EMA&EMB Series Servo Drive User's Manual

EMHEATER

User's Manual

EMA&EMB Series Servo Drive

China EM Technology Limited

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China EM Technology Limited

Safety Notes

The EMA and EMB 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 or equipment damaged.

 **Notice :** Neglect of this notice may cause undesired results or situations.

 **Forbidden:** Strictly forbidden actions, otherwise the device may be damaged or useless.

1. Product Inspection

 **Warning**
● AC servo drive must match with proper servo motor. ● Products being damaged or malfunctioned can't be used or it may cause fire or equipment damaged. ● If customer want to use 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 chemicals.

3. Wiring

 **Danger**
● Brake resistor must be connected in the designed way; otherwise it may damage to the driver. ● Don't connect servo drive 220V with the 380V power, or there are dangers of equipments damage, electric shock or fire. ● Confirm the one-to-one correspondence between the drive U,V,W output terminals and the motor binding post U,V,W , otherwise the motor may over speed and cause equipment damage or personal injury. ● The grounding terminal must be grounded correctly and fastened; bad grounded may cause electric shock or fire.

4. Notes for Operation

Notice

- Before power on, please make sure the servo driver and servo motor have been installed and fixed correctly, and the power voltage and wiring was 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 damaged 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 driver and motor, otherwise it may cause electric shock or injury.
- Don't turn on and off the power frequently. If necessary, please limit the turn frequency is below one time every minute.

5. Trouble Handling

Notice

- Except the specified professional staff, please don't connect, install, operate, dismantle and repair this product, for there are risks of electric shock and causing damage to the equipment or personal injury.
- Please don't reform this product by oneself because 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 repower on after unexpected power off, 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 in running, otherwise it may cause electric shock

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1. Products Introduction

1.1 Nameplate and model introduction

1. Nameplate introduction:

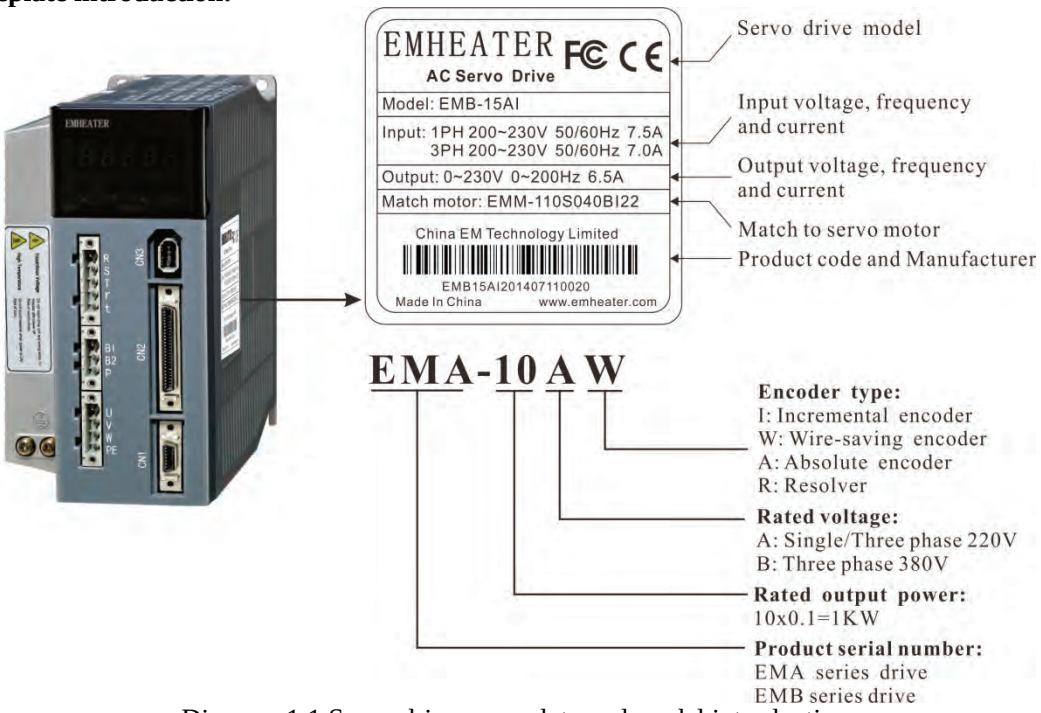
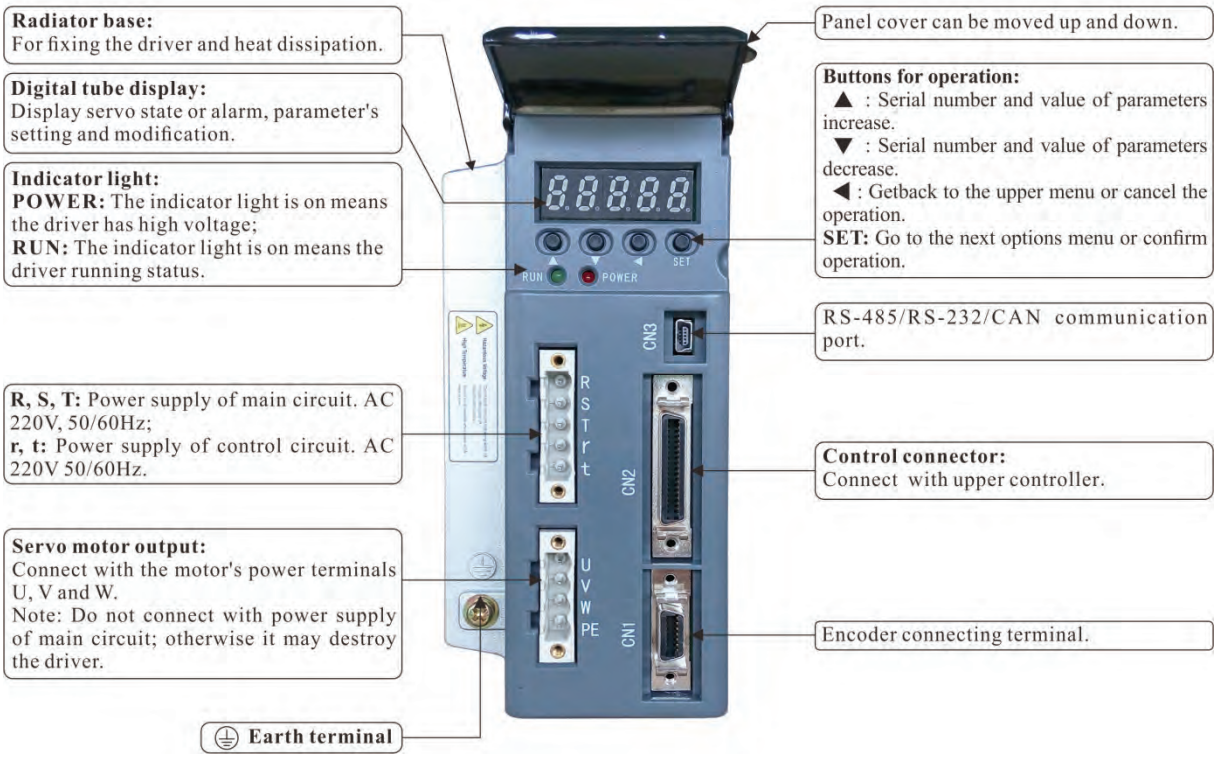


Diagram 1.1 Servo drive nameplate and model introduction

1.2 Names of the driver's parts

EMA servo drive:



EMB servo drive:

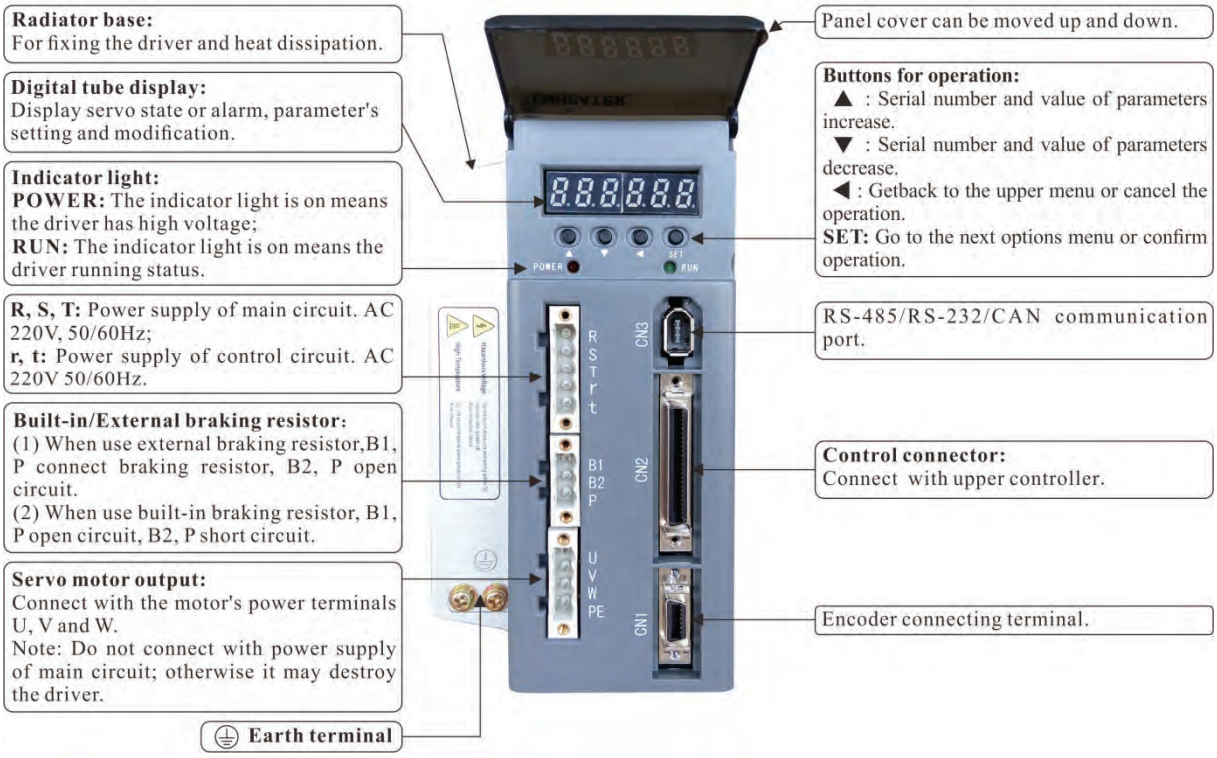


Diagram 1.2 Names of the driver's parts

1.3 Specifications of servo driver

Model		EMA servo drive	EMB servo drive
Control Power Supply		Single phase AC 220V (-15% ~ +10%),50/60Hz, Three phase AC 220V (-15% ~ +10%),50/60Hz	
Operating condition	Temperature	Operating temperature:0~40°C storage temperature:-40~50°C	
	Humidity	Less than 90%, no moisture condensation	
	Vibration	Less than 0.5G(4.9m/s^2) 10~60Hz,operate discontinuously	
Control Mode		(1) Position control mode; (2) Speed control mode; (3) Torque control mode; (4) Position/Speed control mode; (5) Speed/Torque control mode; (6) Torque/Position control mode; (7) Open loop running.	
Regenerative Braking		Built-in	Built-in or External
Feature	Frequency response	≥200Hz	≥400Hz
	Speed fluctuation ratio	< 0.03(load 0~100%)	
	Speed regulation ratio	1:5000	
	Input pulse frequency	differential input:≤500Kpps, open collector input:≤200Kpps	
Control input		5 programmable IO input	7 programmable IO input
		(1) Servo enable; (2) Alarm clearing; (3) CCW drive forbidden; (4) CW drive forbidden; (5) Deviation counter clearing; (6) Pulse command disable; (7) Zero speed position clamping; (8) CCW torque limit; (9) CW torque limit;	

