SAFETY NOTES

The ESDB series general servo driver, which adopts DSP+FPGA system framework, has a series of virtues: it speeds up the process of data collection and processing, with high integration level and reliability; it has abundant interfaces for digital and analog input, which can match diversified upper control devices; its optimized control algorithm makes accurate full-digital control of torque, speed and position come true, which can be used in various manufacturing fields.

Before storing, installing, wiring, operating, checking and repairing, make sure to understand and obey the following important notes, so as to operate the product safely.

⚠DANGER	Incorrect handling may cause dangerous situation resulting in personal injury or death.
⚠WARNING	Incorrect handling may cause dangerous situation resulting in personal injury and device damage.
⚠NOTICE	Neglect of this notice may cause undesired results or situation.
⊘FORBIDDEN	Strictly forbidden actions, or the device may be damaged or discarded as useless.

1. Product Inspection

⚠WARNING
● AC servo drive must operate with matched servo motor. ● Products being damaged or out of order can't be used, or it may cause fire or equipment failure. ● If using your own motor, please contact our company's technicians, or normal operation of the driver can't be guaranteed.

2. Product Installing

DANGER
● Don't expose the product to steam, corrosive and combustible gas, otherwise it may cause electric shock or fire. ● Don't use the product in the place with direct sunlight or lots of dust, salinity and metal powder. ● Don't use the product in the place with drippy water, oil and medicine.

3. Wiring

DANGER
● Brake resistor must be connected in the designed way, otherwise it may cause damage to the driver. ● Don't join up the driver of 220V with the power supply of 380V, or there are danger of machine damage, electric shock and fire. ● Confirm the one-to-one correspondence between the U,V,W output terminals and the U,V,W binding posts, otherwise the motor may overspeed and cause damage to the machine and personal injury. ● The grounding terminal must be grounded correctly; bad ground may cause electric shock or fire.

4. Notes for Operation

NOTICE
● Before power on, please make sure the servo driver and servo motor have already been installed and fixed correctly, and the power voltage and wiring is right. ● Before using the driver, confirm the machine's coupling and belt are separated, and set the driver's parameter to suitable value. Test the servo motor to confirm it is operating correctly, and then connect to the load; otherwise it may cause machine damage and breakdown. ● Before operating, please confirm the emergency switch can be turned on at any time to stop the machine.

FORBIDDEN
● Don’t touch any rotating part of the motor; otherwise it may cause personal injury. ● When the equipment is running, don’t move the stub cable, otherwise it may cause personal injury or machine damage. ● When the equipment is running, don’t touch the drive and motor otherwise it may cause electric shock or scald. ● Don’t turn on and off the power frequently. If necessary, please control the frequency is below once every minute.

5. Trouble Handling

NOTICE
● Except the specified professional staff, please don’t connect, install, operate, dismantle and repair the machine, for there are risks of electric shock and causing damage to the equipment. ● Please don't reform the driver by oneself for there is danger of electric shock and personal injury. ● Don’t touch the circuit board with hand directly, or it may destroy the board because of electrostatic induction. ● When the equipment gives an alarm signal, check it and clear the trouble. Reset the alerting signal before restarting. ● Be far away from the machine when restart it after unexpected power cut, for it may start suddenly. (The machine’s design should make sure it wouldn’t be dangerous when restarts.)

6. Maintain and Safeguard

FORBIDDEN
● Don’t touch the interior of the driver and motor, for there is danger of electric shock. ● Don’t dismantle panels of the driver when it’s power on, otherwise it may cause electric shock. ● Don’t touch binding post in 5 minutes after power off, otherwise the remaining high voltage may cause electric shock. ● Change the wiring when power on is not allowed, otherwise it may cause electric shock. ● Don’t dismantle the servo motor, otherwise it may cause electric shock.

REMARKS

Chapter1 Products Inspection and Model Introduction

1.1 Receiving Inspection

When products are arrived, please check the following items:

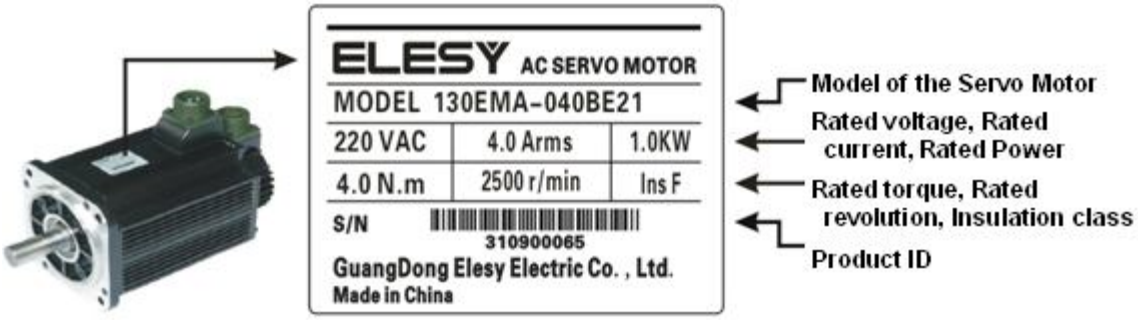
Checking Items	For Reference
Whether the arrived product is in accordance with the ordered model.	Check and confirm the nameplates of servo motor and servo driver.
Whether the servo motor shaft can run smoothly.	It's normal if you can rotate it with hand lightly, however the motor with brake doesn't rotate.
Whether the appearance of servo motor and driver is intact.	Check it to confirm there isn't scratch because of transportation.
Whether there is any screw is loose.	Please check them by sight.

For the above checking items, if you found any problem, please contact promptly with the local store or our company's sales department.

⚠WARNING	➢ Product being damaged or out of order must not be put into service; otherwise there is danger of fire or equipment failure. ➢ The servo driver must be used with the performance-matched servo motor.

1.2 Nameplate Introduction

■ The Servo Motor



■ The Servo Driver

1.3 Model Introduction

■ The Servo Motor

130 EM A 040 B E 1 1

Shaft Extension Rules:
1. direct shaft without key (normal).
2. direct shaft, with key, with screwed hole.

Choose Parts: 1. without parts; 2. with oil seal;
3. with brake; 4 with oil seal and brake.

Feedback Element: E, Incremental encoder 2500P/R;
P, Wire- saving encoder; S, Absolute encoder 131072P/R;
R, Rotary transformer.

Rated Revolution: A，3000min^{-1}；B，2500min^{-1}；
C，2000min^{-1}；D，1500min^{-1}；E，1000min^{-1}。

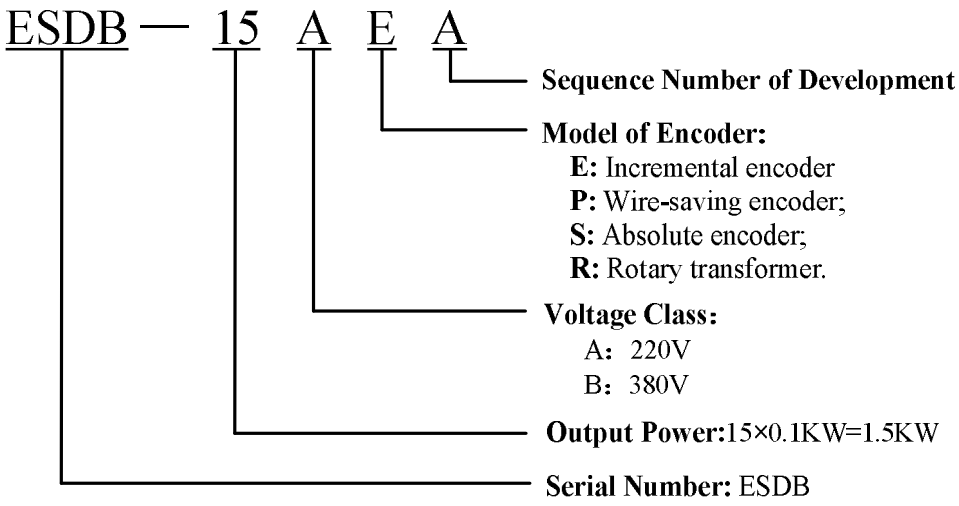
Rated Torque: 40，4Nm； 050，5NM； 060，6NM；
075，7.5Nm； 100，10NM； 150，15NM。

Design Order: A, Normal; B, Enhanced.

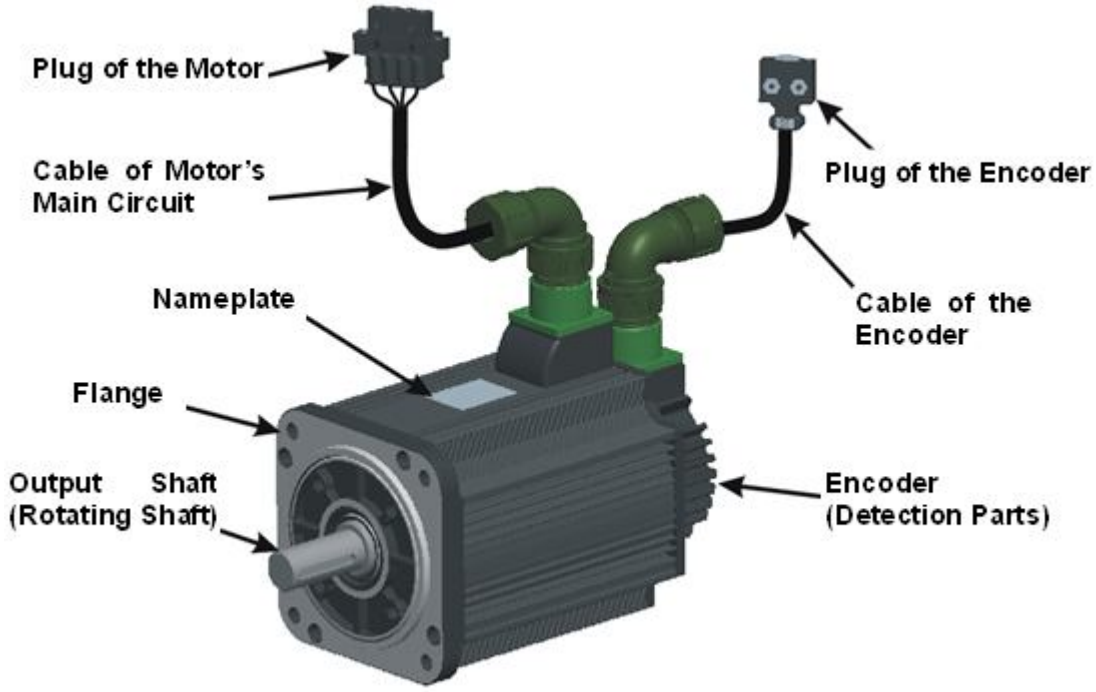
ELESY Servo Motor

Foundation Bed Number

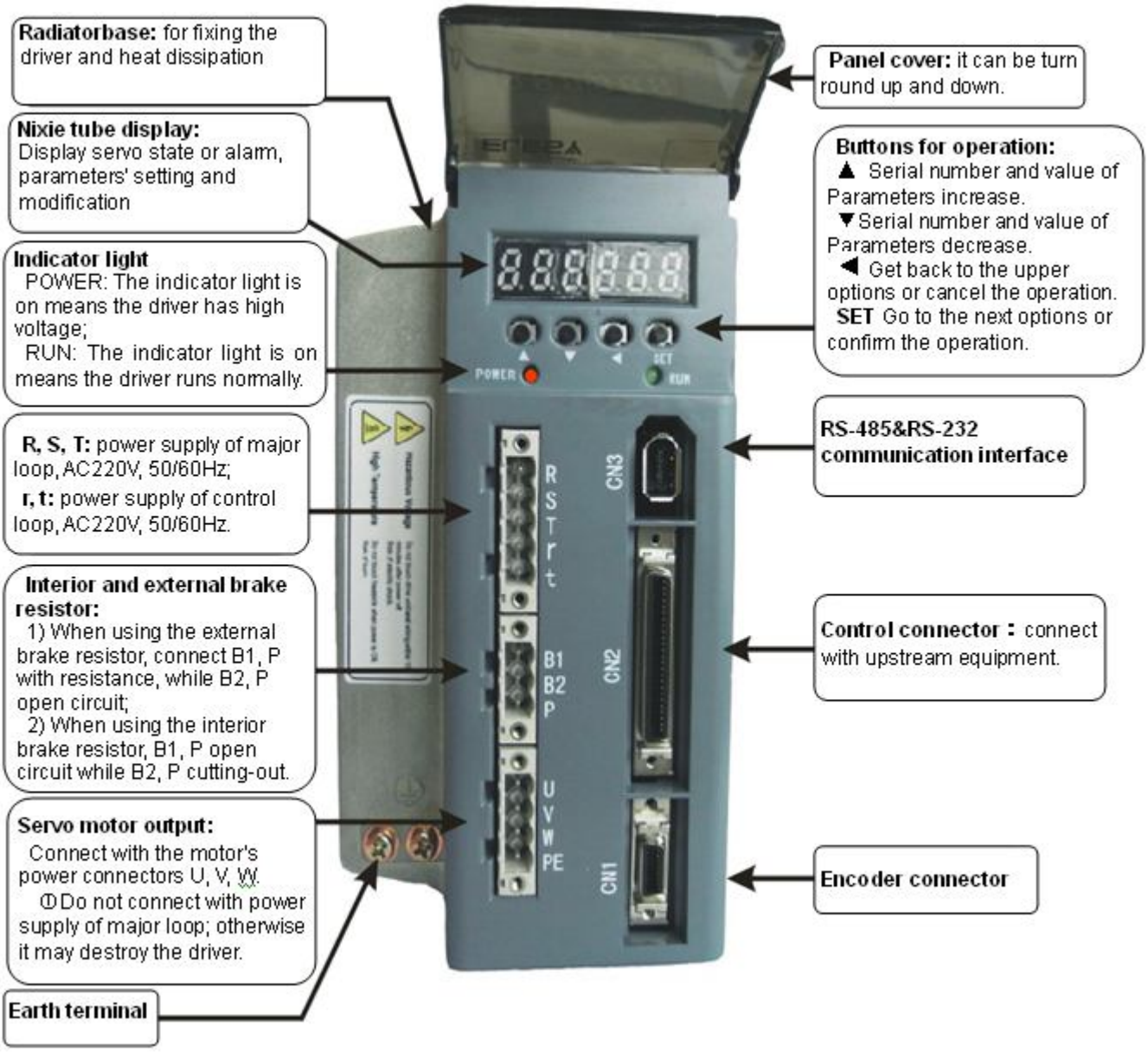
■ **The Servo Driver**



1.4 Names of Motor's Parts



1.5 Names of the Driver's Parts



1.6 Specifications of Servo Driver

Power Supply		single phase AC220V (-15%～+10%),50/60Hz	three phase AC220V （-15%～+10%），50/60Hz
Operating condition	**Temperature**	operating temperature:0～40℃ storage temperature:-40～50℃	
	Humidity	Less than 90%, no moisture condensation	
	Vibration	Less than 0.5G(4.9m/S2) 10～60Hz,operate discontinuously	
Control Mode		①position control; ②speed control; ③speed test running; ④JOG running.	
Regenerative Braking		Internally installed or out-connected.	
Response	**Frequency response**	200Hz or higher	
	Speed fluctuation ratio	< 0.03(load 0～100%)	
	Speed regulation ratio	1:5000	
	Input pulse frequency	0～500kHz	
Control input		① Servo enable; ② Alarm clearing; ③ Deviation counter clearing/ set inside speed 1;④Command pulse disable/set inside speed 2;⑤CCW drive disable;⑥CW drive disable; ⑦ The second electronic gear ratio/zero-speed clamping	
Control output		①Servo ready for output;②Servo alarm output;③Position fixing finished/Speed reaches output; ④mechanical brake; ⑤Encoder signal division outputs.	
Position control	Input mode	①Pulse + Direction;②CCW pulse / CW pulse; ③Two phase orthogonal pulse	
	Electronic gear ratio	Setting limits:1～32767/1～32767	
	Feedback pulse	Adjustable according to encoder's resolution （20000 pulse/rotation at most）	
Speed control		①internal 4-segment speed setting; ②external -10～+10V analog signal control	
Acceleration and deceleration function		Parameter sets 1～10000ms(0～1000r/min or 1000～0r/min)	
Torque limitation function		Torque limitation limits: -300%～+300%	
Monitoring function		Rotating speed, current position, command pulse accumulation, position deviation, motor torque, motor current,	

	rotor position, command pulse frequency, running state, input and output terminals signal, etc.
Protection function	Overspeed; major power supply overvoltage or undervoltage, overcurrent, overload, braking abnormity; encoder abnormity, control power supply undervoltage, overheated, position deviation, etc.
Operation display	6-bits LED nixie tube, 4 button, 2 indicator lights
Applicable load inertia	Smaller than 5 times of the inertia of motor

Chapter 2 Installation

2.1 Installation of the Servo Motor

The installation of the servo motor should be in accordance with the manual. If being installed improperly or in the wrong place, the motor's service life would shorten, even may cause unexpected accident. The shaft end of the servo motor had been daubed with antirust additive, so please clear the antirust additive before installation.

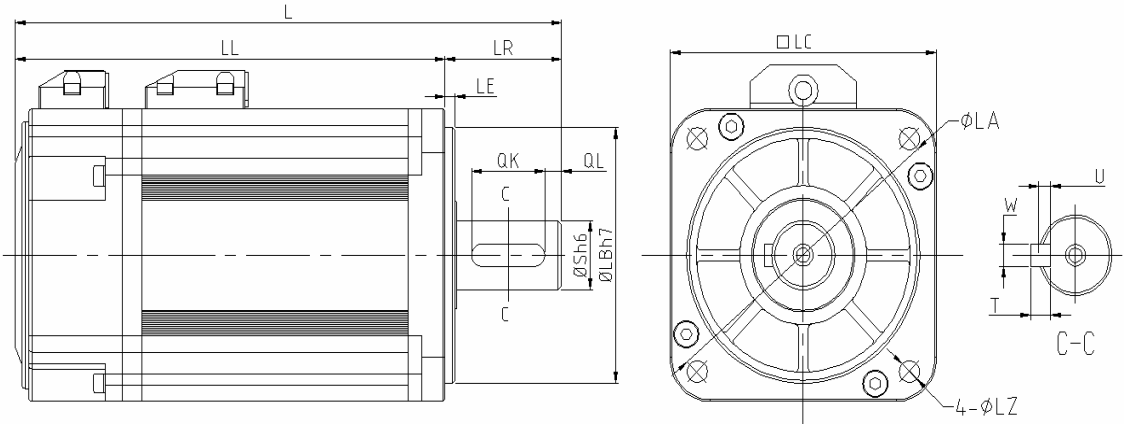
2.1.1 Installation Site

The servo motor should be installed inside the room, and the following ambient conditions be satisfied:

- There is no corrosive, inflammable and explosive gas.
- Draughty, no dust and dry.
- The ambient temperature for operation is within the limits of 0～40℃.
- Storage temperature: －10℃～50℃.
- The relative humidity keeps in the limits of 30%～95%RH; no moisture condensation.
- Be convenient for examining and clearing.

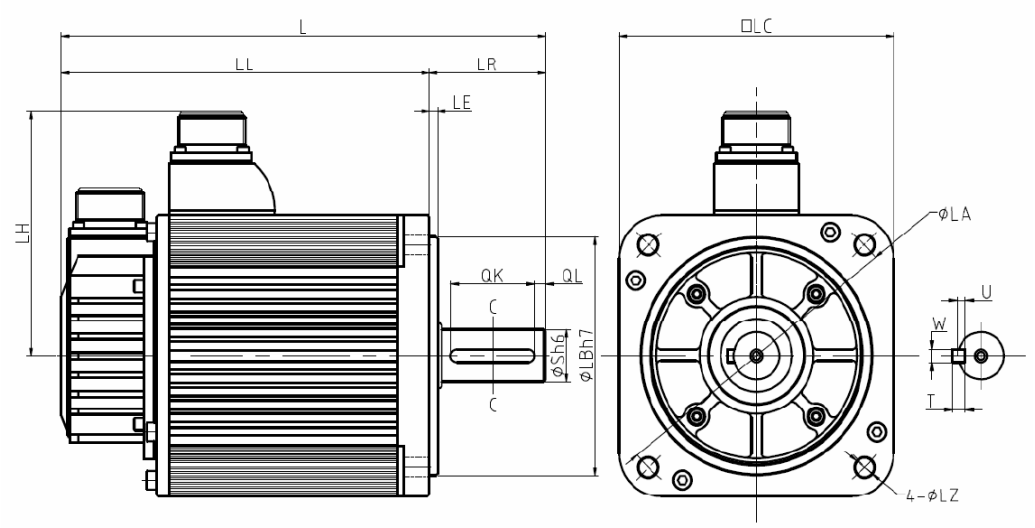
2.1.2 Installation Dimension

1. 60EMA and 80EMA Series



Servo Motor	**Unit**	60EMA006A	60EMA013A	80EMA024A	80EMA032A
Rated Output	KW	0.2	0.2	0.75	1
Rated Torque	N · m	0.64	1.27	2.39	3.19
Rated Current	Arms	1.6	2.9	4.1	5.9
Rated Revolution	r/min	3000			
Rotor Rotary	$\times 10^{-4}$	0.19	0.32	1.27	1.63
L	mm	142	168	173	193
LL	mm	112	138	138	158
LR	mm	30	30	35	35
LA	mm	70	70	90	90
LB	mm	50	50	70	70
S	mm	14	14	19	19
LC	mm	60	60	80	80
LE	mm	3	3	3	3
LZ	mm	5	5	6	6
QK	mm	16	16	22	22
QL	mm	4	4	4	4
W	mm	5	5	6	6
T	mm	5	5	6	6
U	mm	3	3	3.5	3.5

2. 130EMA Series



Servo motor model	130EMA-	040B	050B	060B	075B	075C	100C	100D	150D
Rated output power	KW	1.0	1.3	1.57	1.96	1.57	2.1	1.57	2.35
Rated torque	N•m	4.0	5.0	6.0	7.5	7.5	10	10	15
Rated current	Arms	4.2	5.0	6.2	7.8	6.5	9.0	7.5	9.0
Rated revolution	r/min	2500				2000		1500	
Rotor's rotary inertia	$\times 10^{-3} kg.m^2$	0.89	0.97	1.24	1.72	1.72	2.19	2.19	2.89
L	mm	215	221	231	251	251	271	271	301
LL	mm	159	165	175	195	195	215	215	245
LR	mm	56	56	56	56	56	56	56	56
LA	mm	145	145	145	145	145	145	145	145
LB	mm	110	110	110	110	110	110	110	110
S	mm	22	22	22	22	22	22	22	22
LC	mm	130	130	130	130	130	130	130	130
LE	mm	4	4	4	4	4	4	4	4
LH	mm	114	114	114	114	114	114	114	114
LZ	mm	9	9	9	9	9	9	9	9
QK	mm	35	35	35	35	35	35	35	35
QL	mm	5	5	5	5	5	5	5	5
W	mm	6	6	6	6	6	6	6	6
T	mm	6	6	6	6	6	6	6	6
U	mm	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5

2.1.3 Installation Direction

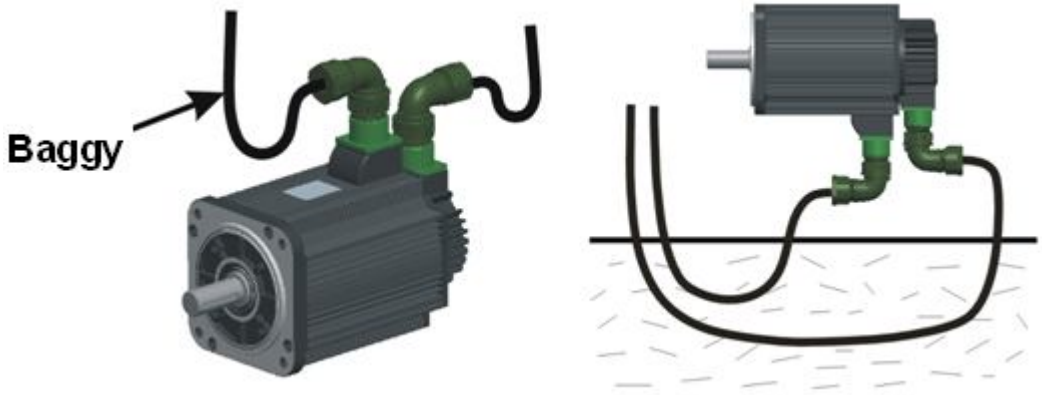
The servo motor can be installed horizontally, vertically, or in any direction.

