

$$\text{Motor rotation turns} = \frac{Pulse\times N}{Pt\times M}$$

Where pulse is the number of input pulses , For example , the number of encoder lines C=2500 lines， N=20，M=30，pulse=1000, calculating as follows：

$$\text{Number of motor rotations} = \frac{1000\times 20}{10000\times 3} = \text{Motor selection turns} = \frac{2}{3}(r)$$

5. The relationship between the motor rotation speed and electronic gear ratio

The relationship between the motor rotation speed and the electronic gear ratio as follow :

$$\text{motor speed（r/min）} = \frac{f(Hz)\times 60\times N}{Pt\times M}$$

Where f is the input pulse frequency in Hz(pps),

For example , the number of encoder lines C=2500 lines ,N=3，M=1，f=100kHz(kpps), calculating as follows：

$$\text{motor speed（r/min）} = \frac{100\times 10^3\times 60\times 3}{10000\times 1} = 1800(r/min)$$

7.15.2 Hysteresis pulse during position control

When the servo motor is controlled by pulse train , there is difference between the command pulse and the feedback pulse ,called the lag pulse which is accumulated in position deviation counter . It has the following relationship with the command pulse frequency , electronic gear ratio and the position proportional gain:

$$\varepsilon = \frac{f^*\times G}{Kp}$$

ε : lag pulse（pulse）;
f*: command pulse frequency（Hz）;
Kp: position proportional gain（1/S）;
G: electronic gear ratio

【Note 1】The above relationship is obtained under the condition that [position feedforward gain] is 0% , If position feedforward gain]]＞0%, the hysteresis pulse will be smaller than the calculated value in the above equation .

chapter 8 Specification

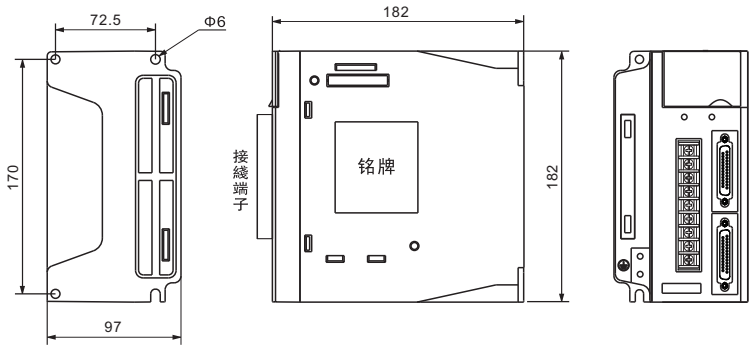
8.1 Servo driver specifications

HK 30A

Marks	Output power
20A	1.0 KW
30A	2.2 KW

Product series

8.2 Servo driver mounting size



Picture 8.1 HK -30A dimension size

8.3 Servo driver specifications

Model		HK-30A
Input power		3PHASE AC220V −15%~+10% 50/60Hz
Environment	Temperature	working : 0~40℃ Saving: −40℃~50℃
	Humidity	40%~80% (No condensation)
	Pressure	86~106kPa
	Control Method	position control/speed control/torque control
Regenerative brake		Built-in
Character	Velocity frequency response	■00Hz
	Speed fluctuation ratio	＜±0.03 (Load 0~100%) ; ＜±0.02 (Power supply −15%~+10%)
	Speed ratio	1:5000
	Impulse frequency	■00kHz
Control input		1. SRV-ON 2. ALM-RST 3. CCW driving limited 4. CW driving limited 5. the deviation counter is cleared to zero/speed selection 1/zero speed clamp 6. command pulse to forbid/speed selection 2 7. CCW torque limited 8. CW torque limited
Control output		1. Servo ready for output 2. Servo alarm output 3. Positioning complete output/Velocity reach output 4. Mechanical brake output
Position control	Input mode	1. Pulse+symbol 2. CCW pulse/CW pulse 3. two phase A/B orthogonal pulses
	electronic gear	1~32767/1~32767
	feedback pulse	2500 lines/r
Speed control		4 seconds internal velocity
Increase/reduce speed function		Parameter setting 1~10000ms / 1000r/min
Monitoring function		Speed, current position , command pulse accumulation , position deviation , motor torque motor current , absolute position of linear speed rotor command pulse frequency , operating state , input and output terminal signal ,etc
Protecting function		overspeed, overvoltage and undervoltage of main power supply, overcurrent, overload, abnormal braking abnormal encoder,abnormal control power supply, excessive position etc
Applicable load inertia range		Less than 5 bits of motor inertia