Model		EMA servo drive	EMB servo drive
Control input		(10) Torque mode switch; (11) Internal position selection 1; (12) Internal position selection 2; (13) Internal position selection 3; (14) Internal speed selection 1; (15) Internal speed selection 2; (16) Internal speed selection 3; (17) Internal torque selection 1; (18) Internal torque selection 2; (19) Electronic gear ratio selection 1; (20) Electronic gear ratio selection 2; (21) Running direction selection 1; (22) Running direction selection 2; (23) Running direction reverse; (24) Emergency stop; (25) Launch the origin back; (26) Origin back reference point; (27) Internal position running startup signal	
Control output		3 programmable IO output	4 programmable IO output
		(1) Servo ready; (2) Servo alarm. (3) Position fixing finished; (4) Electromagnetic brake; (5) Speed reached signal; (6) Torque reached signal; (7) Homing completion; (8) Zero speed signal	
Position control	Pulse input mode	(1)Pulse + Direction; (2)CCW pulse/CW pulse; (3)Two phase A/B quadrature pulse	
	Electronic gear	Setting range:1~65535/1~65535	
	Feedback pulse	Adjustable according to encoder’s resolution	
Speed control		(1)Internal 8-segment speed setting; (2)External -10 ~ +10V analog signal input control.	
Torque control		(1)Internal 4-segment speed setting; (2)External -10 ~ +10V analog signal input control.	
Acceleration and deceleration function		Parameter sets 1~10000ms(0~1000r/min or 1000~0r/min)	
Torque limitation function		Torque limited range: -300%~+300%	
Monitoring function		Rotating speed, present position, command pulse accumulation, position deviation, motor torque, motor current, rotor position, command pulse frequency, control mode, input and output terminals signal, etc.	
Protection function		Overspeed; main power overvoltage; under-voltage, overcurrent; overload, braking abnormity; encoder abnormity, control power supply under-voltage, overheated, position deviation abnormity, etc.	
Operation display		5-digit LED display panel, 4 keys, 2 LED lights	6-digit LED display panel, 4 keys, 2 LED lights
Suitable load inertia		Less than 5 times of motor inertia	
Communication function		RS485/RS232/CAN	

2. Installation

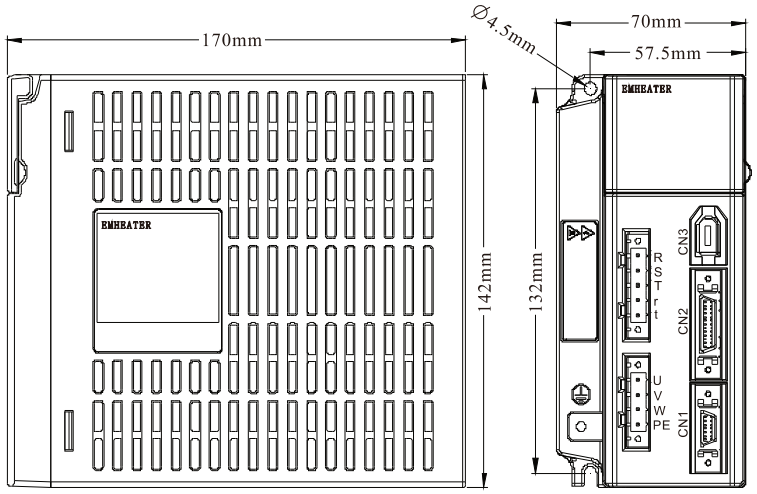
2.1 Installation site

Items	EMA and EMB Servo Driver
Temperature/humidity of operation	0~40°C(no freeze); 90%RH below(no dewing)
Temperature/humidity of storage & transportation	-40~50 °C, 0%RH below(no dewing)
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	IP20

2.2.2 Installation dimension

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

EMA servo drive:



EMB servo drive:

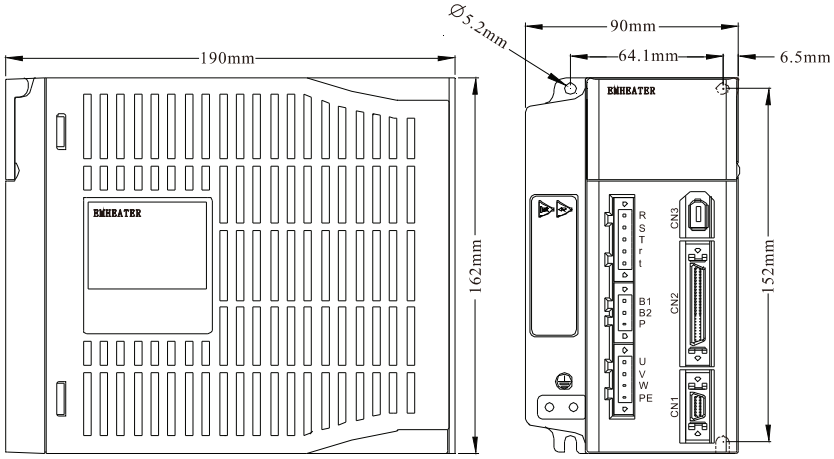


Diagram 2.1: Servo drive structure and installation dimension

2.3 Installation direction

As diagram 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.