2.1.4 Dampproof and Dustproof

1. When being used in the place with water-drop dripping, please employ it on the base of confirming the servo motor's protection framework (expect the shaft opening part).

2. When being used in the place where there is oil-drop dripping to the shaft opening, please appoint servo motor with oil seal. Please make sure the oil level is lower than the oil seal's lip while using, and the oil seal can keep the splashing oil-foam in good condition. When using servo motor above the shaft, please confirm there is no oil-logged of the oil seal's lip.

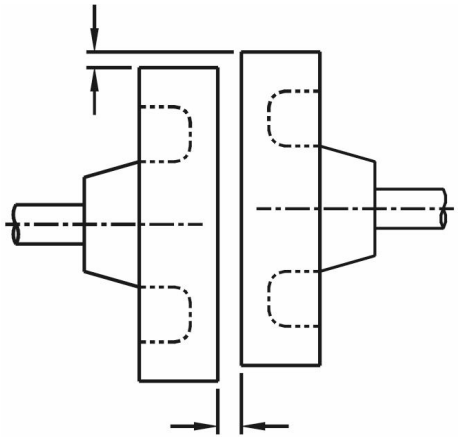
3. When the aviation plug (the lead outlet) can only be installed upwards, please keep the cable baggy to prevent oil and water, as the following chart shows. Meanwhile, the cable mustn't be soaked in water or oil.



2.1.5 Coordination with Machine

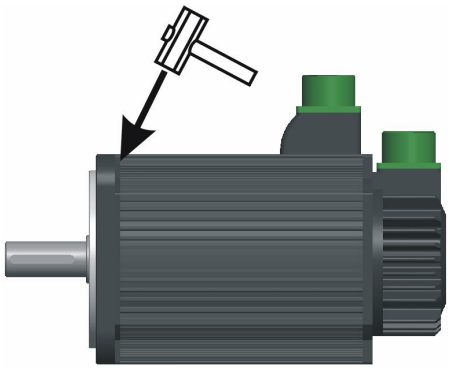
1. When connecting with machine, please use elastic couplings as far as possible, and keep the axle centre of servo motor is in a line with that of mechanical load. The installation of servo motor should meet the demand of concentricity tolerance as the following chart shows.

To measure in the quartering of a round, the difference of the maximum and the minimum is less than 0.03mm (rotating with coupling).

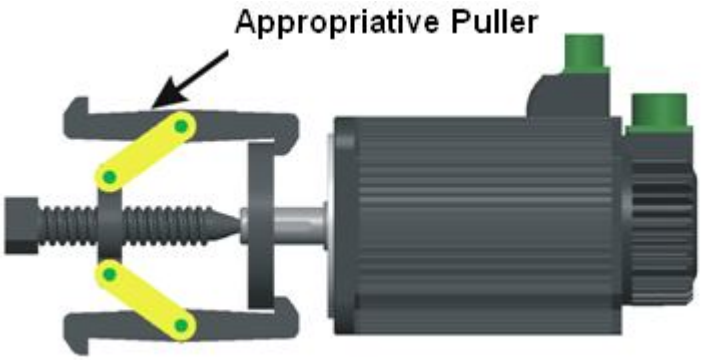


⚠WARNING	● If the concentricity were out of tolerance, it would cause mechanical vibration which may damage the bearings and encoder.

2. The encoder is installed in the back end cap of the motor, connecting directly with motor shaft. Do not thump the motor. If to knock the motor is inevitable because of positioning or any other reason, please knock the front end of flange plate with rubber hammer or plastic hammer as far as possible.



3. For removing wheel and pulley, please use an appropriative puller.



2.2 Installation of the servo driver

2. 2. 1 Installation Site

Items	ESDB Servo Driver
Temperature/humidity of operation	0～40℃（no freeze）; 90%RH below（no moisture condensation）
Temperature/humidity of storage & transportation	-40～50℃，0%RH below（no moisture condensation）
Air environment	Confirm there is no corrosive gas, inflammable gas, oil mist, dust, etc. inside the cabinet
Installation environment	Should be installed in the place where there is no high-radiation equipment, vapor, water-drop, floating metal particle, electromagnetic interference or noise jamming
Altitude	1000m below sea level
Vibration	0.5G (4.9m/s^2) ， 10～60HZ (operating discontinuously)
Protection grade	IP00（no protection）

2.2.2 Installation Dimension

It can be installed in the way of baseplate installation, and the installation dimension is upwards perpendicular to fitting surface. Chart 2.1shows the baseplate installation way.

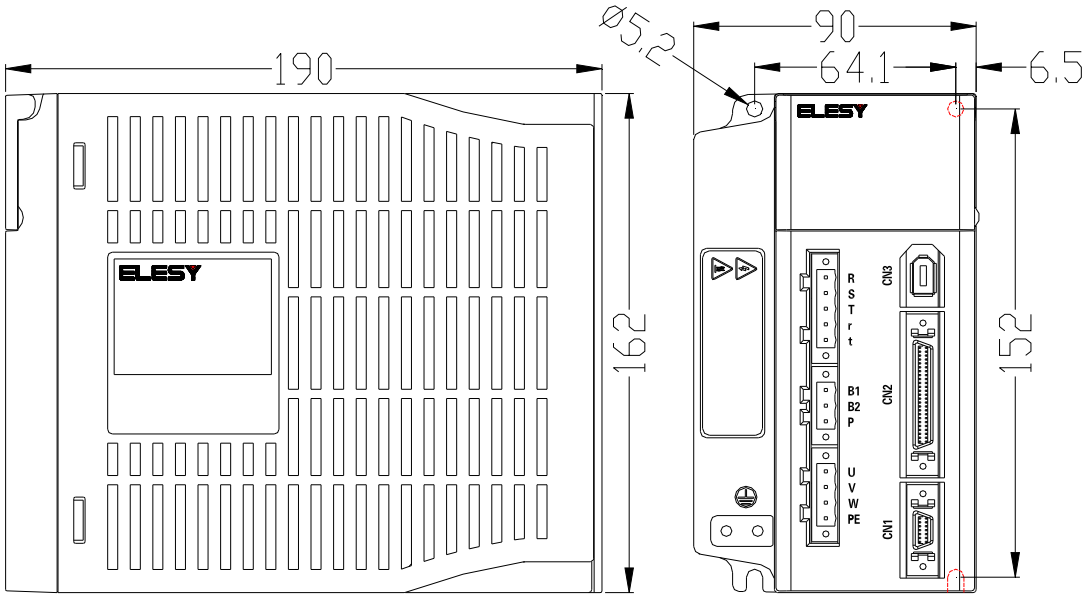


Chart 2.1 the driver's structure and installation dimension（unit: mm）

2. 2. 3 Installation Direction

As Chart 2.2 shows, the installation direction should be perpendicular to the wall's direction. Adopt mounting holes in the four corners to fix the servo driver on the wall firmly.

If necessary, please install an air fan to apply forced-cooling to the servo driver.

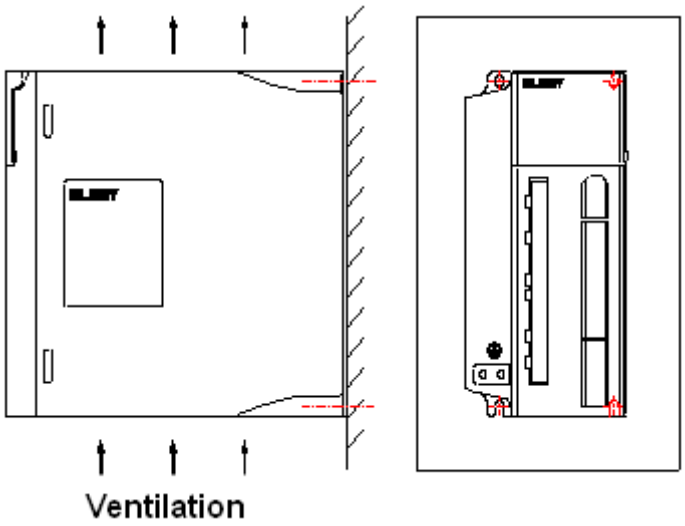


Chart 2.2 Installation direction of the driver

2.2.4 Installation Interval)

The installation interval for single driver is shown in Chart 2.3, and that for multi drivers is shown in Chart 2.4. Please leave enough space as far as possible in practical installation, so as to guarantee good heat dissipation condition.

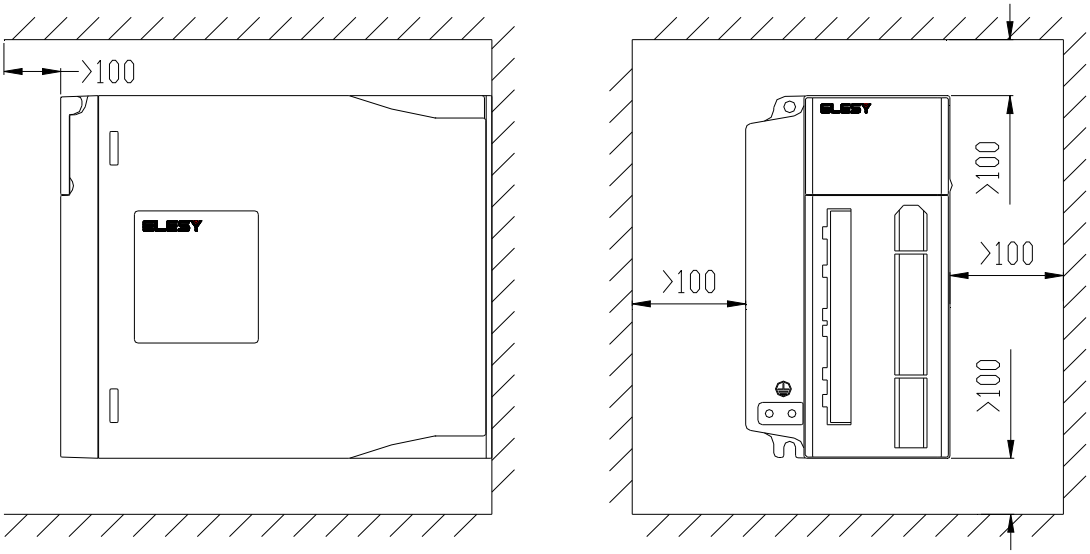


Chart 2.3 Installation interval for single driver

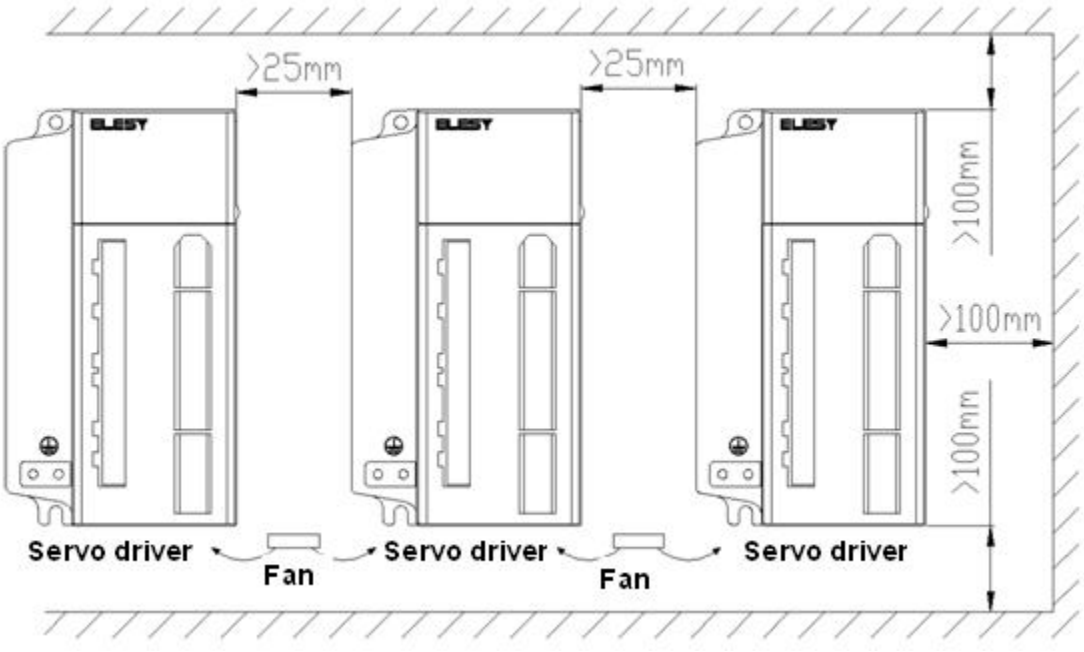


Chart 2.4 Installation pitch for multi drivers

⚠WARNING	➢ For avoiding the environmental temperature of the driver rising too high, there should be a radiator blowing convection air to the driver inside the electric closet.

While installing multi drivers, as shown in Chart 2.4, please leave room larger than 25mm in each of the two crosswise sides, and more than 100mm in each of the two vertical sides. Please keep the temperature inside the electric closet in balance, for avoiding local temperature of the servo driver rising too high. If necessary, please install forced-cooling convectional fan in the electric closet above the servo driver to pump air out.

Chapter 3 Wiring

3.1 Connection of Peripheral Equipments

The application of servo driver should be provided with some peripheral equipment. Using proper peripheral equipment can guarantee the driver's stable operation; otherwise it might reduce the driver's service life, even damage the servo motor.

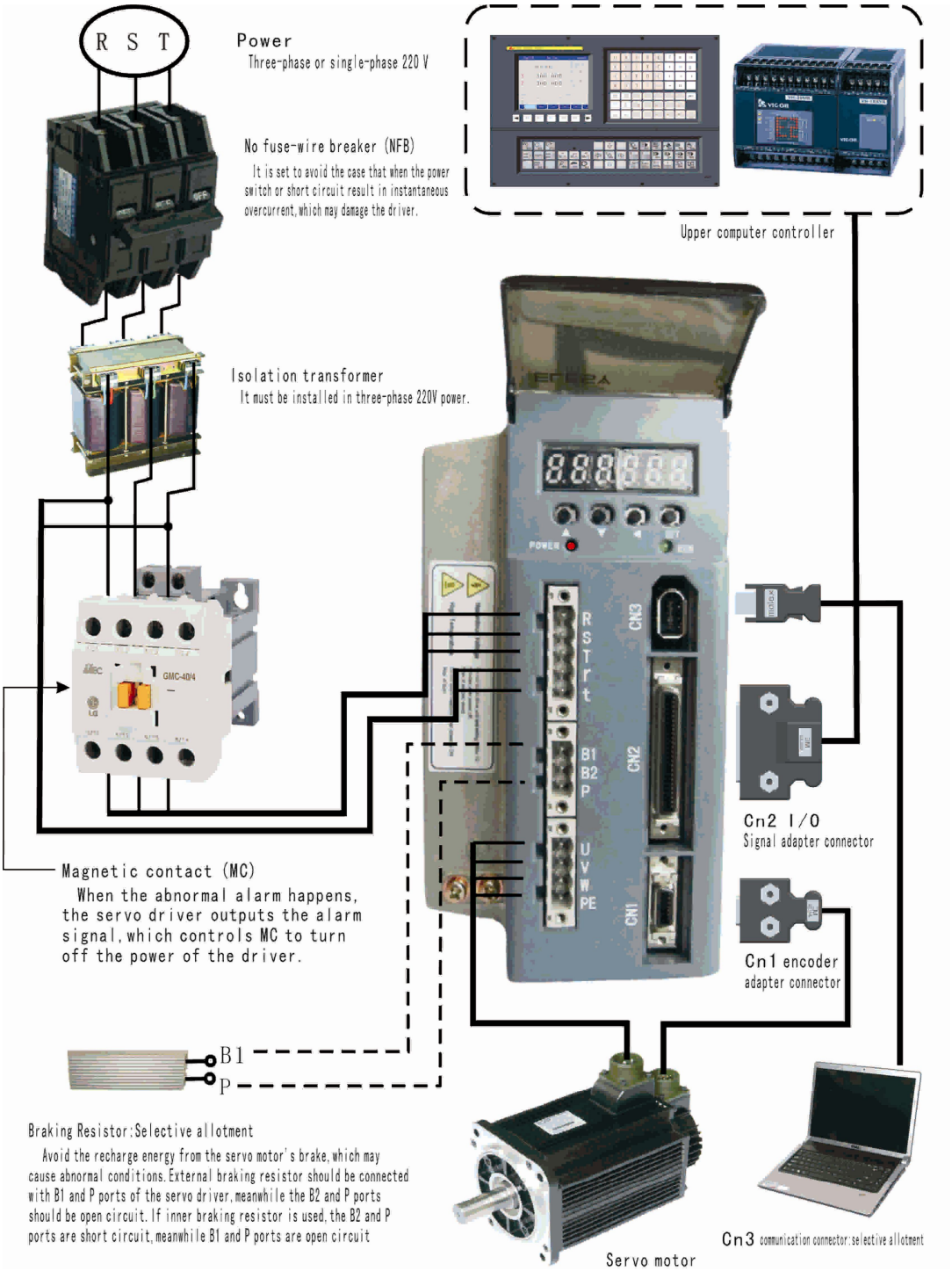


Chart 3.1 Connection of Peripheral Equipment

WARNING	➢ Braking resistor should be connected in strict accordance with the manual requests. B1 and P can't be short circuit; otherwise the driver will be destroyed after power-on. ➢ Before power on, check whether R, S, T and r, t power lines are correct. ➢ Check whether U, V, W wiring is correct. Three-phase terminal sequence can't be changed to reverse the motor. ➢ Motor ground terminal must be connected with driver ground terminal PE. There is large volume electrolytic capacitor in the servo driver，so high voltage will exist even after power outage. Please don't touch the driver or motor in five minutes after outage.

Main Circuit Wiring Examples

Servo driver power line has two connections which are single-phase 220V and three-phase 220V. Single-phase connection is only used at below 1.5KW situations. In the three-phase connection, control power r and t can be connected with any two phases of the three phases.

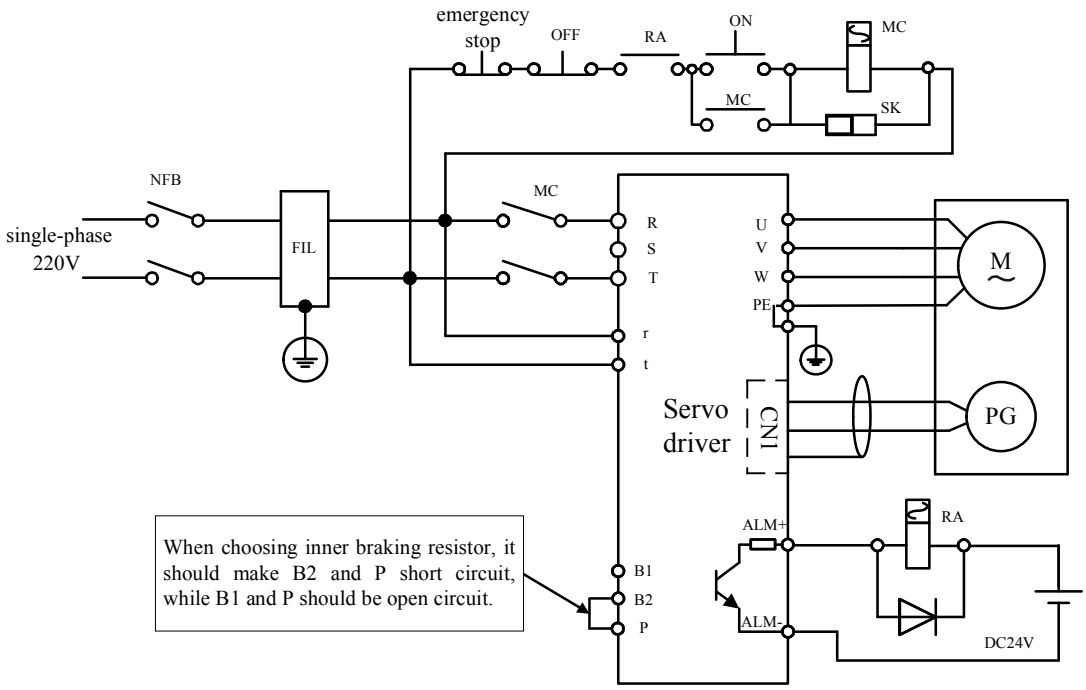


Figure 3.2 Single-phase Power Wiring Figure

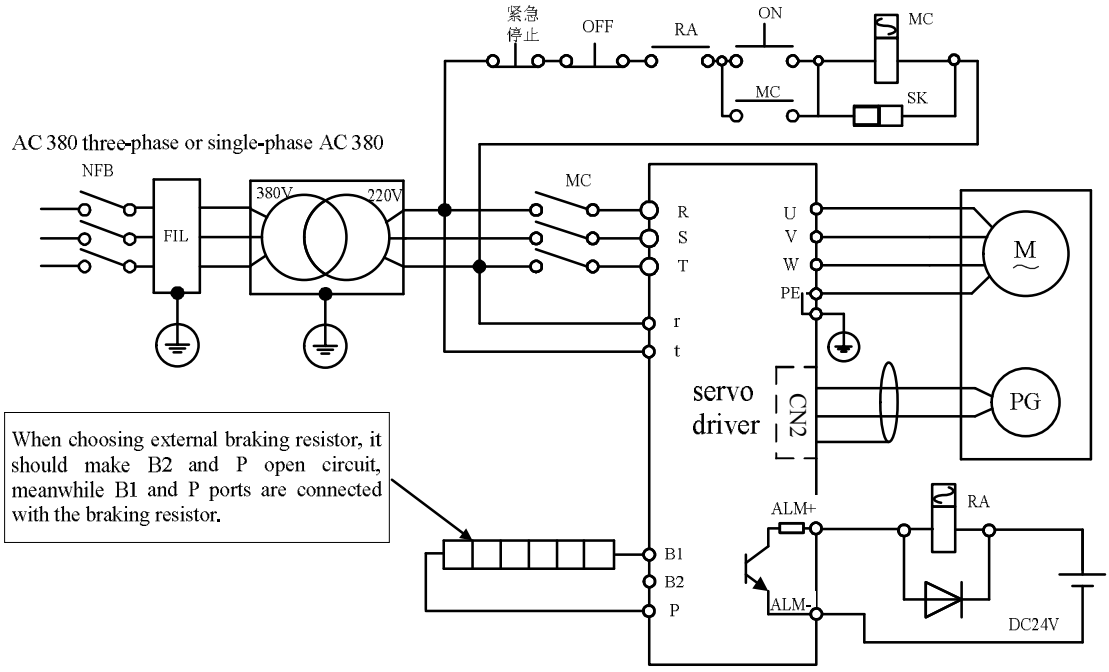
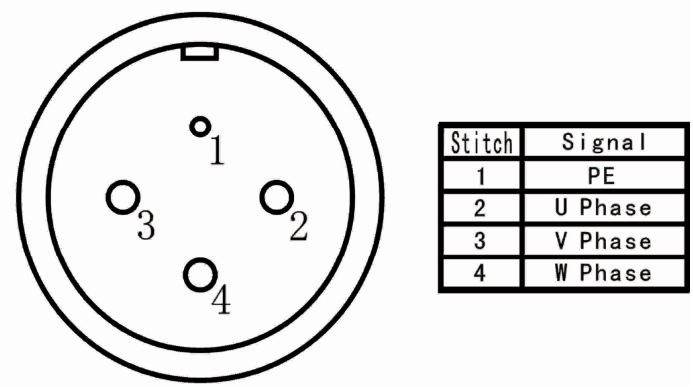


Figure 3.3 Three-phase Power Wiring Figure

Main Circuit Terminals

Terminal sign	Signal name	Functions
r，t	Control power supply terminal	Control Circuit power input terminal:AC220V，50～60Hz
R，S，T	Main Circuit power	Main Circuit power input terminal: AC220V，50～60Hz
U，V，W，PE	Motor output terminal	Servo motor output terminal must be connected in accordance with U, V and W terminal.
B1，B2，P	Braking resistor terminal	When using inner braking resistor, the B2 and P ports are short circuit, meanwhile B1 and P ports are open circuit.
		When using external braking resistor, the B2 and P ports are open circuit, meanwhile B1 and P ports are connected with the external braking resistor.
⏚	Ground terminal	Be connected with power ground wire and motor ground wire

The requests for driver power wire diameter are as follows:



Stitch	Signal
1	PE
2	U Phase
3	V Phase
4	W Phase

- Wire diameter ：R、S、T、B1、B2、P 、U、V、W、PE terminal wire cross-sectional area ≥1.5mm^2（AWG14-16）。
- s、t terminal wire cross-sectional area≥1.0mm^2（AWG16-18）。

3.2 Control Terminal Wiring

3.2.1 CN2 Connector Terminal

Figure 3.4 shows CN2 connector terminal pin soldering lug of the servo driver (in the face of soldering lug of the pin). It uses SCSI 50P connector，with the socket in needle type and the plug

in cellular type.