8.4 Servo code parameters & motor comparison table

The setting value of parameter Pa1 (model code) must match the driver and motor used. the setting value of parameter PA1 is shown in the table below. If it does not match , it will cause performance degradation or alarm . Each model code has a different combination of default parameters .The corresponding parameter PA1 has been set when device leaves the factory ,and it is restored to corresponding default parameter combination . If you need to modify the model code or restore the factory default parameter combination , please refer to Section 7.14.1 for implementation

Table 8.1 Motors adapted to the HK-30A driver

Model code	Adaptation motor	Power ■kW■	Rated torque ■N.m■	Rated speed ■r/min■
73	SH4MN060A-P63FFI2D-01	0.2	0.637	3000
74	SH4MN060A-013FFI2D-01	0.4	1.27	3000
75	SH4MN060A-019FFI2D-01	0.6	1.91	3000
76	SH4MN080A-013FFI2D-01	0.4	1.27	3000
77	SH4MN080A-024FFI2D-01	0.75	2.4	3000
78	SH4MN080A-035DFI2D-01	0.73	3.5	2000
79	SH4MN080A-040EFI2D-01	1.0	4.0	2500
80	SH4MN090A-024FFI2D-01	0.75	2.4	3000
81	SH4MN090A-035DFI2D-01	0.73	3.5	2000
82	SH4MN090A-040EFI2D-01	1.0	4.0	2500
83	SH4MN110A-020FFI2D-01	0.6	2.0	3000
84	SH4MN110A-040DFI2D-01	0.8	4.0	2000
85	SH4MN110A-040FFI2D-01	1.2	6.0	3000
86	SH4MN110A-050FFI2D-01	1.5	5.0	3000
87	SH4MN110A-060DFI2D-01	1.2	6.0	2000
88	SH4MN110A-060FFI2D-01	1.8	6.0	3000
89	SH4MN130A-040EFI2D-01	1.0	4.0	2500
90	SH4MN130A-050EFI2D-01	1.3	5.0	2500

Model code	Adaptation motor	Power ■kW■	Rated torque ■N.m■	Rated speed ■r/min■
91	SH4MN130A-060EFI2D-01	1.5	6.0	2500
92	SH4MN130A-077EFI2D-01	2.0	7.7	2500
93	SH4MN130A-100BFI2D-01	1.0	10	1000
94	SH4MN130A-100CFI2D-01	1.5	10	1500
95	SH4MN130A-100EFI2D-01	2.6	10	2500
96	SH4MN130A-150CFI2D-01	2.3	15	1500

8.5 Servo motor model

SH4MN	130	A	-	040	E	F	A1	D	-	0	1
1	2	3		4	5	6	7	8		9	10

1	Motor type	SH4MN: Standard uniform series 4 Antipodes SH4MA: Small inertia series 4 Antipodes SH5MB: Middle inertia series 5 Antipodes SH4ME: Compact size series 4 Antipodes
2	Flange specifications	040: 40 Flange 060: 60 Flange 080: 80 Flange 090: 90 Flange 110: 110 Flange 130: 130 Flange 150: 150 Flange 180: 180Flange
3	Output shaft type	A: straight shaft with keyway and screw hole B:cone shaft, keyway , screw hole C: straight axis , no keys D: straight shaft with keyway
4	Rated torque	P16:0.16N.m P32:0.32N.m 040:4N.m 050:5N.m 060:6N.m 077:7.7N.m 100:10N.m 150:15N.m A00:100N.m A18:118N.m B00:200N.m C00:300N.m