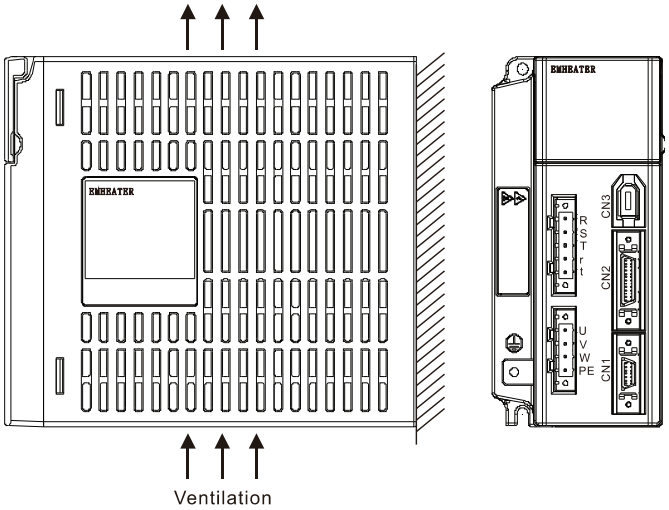


Diagram 2.2: Installation direction of the driver

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

2.4 Installation space

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

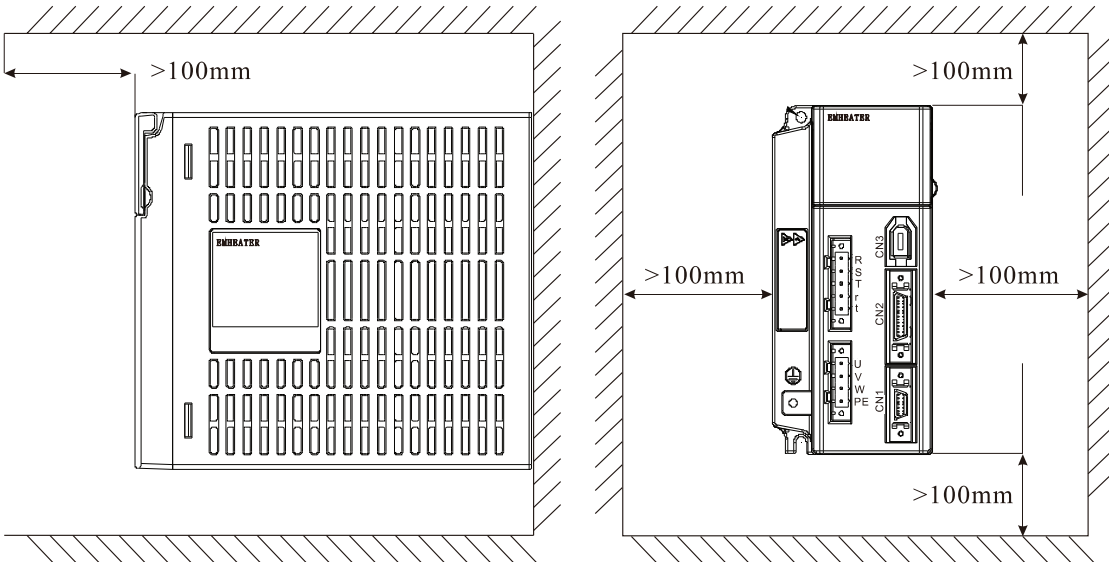


Diagram 2.3: Installation interval for single driver

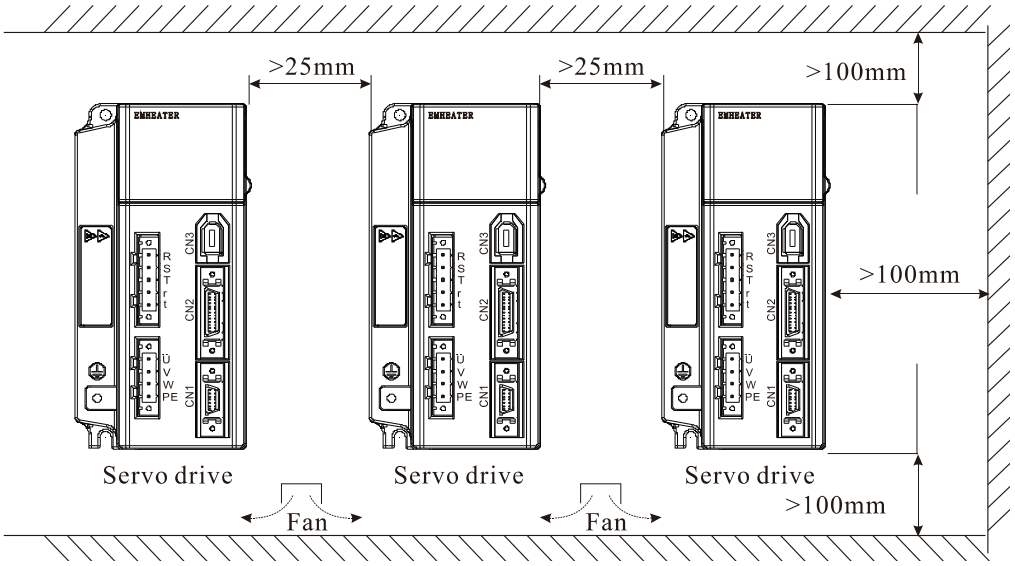


Diagram 2.4: Installation inverter for multi drivers

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

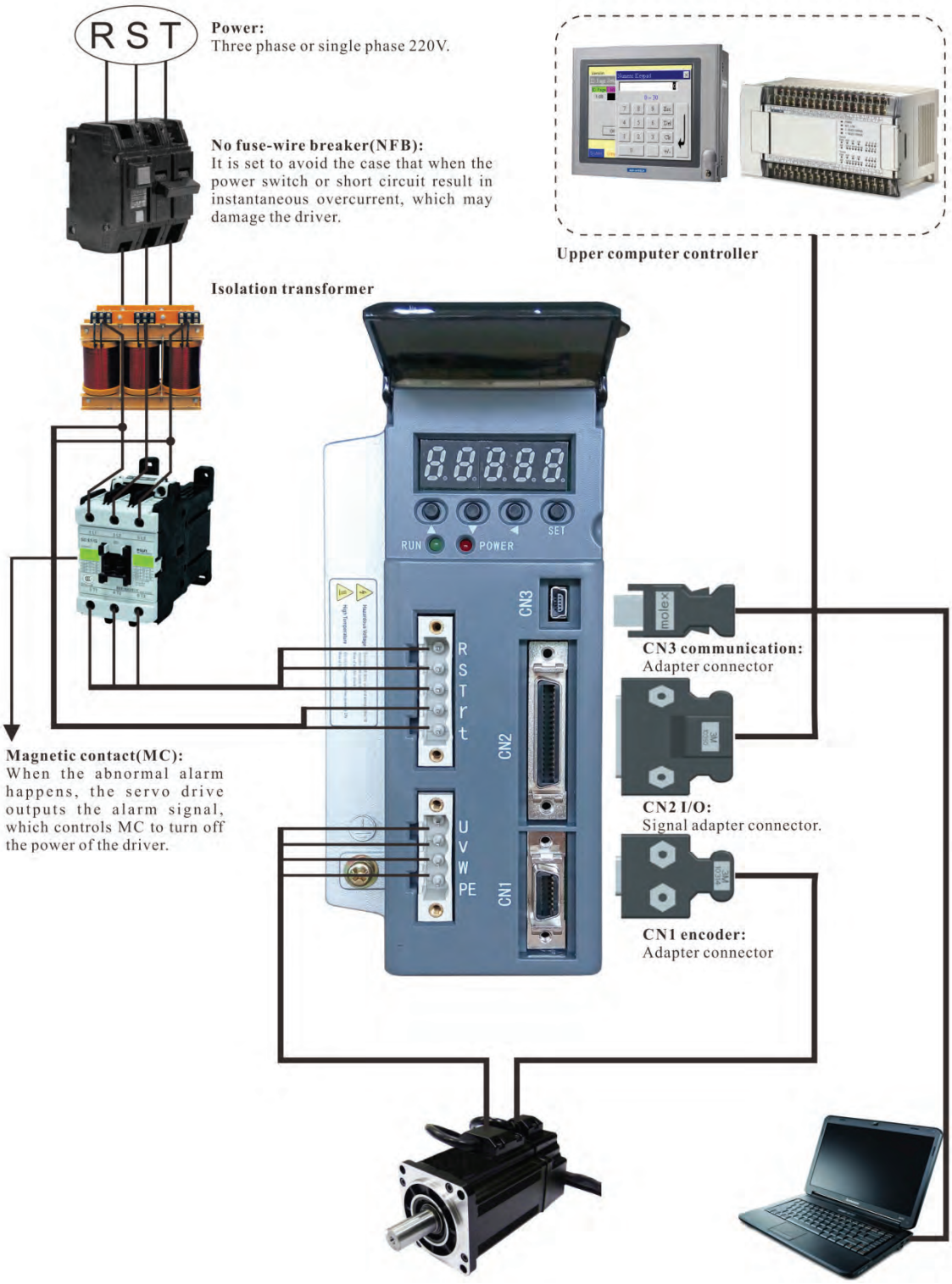
While installing multi drivers, as shown in diagram 2.4, please leave room larger than 25mm in each of the two crosswise sides, and more than 100mm in each of the two vertical sides. Please keep the temperature inside the electric closet in balance, for avoiding local temperature of the servo driver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

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.

EMA servo drive:



EMB servo drive:

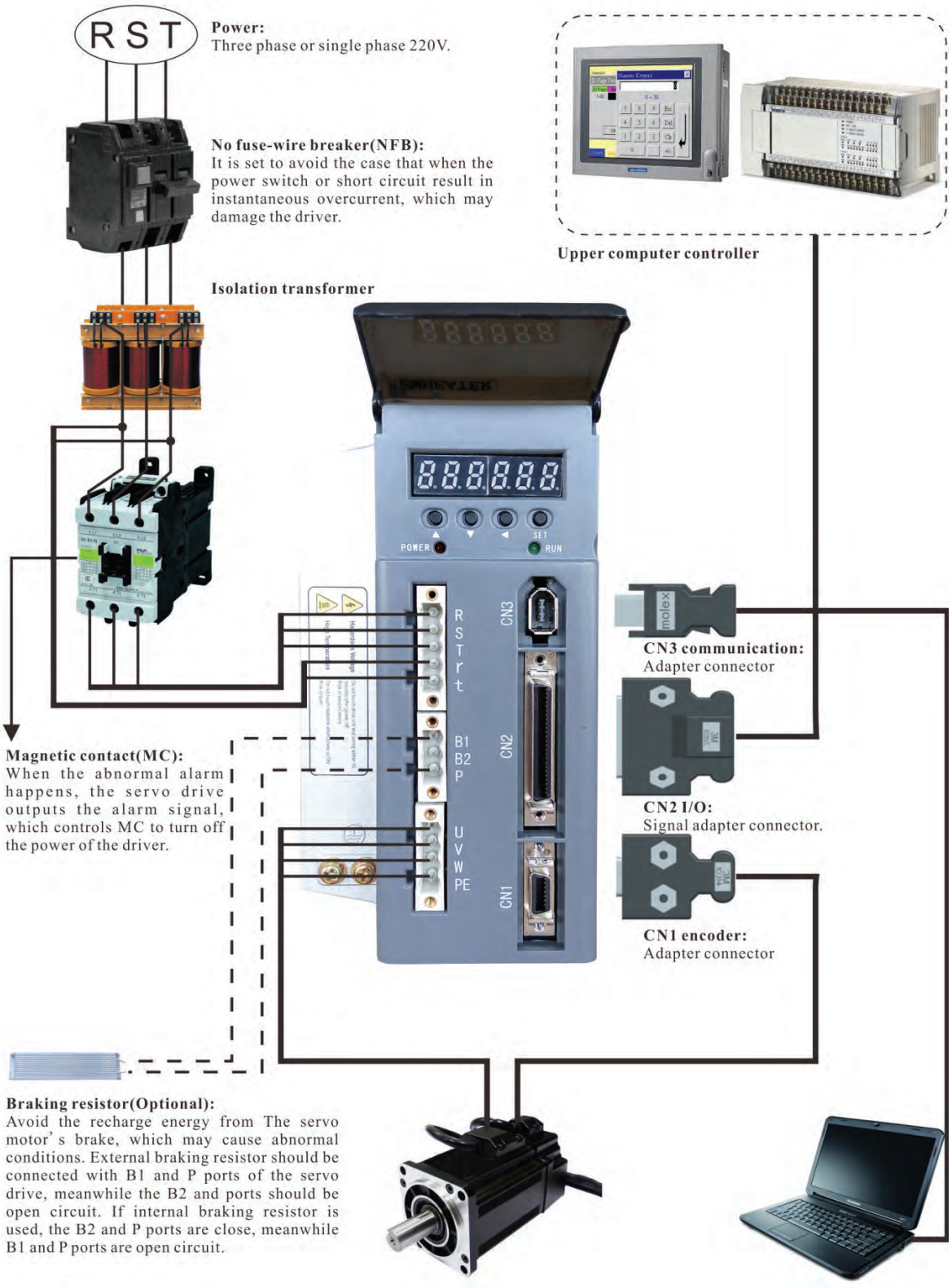


Diagram 3.1: Connection of peripheral equipment

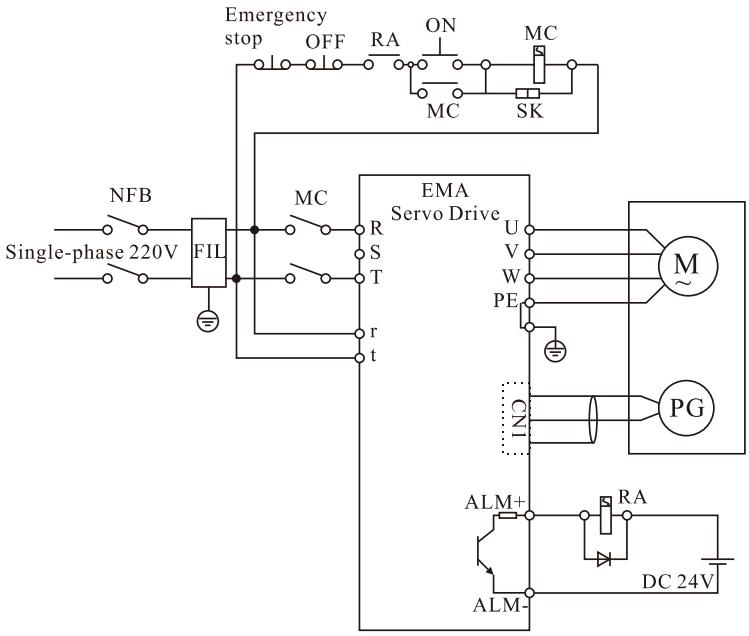
Warning	● Braking resistor should be connected in strict accordance with the manual requests. B1 and P can't be short circuit, otherwise the driver will be destroyed after power-on. ● Before power on, check whether R, S, T and r, t power lines are correct. ● Check whether U, V, W wiring is correct. three-phase 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.

3.2 Main circuit wiring examples

Servo driver power can use one or three phase AC 220V. Single-phase 220V connection is same as diagram 3.2. The three-phase connection is same as diagram 3.3. The control power r and t can be connected with any two phases of the three phases same as diagram.