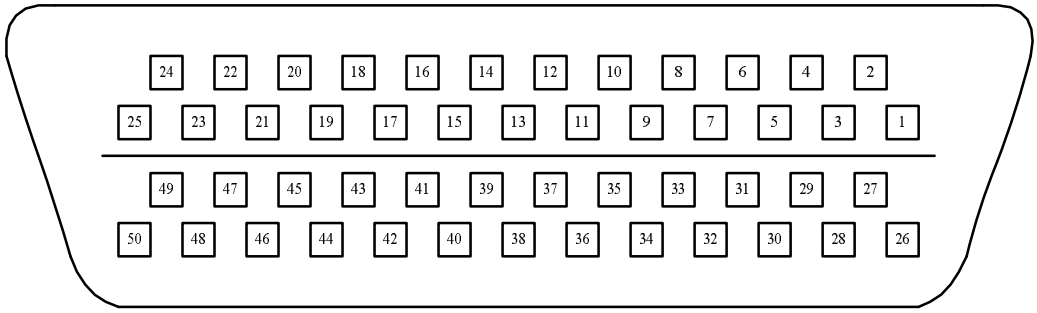


Chart 3.4 Driver CN2 Plug（Control Terminal）

I/O Signal Functions Table

■ Input Signal

Terminal number	Signal name	Application way	Functions
CN2-11	EXVCC	P,S	I/O input terminal power, +12V~+24V
CN2-9	SV_EN	P	Servo enable input terminal
CN2-33	RSTSV	P,S	alarm clearing input terminal
CN2-31	CCWDI	P	CCW（anticlockwise）drive forbidden input terminal
CN2-32	CWDI	P	CW（clockwise）drive forbidden input terminal
CN2-34	PECLR/SC1	P	Position deviation counter clearing input terminal Speed control：inner speed choose switch SC1
CN2-8	PINH/SC2	P	Position control：position command pulse forbidden input terminal Speed control：inner speed choose switch SC2
CN2-30	GEAR	P	Position control：the second electronic gear ratio input terminal Speed control：zero speed clamping input terminal
CN2-41	PULS+	P	External command pulse input terminal 1） pulse +signal 2） CCW/CW pulse 3） two phase orthogonal pulse
CN2-43	PULS-		
CN2-37	DIR+		
CN2-36	DIR-		
CN2-42	ADCI	S	External analog input -10V～+10V
CN2-44	ADID		

■ Output Signal

Terminal number	Signal name	Application way	Functions
CN2-7	SV_RY+	P,S	SV_RY：servo ready output terminal
CN2-6	SV_RY-		
CN2-28	ALM+	P,S	ALM：servo warning output terminal
CN2-27	ALM-		
CN2-3	SV_F＋	P,S	SV_F: Positioning finished output terminal
CN2-2	SV_F-		
CN2-1	BRK+	P,S	BRK：mechanical braking output terminal
CN2-26	BRK-		
CN2-21	EXTA+	P,S	Position feed pulse A-phase differential output
CN2-22	EXTA-		
CN2-25	EXTB+	P,S	Position feed pulse B-phase differential output
CN2-23	EXTB-		
CN2-50	EXTZ+	P,S	Position feed pulse Z-phase differential output
CN2-24	EXTZ-		
CN2-48	EXCZ+	P,S	Position feed pulse Z-phase open-collector output
CN2-47	EXCZ-		

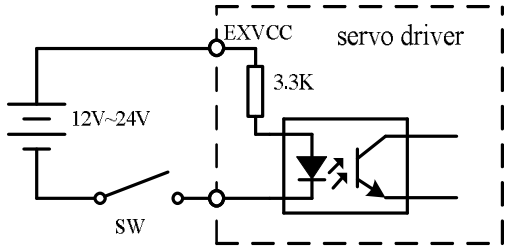
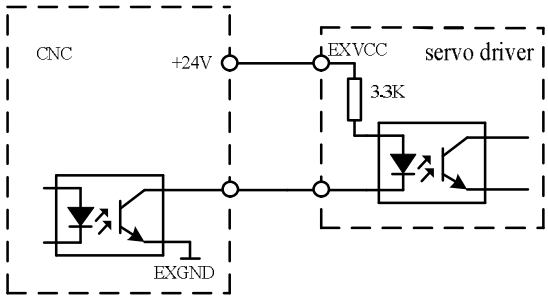
3.2.2 Input signal ports and explanations

Input signals are divided into three types: switching value input、pulse command differential input and analog input.

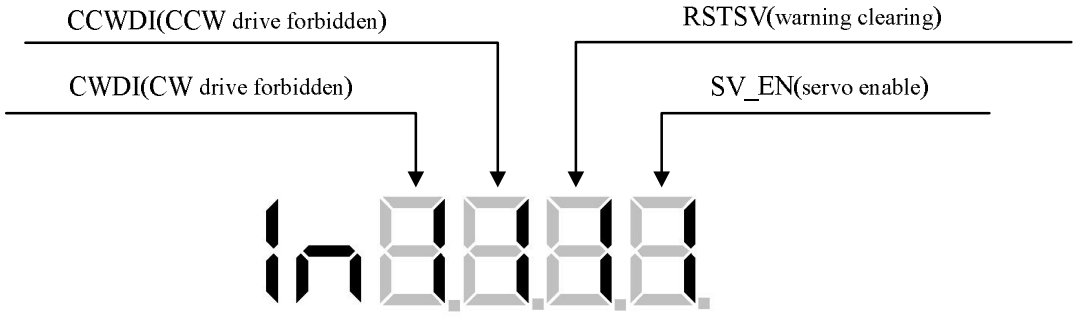
（1） switching value input signal

The switching value input signals of the driver include SV_EN、RSTSV、CCWDI、CWDI、PECLR、PINH and GEAR，with two connections as follows. When the input signal is in low level, the optical-coupler is conducting and the input is valid. The corresponding value for driver monitoring parameters DP-InL and DP-InH change from “1” to “0”.

Users supply power for the input signal with DC12～24V，and the current should excess 100mA. If the current polarity is inversed, the driver won’t work and the input current for any terminal can’t excess 50mA.

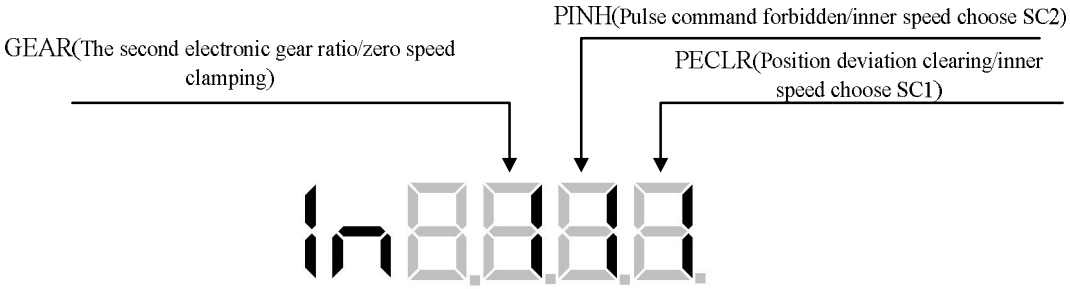
Relay circuit example	Open-collector example
	

- Definitions of nixie tubes in DP-InL:



(驱动禁止：drive forbidden 报警清除：warning clearing 伺服使能：servo enable)

- Definitions of nixie tubes in DP-InH：



The functions for each input signal are introduces as follows:

- **EXVCC**：IO terminal power，which is supplied by users. Voltage range is +12V~+24V and load capacity is above 100mA.
- **SV_EN**： The servo is enabled when SV_EN is ON, and servo enable is cut off when SV_EN is OFF while the motor is set to be free. Besides this way, the servo can be compelled to enable through setting inner parameter Pn57=2.
- **RSTSV**：the system warning will be cleared when RSTSV is ON and retain when RSTSV is OFF. Some warning can be cleared by this signal. For more specific details please refer to “Chapter 8 warning and handling”. After clearing the alarm, the driver’s alarm output signal

is OFF and there will be no alarm output.

- **CCWDI** and **CWDI**：mainly used in mechanical over travel which is as follows：

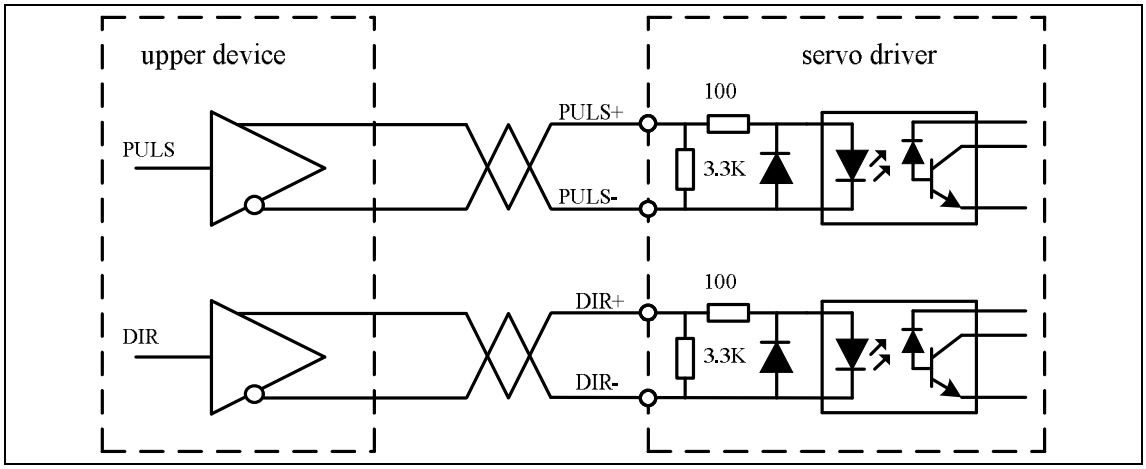
Input signal	Pn4=0，Pn20=0	Pn4=0，Pn20=1
CCW drive forbidden	When the switch is OFF，anticlockwise torque is zero, then the motor can be turned anticlockwise manually until the switch is ON.	drive forbidden input is invalid
CW drive forbidden	When the switch is OFF，clockwise torque is zero, then the motor can be turned clockwise manually until the switch is ON.	drive forbidden input is invalid

- **PECLR/SC1**：In the position control mode, when this signal is ON, the deviation counter will be cleared and the servo motor is locked. In the speed control mode, inner speed choose switch SC1.
- **PINH/SC2**：In the position control mode, command pulse input is forbidden. When this signal is ON, even if the command pulse inputs, it will not count and the servo motor will be locked. In the speed control mode, inner speed choose switch SC2. SC1、SC2 are combined to choose inner speed, for more details, please refer to Chapter 6.2.4.
- **GEAR**：In the position control mode, it is the second electronic gear ratio terminal. In the analog input speed control mode，it is zero clamping control terminal. In the latter case even if the analog input command voltage is not 0V, the motor speed is zero and the servo moto is locked.

（2）Pulse command input

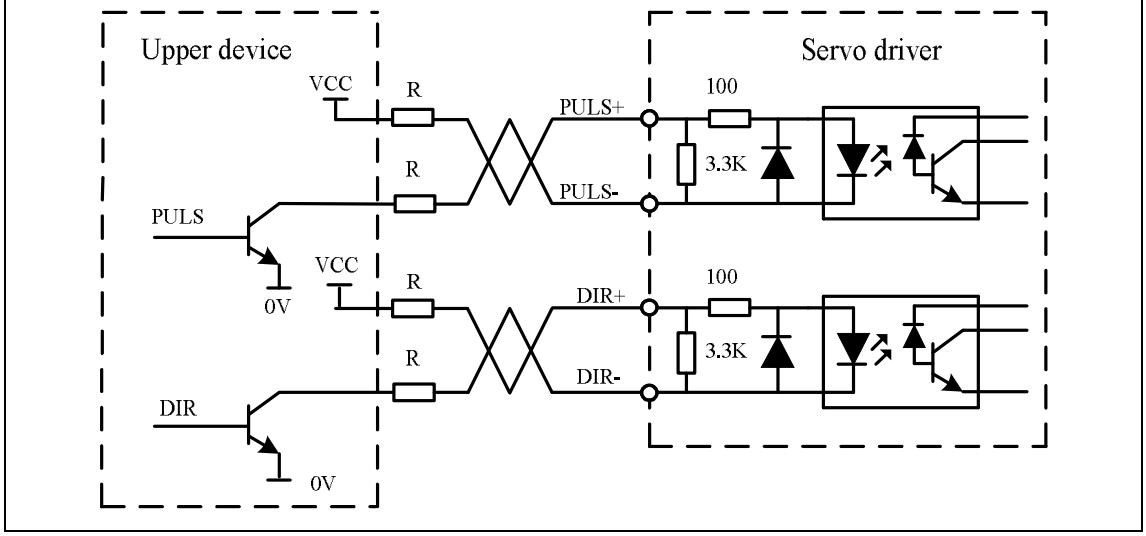
We can use both differential input connection and open-collector single input connection.

Pulse Command Differential Input
The maximum frequency is 500KHZ. In order to transmit pulse quantity correctly, differential driving mode is suggested.



Pulse command open-collector input

The maximum frequency is 300KHZ. The driving current is10～15mA，and circumscribed resistance R should be adjusted by VCC.



Notice

- When using single-terminal driving mode, the external power will be supplied by users. Notice that the servo driver will be destroyed if the power polarity is inversed.
- In order to improve the anti-jamming capacity, the differential input mode is suggested.
- Single-terminal mode will decrease the maximum command pulse frequency.

There types command pulse can be received, which is selected by Pn14,and every type can be reversed by setting Pn15.

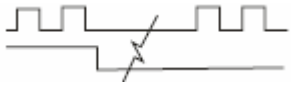
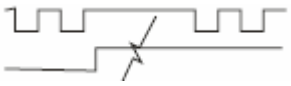
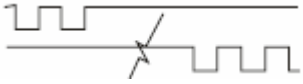
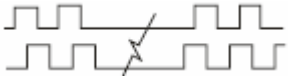
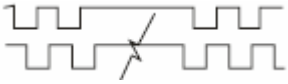
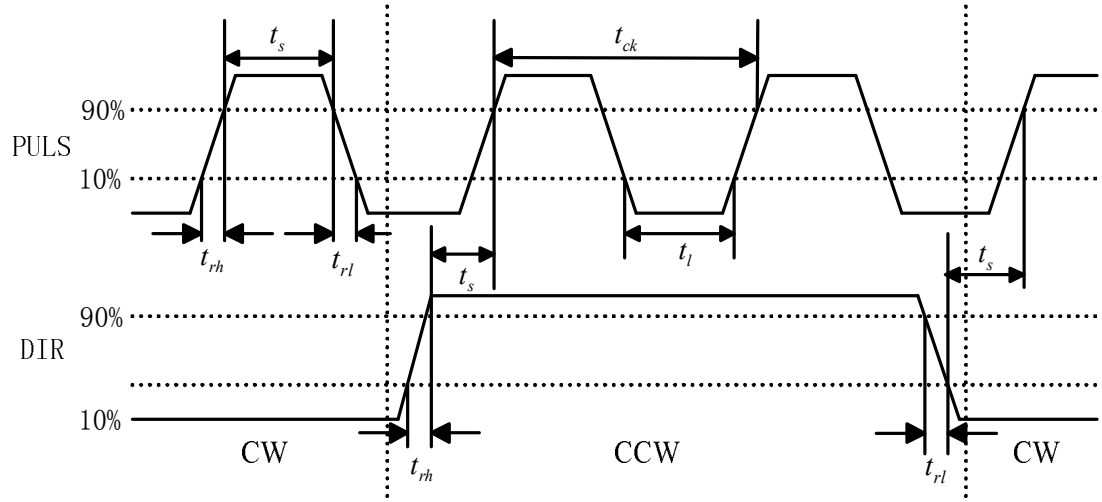
Pn14 value	Pulse form	Pn15=0		Pn15=1	
		Run in positive direction	Run in reverse direction	Run in positive direction	Run in reverse direction
Pn14=0	Pulse + direction				
Pn14=1	CCW /CW pulse				
Pn14=2	two phase orthogonal pulse				

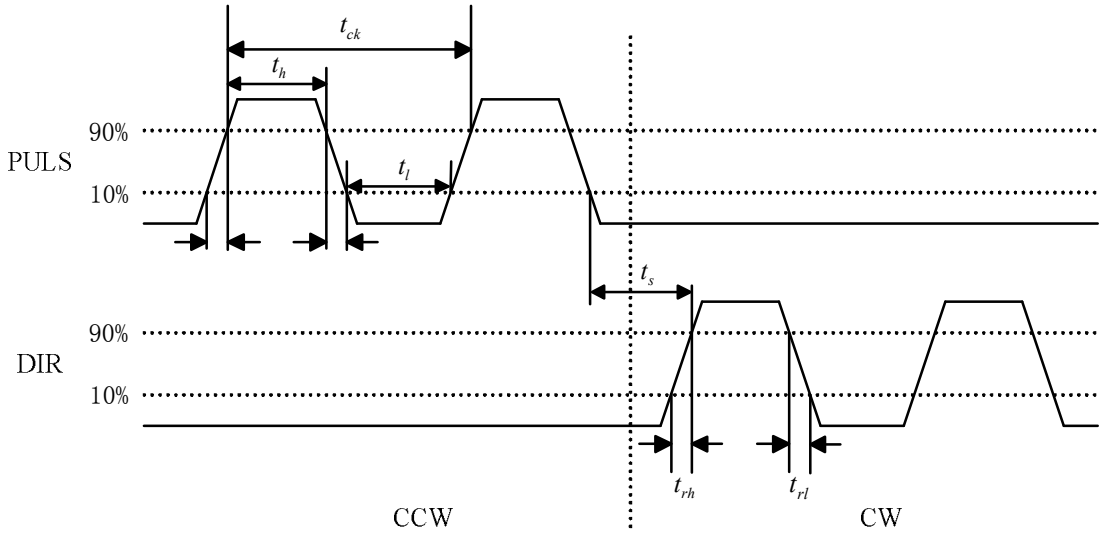
Table 3.5 Pulse Input Sequence Parameters

Parameters	Differential driving input	Single terminal driving input
t_{ck}	>2 μ S	>5 μ S
t_h	>1 μ S	>2.5 μ S
t_l	>1 μ S	>2.5 μ S
t_{rh}	<0.2 μ S	<0.3 μ S
t_{rl}	<0.2 μ S	<0.3 μ S
t_s	>1 μ S	>2.5 μ S
t_{qck}	>8 μ S	>10 μ S
t_{qh}	>4 μ S	>5 μ S
t_{ql}	>4 μ S	>5 μ S
t_{qrh}	>0.2 μ S	<0.3 μ S
t_{qrl}	>0.2 μ S	<0.3 μ S
t_{qs}	>1 μ S	>2.5 μ S

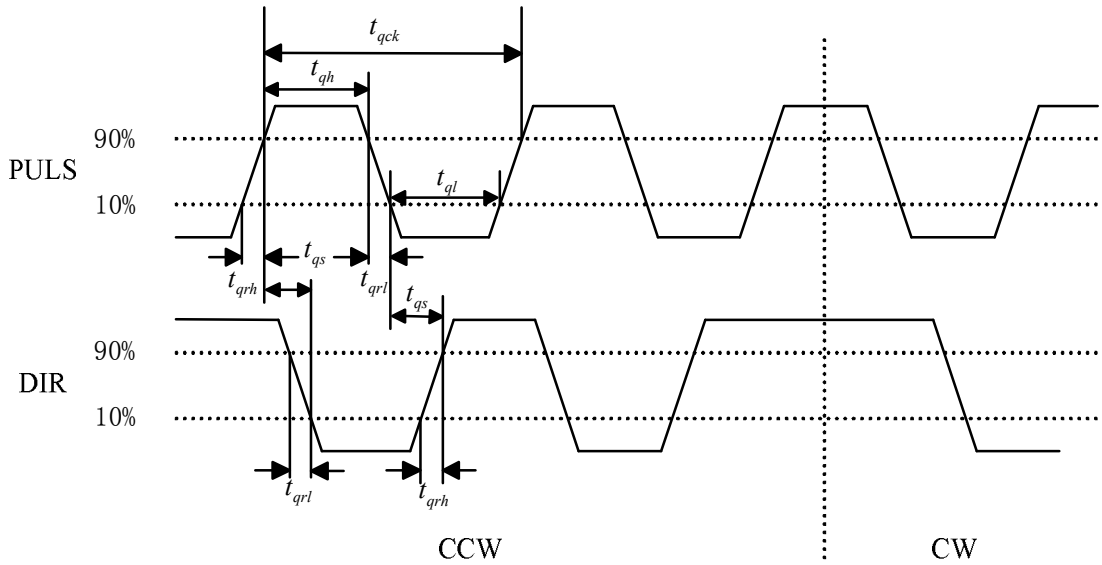
(1) pulse + direction input interface sequence chart（the maximum frequency is 500KHZ）



(2)CCW pulse/CW pulse input interface sequence chart（the maximum frequency is 500KHZ）



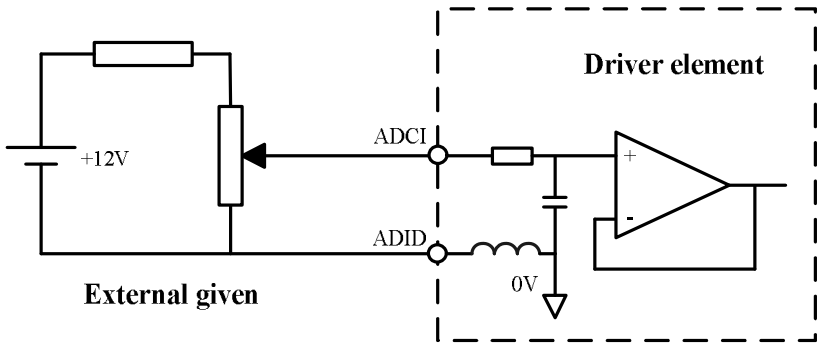
(3) two phase orthogonal pulse input interface sequence chart（the maximum frequency is 300KHZ）



analog command input

Analog input voltage range is -10V~+10V，and the driver may be damaged if the voltage is in excess of this range. The analog interface is not isolated. The analog ground line and the negative terminal of the analog input are connected in the driver side.