5	Rated speed	A: 500r/min B: 1000r/min C: 1500r/min D: 2000r/min E: 2500r/min F: 3000r/min G: 4000r/min H: 5000r/min
6	Rated Voltage	A: 24V B: 48V C: 60V D: 72V E: 110V F: 220V G: 380V
7	Encoder specification	I1: Photoelectric increment 1000 lines I2: Photoelectric increment 2500 lines I3: Photoelectric increment 5000 lines I4: Photoelectric saving line type 2500 line A1: Photoelectric multi-turn absolute value 17bits A5: Photoelectric multi-turn absolute value 23bits A6: Photoelectric single turn absolute value 17bits A9: Photoelectric single turn absolute value 23bits B1: Photoelectric split type multi-turn absolute value 17bits B2: Photoelectric split type multi-turn absolute value 20bits R2: Winding type 2 antipolar rotation R3: Magnetoresistive type 2 antipolar rotation M1: 1000 line incremental magnetic knitting M7: 12-bit absolute value magnetic coding 00: No encoder
8	■■■■■	D: TAMAGAWA N: NEMICON C: YUHENG B: PENON Y: SICK S: SIDI H: DANAHER G: CDHD L: LTN
9	■■■■	0: No brake 1: Electromagnetic brake 2: Permanent magnet brake 3: Manual brake
10	■■	0: Without oil seal 1: With oil seal

8.6 Servo motor wiring

8.6.1.1 Winding wiring (Aviation plug lead)

Terminal symbols	Terminal number	Terminal instructions
U	2	electronic U phase power input
V	3	electronic W phase power input
W	4	electronic V phase power input
⏚	1	motor housing grounding terminal

8.6.1.2 Winding wiring (Plastic plug lead)

Terminal symbols	Terminal number	Terminal instructions
U	1	electronic U phase power input
V	2	electronic W phase power input
W	3	electronic V phase power input
⏚	4	motor housing ground terminal

8.6.2 Brake

Terminal symbols	Terminal number	Terminal instructions
DC+	1	Brake power supply
DC-	2	
⏚	3	Motor housing ground terminal

8.6.3.1 Standard encoder（Aviation plug lead）

Terminal symbols	Terminal number	Terminal instructions
5V	2	Encoder 5V power input
0V	3	
A+	4	Encoder phase A power input
A-	7	
B+	5	Encoder phase B power input
B-	8	
Z+	6	Encoder phase Z power input
Z-	9	
U+	10	Encoder phase U power input
U-	13	
V+	11	Encoder phase V power input
V-	14	
W+	12	Encoder phase W power input
W-	15	
FG	1	Encoder housing

8.6.3.2 Standard encoder（Plastic plug lead）

Terminal symbols	Terminal number	Terminal instructions
5V	2	Encoder 5V power input
0V	3	
A+	9	Encoder phase A power input
A-	13	
B+	4	Encoder phase B power input
B-	14	
Z+	7	Encoder phase Z power input
Z-	5	
U+	6	Encoder phase U power input
U-	8	
V+	10	Encoder phase V power input
V-	12	
W+	11	Encoder phase W power input
W-	15	
FG	1	Encoder housing

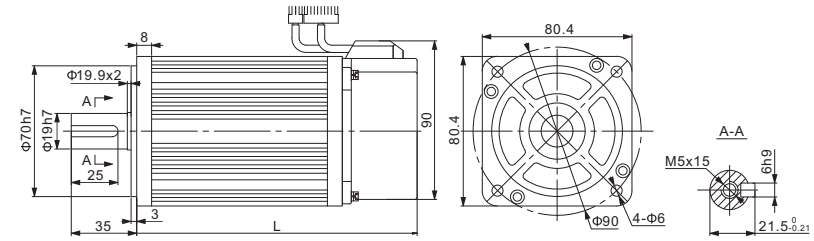
8.6.4 Provincial encoder

Terminal symbols	Terminal number	Terminal instructions
5V	2	Encoder 5V power input
0V	3	
A+	4	Encoder phase A power input
A-	7	
B+	5	Encoder phase B power input
B-	8	
Z+	6	Encoder phase Z power input
Z-	9	
FG	1	Encoder housing