EMA servo drive:



EMB servo drive:

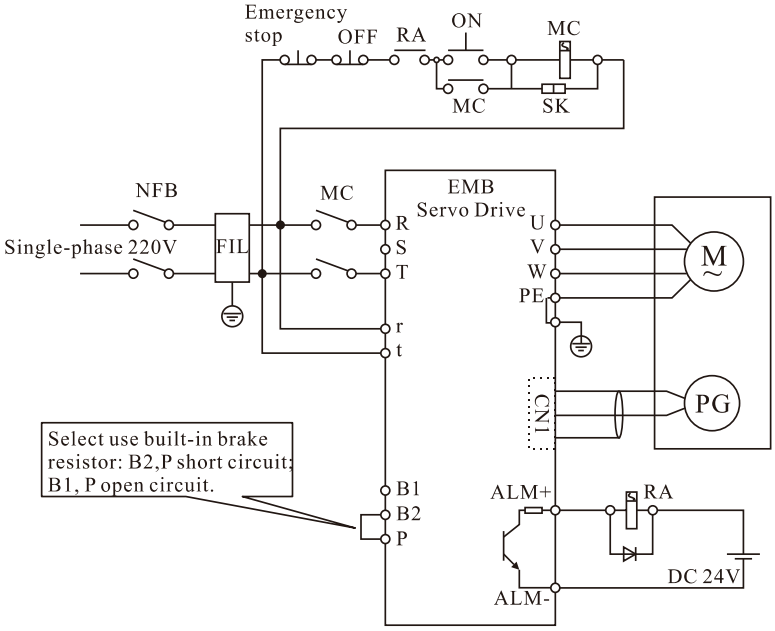
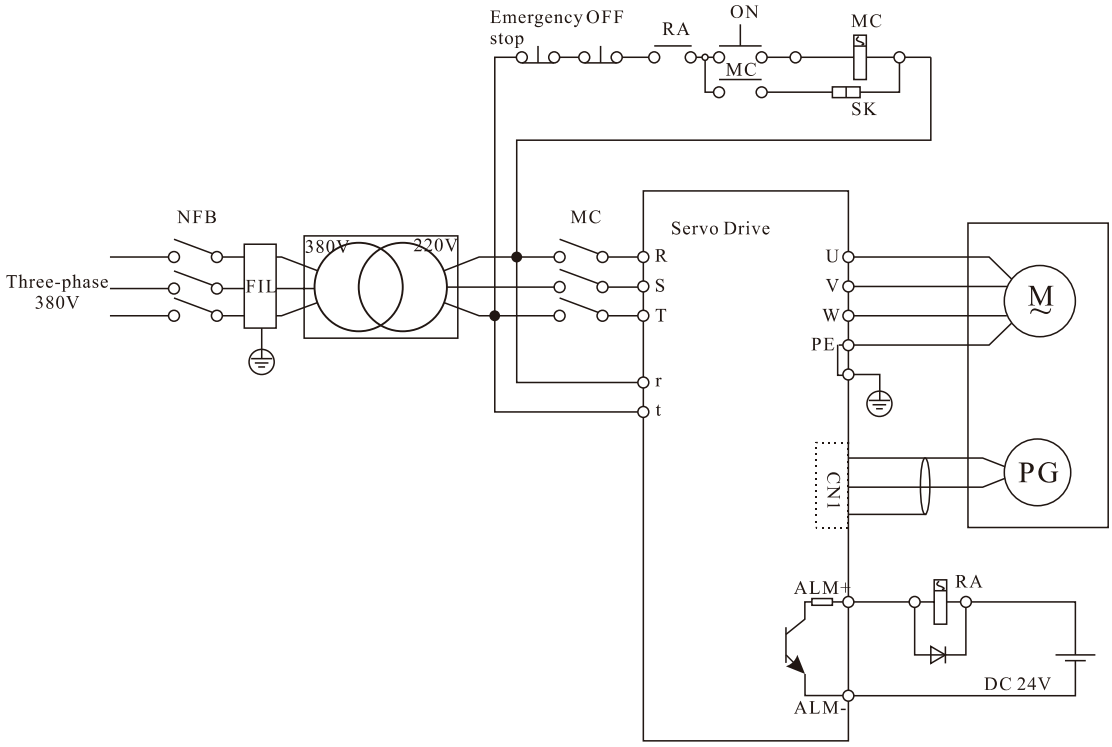


Diagram 3.2: Single-phase power wiring diagram

EMA servo drive:



EMB servo drive:

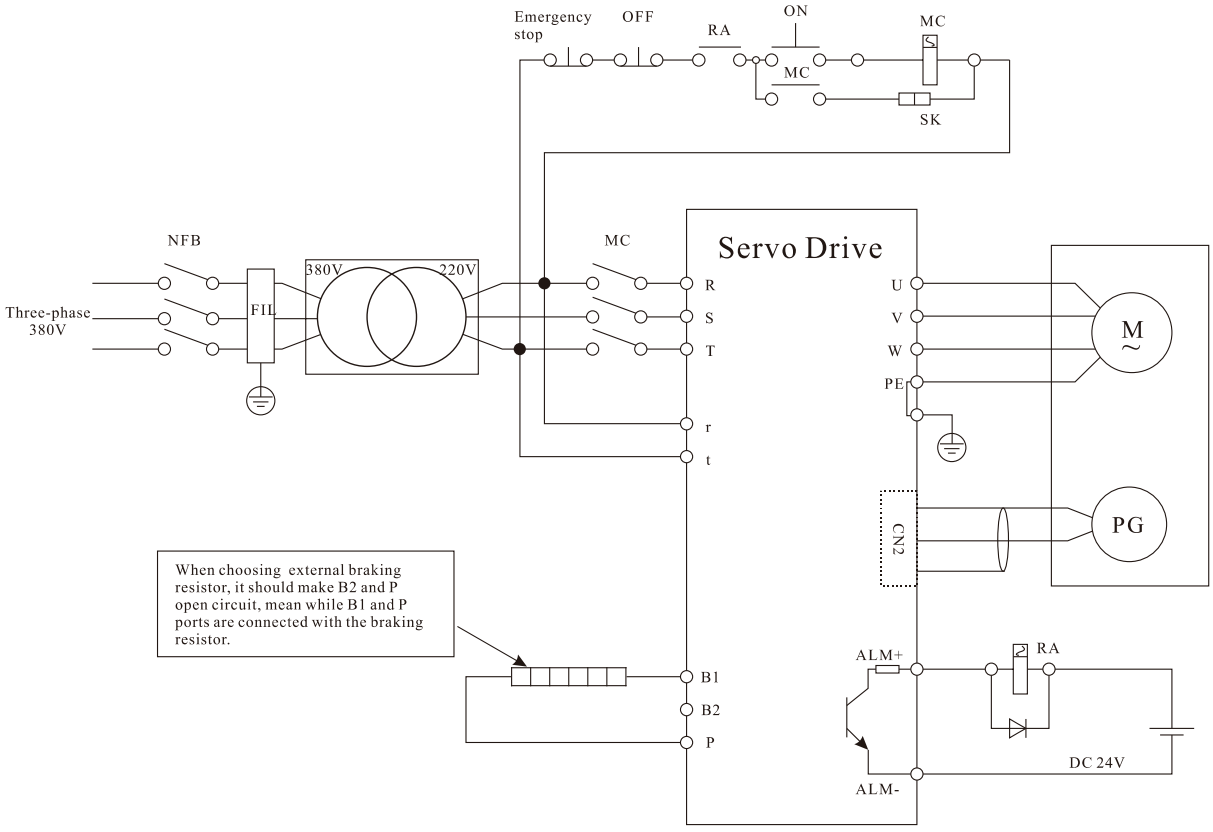
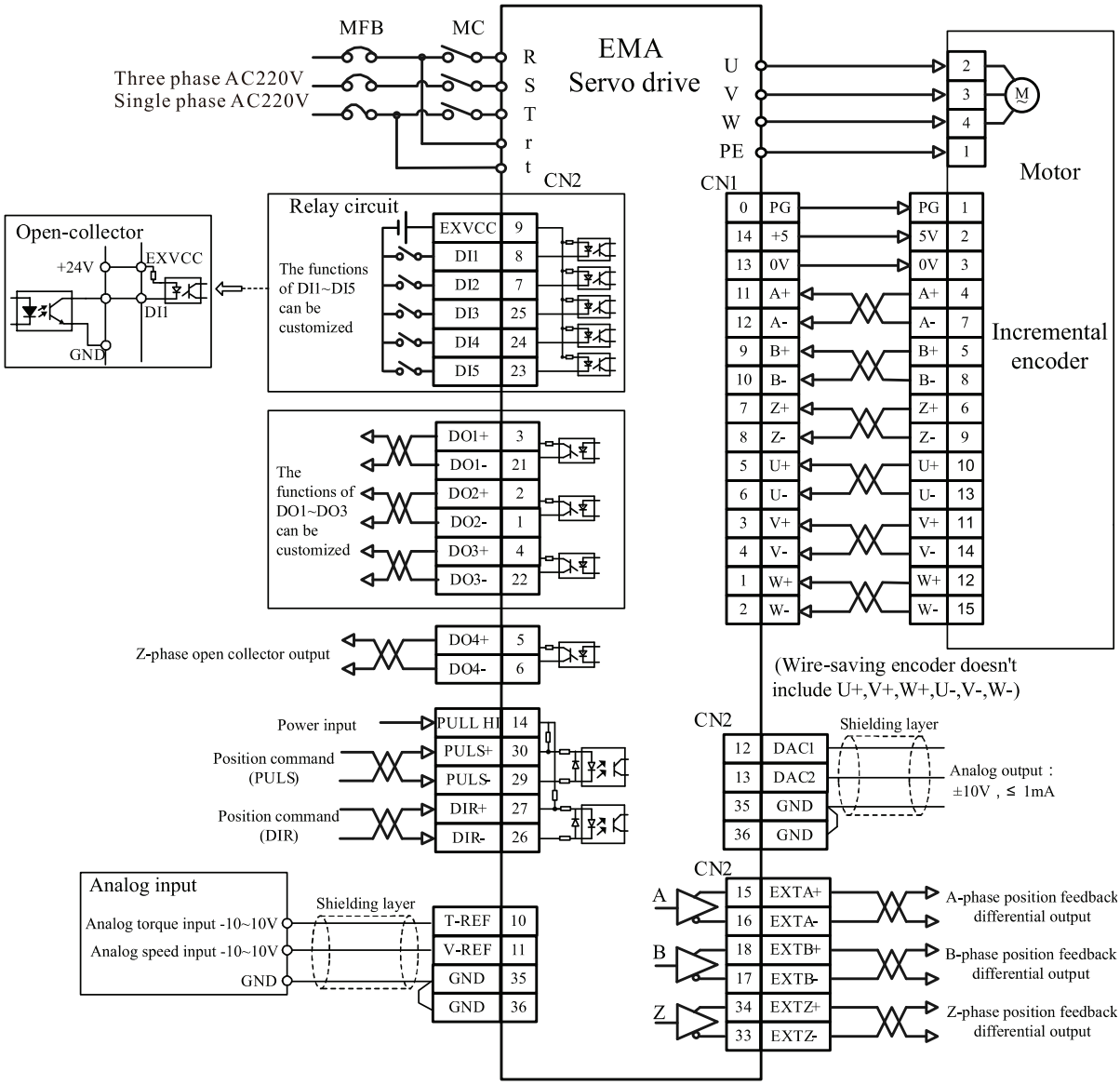