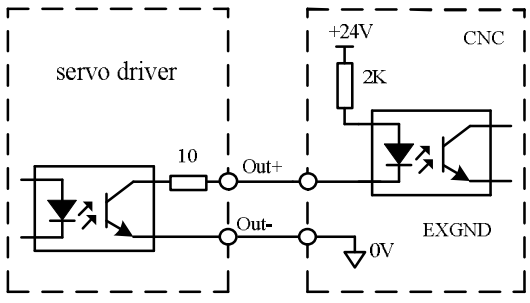
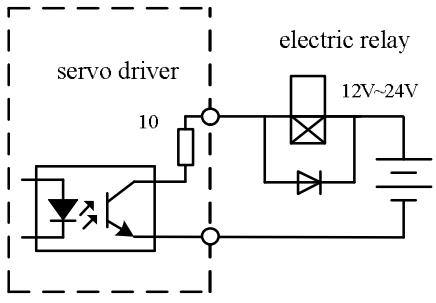
Zero offset exists in the analog input, which can be adjusted by parameter Pn44. For more details, please refer to chapter 6.3.1.

Analog Input Interface


3.2.3 Output Signal Ports and Explanations

（1）Switching Value Output Ports

The switching value output signals of the driver include SV_RY、ALM、SV_F and BRK，which are all couple-terminal open-collector output. In order to guarantee reliability of signal transmission, all the output signals are valid only when the optical-coupler is conducting. The wiring is showed in the below figure, where the four output signals BRK, SV_RY, ALM and SV_F can be judged by the corresponding changing bits of driver monitoring parameter of “DP-oUt”. Mechanical braking signal output is in Darlington driver structure.

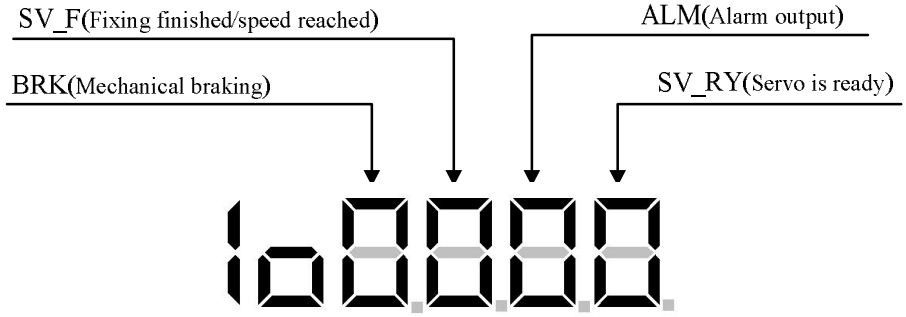
External Optical-coupler Output Examples	External Relay Output Examples
	

The external power is supplied by users. Notice that the servo driver will be damaged if the power polarity is reversed.

The output is in open-collector form, with the maximum current of 50 mA and the largest outer voltage of +24V. Hence, the load capacity of the switching value output signal must satisfy this request. If it is beyond the permitting range or connected with the power directly, the servo driver might be damaged.

If the load is an inductive load such as electric relay, it is necessary to wire a fly-wheel diode parallel with the load. If the fly-wheel diode is in a wrong direction, the servo driver will be damaged.

Definitions of Nixie tubes in‘DP-oUt’:



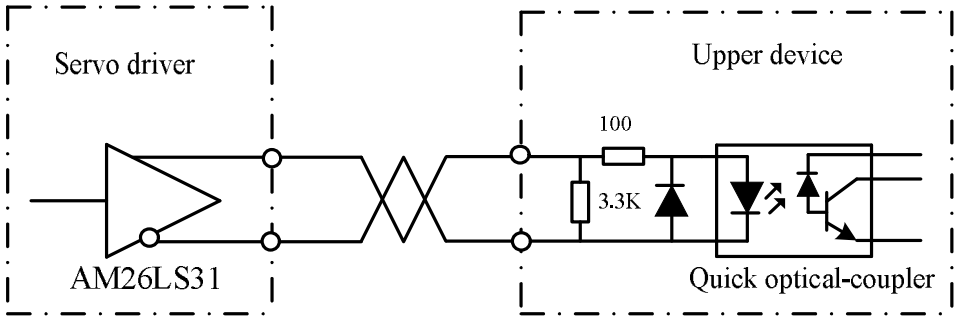
The introduction of the switching value output signal functions are as follows:

- **SV_RY：** It shows whether servo is ready. After the driver is enabled for 4ms and the motor is excited, the signal is ON.
- **SV_F： Positioning finished and speed reached signal.** In the position mode, the position deviation remaining pulse is less than or equal to the value of Pn16, the signal outputs ON. In the speed mode, when the actual speed of the motor surpasses the value of Pn28, it outputs ON. For more details, please refer to chapter ’6.2.4 and’6.3.3’.
- **ALM：Alarm signal.** When the driver menu dP-Err displays one alarm, it outputs ON.
- **BRK：Mechanical braking signal.** It controls the running of braking motor effectively. It can’t brake suddenly during the servo running, or the brake will be damaged.

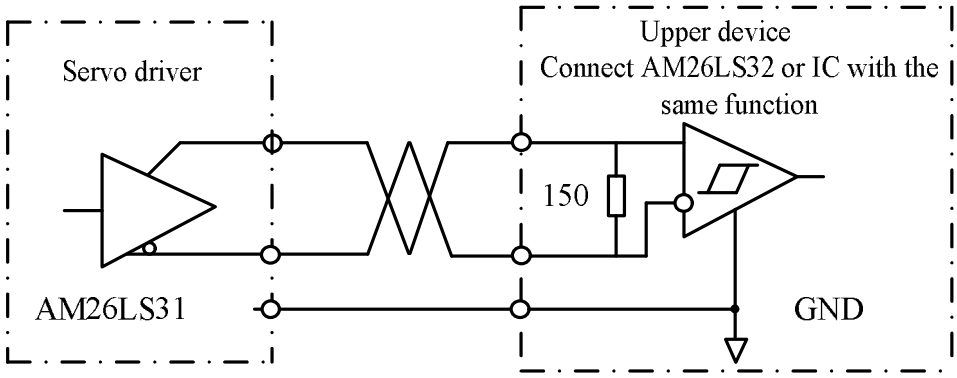
（2）Encoder signal differential output

Position output signals EXTA+/EXTA-、EXTB+/EXTB-、EXTZ+/EXTZ- use differential output way. The position signal outputted from CN2 is pulse signal feed by incremental encoder. The wiring schematic diagram is as follows：

Position Feed Pulse Optical-coupler Connection



Position Feed Pulse Differential Connection



3.3 Encoder Feed Terminal Wiring

Table 3.6 Encoder Terminal CN1

Terminal number	Signal name	Sign	Functions
CN1- 1	Encoder W+ input	W+	Connect with W phase output of encoder
CN1- 2	Encoder W-input	W-	
CN1- 3	Encoder V+ input	V+	Connect with V phase output of encoder
CN1- 4	Encoder V- input	V-	
CN1- 5	Encoder U+ input	U+	Connect with U phase output of encoder
CN1- 6	Encoder U- input	U-	
CN1- 7	Encoder Z+ input	Z+	Connect with Z phase output of encoder
CN1- 8	Encoder Z- input	Z-	
CN1- 9	Encoder B+ input	B+	Connect with B phase output of encoder
CN1-10	Encoder B- input	B-	
CN1-11	Encoder A+ input	A+	Connect with A phase output of encoder
CN1-12	Encoder A- input	A-	
CN1-13	Encoder power negative output	0V	The encoder of the servo motor applies +5V power. When the cable is relatively long, it should use multi-wires in parallel connection.
CN1-14	Encoder power positive output	+5V	

Figure 3.5 shows junctor terminal of servo driver CN1, which uses SCSI 14P connector，with the socket in needle type and the plug in cellular type.

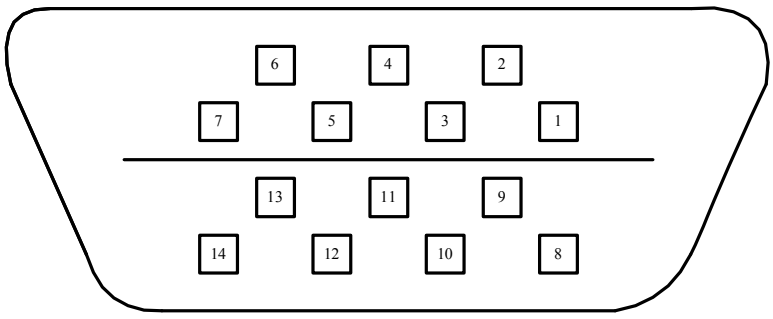
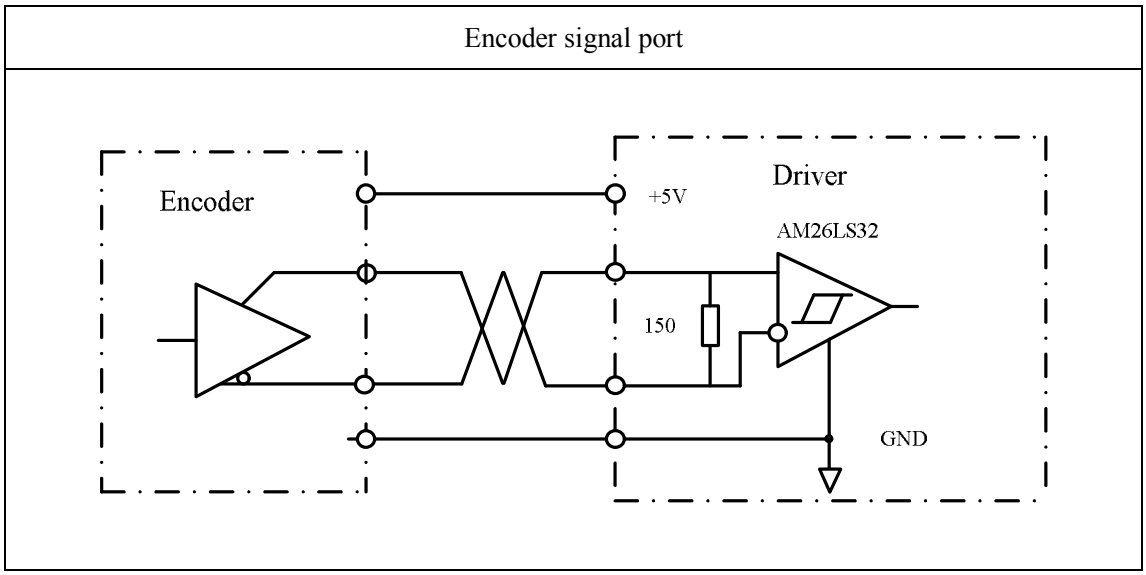


Figure 3.5　Driver CN1 Plug（in the face of soldering lug of the plug）

Incremental encoder signal cables are all in differential driving connection. The wiring schematic diagram is as follows：



The encoder signal wiring showed in the below figure is the standard wiring for ELESY -130 series motor. If customers use other manufacturers' motor or DIY encoder wire, please refer to the position control mode standard wiring in Figure 3.9.

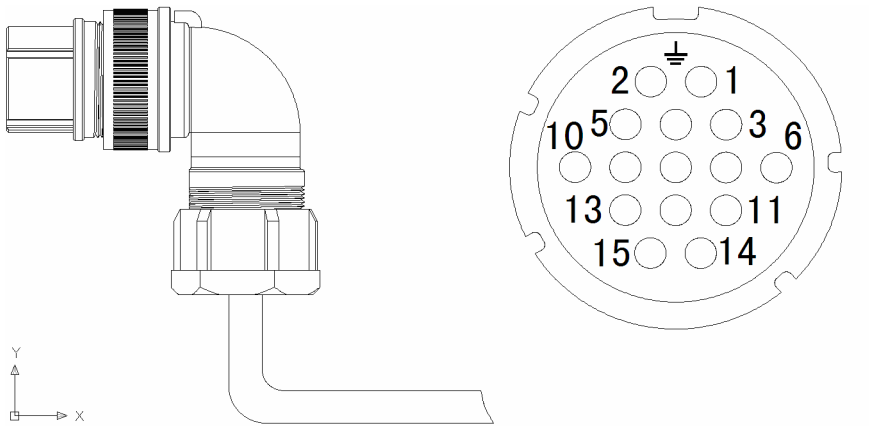


Figure 3.6　ELESY-130 Series Encoder Aviation Plug Wiring（Plug Side）

3.4 Communication Terminal Wiring

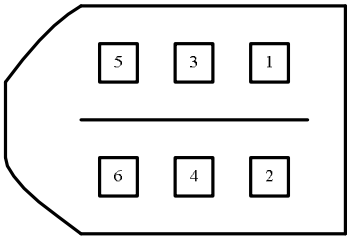


Figure 3.7　CN3 Plug of Driver Communication Terminal（in the face of soldering lug of

the plug）

Communication terminal CN3

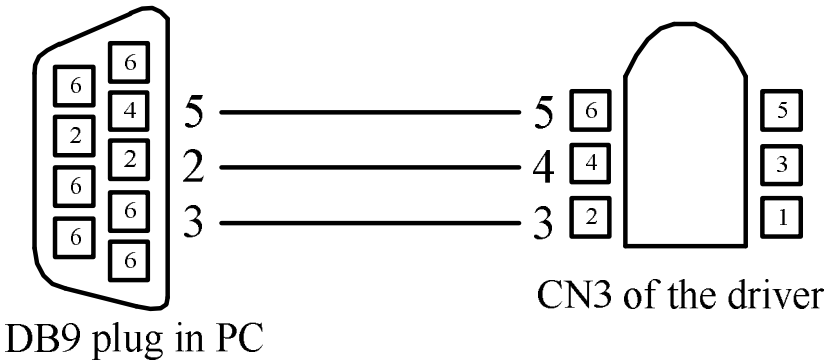


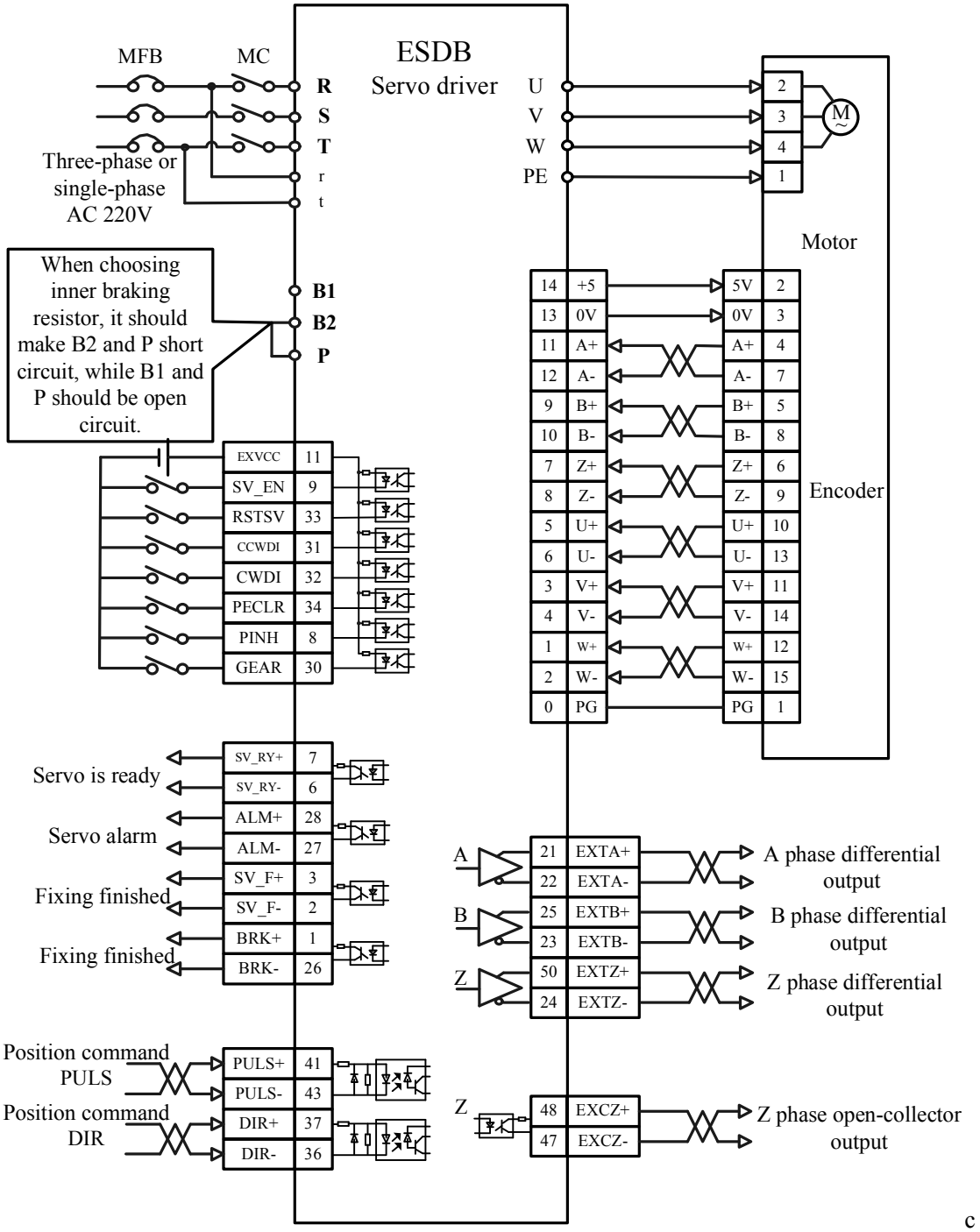
Figure 3.8 Wiring Connected with PC

Table 3.4 Communication Terminal CN3

Terminal number	Signal name	Sign	Functions
CN3-1	RS485 differential signal +	RS-485+	RS-485 communication data bus，full-duplex communication
CN3-2	RS485 differential signal +	RS-485-	
CN3-3	RS-232 data receiving	RXD232	Data receiving end of the driver, to connect with the data transmitting end of PC
CN3-4	RS-232 data transmitting	TXD232	Data transmitting end of the driver, to connect with the receiving data end of PC
CN3-5	RS-232 signal ground	GND	RS-232 signal ground
CN3-6	Reserved	Reserved	Reserved

3.5 Standard Wiring Figure

3.5.1 Position Control（Inner Braking）



c

Figure 3.9 Standard Wiring in Position Control Mode

3.5.2 Speed Control（Inner Braking）

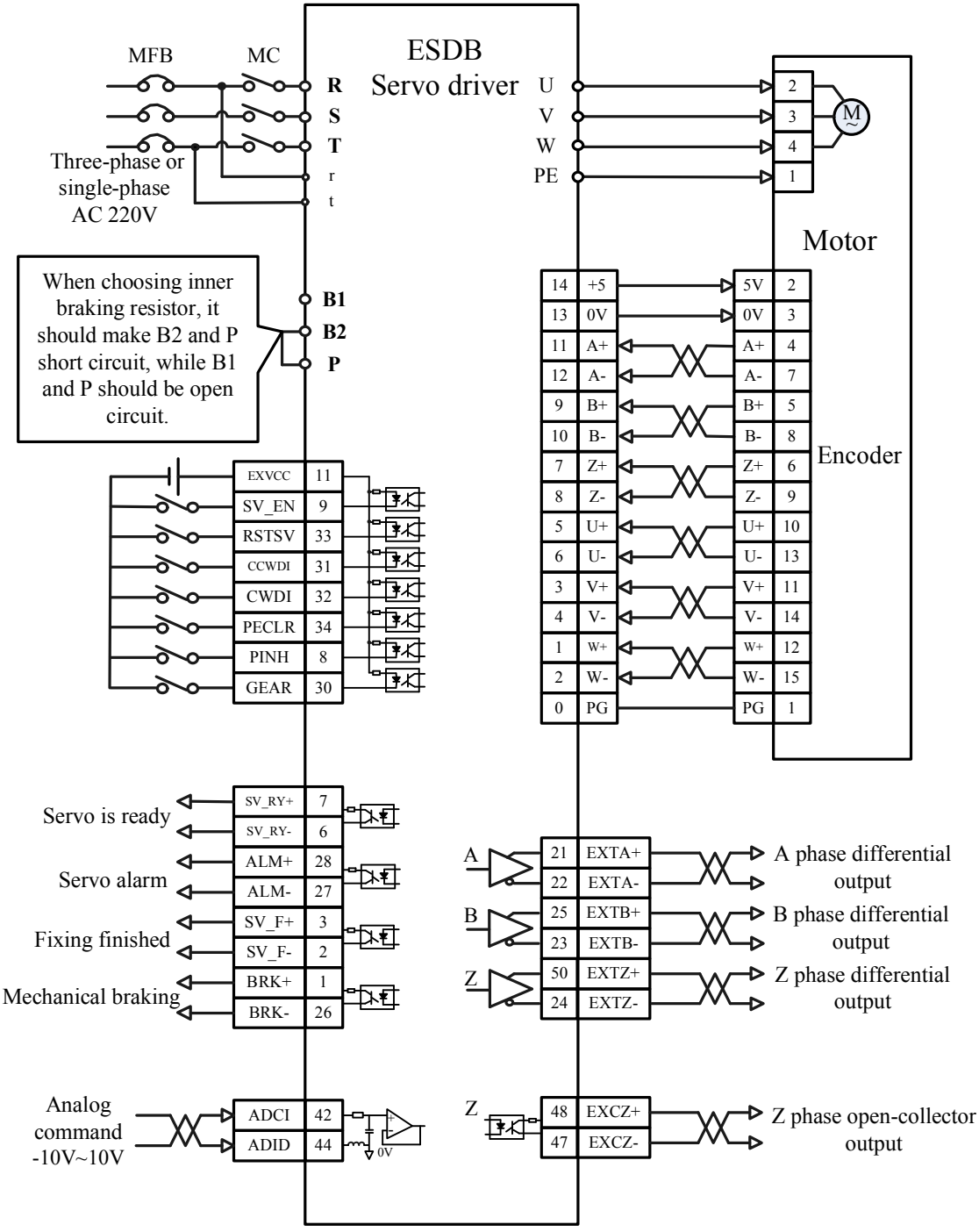


Figure 3.10 Standard Wiring in Analog Speed Control Mode

Chapter 4 Display and Operation

4.1 Overview

The driver panel is made up of 6 bits 7-segment LED digital tube, 4 keys and 2 indicator lamps. They are used for displaying various states of the driver and setting parameters. The following Chart 4.1 shows the driver's operation panel.