8.7 Servo motor specifications

8.7.1 80 series motor specifications

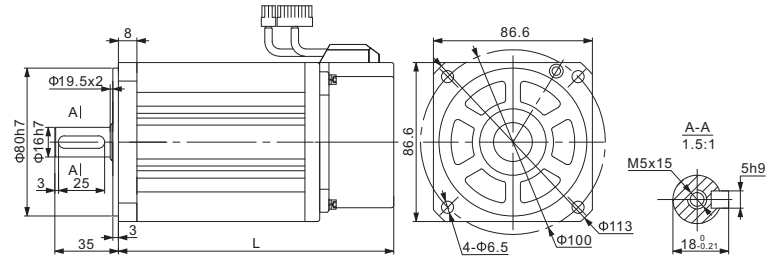
Model	SH4MN080A-013FFI2D-01	SH4MN080A-024FFI2D-01	SH4MN080A-035DFI2D-01	SH4MN080A-040EFI2D-01
Power	0.4 kW	0.75 kW	0.73 kW	1 kW
Rated torque	1.27 N.m	2.39 N.m	3.5 N.m	4 N.m
Rated speed	3000 rpm	3000 rpm	2000 rpm	2500 rpm
Rated current	2 A	3 A	3 A	4.4 A
Rotor inertia	1.05×10^{-4}	1.82×10^{-4}	2.63×10^{-4}	2.97×10^{-4}
Max current	6 A	9 A	9 A	13.2 A
Max torque	3.8 N.m	7.1 N.m	10.5 N.m	12 N.m



Motor model	SH4MN080A-013FFI2D-01	SH4MN080A-024FFI2D-01	SH4MN080A-035DFI2D-01	SH4MN080A-040EFI2D-01
L without brake	124 mm	151 mm	179 mm	191 mm
L with brake	164 mm	191 mm	219 mm	231 mm

8.7.2 90 series motor parameters

Model	SH4MN090A-024FFI2D-01	SH4MN090A-035DFI2D-01	SH4MN090A-040EFI2D-01
Power	0.75 kW	0.73 kW	1 kW
Rated torque	2.4 N.m	3.5 N.m	4 N.m
Rated speed	3000 rpm	2000 rpm	2500 rpm
Rated torque	3 A	3 A	4 A
Rotor inertia	2.45×10^{-4}	3.4×10^{-4}	3.7×10^{-4}
Max current	9 A	9 A	12 A
Max torque	7.1 N.m	10.5 N.m	12 N.m

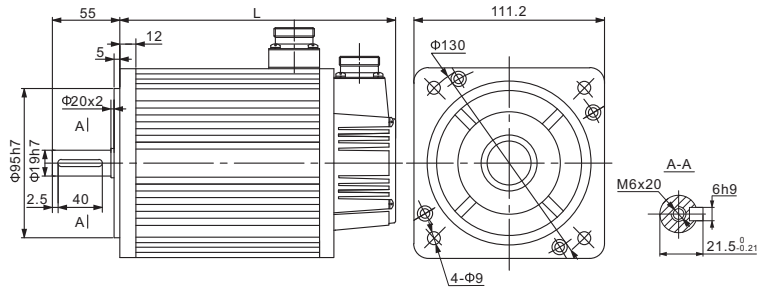


Motor model	SH4MN090A-024FFI2D-01	SH4MN090A-035DFI2D-01	SH4MN090A-040EFI2D-01
L without brake	150 mm	172 mm	182 mm
L with brake	198 mm	220 mm	230 mm

8.7.3 110 series motor parameters

Model	SH4MN110A-020FFI2D-01	SH4MN110A-040DFI2D-01	SH4MN110A-040FFI2D-01
Power	0.6 kW	0.8 kW	1.2 kW
Rated torque	2 N.m	4 N.m	4 N.m
Rated speed	3000 rpm	2000 rpm	3000 rpm
Rated current	2.5 A	3.5 A	5 A
Rotor inertia	0.31×10^{-3}	0.54×10^{-3}	0.54×10^{-3}
Max torque	6 N.m	12 N.m	12 N.m