Diagram 3.3: Three-phase power wiring diagram

3.3 Standard wiring diagram

3.3.1 Standard wiring diagram of the servo drive

EMA servo drive:



EMB servo drive:

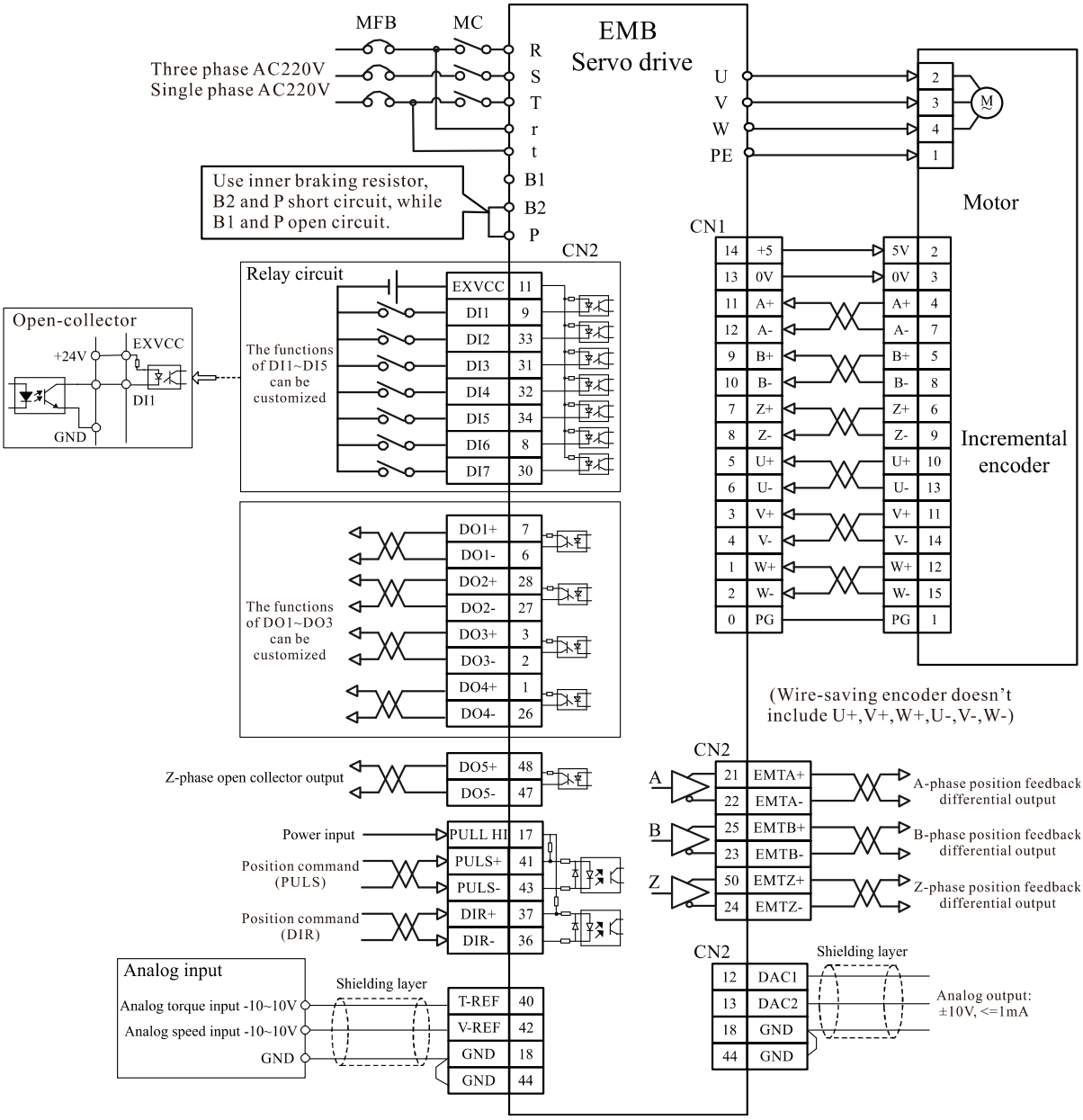
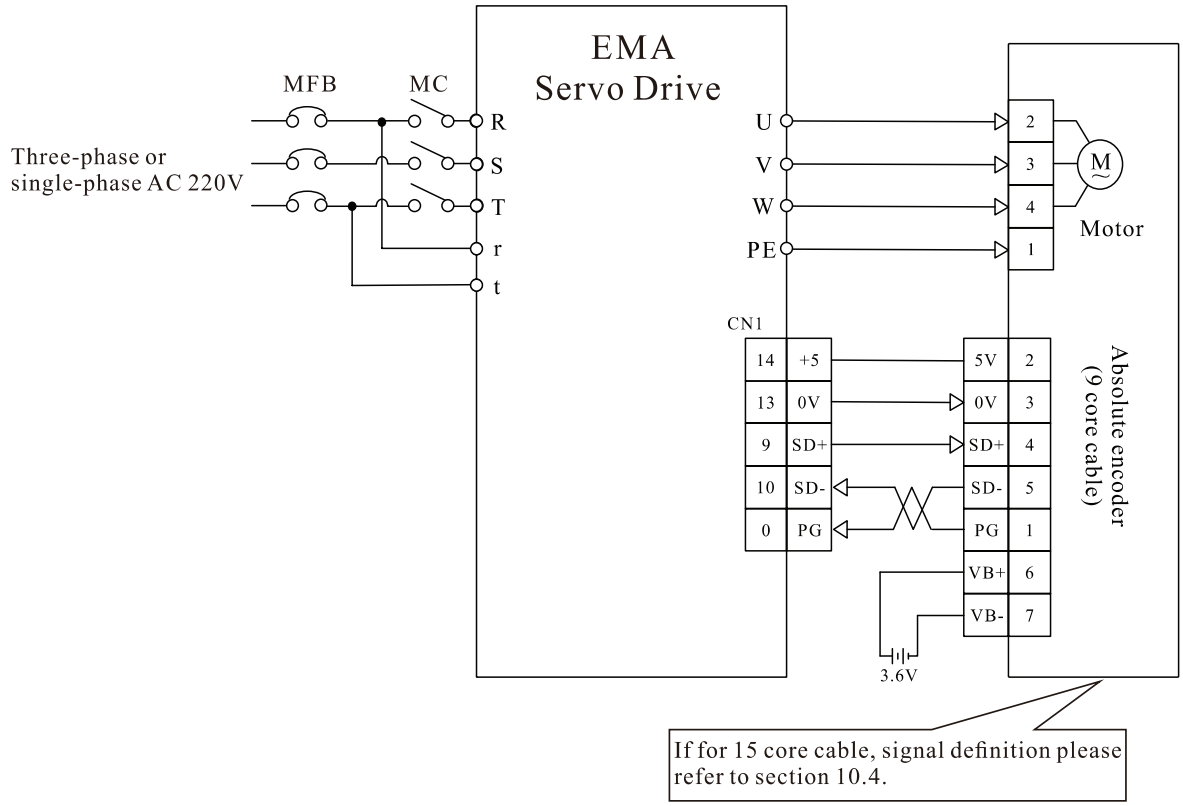


Diagram 3.4: Standard wiring in position control mode

3.3.4 Absolute encoder wiring diagram

EMA servo drive:



EMB servo drive:

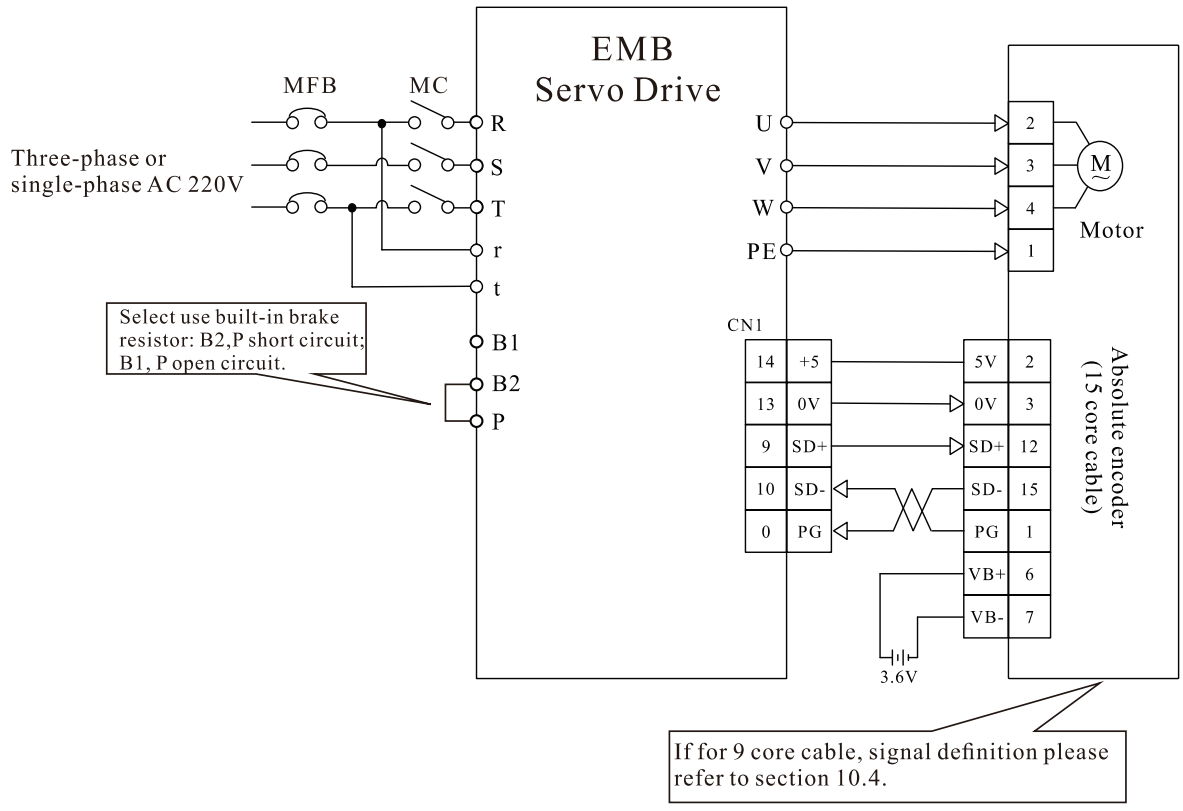
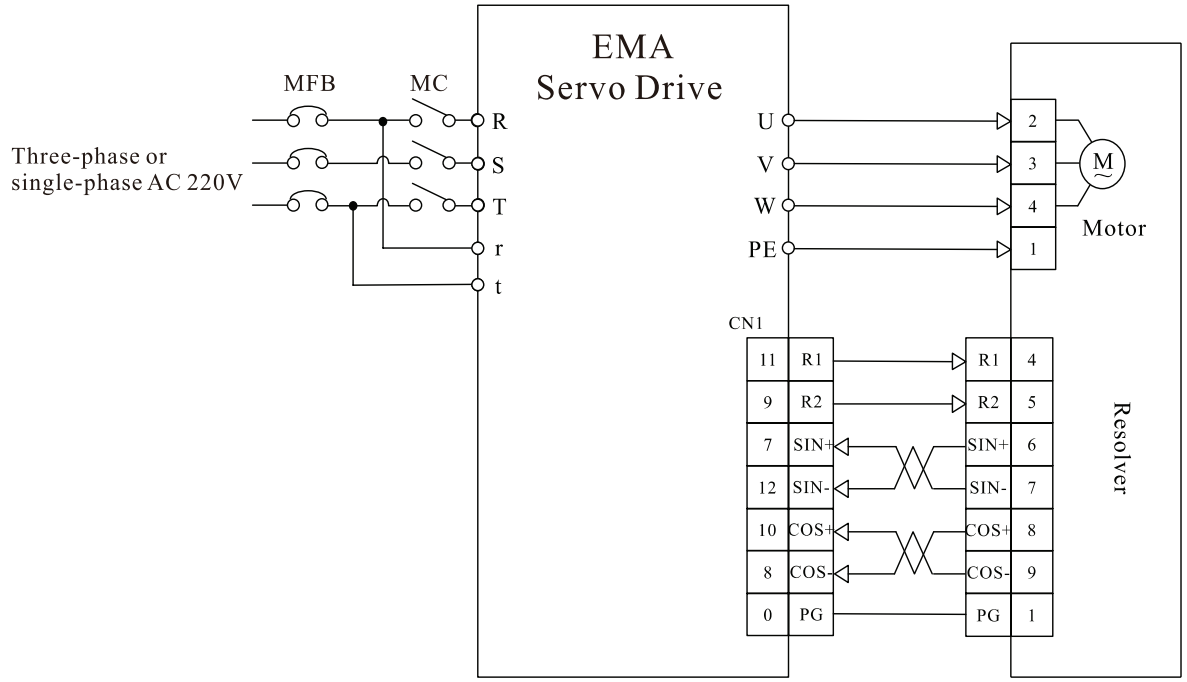