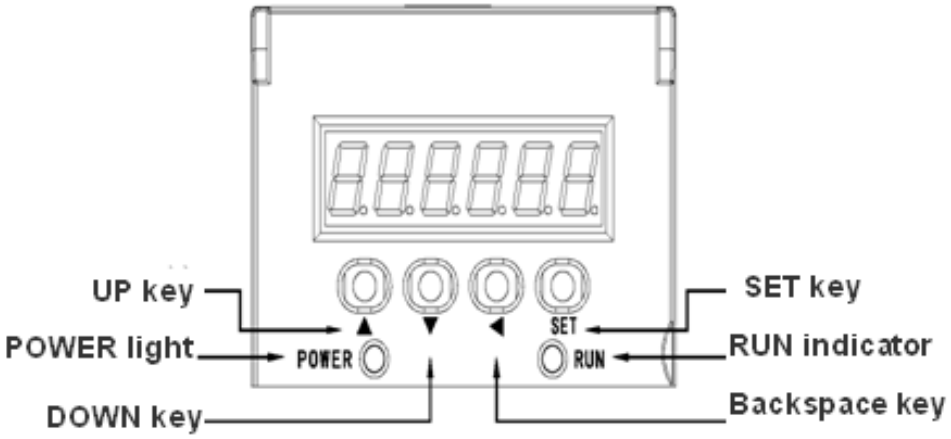


Chart 4.1 Operation Panel

The specific function of each part is illustrated as follows:

Name	Function
Display	The 6 bits 7-segment digital tube is used for displaying monitoring value, setting value, parameter value and alarm information.
UP key	Change menu, parameter number or modification of numerical value
DOWN key	Change menu, parameter number or modification of numerical value
Backspace key	Return to upper layer menu, or cancel operation.
SET key	Enter the next layer menu, or input confirmed.
POWER light	To show whether there is electricity in the major circuit, light's on means YES
RUN indicator	To show whether the driver enables, light's on means YES

The driver's operation adopts multilayer menu structure, and the first layer is main menu, including eight submenus of fundamental function. The projects and block diagram for operation are shown in Fig. 4.2.

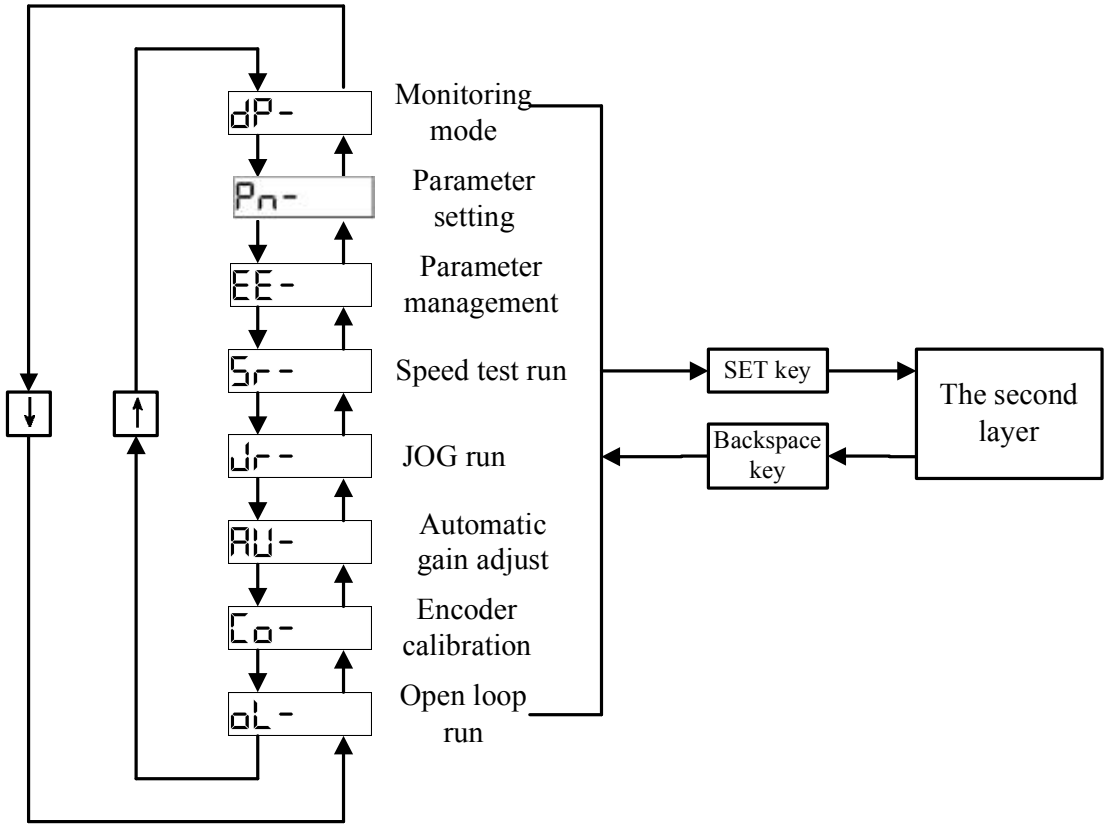


Fig. 4.2 Block diagram for the first layer operation menu

As shown in Fig. 4.2, by pressing UP key or DOWN key, users can switch among sub-items; by pressing SET key, users can enter the second layer menu of corresponding sub-items; by pressing Backspace key in the second layer's menu, users can return to the first layer's menu.

The following words will illustrate the operation of each submenu.

4.2 Monitoring Mode

4.2.1 Status Display

After power-on, the driver enters into monitoring mode automatically, and the display displays the monitoring items which were set in advance (the power-on monitoring items were set by Parameter Pn3, see Section 7.2 for detail setting) .

Users can also select dP- in the first layer's menu, and press SET key to enter monitoring mode. Under this mode, there are 23 monitoring items for users' choosing by UP key or DOWN key, and when press SET key once the driver will display specific monitoring value. The following diagram shows each monitoring item.

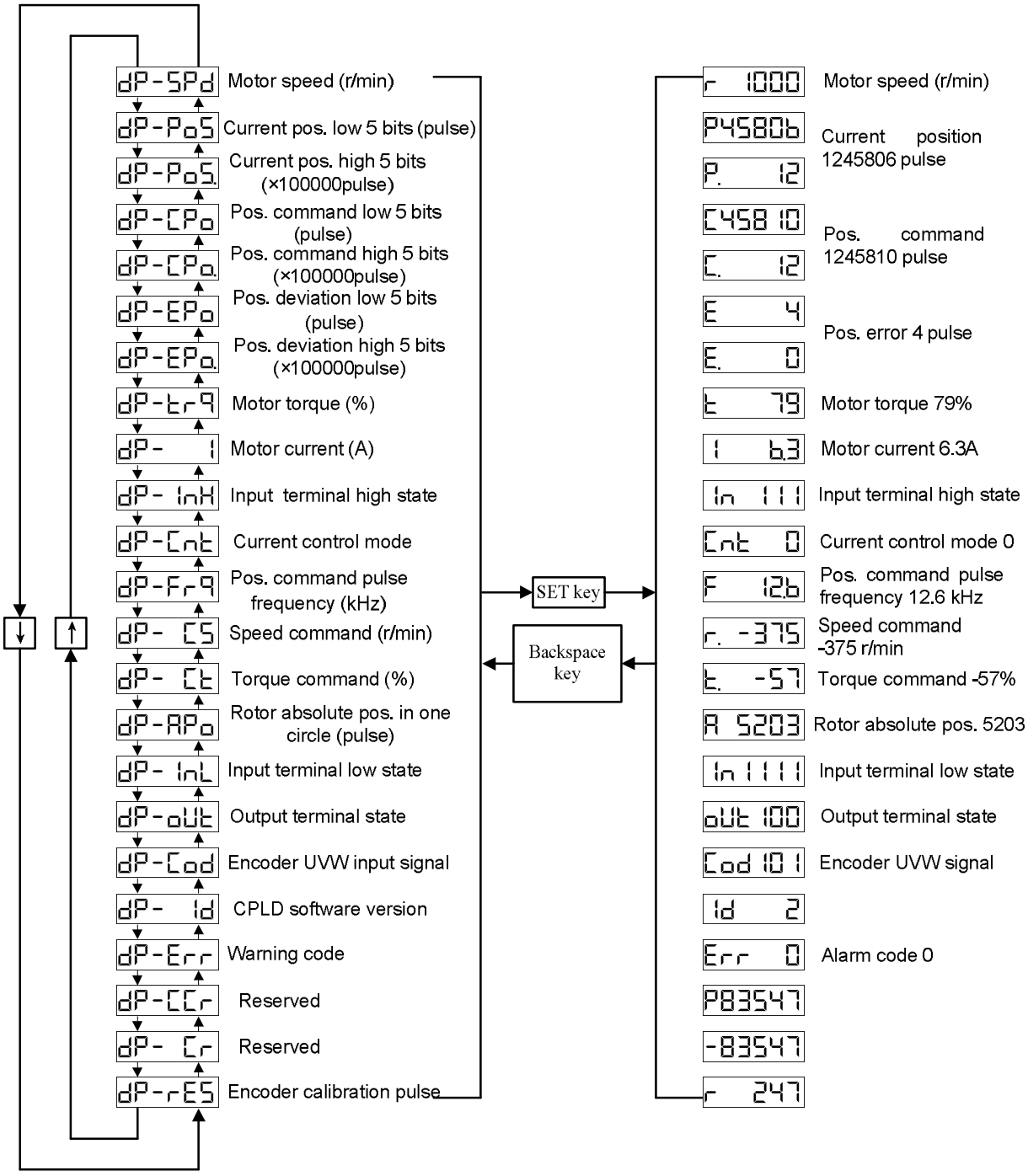


Fig. 4.3 Operation chart of monitoring mode

Instructions to some items in the diagram:

- Position command pulse dP-CPo is the value of input pulse magnified by electronic gear ratio.
- Current position feedback by motor encoder is composed of two parts:

dP-PoS. (high 5 bits) + dP-PoS (low 5 bits). For example, the current position pulse in the above diagram is calculated as following:

P. 12 × 100000 + P45806 = 1245806 pulse

In the same way, position command is also composed of dP-CPo. (high 5 bits) + dP-CPo (low 5 bits).

C. 12 × 100000 + C458 10 = 1245810 pulse

In the same way, position command is also composed of dP-EPo. (high 5 bits) + dP-EPo (low 5 bits).

E. 0 × 100000 + E 4 = 4 pulse

- Current control mode dP-Cnt displays: 0-position control; 1-speed control; 2-speed test run; 3-JOG running; 5- analog input speed running; 7-open loop running.
- If display numbers go up to 6 digits (for example, -12345), it will not display prompt.
- Position command pulse frequency dP-Fr9 is the actual pulse frequency before electronic gear magnifying. The minimum value is 0.1 kHz. Positive rotation displays positive number, and reverse rotation displays negative number.
- Rotator absolute position in one circle dP-APo means the rotator's relative position to stator. The period is one circle and range is 0～9999 (corresponding to 2500-line encoder).
- Alarm code displays dP-Err . For the specific meaning of alarm codes, please read Chapter 8.

4.2.2 Status Display of I/O Port and Encoder

The I/O port of driver dispalys input terminal high state dP- InH, low state dP- InL, and output terminal dP-oUt In addition, dP-Cod is encoder UVW status display. The specific representation method is that: each terminal displays one binary bit of number accordingly. the bit is zero means the terminal is OFF (digital signal 0), while the bit is 1 means

the terminal is ON (digital signal 1). The detailed correspondence is shown as following table:

Display Item	Binary Bit	Meaning
dP-Cod Encoder UVW input signal	Cod888	Encoder W phase
	Cod888	Encoder V phase
	Cod888	Encoder U phase

4. 3 Parameter Setting

The following figure is operation block diagram of parameter checking, modification and setting:

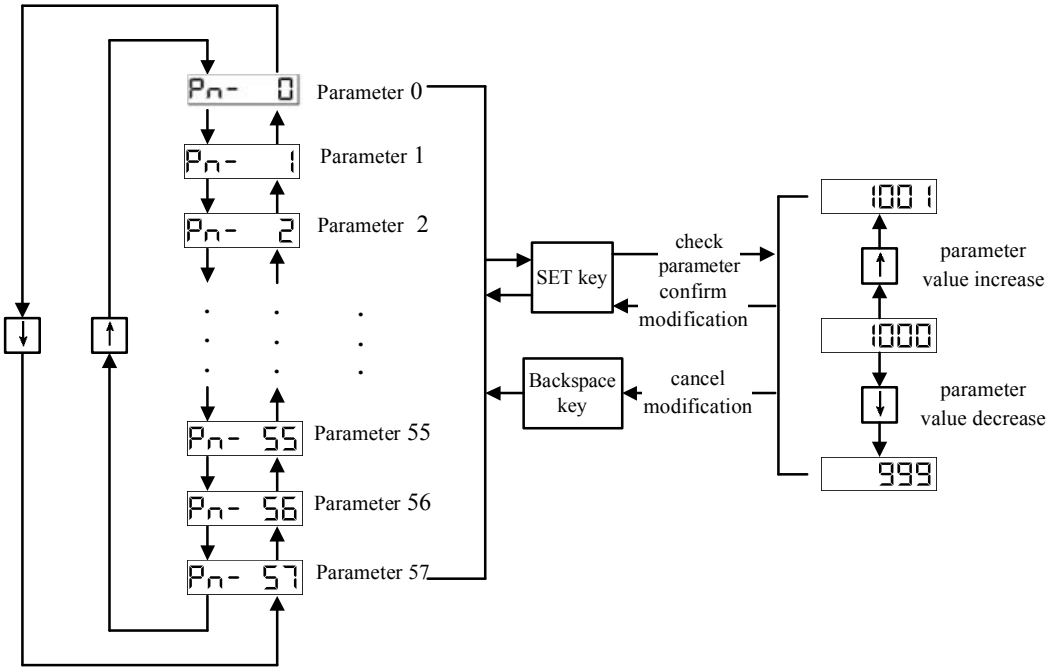
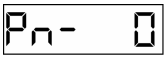


Fig. 4.4 Block diagram of parameter setting

- **Parameter operating password**

For avoiding parameter being set by mistake, the driver adopts two-stage password protection mechanism. After initial power on, before any operation of parameter checking and modification, users must enter and confirm correct operating password. The specific operating steps are as follows:

Step1：After the driver power on, select Pn- in main menu, and press SET key to enter parameter setting mode.

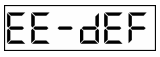
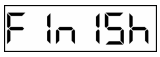
Step2：Press UP key or DOWN key to select  , then press SET key to change password. User password is 288, corresponding to operating permissions of user parameters Pn0 to Pn57.

Step3：After password being set correctly, press SET key to confirm it. Then, users can undertake operations of parameter checking, modification and so on.

Tips: The following operations are all on the basis of entering and confirming password correctly.

- Operation of resetting to factory default setting：

Step1：Select the correct motor model code by setting Pn-1. For motor model code information, please refer to Appendix A.

Step2：Enter EE menu, then choose  sub-menu, press SET key and hold on for more than 3 seconds, and then display will show  , which means the parameter resetting is carrying out. If resetting succeeds, display will show  in 1~2 seconds; If display shows  , it means operation fails, and users need to repeat Step2.

Step3：Restart the servo driver, and it has been reset to factory default setting.

- Operation of parameter modification:

Step1：Select  in main menu, and press SET key to enter parameter setting mode.

Step2：Press UP key or DOWN key to choose the parameter for modifying. Users can check current parameter value by pressing SET key, and modify the value by pressing UP key or DOWN key. If press and hold on the key, parameter value will increase or decrease constantly.

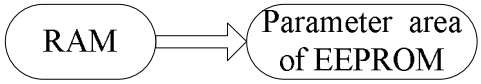
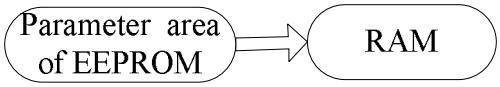
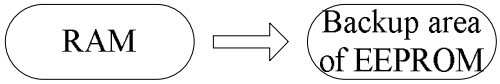
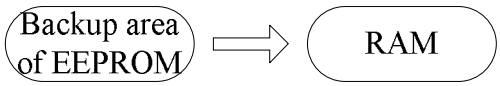
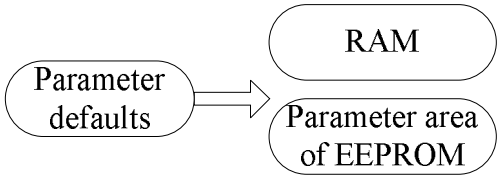
Step3：After parameter modification, confirm it by pressing SET key. If press Backspace key, the modification will be canceled and parameter value recover the former one.

Tips: Among all parameters, some of them will effect immediately after modification, while some of them will effect after being saved to EEPROM and restarting the driver. After parameter modification, if there is no operation of writing into EEPROM, the parameter will recover to the value before modification when the driver restarts.

4.4 Parameter Management

The driver uses a piece of nonvolatile Electrically Erasable Programmable ROM (EEPROM for short) to save parameters. Each time the driver powers on, DSP will read parameter value from EEPROM, so as to initialize the register of DSP controller (RAM for short). The important difference between EEPROM and RAM is that: users' operations of parameter modification and setting in Pn- parameter management mode are all acting on the parameters in RAM, which will be lost after driver's power-off; while parameters in EEPROM will be saved after driver's power-off, and will be used to initialize RAM at the time of driver's next power-on. Parameter management is mutual copy operation of parameters between EEPROM and RAM.

The parameter management submenu of EE- under driver's main menu provides users with parameter management functions. The following table lists introductions to each parameter operation item.

Parameter Operation Item	Operation	Introduction
EE-SEt Write parameter		Write the current parameter value of RAM into EEPROM parameter area, for avoiding losing RAM parameter because of power-off.
EE- rd Read parameter		Copy the parameter inside EEPROM parameter area to RAM, which equals to the effect of driver's power-on again.
EE- bA Backup parameter		Copy current parameter value of RAM into the backup area of EEPROM.
EE- rS Recover backup		Recover parameter into RAM from the backup area of EEPROM.
EE-dEF Recover defaults		Recover parameter of RAM and EEPROM to its defaults from factory.

Operation Instructions：As shown in following figure, select operation mode in EE- parameter management secondary menu, press SET key and hold on for more than 3 seconds, and then display will show StArt, which means the parameter operation selected is carrying out. If operating succeeds, display will show F in 15h in 1~2 seconds; If display shows Error, it means operation fails, and users need to undertake the selected operation again.

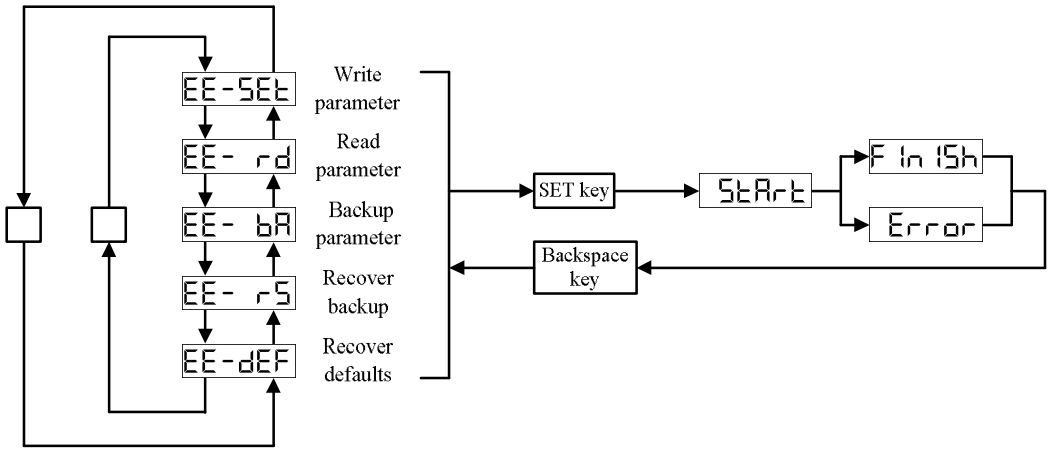


Figure 4.5 Operation diagram of parameter management 图

Chapter 5 Trial Running without Load

According to operation steps in *ELESY servo driver operating manual*, users can only connect the servo motor's load when the motor would function well, so as to avoid damage to the driver and system device while motor entering into service. Generally, a driver can be put into service after going through the following inspections: 1) wiring; 2) turning ON the driver, parameter tuning; 3) no-load operation; 4) control function tuning.

This chapter mainly illustrates operations of trial running without load after driver's power-on, and control function debugging will be introduced in the next chapter.

5.1 Inspections before Power on

Undertake wiring operation as Chapter 3. Before turning ON the driver, the following inspections must be carried through:

Inspection Items	Inspection Method
Whether the specifications of driver and motor match each other.	Look up the instruction manual to check nameplates of the driver and motor.
Whether there are odd parts inside the driver, such as screw.	Shake the driver softly to check whether there is sound of screw vibrating.
Whether there is isolation transformer connected, and voltage is normal or not.	Use multi-meter directly to check whether the output of transformer is 220V.
Whether the brake resistor's connection is correct.	Look up Chapter 3 of the instruction manual
Whether the connection of terminals of main circuit is strict; whether there is short circuit.	Check up if the terminals are inserted strictly and whether there is bareness of copper wire.
Whether the phase sequence of motor wiring UVW is correct.	Look up Chapter 3 of the instruction manual
Whether the encoder terminals' connection is correct.	Look up Chapter 3 of the instruction manual

⚠WARNING	➢ If external brake resistor is used, don't put it on combustibles for there is danger of fire. ➢ Power lines R,S,T shouldn't be connected to motor connectors U,V,W,PE.

5.2 Switch on the driver

After the inspection of Section 5.1, users can switch on the power to supply the control circuit and main circuit. In the condition of factory-default parameter of driver, the panel will normally display:

If there is abnormal condition, please check and dispose as the following table:

No.	Abnormal phenomena	Possible reason	Disposal method
1	No display in panel	Control circuit is undervoltage.	Check the connection of power supply terminals r, t; measure the input voltage, and supply power as specification standard.
2		Short circuit of motor power line.	Check wiring state of motor and driver; confirm there is no bareness of U,V,W,PE, or direct/indirect short circuit .
3		Major circuit is undervoltage.	Check the connection of power supply terminals R,S,T; measure the input voltage, and supply power as specification requirements in the manual.
4		Major circuit is overvoltage.	Measure the input voltage, and supply power as specification requirements in the manual.
5		Driver's model is incorrect.	Check whether the driver's model is in accordance with the ordered one.
6		Encoder fault	Check the connection of encoder's connector; check whether each signal wire is connected correctly, or whether there is poor soldering.
7		Encoder signal transmission fault.	

Timing sequence for connecting power supply (Driver factory parameters when the output is not inversed.)

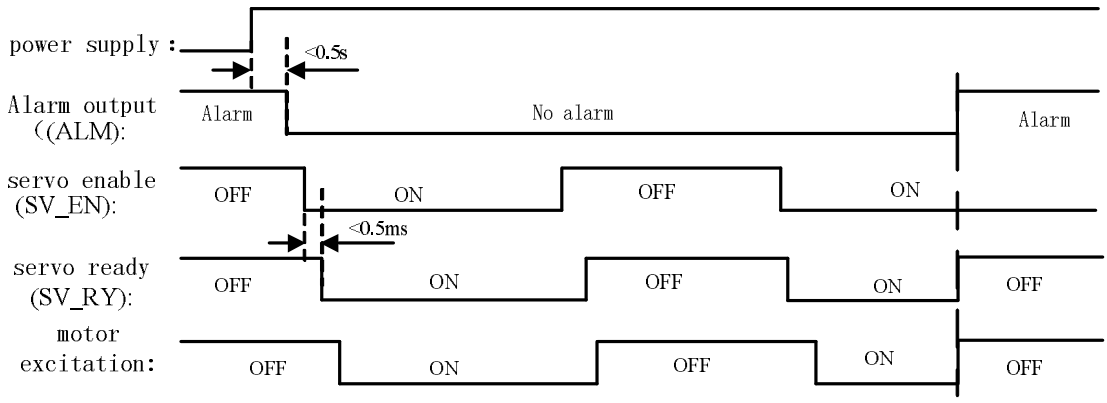


Figure 7.2 Sequence chart for connecting power supply

5.3 Speed and JOG Trial Running

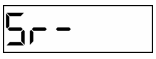
For testing motor and driver in the way of speed trial running and JOG trial running, users need only to connect the encoder line, power-line and motor power line to make an easy and direct judgment of whether the system is working properly. The following are specific steps.