Model	SH4MN110A-050FFI2D-01	SH4MN110A-060DFI2D-01	SH4MN110A-060FFI2D-01
Power	1.5 kW	1.2 kW	1.8 kW
Rated torque	5 N.m	6 N.m	6 N.m
Rated speed	3000 rpm	2000 rpm	3000 rpm
Rated current	6 A	4.5 A	6 A
Rotor inertia	0.63×10^{-3}	0.76×10^{-3}	0.76×10^{-3}
Max torque	15 N.m	12 N.m	18 N.m



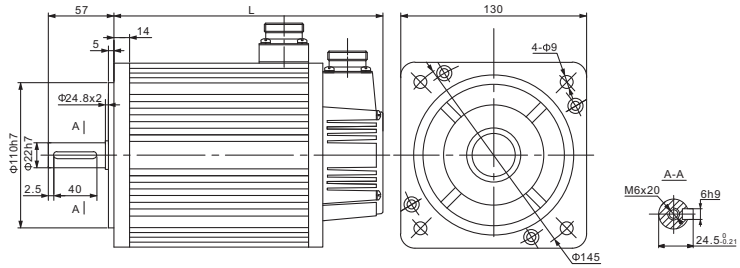
Motor model	SH4MN110A-020FFI2D-01	SH4MN110A-040DFI2D-01	SH4MN110A-040FFI2D-01
L without brake	159 mm	189 mm	189 mm
L with brake	233 mm	263 mm	263 mm

Motor model	SH4MN110A-050FFI2D-01	SH4MN110A-060DFI2D-01	SH4MN110A-060FFI2D-01
L without brake	204 mm	219 mm	219 mm
L with brake	278 mm	293 mm	293 mm

8.7.4 130 Series motor data

Motor model	SH4MN130A-040EFI2D-01	SH4MN130A-040EFI2D-01	SH4MN130A-060EFI2D-01	SH4MN130A-077EFI2D-01
Power	1 kW	1.3 kW	1.5 kW	2 kW
Rated torque	4 N.m	5 N.m	6 N.m	7.7 N.m
Rated speed	2500 rpm	2500 rpm	2500 rpm	2500 rpm
Rated current	4 A	5 A	6 A	7.5 A
Rotor inertia	$0.85^{3}\times 10$	1.06×10^{-3}	1.26×10^{-3}	1.53×10^{-3}
Max current	6 A	9 A	9 A	13.2 A
Max torque	12 N.m	15 N.m	18 N.m	22 N.m

Model	SH4MN130A-100BFI2D-01	SH4MN130A-100CFI2D-01	SH4MN130A-100EFI2D-01	SH4MN130A-150CFI2D-01
Power	1 kW	1.5 kW	2.6 kW	2.3 kW
Rated torque	10 N.m	10 N.m	10 N.m	15 N.m
Rated speed	1000 rpm	1500 rpm	2500 rpm	1500 rpm
Rated current	4.5 A	6 A	10 A	9.5 A
Rotor inertia	1.94×10^{-3}	1.94×10^{-3}	1.94×10^{-3}	2.77×10^{-3}
Max current	6 A	9 A	9 A	13.2 A
Max torque	20 N.m	25 N.m	25 N.m	30 N.m



Motor model	SH4MN130A-040EFI2D-01	SH4MN130A-050EFI2D-01	SH4MN130A-060EFI2D-01	SH4MN130A-077EFI2D-01
L without brake	166 mm	171 mm	179 mm	192 mm
L with brake	223 mm	228 mm	236 mm	249 mm

Motor model	SH4MN130A-100BFI2D-01	SH4MN130A-100CFI2D-01	SH4MN130A-100EFI2D-01	SH4MN130A-150CFI2D-01
L without brake	213 mm	213 mm	209 mm	241 mm
L with brake	294 mm	294 mm	290 mm	322 mm