Diagram 3.5 Absolute encoder wiring diagram

3.3.4 Resolver wiring diagram

EMA servo drive:



EMB servo drive:

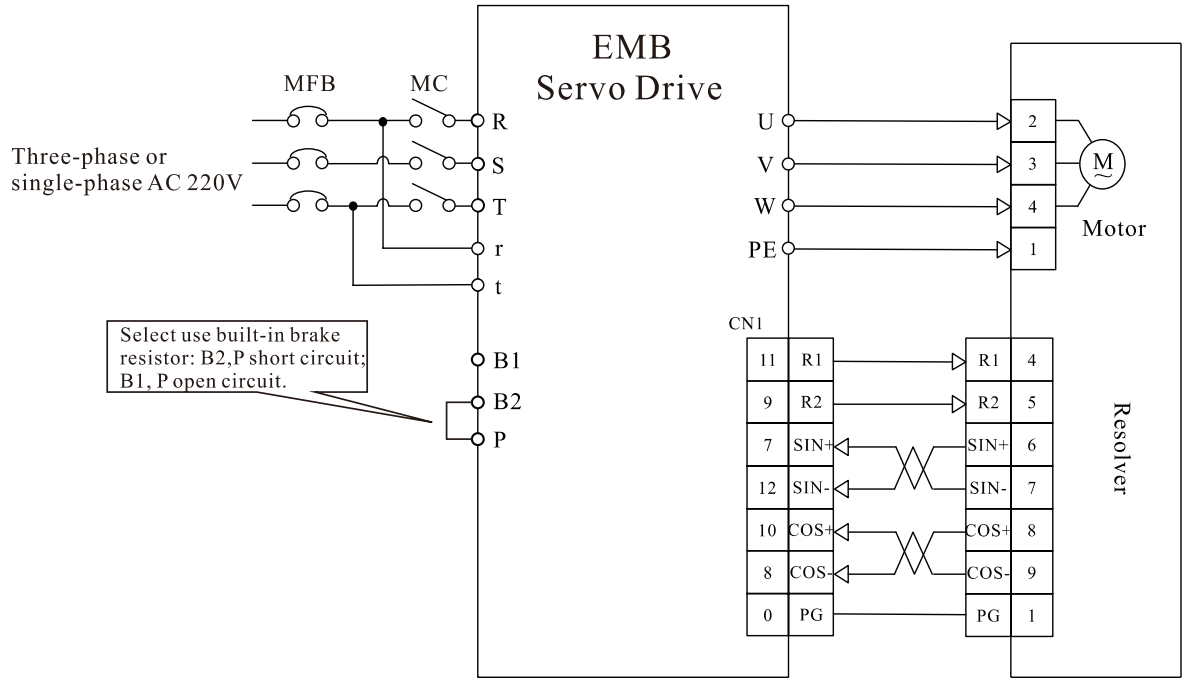


Diagram 3.6: Resolver wiring diagram

4. Port

4.1 Power supply terminal

Terminal sign		Signal name	Functions	Wire diameter	
EMA	EMB			<2.0KW	≥2.0KW
r, t		Control power supply terminal	Control Circuit power input terminal: AC220V, 50~60Hz	1.25mm^2	
R, S, T		Main circuit power	Main Circuit power input terminal: AC220V, 50~60Hz	1.25mm^2	2.0mm^2
U, V, W, PE		Servo drive output terminal	Servo motor output terminal must be connected in accordance with U, V and W terminal. Connect PE with PE of servo motor	1.25mm^2	2.0mm^2
--	B1, B2, P	Brake resistor terminal	Use built-in brake resistor, B2, P short circuit, B1, P open circuit	1.25 mm^2	
			Use external brake resistor, B2, P open circuit, B1, P connect external brake resistor		
⏚		Earth terminal	Be connected with earth ground	>2.0mm^2	
1	2				

4.2 Encoder feedback terminal CN1

Diagram 4.1 shows junctor terminal of servo driver CN1, which uses SCSI 14P connector, with the socket in needle type and the plug in cellular type.

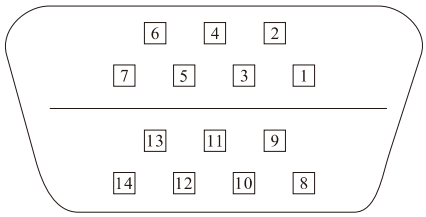


Diagram 4.1: Driver CN1 Plug (in the face of soldering lug of the plug)

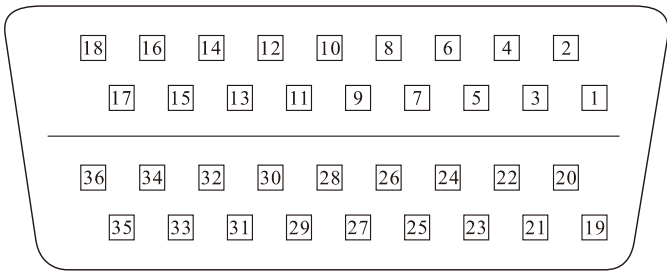
Table 4.1 Encoder feedback terminal CN1

Terminal NO.	Signal name and Code (Encoder)			
	Incremental	Wire- saving	Absolutely	Resolver
CN1- 1	Encoder W+ input: W+	---	---	---
CN1- 2	Encoder W- input: W-	---	---	---
CN1- 3	Encoder V+ input: V+	---	---	---
CN1- 4	Encoder V- input: V-	---	---	---
CN1- 5	Encoder U+ input: U+	---	---	---
CN1- 6	Encoder U- input: U-	---	---	---
CN1- 7	Encoder Z+ input: Z+		---	Analog Input SIN+: SIN+
CN1- 8	Encoder Z- input: Z-		---	Analog Input COS-:COS-
CN1- 9	Encoder B+ input: B+		Encoder SD+ Input: SD+	R2
CN1-10	Encoder B- input: B-		Encoder SD-Input: SD-	Analog Input COS+: COS+
CN1-11	Encoder A+ input: A+		---	R1
CN1-12	Encoder A- input: A-			Analog input SIN-: SIN-
CN1-13	Encoder power output negative: 0V			---
CN1-14	Encoder power output positive: +5V			---

4.3 Control terminal CN2

Diagram 4.2 shows CN2 connector terminal pin soldering lug of the servo driver (in the face of soldering lug of the pin). It uses SCSI 36connector for EMA servo drive and SCSI 50P connector for EMB servo drive with the socket in needle type and the plug in cellular type.

EMA servo drive:



EMB servo drive:

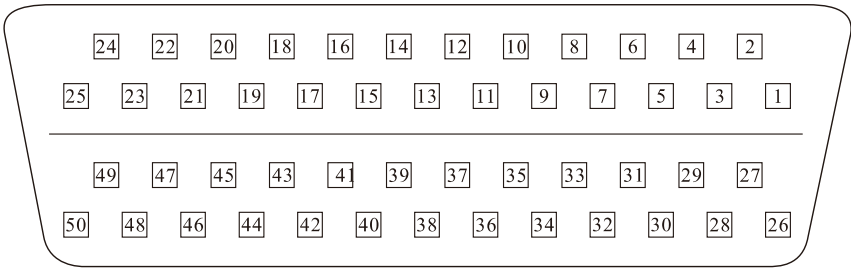


Diagram 4.2: EMA and EMB driver CN2 Plug(Control Terminal)

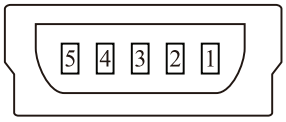
Table 4.2 CN2 connect terminal

Terminal No.		Signal name	Application way	Functions
EMA	EMB			
CN2-9	CN2-11	EXVCC	P,S,T	I/O input terminal power, +12V~+24V
CN2-8	CN2-9	DI1	P,S,T	Photoelectric isolation programmable digital input pins. Functions of DIn can be customized by parameters P[n]-301~P[n]-307.
CN2-7	CN2-33	DI2		
CN2-25	CN2-31	DI3		
CN2-24	CN2-32	DI4		
CN2-23	CN2-34	DI5		
--	CN2-8	DI6		
--	CN2-30	DI7		
CN2-30	CN2-41	PULS+	P	External command pulse input terminal (1) Pulse + symbol (2) CCW/CW pulse (3) Two-phase A/B quadrature pulse
CN2-29	CN2-43	PULS-		
CN2-27	CN2-37	DIR+		
CN2-26	CN2-36	DIR-		
CN2-14	CN2-17	PULL HI	P	External DC24V power for pulse input using open collector connection.
CN2-20	CN2-19	VPP	P,S,T	The +24V voltage is supplied by driver.
CN2-19	CN2-20	COM		The ground of VPP.
CN2-12	CN2-12	DAC1	S,T	Analog signal output, -10V~+10V.
CN2-13	CN2-13	DAC2		
CN2-10	CN2-40	T-REF	S,T	Analog torque command input -10V~+10V
CN2-11	CN2-42	V-REF		Analog speed command input -10V~+10V
CN2-35	CN2-18	GND	S,T	Analog ground.
CN2-36	CN2-44	GND		
CN2-3	CN2-7	DO1+	P,S,T	Photoelectric isolation programmable digital output pins. Functions of DOn can be customized by parameters P[n]-309~P[n]-312.
CN2-21	CN2-6	DO1-		
CN2-2	CN2-28	DO2+		
CN2-1	CN2-27	DO2-		