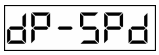
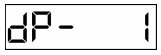
1. Speed trial running

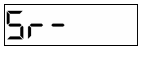
The operating steps are as follows:

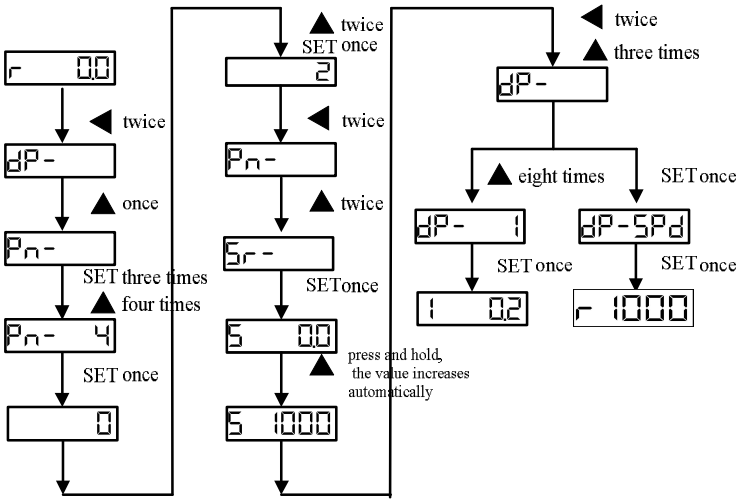
（1）Power up the driver, which displays 

（2）Set parameter of ‘Pn4’ as 2 to select speed trial running control mode.

（3）Enter into the menu of  . Set speed command by ▲ and ▼, and observe whether the motor shaft is rotating properly at that moment, including its stationarity and direction of rotation.

（4）Keep pressing on ▲ key to increase speed command until 1000rpm, then enter into  submenu to observe whether the actual rotate speed of motor is the setting velocity. Enter into submenu of  to observe motor’s actual current, which in normal cases is 0.1~0.2A.

（5）Enter into submenu of  again. Keep pressing on ▼key until motor’s running speed reaches -1000rpm, then observe whether the symbol of motor’s current and speed is contrary with that in (4).



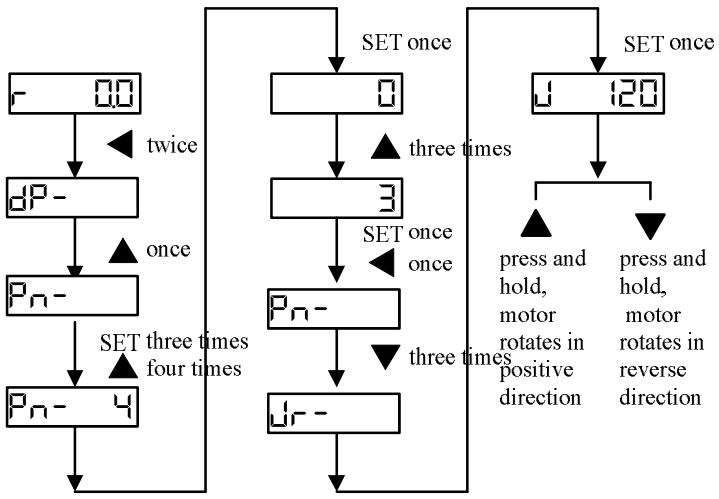
2. JOG trial running

The operation steps are as follows:

（1） Set parameter of ‘Pn4’ as 3 to select JOG trial running control mode.

（2）Modify parameter ‘Pn22’, and set suitable JOG trial running speed, which unit is r/min. For the purpose of safety, that speed should not be set to exceed 500r/min.

（3）Enter into menu of Jr-, the nixie tube will display Jr- 120, the numerical part of which is speed value set by parameter ‘Pn22’. At the moment, pressing ▲ key and hold, motor will rotate in the direction of CCW at constant setting speed. While pressing ▼ key and hold, motor will rotate in the direction of CW at constant setting speed. For loosening the key, motor will be in the state of zero-speed locked.



5.4 Internal Speed Running

In the mode of internal speed running, users can choose internal speed by speed command through external input ports of CN2-34(SC1) and CN2-8(SC2). The following are specific steps.

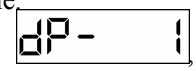
（1）there are four groups of internal speed, which are set by Pn24, Pn25, Pn26 and Pn27 respectively. Before internal speed running, users should set reasonable internal speed.

（2）set Pn4 as 1 to select speed control mode. In such case it is necessary to use enable signal, which can be reached by external CN2-9（SV_EN）to enable, or be inner compelled to enable by setting Pn57 as 2.

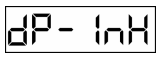
（3）select respective internal speed by external input terminals（SC1、SC2）, and the corresponding relationship is as follows:

SC1	SC2	Speed command	Parameter No.
OFF	OFF	Internal speed 1	Pn24
ON	OFF	Internal speed 2	Pn25
OFF	ON	Internal speed 3	Pn26
ON	ON	Internal speed 4	Pn27

（4）change internal speed by altering the SC1 and SC2. observe whether the motor shake or make noise, and whether the speed is stable.

（5）Enter into monitoring mode, select  , and observe the current value. Under normal circumstance, the current shouldn't exceed motor's rated current value.

Notice：

if the motor revolution is different from the speed selective input signal, check  to judge whether the input signal is correct.

5.5 Analog Speed Running

In the analog input speed control mode, the driver controls the motor rotates with direction and speed which are determined by the analog voltage. The following is the operation steps in the analog input speed control mode:

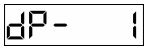
（1） Please refer to figure 3.10 for the correct wiring. Notice that necessary input signals in the

below table must be connected;

Necessary input signals	**Terminal number**	**Functions**
EXVCC	CN2-11	Input common terminal, the control power input terminal
ADCI	CN2-42	Analog voltage command input terminal
ADID	CN2-44	
SV_EN	CN2-9	Servo enabled signal

（2） After the confirmation of correct wiring, keep all the signals ON, switch on the power, and set the below necessary parameters;

Necessary parameters	**Parameters description**
Pn4	Pn4=5, select the analog input speed control mode
Pn15	Inverse the speed command polarity: Pn15=0；when the speed command is positive, the motor rotates clockwise; Pn15=1: when the speed command is positive, the motor rotates counter-clockwise;
Pn51	Analog input gain: set the proportion between speed command input voltage and motor actual speed.

（3） After finishing setting the necessary parameters, firstly make SV_EN ON to enable the driver, secondly give relatively small analog speed command to let the motor starting rotate. Observe the motor current by monitoring  . In normal case, the motor current won't exceed the rated current；

（4） Increase the analog speed command slowly, to make the motor accelerate running in accordance with the command. Meanwhile observe whether there is vibration or noise, whether the speed is steady or not, and whether the motor current exceeds rated current.

NOTICE

- Even if the analog input is 0V, the motor may rotate resulted from zero-drift by analog command. For how to adjust, please refer to chapter 6.3.1.
- The analog input voltage can't exceed 10V, otherwise the motor may be destroyed.

5.6 Position Running

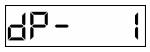
In the position control mode, digital pulse can be used to determine the rotation direction and angle of the motor. The driver controls the motor shaft to turn the corresponding angle at the determined direction. The following are the operation steps in the position control mode.

（1） Please refer to figure 3.9 for the correct wiring. Notice that necessary input signals in the below table must be connected;

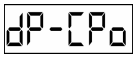
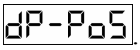
Necessary input signals	**Terminal number**	**Functions**
SV_EN	CN2-9	Servo enabled signal
PULS+	CN2-41	Position command input
PULS-	CN2-43	
DIR+	CN2-37	
DIR-	CN2-36	
EXVCC	CN2-11	Input common terminal, the control power input terminal

（2） After the confirmation of correct wiring, keep all the signals OFF, switch on the power, and set the below necessary parameters;

Necessary parameters	Parameters description
Pn4	Pn4=0，select position control mode
Pn12 Pn13	Electronic Gear Ratio numerator Electronic Gear Ratio denominator （refer to chapter 6.2.2 for specific calculating method）
Pn14	Position command input way: Pn14=0：pulse + code Pn14=1：CCW pulse + CW pulse Pn14=2：two phase orthogonal pulse input
Pn15	Inverse the direction of position command Pn15=0：normal Pn15=1：inverse the direction of position command pulse

（3） After finishing setting the necessary parameters, firstly make SV_EN ON to enable the driver, secondly give relatively small position pulse command to let the motor starting rotate. Observe the motor current by monitoring  . In normal case, the motor current won't exceed the rated current；

（4） Increase the frequency of position command slowly, to make the motor accelerate running in accordance with the command. Meanwhile observe whether there is vibration or noise, whether the speed is steady or not, and whether the motor current exceeds rated current;

（5） Stop the position pulse command input to bring the motor to stop. Check whether the position command pulse quantity displayed on  is equal to the result of  .

NOTICE

When the motor can't work, please observe DP-CPo.

- If DP-CPo has data and the motor don't rotate, please check the motor power wire and the necessary parameter setting.
- If DP-CPo don't have data and the motor don't rotate, please check the wiring of upper device and whether the upper device setting is reasonable. Meanwhile check whether the driver is enabled or not.
- If DP-CPo has data which is different from the upper device pulse quantity, please check whether the signal wire is poor soldering, shield is connected and whether there is strong interference source nearby.
- The rotating direction of motor is determined by 'Pn15'.

Chapter 6 Control Functions setting

6.1 Technical Notes for Rotation Direction

The servo driver can change the rotate direction of motor shaft corresponding to CCW under the condition of not altering the wiring of motor. In the standard setting, CCW means the motor shaft rotates counter-clockwise (observe in the face of motor shaft); in the inverse mode, CCW means the motor shaft rotates clockwise (observe in the face of motor shaft). The inverse mode is decided by‘Pn15’which is showed in the below figure：

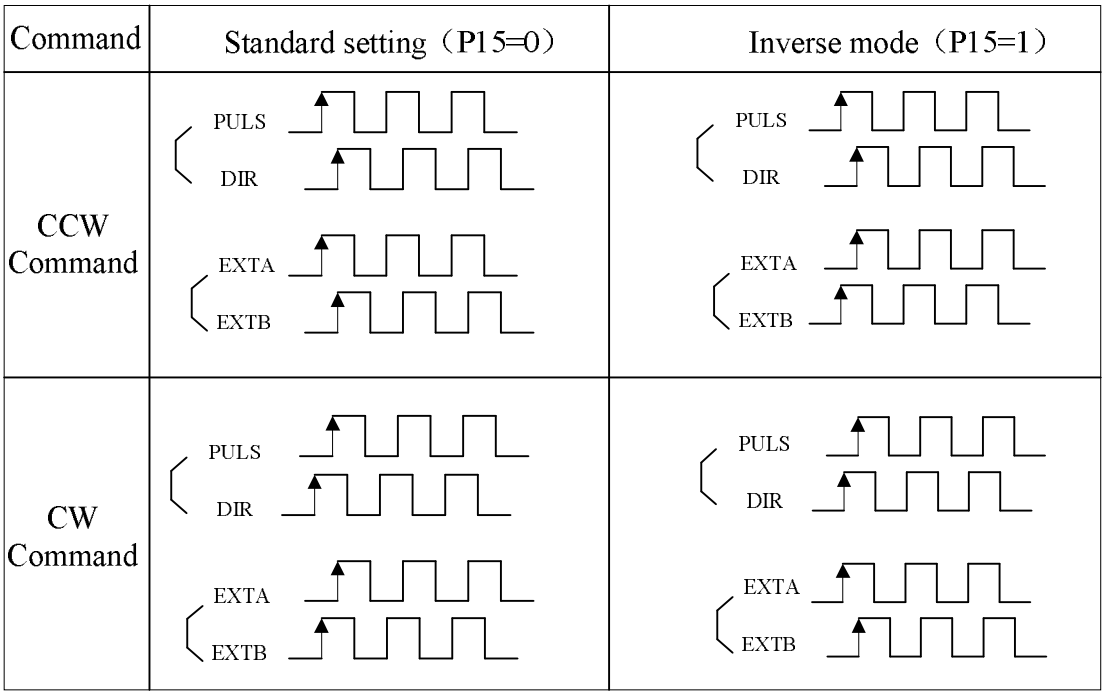


Figure 6.1 Motor Direction Switching Figure

PULS and DIR are command pulses，and A, B are encoder output pulses. The default setting of the driver is the standard mode, and in this case pulse command is exactly the same with encoder feed signal direction, which are opposite in the inverse mode.

Before the function adjustment, it is necessary to determine the running mode of the motor, which can be modified by setting the value of‘Pn15’and electrifying anew.

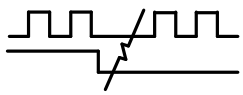
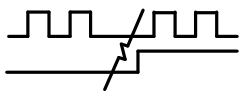
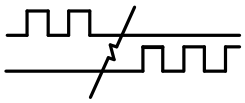
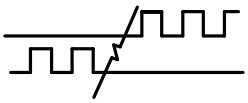
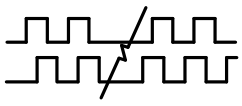
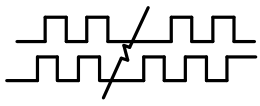
6.2 Position Control Mode

Position mode is mainly used in pinpoint situations such as numerical control machines.

6.2.1 Position Command

In the AC servo application system, position command is input from CN2 upper controller terminal, which can be either differential input or open-collector input. Refer to chapter 3.2.2 for the wiring method.

There are three forms for pulse command, which is selected by setting ‘Pn14’. Every form can be inversed, which is decided by Pn15.

Pn14	Pulse form	Pn15=0		Pn15=1	
		clockwise	counterclockwise	clockwise	counterclockwise
Pn14=0	Pulse +Direction				
Pn14=1	CCW/CW pulse				
Pn14=2	Two-phase orthogonal pulse				

6.2.2 Position Command Electronic Gear Ratio

Relative Parameters

Parameter Number	Name	Parameter range	Default setting	Unit
Pn12	Electronic Gear Ratio numerator	1～32767	5	
Pn13	Electronic Gear Ratio denominator	1～32767	3	

In the position control mode, by setting the value of parameters Pn12 and Pn13, it can match with various pulse sources conveniently, in order to reach desired control resolution(angle

divides pulse).

- P×G=N×C×4

  P：Input command pulse quantity

  G：Electronic gear ratio

  $$G=\frac{PA-12}{PA-13}$$

  N：Motor rotation cycle numbers

  C：Encoder lines / cycle， C=2500 in this system.

- （Example）when the input command pulse quantity is 6,000 and the motor rotates one cycle, then G=N×C×4/P=1×2500×4/6000=5/3
- The recommended electronic gear wheel ratio range is :

  1/50≤G≤50

6.2.3 Encoder Signal Output

ESDB series servo drivers can output encoder A, B and Z pulse signal, in order to match with upper device. The signal manipulation includes fractional frequency to A and B orthogonal pulse and zero-position pulse broadening. Relative parameters are showed in the below table. Please refer to chapter 3.2.4 for the wiring method.

Parameter number	Name	Parameter range	Default setting	Unit
Pn31	Encoder pulse division output numerator	1～32767	5	
Pn32	Encoder pulse division output denominator	1～32767	3	
Pn55	Encoder zero-position pulse broadening	1~32	1	

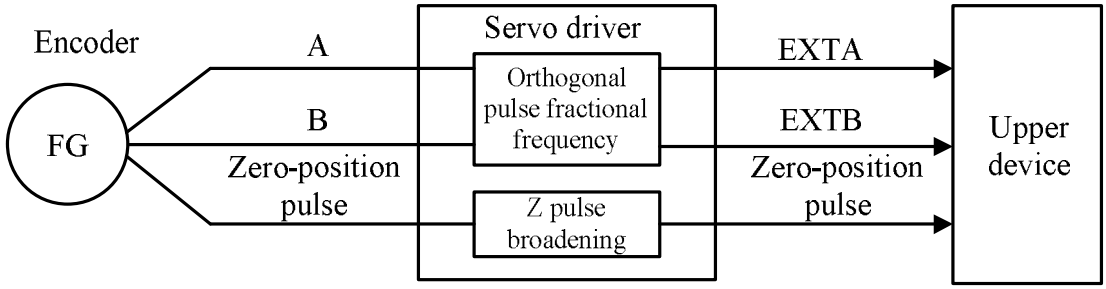
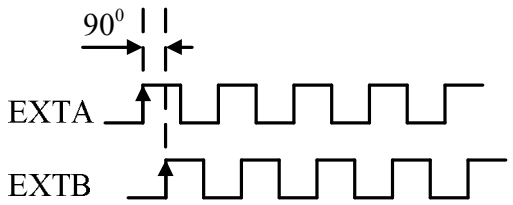
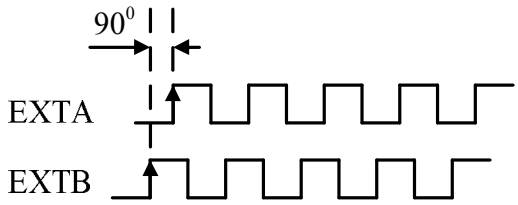


Figure 6.2 Encoder Signal Manipulation

Encoder pulse electronic gear ratio $= \frac{N}{M} = \frac{PA-56}{PA-57}$. Take 2500ppr encoder as example, $\frac{N}{M} = \frac{2000}{2500}$, it means that every turn the motor rotates, the driver will output 2000 pulse. The output pulse is only changing amount, but it is still orthogonal pulse with the same phase.

Motor rotates clockwise（CCW）	Motor rotates anticlockwise（CW）
	

Notice: Even if the motor runs in the anticlockwise mode, the feed pulse driver outputs is the same with the standard setting.

Z pulse broadening: encoder zero-position pulse width decreases when the motor speed grows up. Being affected by some factors such as filtering latency in the circuit signal handling, Z pulse is highly possible to disappear, so it needs to broaden.

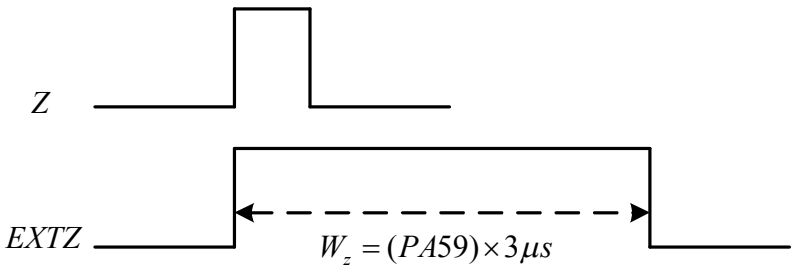


Figure 6.3 Zero-position Pulse Broadening

6.2.4 Other Functions

（1） Positioning completion output

In the position control mode, SV_F is the positioning completion signal for the servo motor, while it is speed reached signal in the speed control mode.

Terminal number	Name	Functions
CN2-3	SV_F＋	positioning completion output terminal. When position deviation is smaller than or equal to the value of Pn16, it outputs ON signal.
CN2-2	SV_F-	

Parameter Number	Name	Parameter range	Default setting	Unit	Application way
Pn16	Positioning completion range	0～30000	1000	Pulse	P
Pn17	Checking range for position deviation	0～30000	4000	×100 pulse	P

Notice: the setting of‘Pn16’does not affect the final positioning accuracy of the servo system. When the position deviation is larger than the setting value of Pn17, the driver will output position out-of-tolerance alarm Err-9.

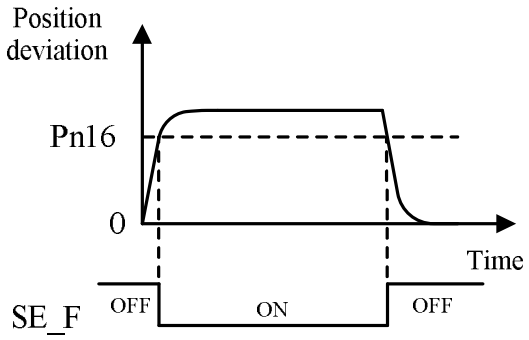


Figure 6.4 Positioning Completion Schematic Diagram

（2） Deviation counter clearing

In the position control mode, PECLR is position deviation clearing signal. When this signal is ON, it will clear away the pulse of driver position deviation counter.

Terminal Number	Name	Functions
CN2-34	PECLR/ SC1	Position deviation counter clearing input terminal PECLR ON：in the position control mode, the position deviation counter is zero-clearing; In the speed control mode, internal speed selects switch SC1。

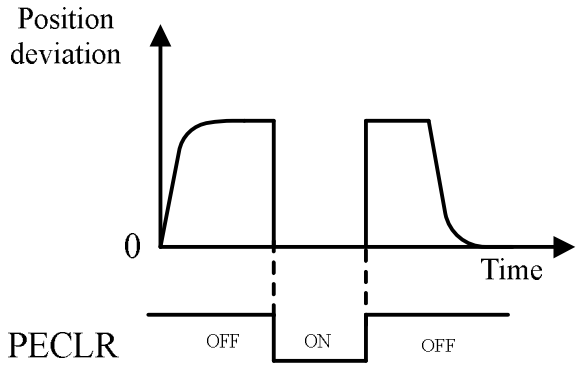


Figure 6.5 Deviation Counter Clearing Schematic Diagram

（3）Pulse command forbidden

The function of PINH is forbidding the command pulse counting in the position control mode. The servo motor is locked when this function is effective.

Terminal Number	Name	Functions
CN2-8	PINH/ SC2	In the position control mode: position command pulse forbidden input terminal. PINH ON：command pulse input is forbidden. PINH OFF：command pulse input is effective. In the speed control mode: Internal speed select switch SC2。

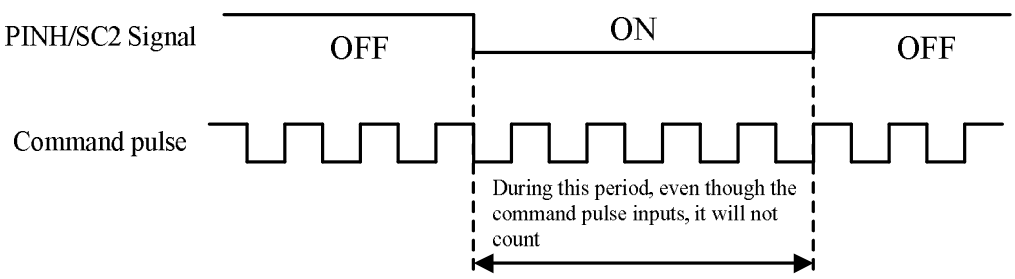


Figure 6.6 Pulse Command is Forbidden Schematic Diagram

6.2.5 Position Mode Regulator Parameter Adjustment

If the motor vibrates, makes noise or other abnormal situations appear, users should adjust the position loop and speed loop regulator parameters properly. As shown in Figure 6.7, the servo system has three closed loop which are position loop, speed loop and circuit loop. Among them the circuit loop response speed is the fasted, and the response speed of speed loop is faster than position loop. If this principle is not abided by, the vibration or bad response will appear. Therefore, generally users adjust internal loop firstly and external loop secondly to reach a set of reasonable parameters, in order to ensure good response features of servo driver.

When it needs quick response, not only the response of the servo system (Controller, servo driver, motor and encoder) but also high stiffness of the mechanical system should be ensured.