Terminal No.		Signal name	Application way	Functions
EMA	EMB			
CN2-4	CN2-3	DO3+	P,S,T	Photoelectric isolation programmable digital output pins. Functions of DOn can be customized by parameters P[n]-309~P[n]-312.
CN2-22	CN2-2	DO3-		
--	CN2-1	DO4+		
--	CN2-26	DO4-		
CN2-5	--	DO4+	P,S,T	Z-phase open collector output.
CN2-6	--	DO4-		
--	CN2-48	DO5+	P,S,T	Z-phase open collector output.
--	CN2-47	DO5-		
CN2-15	CN2-21	EXTA+	P,S,T	Position feed pulse A-phase differential output
CN2-16	CN2-22	EXTA-		
CN2-18	CN2-25	EXTB+	P,S,T	Position feed pulse B-phase differential output
CN2-17	CN2-23	EXTB-		
CN2-34	CN2-50	EXTZ+	P,S,T	Position feed pulse Z-phase differential output
CN2-33	CN2-24	EXTZ-		

4.4 Communication terminal CN3

EMA servo drive:



EMB servo drive:

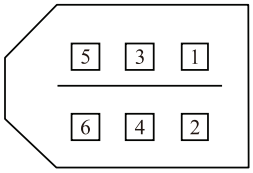
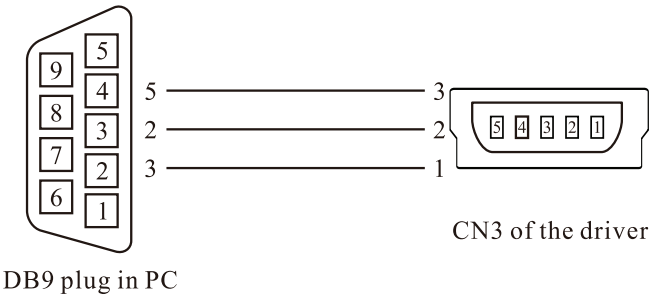


Diagram 4.3: CN3 Plug of Driver Communication Terminal (in the face of soldering lug of the plug)

EMA servo drive:



EMB servo drive:

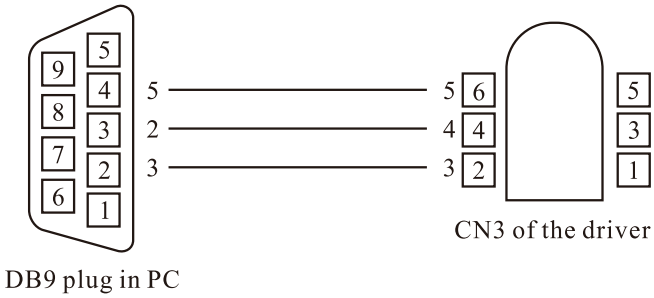
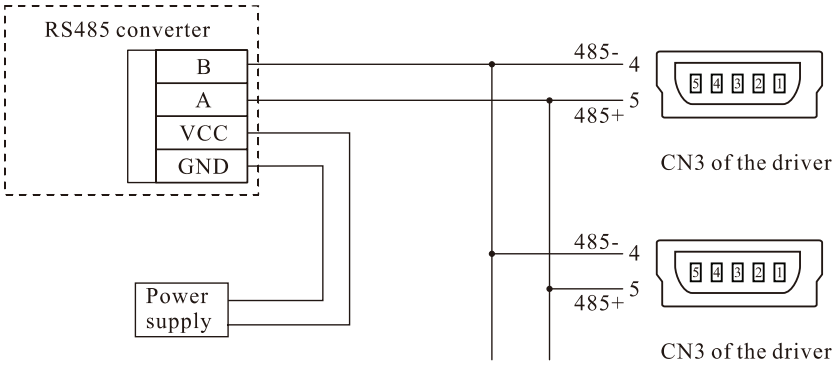


Diagram 4.4: Driver communication terminal CN3 plug, RS232 and PC wiring diagram

EMA servo drive:



EMB servo drive:

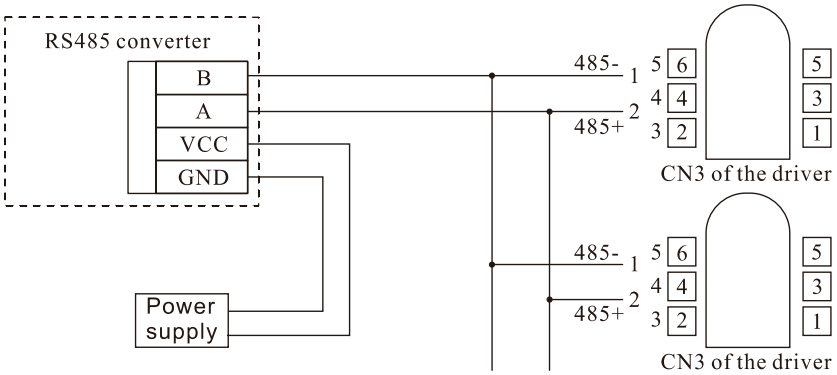


Diagram 4.5: Driver communication terminal CN3 plug and RS485 converter wiring diagram

Communication interface adopt standard RS485, connect at most 32pcs driver at the same time online, cable length is relate to Baud rate and cable thickness. Such as 9600bps Baud rate, adopt AWG26 cable, longest communication distance is 1Km.

Table 4.3 Communication Terminal CN3

EMA servo drive:

Pin	Signal name	Sign	Functions
CN3-1	RS-232 data receiving	RXD232	Data receiving terminal of driver RS232 interface, connect to PC data transmitting terminal.
CN3-2	RS-232 data transmitting	TXD232	Data transmitting terminal of driver RS232 interface, connect to PC data receiving terminal.
CN3-3	RS-232 signal ground	GND	Ground of RS-232 signal
CN3-4	RS485 differential signal -	RS-485-	RS-485 communication data bus, or CAN communication data bus. Select communication data bus by jumper.
	CAN differential signal -	CANL	
CN3-5	RS485 differential signal +	RS-485+	
	CAN differential signal +	CANH	

EMB servo drive:

Pin	Signal name	Sign	Functions
CN3-1	RS485 differential signal -	RS-485-	RS-485 communication data bus, or CAN communication data bus. Select communication data bus by jumper.
	CAN differential signal -	CANL	
CN3-2	RS485 differential signal +	RS-485+	
	CAN differential signal +	CANH	
CN3-3	RS-232 data receiving	RXD232	Data transmitting end of the driver, to connect with the receiving data end of PC
CN3-4	RS-232 data transmitting	TXD232	
CN3-5	RS-232 signal ground	GND	Ground of RS-232 signal
CN3-6	+5V	+5V	Backup power

4.5 Switch value input and output signal ports and explanations

4.5.1 Switch value input signal ports and explanations

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

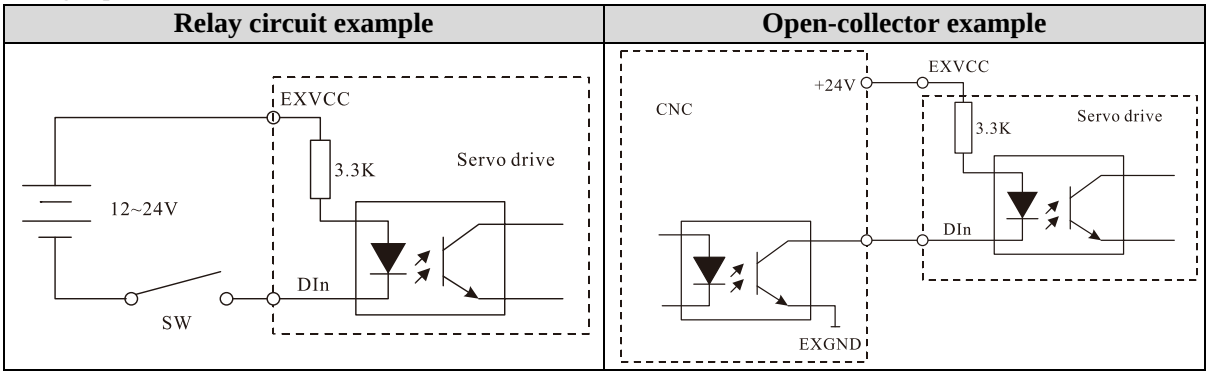


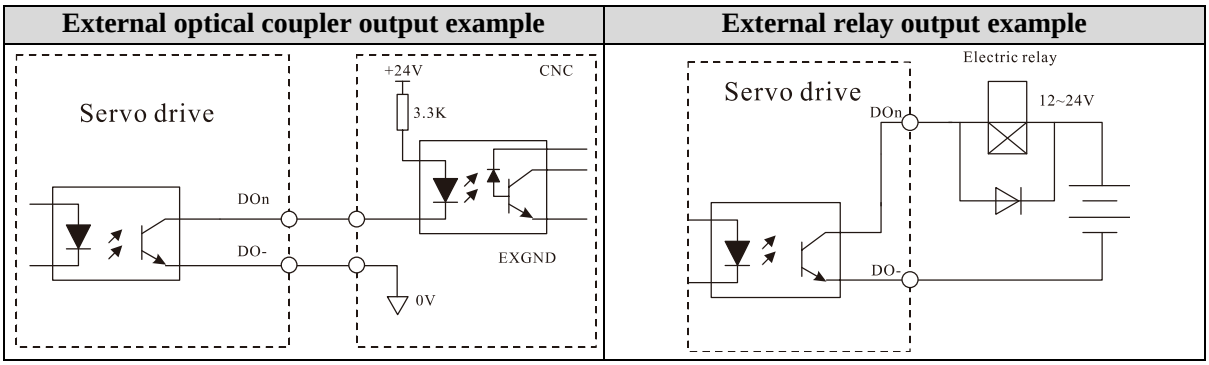
Diagram 4.6: Switch value input signal ports

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

4.5.2 Switch value output signal ports and explanations

The switching value output signals 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. The signal output is in Darlington driver structure.