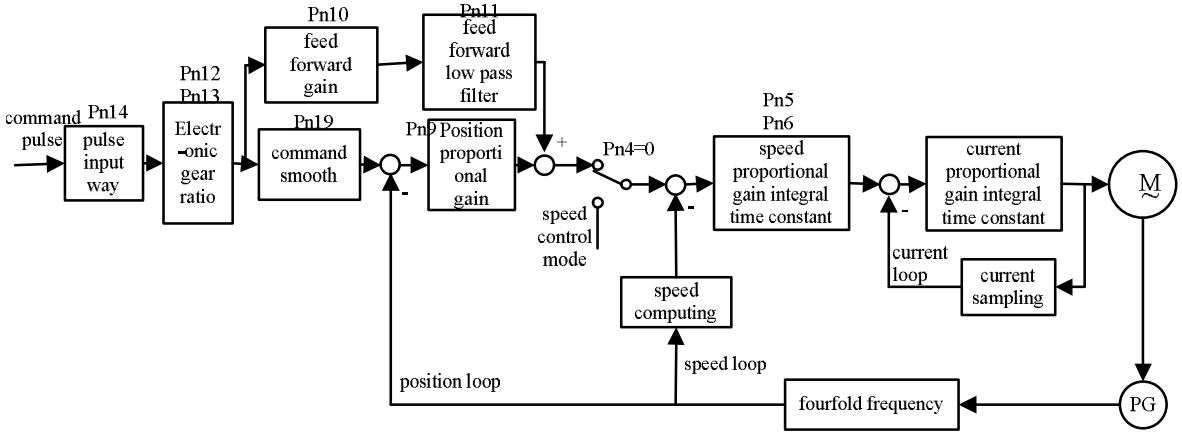


Figure 6.7 Position mode parameter adjustment

Parameter Number	Name	Parameter range	Default setting	Unit	Application way
Pn9	Position proportional gain	1～1000	100	1/S	P
Pn10	Position feed forward gain	0～100	0	%	P
Pn11	Position feed forward low pass filter cut-off frequency	1～1200	0	Hz	P
Pn19	Position command smooth filter	0～30000	0	0.1mS	P

Parameters in the system are restricted with each other. If only position proportional gain increases, the position loop output command may be unstable, which could lead to instability of

the whole servo system response. Generally the system should be adjusted referring to the following steps:

a）At first set the position proportional gain at relatively low value, and then under the premise of not producing abnormal noise or vibration, increase the speed proportional gain value gradually to the largest.

b）Secondly reduce the speed proportional gain gradually and increase the position proportional gain at the same time. Under the premise that the whole response does not have overstrike or shake, increase the position proportional gain to the largest.

c）Thirdly speed integral time constant depends on the length of positioning time. Under the premise that the mechanical system does not shake, reduce this value as you can.

d）At last fine-tune the position proportional gain, the speed proportional gain and integral time constant to find the best values.

The position control mode of servo driver is closed loop control based on position deviation, which change the revolving speed and torque of the motor on the basis of position error. Hence, the larger the position gain Pn9 is, the faster the system adjustment is, the smaller the tracking error is. But if the value of Pn9 is too large, overstrike or shake may appear, which is showed in the below curve.

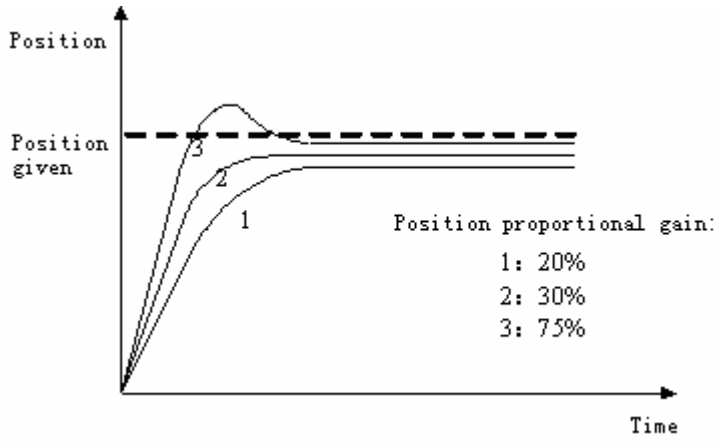


Figure 6.8 Position Curve

If the system tracking error can't satisfy the demand by changing the position proportional gain, it should adjust the feed forward parameter. When the feed forward gain proportion increases, the position error will decrease obviously.

6.3 Speed Control Mode

6.3.1 Speed Control Command

Analog voltage command

Terminal Number	Name	Application way	Functions
EXVCC	CN2-11	P，S	Input terminal power
CN2-9	SV_EN	P	Servo enabled input terminal
CN2-42	ADCI	S	External analog input -10V—+10V
CN2-44	ADID		

Parameter Number	Name	Parameter range	Default setting	Unit	Application way
Pn4	Control mode selection	0～7	0		ALL
Pn44	Analog input zero drift compensation value	-5.00～5.00	0	V	S
Pn45	Analog input zero speed clamping voltage	0～10.00	0.010	V	S
Pn51	Analog input gain	0～1000	100	%	S

The speed command of motor is controlled by the analog voltage of ADID and ADIC, the speed in line with 10V is the motor's rated revolution, and 'Pn51' determines the slope of "Speed —Analog voltage" curve, as shown in the below figure.

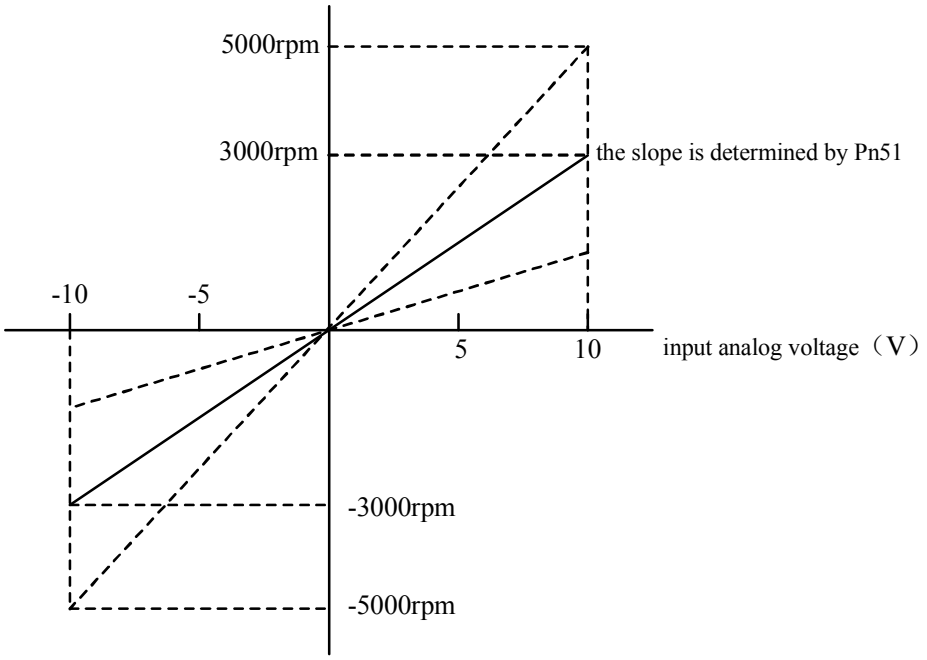


Figure 6.9 Analog Command

E.g.: suppose that the rated revolution of motor is 2500rpm，Pn51=100%，then the motor revolution is 2500rpm with 10V input, 1250 rpm with 5V and -1250rpm with -5V.

In the speed mode, even if the analog command voltage is 0V, sometimes motor still rotates at tiny speed, which is caused by the tiny 'shift'(mV unit) upper device or external command voltage carry with. It can be compensated automatically or manually by parameter setting.

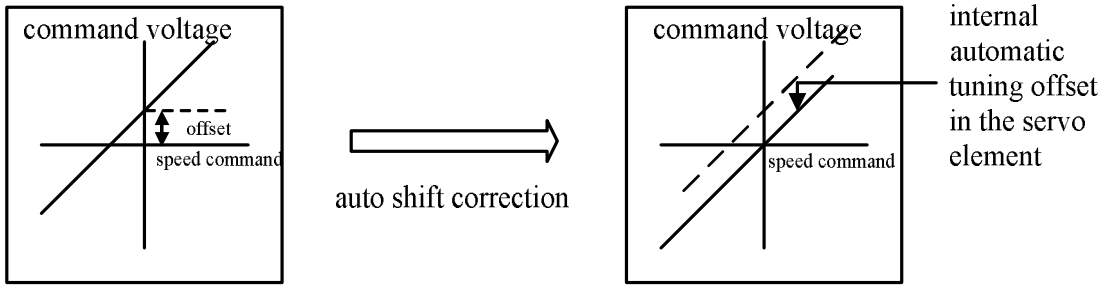


Figure 6.10 Analog Command Compensation Schematic Diagram

Auto compensation：Au-Set.

Manual compensation: after the servo is enabled, the motor runs in the analog mode. The speed command offset can be observed by DP-CS, and then users can manually change the value of Pn51 based on the observed offset.

When the analog input is 0V, Pn45 can be used in order to make sure motor stop stably and not rotate. If the analog input voltage (absolute value) is smaller than the setting value, the motor will be locked.

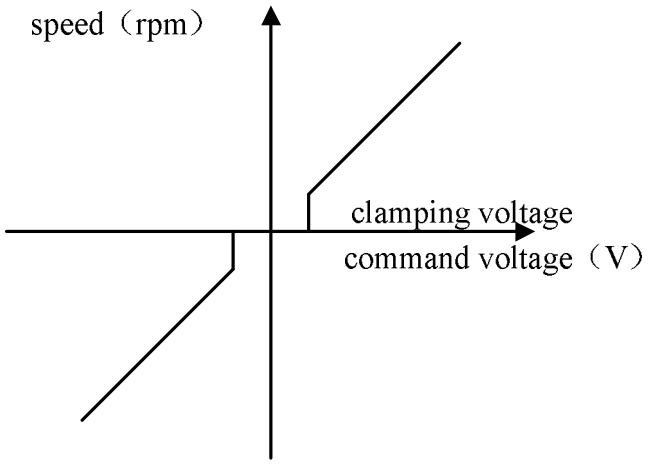


Figure 6.11 Analog Command Compensation Schematic Diagram

Internal speed command

Terminal number	**Signal name**	**Way**	**Functions**
CN2-11	EXVCC	PS	Input terminal power
CN2-9	SV_EN	P	Servo enabled input terminal
CN2-34	SC1	P	Internal speed choose switching SC1
CN2-8	SC2	P	Internal speed choose switching SC2

Pn4=1，select internal speed running mode

Speed select IO situation		Running speed	Corresponding parameter
SC1	SC2		
OFF	OFF	Internal speed 1	Pn24
OFF	ON	Internal speed 2	Pn25
ON	OFF	Internal speed 3	Pn26
ON	ON	Internal speed 4	Pn27

When the servo is enabled, motor will run at the speed which is decided by the parameter in accordance with the combination of SC1 and SC2.

6.3.2 Speed Mode regulator Parameter Adjustment

In the speed control mode, the servo system structure is showed in Figure 6.9, and there are only circuit loop and speed loop.

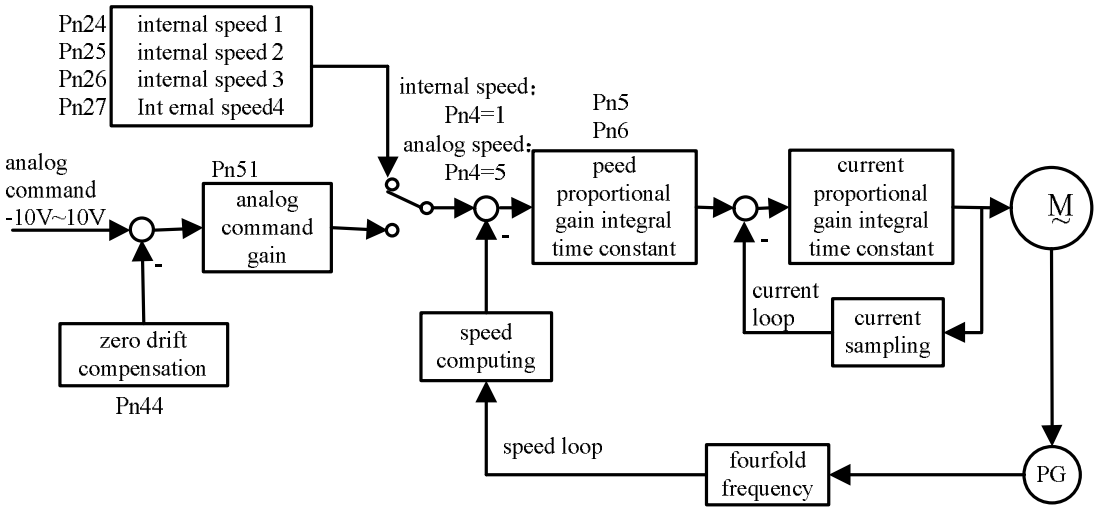


Figure 6.12 Speed Mode Parameter Adjustments

Speed proportional gain Pn5 is mainly used to determine the response speed of the speed loop. Under the premise that the mechanical system not vibrate, the response speed increases with larger parameter value.

The larger the speed integration time constant Pn6 is, the slower the system response is, and the weaker the integral effect is; to the contrary, the smaller the parameter value is, the quicker the response is. However, if the value is too large, the system will lose stability and even result in vibration.

6.3.3 Speed Reached Signal

In the speed control mode, external input signal SV_F（CN2-2、CN2-3）is speed reached signal. When the motor's actual speed exceeds the setting value of Pn28, speed reached signal outputs ON.

Parameter number	Name	Parameter range	Default setting	Unit	Application way
Pn28	Speed reached	0～3000	500	r/min	S

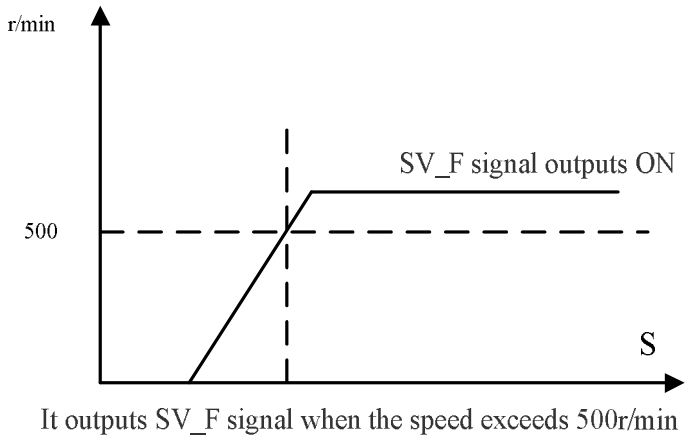


Figure 6.13 Speed Reached Output Schematic Diagram

6.3.4 Zero Speed Clamping Signal

In the analog speed control mode, GEAR（CN2-30）is zero speed clamping signal. Zero speed clamping function is used in the case that users demand that the motor be halted and servo be locked even if the analog voltage command is not “0V”.

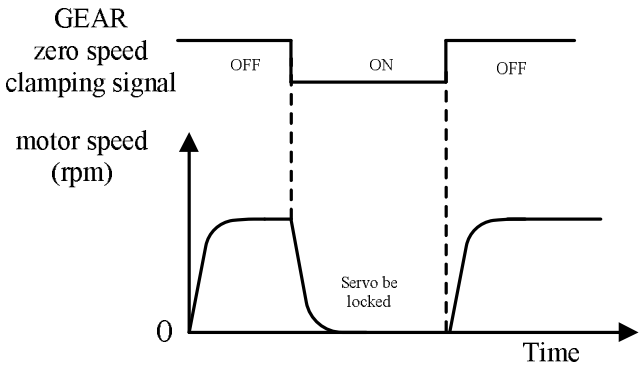


Figure 6.14 Zero Speed Clamping Output Schematic Diagram

Chapter7 Parameters and Functions

7.1 Parameters Table

- The default setting values in the following table take drivers suitable for B-series motors as example. Parameters for different motors are different.

  Control mode summary: P represents position control mode
  S represents speed control mode
  T represents torque control mode

Table 7.1 Parameters Table

Parameters number	Name	Parameter range	Default	Unit	Application way
Pn0	Password	0～9999	288		ALL
Pn1	Motor model	0～51	3		ALL
Pn2	Software version (read-only)	*	2		ALL
Pn3	Initial display content	0～21	0		ALL
Pn4	Control mode selection	0～7	0		ALL
Pn5	Speed proportional gain	5～2000	260	Hz	ALL
Pn6	Speed integral time constant	1～1000	20	mS	ALL
Pn7	Current command filter	1～500	100	%	ALL
Pn8	Speed feedback filter	1～500	99	%	ALL
Pn9	Position proportional gain	1～1000	100	1/S	P
Pn10	Position feed forward gain	0～100	0	%	P
Pn11	Position feed forward low pass filter cut-off frequency	1～1200	300	Hz	P
Pn12	Electronic Gear Ratio numerator	1～32767	5		P

Pn13	Electronic Gear Ratio denominator	1～32767	3		P
Pn14	Input mode for position command pulse	0～2	0		P
Pn15	Inverse the direction of position command pulse	0～1	0		P
Pn16	Range of positioning completion	0～30000	1000	pulse	P
Pn17	Measure range of position deviation	0～30000	4000	× 100pulse	P
Pn18	Output signal polarity selection	0~15	0		ALL
Pn19	Position command smooth filter	0～30000	0	0.1mS	P
Pn20	Drive forbid input invalid selection	0～1	1		P，S
Pn21	Factory parameter				
Pn22	JOG run speed	-3000～3000	120	r/min	S
Pn23	Maximum speed limit	0～4000	1000	r/min	P，S
Pn24	Internal speed 1	-3000～3000	10	r/min	S
Pn25	Internal speed 2	-3000～3000	100	r/min	S
Pn26	Internal speed 3	-3000～3000	500	r/min	S
Pn27	Internal speed 4	-3000～3000	0	r/min	S
Pn28	Speed reach signal threshold	0～3000	500	r/min	S
Pn29	Acceleration and deceleration time constant		0		S
Pn30	Factory parameter	0～2	0		S
Pn31	Encoder pulse division	1～32767	1		ALL

	output numerator				
Pn32	Encoder pulse division output denominator	1～32767	1		ALL
Pn33	Factory parameter		2		
Pn34	Internal CCW torque limit	0～300	220*	%	ALL
Pn35	Internal CW torque limit	-300～0	-220*	%	ALL
Pn36	External CCW torque limit	0～300	220	%	ALL
Pn37	External CW torque limit	-300～0	-220	%	ALL
Pn38	Torque limit for speed trial run and JOG	0～3000	100	%	S
Pn39	Software overcurrent limit	0～20	15	0.1A	P，S，T
Pn40	Permitted overcurrent time limit	1～10000	800	mS	S
Pn41	Fault clearing times limit		5		P
Pn42	The second electronic gear ratio numerator	1～32767	5		P
Pn43	The second electronic gear ratio denominator	1～32767	3		P
Pn44	Analog input zero offset compensation value		0	0.01V	S
Pn45	Analog input zero speed clamping threshold		0.1	0.01V	S
Pn46	Over-speed checking range		20	%	ALL
Pn47	Factory parameter				
Pn48	Over-speed permitting time		5000	ms	ALL
Pn49	Permitted time for speed above the maximum limit		5000	ms	T
Pn50	Factory parameter				

Pn51	Analog input gain		100	%	S
Pn52	Torque acceleration and deceleration time		1000	ms	T
Pn53	Speed acceleration and deceleration time		1000	ms	S
Pn54	Factory parameter				
Pn55	Encoder zero-position pulse broadening	1～31	1	×3uS	ALL
Pn56	Factory parameter				
Pn57	Compel to enable	0～5	3		ALL

7.2 Parameters function explanations

Pn0	Password	Parameter range	Default	Unit	Application way
		0～9999	288		ALL

- The user password is 288，which can be used to revise Pn0~Pn57。Guarantee this parameter not be revised incorrectly, and the other parameters can't be interviewed with wrong user password.
- The other special operation need to set suitable passwords.

Pn1	Motor model	Parameter range	Default	Unit	Application way
		*	*		ALL

- Set the corresponding mode code according to the "*Driver adaptation table*" (Appendix A),and it can be used to recover the default settings of the correlated parameters. It has been already set at the factory and suggested not to be modified by users.

Pn2	Software version (read-only)	Parameter range	Default	Unit	Application way
		*	*		ALL

- The version code for the driver software, it is one read-only parameter which can't be modified.

Pn3	Power-on initial display settings	Parameter range	Default	Unit	Application way
		0～20	0		ALL

- Parameter function：select the initial display contents when power-on:

Pn3	Display content	Pn3	Display content
0	Motor revolving speed	11	Position command pulse
1	Present position low 5 bit	12	Speed command
2	Present position high 5 bit	13	Torque command
3	Position command low 5 bit	14	Rotor absolute position
4	Position command high 5 bit	15	Input terminal state low 4 bit
5	Position deviation low 5 bit	16	Output terminal state
6	Position deviation high 5 bit	17	Encoder signal
7	Motor torque	18	Motor edition code
8	Motor current	19	Warning code
9	Input terminal state high 3 bit	20	Reserved
10	Control mode	21	Reserved

Pn4	Control mode	Parameter range	Default	Unit	Application way
		0～7	0		ALL

- Set the control mode of the driver by this parameter:

  0：position control mode；

  1：speed control mode；

  2：speed trial control mode；

  3：JOG control mode；

  5: analog input speed mode；

Pn5	Speed proportional gain	Parameter range	Default	Unit	Application way
		5～1000	400	HZ	P，S

- The higher the speed proportional gain is，the greater the stiffness is, the faster the speed response is. If it's over high, noise and vibration will easily generated.
- Under the condition of not shocking the system, set the value relatively high as possible.

Pn6	Speed integral time constant	Parameter range	Default	Unit	Application way
		1～1000	30	ms	P，S

- It is the integral time constant for the speed regulator. The lower the value sets，the faster the integral speed is, the greater the stiffness is. If it's too large, noise and vibration will easily generated.
- Under the condition of not shocking the system, reduce the value as possible.

Pn7	Current low pass filter	Parameter range	Default	Unit	Application way
		1～100	100	%	ALL

- Set the features of torque command filter, which can restrain resonance produced by torque fluctuations. (motor generates shake and sharp noise)
- If the motor generates shake and sharp noise, reduce the parameter value.
- The smaller the value is, the lower the cut-off frequency is, and the lower the noise is. If the load inertia is big, reduce the parameter value properly. If the value is too small, the response will slow down and cause instability. To the contrary, large value will make higher cut-off frequency and faster response. If you need relatively higher machinery stiffness, increase the setting value properly.

Pn8	Speed feedback filter coefficient	Parameter range	Default	Unit	Application way
		1～100	99	%	ALL

- Set the features of speed detection low pass filter.
- The smaller the value is, the lower the cut-off frequency is, and the lower the noise is. If the load inertia is big, reduce the parameter value properly. If the value is too small, the response will slow down and cause instability. To the contrary, large value will make higher cut-off frequency and faster speed feed response. If you need relatively higher speed response, increase the setting value properly.

Pn9	Position loop proportional gain	Parameter range	Default	Unit	Application way
		1～2000	25	HZ	P

- The proportional gain of position loop adjuster. The larger the value is, the higher the gain proportion is, the larger the stiffness is, the smaller the position tracking error is. Too large may produce vibration and overstrike.

Pn10	Position loop feed forward gain	Parameter range	Default	Unit	Application way
		0～100	0	%	P

- Feed forward gain of position loop. Larger parameter values will produce smaller system position tracking error and faster response. When the value is set at 100%, it means position hysteresis is always zero at any command pulse frequency.
- If the feed forward gain of position loop is too large, the system position loop will be unstable and produce shakes. Generally speaking, the position loop feed forward gain is zero.

Pn11	Position feed forward filter coefficient	Parameter range	Default	Unit	Application way
		1～100	1	HZ	P

- The cut-off frequency of position loop feed forward low pass filter. It is used to increase the stability of compound position control.

Parameters number	Name	Parameter range	Default	Unit	Application way
Pn12	Electronic Gear Ratio numerator	1～32767	5		P
Pn13	Electronic Gear Ratio denominator	1～32767	3		P

- Take fractional frequency or frequency doubling on position command pulse, to match with various pulse sources conveniently and get the pulse resolution ratio which uses demand.
- Under the position control mode, set the values for Pn12 and Pn13, the recommended range is: 1/50≤G≤50.

Pn14	Position command input type	Parameter range	Default	Unit	Application way
		0～2	0		P

- Set input type of position command pulse:
  - 0：pulse +code
  - 1：CCW pulse/CW pulse
  - 2：two phase orthogonal pulse input

Pn15	Inverse the direction of position command	Parameter range	Default	Unit	Application way
		0～1	0		P

- Set the direction of position command：
  0：normal
  1：inverse the direction of position command pulse

Pn16	Range of positioning completion	Parameter range	Default	Unit	Application way
		0～30000	1000	pulse	P，S

- Positioning completion range setting under the position control mode. When the remaining pulse in the position deviation counter is less than or equal to the setting value of the parameter, the driver will confirm that positioning has completed, and positioning completion signal SV_F is ON, otherwise SV_F is OFF.

Pn17	Checking range for position deviation	Parameter range	Default	Unit	Application way
		0～30000	4000	×100 pulse	P

- Set the checking range for position deviation. When the count value in the position deviation counter surpasses this parameter value, the servo driver will release position deviation warning signal under the position control mode.
- It won't alarm when the parameter value is zero.

Pn18	Output signal polarity selection	Parameter range	Default	Unit	Application way
		0～15	0		ALL

- Inverse one output signal:
  D0 position or speed is reached 1
  D1 servo is ready 2
  D2 alarm output 4
  D3 mechanical brake output 8
- If need multiple use, add the signal values together and put the result in the driver.
  e.g: If two conditions that servo is ready and alarm signal is inversed are both need to be satisfied, then the value should be added up as 2+4=6, which means Pn18=6.

Pn19	Position command smooth filter	Parameter range	Default	Unit	Application way
		0～30000	0	0.1ms	P

- Conduct smooth filter to command pulse, with the exponential acceleration and

deceleration.

- The filter will not lose input pulse, but the command may be lagged.
- The filter is used：

  1.upper controller don't have acceleration or deceleration features.

  2.electronic gear ratio is relatively large（>10）

  3.command frequency is relatively low

  4.Jump of jitter when motor runs

- The filter is out of use when it is set to be zero.

Pn20	Drive forbid input invalid selection	Parameter range	Default	Unit	Application way
		0～1	1		P，S

- It is set as follows：

  0：CCW、CW input forbid is valid。

  1：CCW、CW input forbid is invalid。

Pn22	JOG run speed	Parameter range	Default	Unit	Application way
		-3000～3000	120	r/min	S

- JOG run speed.

Pn23	Maximum speed limit	Parameter range	Default	Unit	Application way
		0～6000	2000	r/min	P，S

- Set the maximum speed limit of the servo motor.
- It has no relation with rotating direction. If the value exceeds the rated speed, then actual maximum speed limit is the rated speed.

Parameters number	Name	Parameter range	Default	Unit	Application way
Pn24	Internal speed 1	-3000～3000	10	r/min	S
Pn25	Internal speed 2	-3000～3000	100	r/min	S
Pn26	Internal speed 3	-3000～3000	500	r/min	S
Pn27	Internal speed 4	-3000～3000	0	r/min	S

- Internal speed: under speed control mode，use SC1、SC2 to choose internal run speed

SC1	SC2	Speed command	Parameters number
OFF	OFF	Internal speed 1	Pn24
ON	OFF	Internal speed 2	Pn25
OFF	ON	Internal speed 3	Pn26
ON	ON	Internal speed 4	Pn27

Pn28	Speed reach signal threshold	Parameter range	Default	Unit	Application way
		0.5～3000	500	r/min	S

- Set reached speed, no relation with rotation direction. Comparator has hysteresis effect.
- When not in the position control mode, if motor speed exceeds this value, then SV_F is ON, otherwise SV_F is OFF. The parameter is invalid in the position control mode.

Pn29	Acceleration and deceleration time constant	Parameter range	Default	Unit	Application way
		0~100	0	ms	S

- The value shows demanding time for motor accelerating from 0~1000 r/min, or decelerating from 1000~0 r/min. The acceleration and deceleration characteristics are linearity.
- It is only used in speed control mode，and invalid in position control mode. It should be set at zero if the driver is used in combination with external position.

Parameters number	Name	Parameter range	Default	Unit	Application way
Pn31	Encoder pulse division output numerator	1~32767	1		ALL
Pn32	Encoder pulse division output denominator	1~32767	1		ALL

- Output frequency dividing ratio of position feed pulse. When P n31>Pn32, the ratio outputs as 1:1. It can easily match with various host-computers.

Parameters number	Name	Parameter range	Default	Unit	Application way
Pn34	Internal CCW torque limit	0～300	220	%	ALL
Pn35	Internal CW torque limit	-300～0	-220	%	ALL

- Set internal torque limit at the servo motors' CCW, CW direction. The value sets the percentage of rated torque, which is effective at any time.
- If the value exceeds the maximal overload capacity the system permits, the actual torque limit will be the maximal overload capacity.

Parameters number	Name	Parameter range	Default	Unit	Application way
Pn36	External CCW torque limit	0～300	220	%	ALL
Pn37	External CW torque limit	-300～0	-220	%	ALL

- Set external torque limit at the servo motors' CCW, CW direction. The value sets the percentage of rated torque, which is effective at any time.
- If the value exceeds the maximal overload capacity the system permits, the actual torque limit will be the maximal overload capacity.

Pn38	Torque limit for speed trial run and JOG run	Parameter range	Default	Unit	Application way
		0～300	100	%	S

- Set the torque limit under the speed trial run and JOG run. It is independent of rotating direction and effective in two directions.
- The value is the percentage of rated torque. For example, the value should be set at 100 if it is equal to rated torque. Internal and external torque limit are still effective.

Pn41	Fault clearing times limit	Parameter range	Default	Unit	Application way
		1～20	5		ALL

- Set permitted times for warning clearing. The warning can be cleared away through RSTSV signal; however, if the clearing times exceed this parameter value, the warning can't be eliminated.

Parameters number	Name	Parameter range	Default	Unit	Application way
Pn42	The second electronic gear ratio numerator	1～32767	5		P
Pn43	The second Electronic gear ratio denominator	1～32767	3		P

- Parameters meanings are referenced as the definition of Pn12 and Pn13.

Pn44	Analog input zero offset compensation value	Parameter range	Default	Unit	Application way
		-5.00～5.00	0	V	S

- When the speed command input is zero, the speed command analog offset can be eliminated by adjusting this parameter.
- Parameter "AU-Set" can be used as automatic calibration.

Pn45	Analog input zero speed clamping threshold	Parameter range	Default	Unit	Application way
		-5.00～5.00	0.010	V	S

- Set the threshold of analog input. If the analog input is smaller than the parameter value, the motor will be locked.

Pn46	Over-speed checking range	Parameter range	Default	Unit	Application way
		0～100	0	%	ALL

- Set the checking range for over-speed warning. When the count value in the speed deviation counter surpasses this parameter value, the servo driver will release

over-speed warning signal under the speed control mode.

- It won't alarm when the parameter value is zero.

Pn48	Over-speed permitting time	Parameter range	Default	Unit	Application way
		0～30000	5000	ms	ALL

- Set permitting time for over-speed. When the enduring time for motor speed deviation surpassing Pn46 is longer than this value, the driver will alarm.
- when 'Pn46' is zero，this parameter is ineffective.

Pn49	Permitted time for speed above the maximum limit	Parameter range	Default	Unit	Application way
		0～10000	5000	ms	S

- set permitted time for speed above the maximum limit. When the enduring time for motor actual speed surpassing Pn23 is longer than the permitting time, the driver will alarm.

Pn51	Analog input gain	Parameter range	Default	Unit	Application way
		0～1000	100	%	S

- Set the ratio between speed command voltage and motor actual revolving speed.

Pn52	Torque acceleration and deceleration time	Parameter range	Default	Unit	Application way
		0～16000	1000		T

- Torque acceleration and deceleration time

Pn53	Speed acceleration and deceleration time	Parameter range	Default	Unit	Application way
		0～16000	1000		S

- Speed acceleration and deceleration time

Pn55	Encoder zero-position pulse broadening	Parameter range	Default	Unit	Application way
		0～31	1	×3us	ALL

- Set the width of zero pulse. The width decreases when the motor revolving speed rises. It can be adjusted according to actual running conditions, so as to match with various upper-computers.

Pn57	Compel to enable	Parameter range	Default	Unit	Application way
		0~4	3		ALL

- Parameter meanings:

  Pn57=3: only if SV_EN is ON, the motor can be compelled to enable.

  Pn57=2: software compels to enable.

Chapter 8 Alarm and Troubleshooting

8.1 Alarm List

Table 8.1 Alarm list

Alarm Code	Alarm Name	Content
	Normal	Normal
	IPM fault	IPM module protection
	Overcurrent	Output current of driver is higher than its specified instantaneous current.
	Undervoltage	Main input voltage is below the specified value.
	Overvoltage	Main input voltage exceeds the specified value.
	No current in Analog Channel A	Current-measure Channel A fault
	No current in Analog Channel B	Current-measure Channel B fault
	Overspeed	Motor speed exceeds the specified value.
	Position excessive deviation	Position error range exceeds the specified position excessive deviation alarm level.
	Software overcurrent	Motor current exceeds software's restriction of driver.
	FPGA chip fault	FPGA chip can't work normally.
	Encoder fault	Encoder fault
	Encoder signal transmission fault	Encoder signal transmission fault
	Z pulse lose	Z pulse lose
	Driver overload protection	Driver overload protection

8.2 Alarm Causes and Solving

Err 1 : IPM fault

Alarm State Description	Alarm Causes	Alarm Solving
Alarm after driver enable	Driver output is short circuited. IPM fault.	Eliminate short circuit and avoid metal conductor being exposed. If module is damaged, please change the driver.
Alarm during running	Parameter setting is abnormal.	Correctly reset parameter settings
	Driver temperature is too high.	Please change motor and driver for bulky ones.
	Be disturbed.	Bad grounding.
Alarm during starting up or stopping	The load inertia is too large or the acceleration/deceleration time is too short.	Decrease load inertia. Increase acceleration/deceleration time of upper controller.

Err 2 : Overcurrent

Alarm State Description	Alarm Causes	Alarm Solving
Alarm after enable	Driver output is short circuited.	Eliminate short circuit.
Alarm during running	Motor oscillation.	Correctly reset parameter settings
	Load current is too large.	Change for high-capacity driver.
	Motor isolation is broken.	Change motor.
Alarm during starting or stopping	The load inertia is too large or the acceleration/deceleration time is too short.	Decrease load inertia. Increase acceleration/deceleration time of upper controller.

Err 3 : Undervoltage

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during running	Electric network voltage is low.	Measure the electric network voltage.
Alarm during power on	Braking transistor fault.	Return to manufacturers for repairing.
	Circuit board is damaged.	Return to manufacturers for repairing.

	There is no input voltage source for main circuit.	Reconfirm the power supply source.

Err 4 : Overvoltage

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during power on	High voltage of power supply. Circuit board fault.	Check power supply. Change driver.
Alarm during running	Braking doesn't work: Wiring of braking resistor disconnects. Braking transistor fault. Internal braking resistor fault.	Reconnect external braking resistor. Change servo driver.
	Capacity of braking resistor is not enough.	Add additional braking resistor.
	Circuit board fault.	Return to manufacturers for repairing.

Err 5 : No current in Analog Channel A

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during switching on the power	±12V power supply fault.	Return to manufacturers for repairing.
	Analog Channel A of circuit board fault.	Return to manufacturers for repairing.
Alarm during running	±12V power supply fault.	Return to manufacturers for repairing.
	Analog Channel A of circuit board fault.	Return to manufacturers for repairing.

Err 6 : No current in Analog Channel B

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during switching on the power	±12V power supply fault.	Return to manufacturers for repairing.
	Analog Channel B of circuit board fault.	Return to manufacturers for repairing.
Alarm during running	±12V power supply fault.	Return to manufacturers for repairing.
	Analog Channel B of circuit board fault.	Return to manufacturers for repairing.

Err 7 : Overspeed

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during switching on the power	Circuit board fault.	Change driver.
	Encoder fault.	Change motor.
Alarm during running	Input command pulse frequency is too high.	Set input pulse correctly.
	Acceleration/deceleration time constant is too small, causing too large speed overshoot.	Increase acceleration/deceleration time constant of upper controller
	Input electronic gear ratio is too large.	Set electronic gear ratio correctly.
	Encoder fault.	Change servo motor.
	Bad encoder cable.	Change encoder line.
	Servo motor is unstable, causing overshoot.	Reset concerned gain. If gain could not be set to suitable value, please reduce load moment of inertia rate.
Alarm during starting up	Load inertia is too big.	Decrease load inertia. Change for higher-power driver and motor.
	Encoder zero point error.	Change servo motor. Let manufacturer readjust encoder zero point.
	Wrong connection of motor U,V,W leads	Correct wiring.
	Wrong connection of encoder cable lead.	Correct wiring.

Err 8 : Position excessive deviation

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during switching on the power	Circuit board fault.	Change driver.
After putting through main power supply and control line, then inputting command pulse, the motor does not rotate.	Wrong connection of motor U,V,W leads	Correct wiring.
	Wrong connection of encoder cable lead.	Change encoder line.

	Motor locked-rotor.	Check mechanism.
Alarm during running	Position overshoot detection range is set too small.	Increase position overshoot detection range.
	Gain value is set too small.	Increase gain value.
	Torque limit is too small.	Increase torque setting value.
	External load is too large.	Change for high-capacity motor and driver.

Err 9 : Software overcurrent

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during running	Oscillation of motor.	Adjust driver gain parameter.
	The driver and motor don't match each other.	Please confirm they match each other.
	Wrong connection of driver's U,V,W.	Check wiring.

Err 10 : FPGA chip fault

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during power on	Chip data-processing transmission fault.	Power-on afresh.
	Chip or circuit board fault.	Change driver.

Err 11 : Encoder fault

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during switching on the power	Bad connection of encoder's wiring.	Reconnect encoder line well.
	Encoder line fault.	Change encoder line.
	Motor encoder fault.	Change motor.
	Circuit fault of driver encoder.	Change driver.
Alarm during	The encoder's plug gets loose because of	Reconnect encoder line

running	mechanical vibration, for it is not screwed well.	well.
	Encoder cable is too long, making the power supply voltage of encoder too low.	Shorten the cable. Adopt poly-core cable with parallel connection.
	Encoder line fault.	Change encoder line.
	Motor encoder fault.	Change motor.
	Circuit fault of driver encoder.	Change driver.

Err 12 : Encoder signal transmission fault

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during running	Bad connection of encoder's wiring.	Reconnect encoder line well.
	Encoder line suffers from interference.	Shorten encoder line as far as possible, and undertake shielding measures.
	Encoder fault.	Change motor.

Err 13 : Z pulse lose

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during running	Bad connection of encoder's wiring.	Reconnect encoder line well.
	Encoder fault.	Change motor.
	Circuit board fault.	Change driver.

Err 15 : Driver overload protection

Alarm State Description	Alarm Causes	Alarm Solving
Alarm during running	The power line of motor is not connected.	Wiring as it is requested.
	Major loop of driver is not power-on.	
	Motor locked-rotor.	Check whether the motor is seized.
	Output current of driver is too large.	Change driver.

Remarks: Please contact with our technicist if there is usual alarm information which is different from the above table.

Chapter 9 Detection and Maintenance

9.1 Detection Items

Detection items	Detection contents
Daily detection	Whether the ambient temperature and humidity is normal. Whether there is dust, granule or abnormal obstacle.
	Whether the motor has unusual noise or shake.
	Whether it emits heat or peculiar smell unusually
	The ambient temperature is too high or not.
	The panel is clean or not.
	Whether there is loose connection.
	Whether output current displaying value differs from the general value greatly.
	Whether the cooling fan at the bottom of servo driver operates well.
Periodical detection	Whether there is loose screw.
	Whether there is overheat indication.
	Whether there is burnable terminal.

9.2 Maintenance

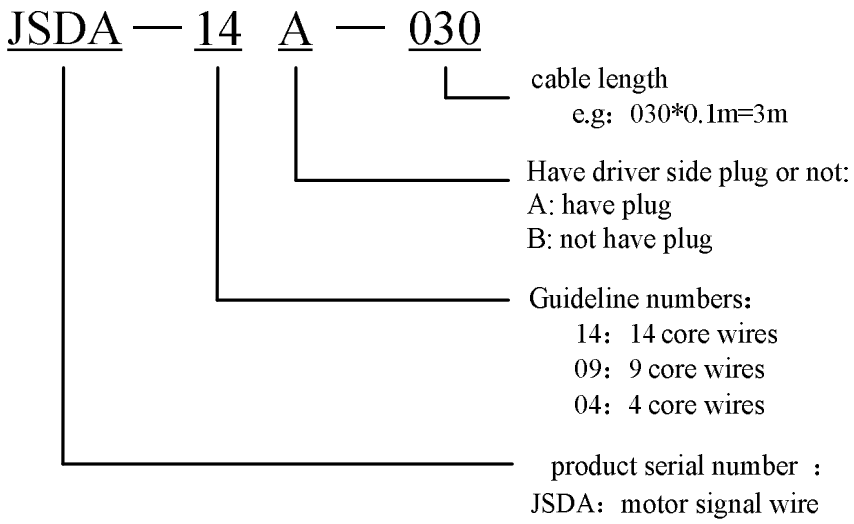
- Please keep and use the product in the proper environment.
- Clean the dust and dirt on the driver and motor shell in time to avoid dust attachment.
- Please don't disassemble the mechanical parts in the cleaning process.
- Clean the air-draft and air-exhaust channels of the driver in due time, to avoid driver breakdown resulted from long use in high temperature.

Appendix A

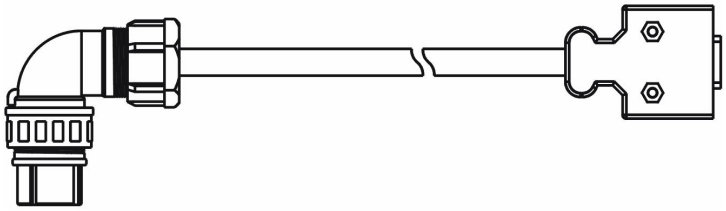
■ Motor Adaptive Table

Motor code (Pn1)	Motor type	Rated torque	Rated revolution	Rated current	Rated power	Adaptive driver
22	130EMA-060E	6Nm	1000rpm	4.1A	630W	ESDA
23	130EMA-075E	7.5Nm	1000rpm	4.5A	780W	ESDA
24	130EMA-100E	10Nm	1000rpm	5.4A	1050W	ESDA
30	60EMA-006A	0.64Nm	3000rpm	1.5A	200W	ESDA
31	60EMA-013A	1.27Nm	3000rpm	2.5A	400W	ESDA
34	80EMA-016A	1.6Nm	3000rpm	3.0A	500W	ESDA
35	80EMA-024A	2.4Nm	3000rpm	4.0A	750W	ESDA
36	80EMA-032A	3.2Nm	3000rpm	5.2A	1000W	ESDA
37	80EMA-038A	3.8Nm	3000rpm	5.0A	1200W	ESDB
40	130EMA-040B	4Nm	2500rpm	4.2A	1000W	ESDA/ESDB
41	130EMA-050B	5Nm	2500rpm	5.0A	1300W	ESDA/ESDB
42	130EMA-060B	6Nm	2500rpm	6.2A	1570W	ESDB
43	130EMA-075C	7.5Nm	2000rpm	6.5A	1570W	ESDB
44	130EMA-100C	10Nm	2000rpm	9.0A	2100W	ESDB
45	130EMA-100D	10Nm	1500rpm	6.5A	1570W	ESDB
46	130EMA-150D	15Nm	1500rpm	9.0A	2350W	ESDB
47	130EMA-075B	7.5Nm	2500rpm	7.8A	1960W	ESDB
48	130EMA-100B	10Nm	2500rpm	10.5A	2600W	ESDB
49	130EMA-150C	15Nm	2000rpm	11.5A	3100W	ESDB
50	110EMA-040B	4Nm	2500rpm	4.0A	1000W	ESDA/ESDB
52	110EMA-060B	6Nm	2500rpm	6.0A	1570KW	ESDB

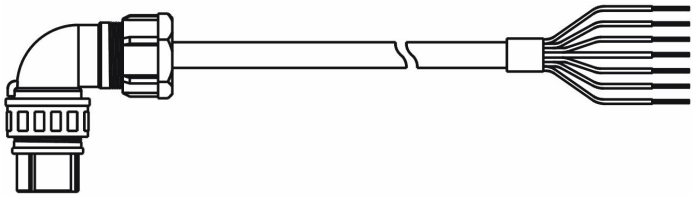
■ Motor signal wire（encoder wire）cable



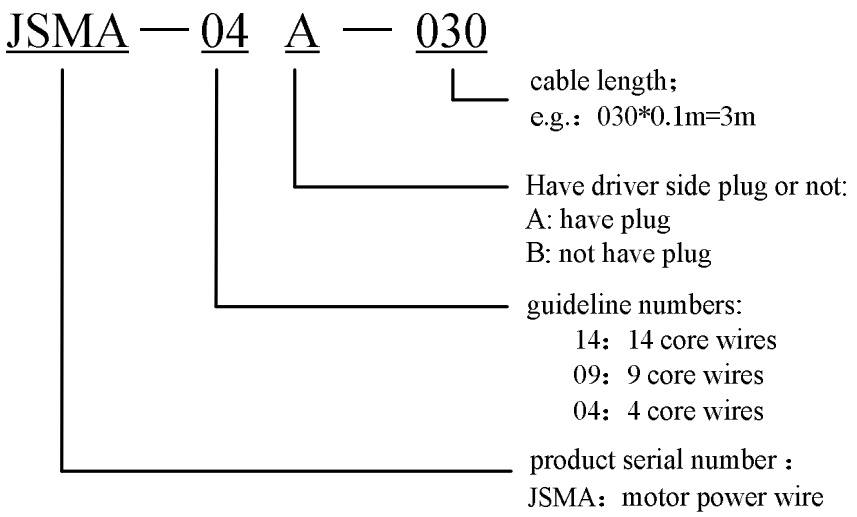
3-meter cable with driver side plug: JSDA-14A-030



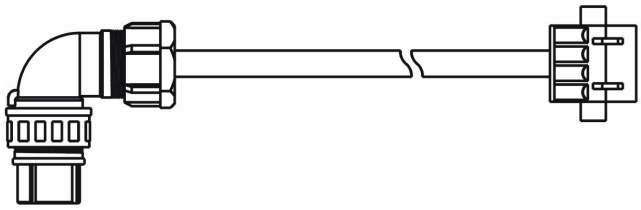
3-meter cable with no driver side plug: JSDA-14B-030



■ Motor Power Wire Cable



3-meter cable with driver side plug: JSMA-04A-030



3-meter cable with no driver side plug:JSMA-04B-030