EMA servo drive:



EMB servo drive:

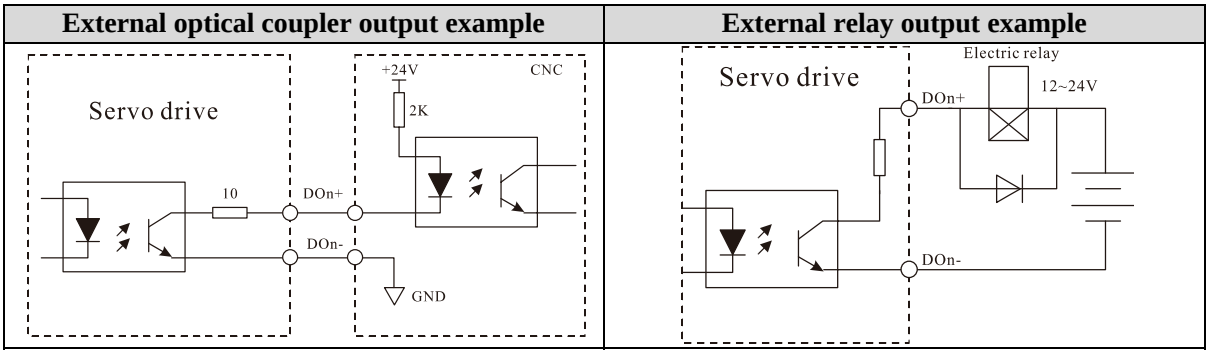


Diagram 4.7: Switch value output signal ports

- The external power is supplied by users. Notice that the servo driver will be damaged if the power polarity is reversed.
- The largest outer voltage is +24V.

- The output is in open-collector form. The maximum current is 150 mA.
- If the load is an inductive load such as electric relay, it is necessary to wire a fly-wheel diode reverse parallel with the load. If the fly-wheel diode is in a wrong direction, the servo driver will be damaged.

4.6 Position pulse command input ports and explanations

4.6.1 Position pulse input port

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

The maximum frequency is 500Khz, in order to correctly transmit position pulse, suggest user adopt differential drive mode.

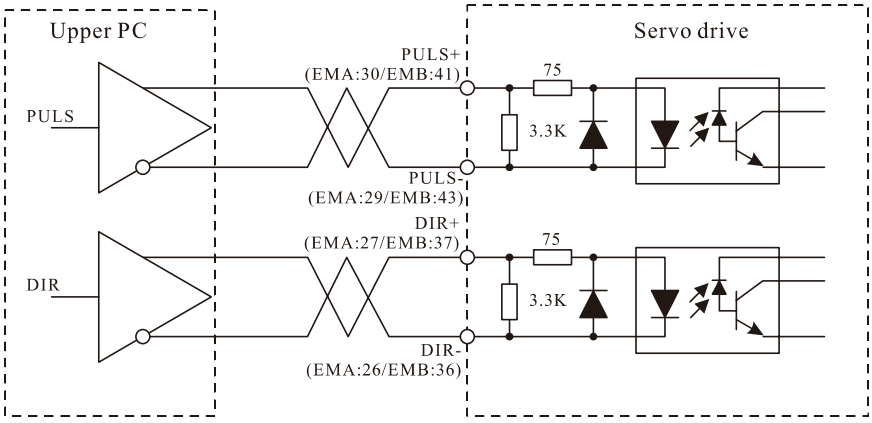


Diagram 4.8 Position pulse command differential input

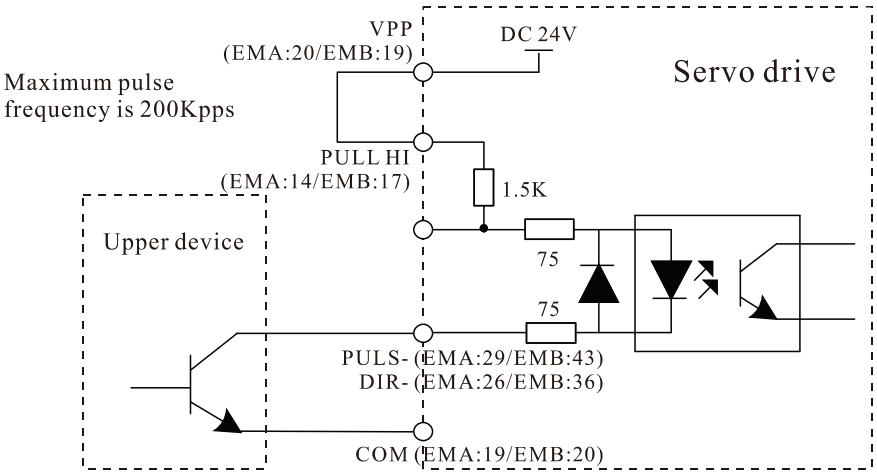
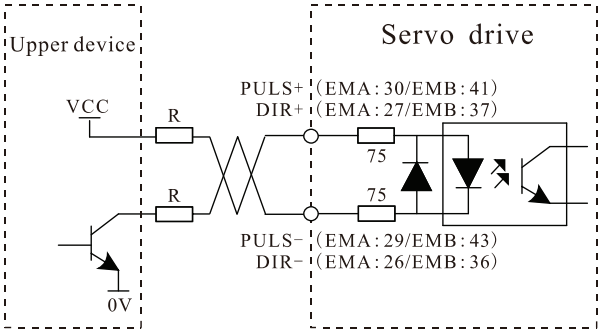


Diagram 4.9 Pulse command input with internal power

The maximum frequency is 200KHz. The driving current range is 6~10mA, and external connecting resistance R should be adjusted by VCC.

The maximum frequency is 200KHz. The driving current range is 6~10mA, and external connecting resistance R should be adjusted by VCC.

VCC	R resistance value
24V	1K Ohm
12V	680 Ohm
5V	100 Ohm



Adjustment using internal resistance , the internal resistance 1.5KΩ. The maximum input pulse frequency is 200Kpps.

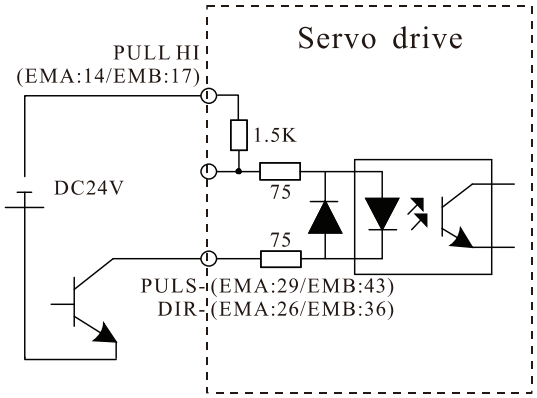


Diagram 4.10 Pulse command input with external power

- There is internal power supply; users do not need connect external power.
- In order to improve the anti-jamming capacity, the differential input mode is suggested.
- Single-terminal mode will decrease the receiving range of pulse frequency command.

4.6.2 Position pulse input command form

There are three optional types of pulse command, which can be set by P[n]-014 each type can be reversed and can be set by P[n]-015.

Table 4.4 Input pulse command form

Parameter		Pulse form	P[n]-015=0		P[n]-015=1	
EMA	EMB		Forward	Reverse	Forward	Reverse
P-014=0	Pn-014=0	Pulse +direction				
P-014=1	Pn-014=1	CCW /CW pulse				
P-014=2	Pn-014=2	Two phase A/B quadrature pulse				

Table 4.5 Pulse input sequence parameters

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

(1) Pulse + direction input interface sequence diagram (Maximum frequency is 500KHZ)

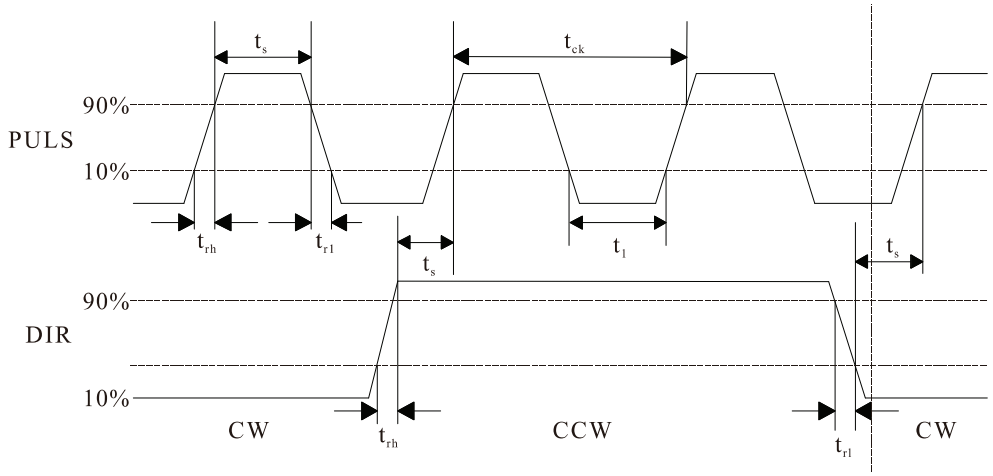


Diagram 4.11: pulse + direction input interface sequence diagram

(2)CCW pulse/CW pulse input interface sequence diagram (Maximum frequency is 500KHZ).

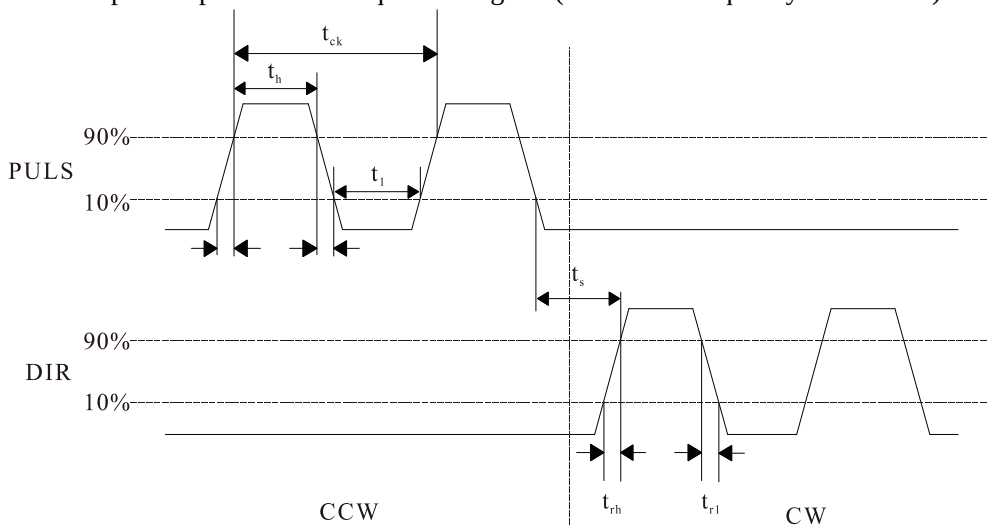


Diagram 4.12: CCW pulse/CW pulse input interface sequence diagram

(3)Two phase orthogonal pulse input interface sequence diagram (Maximum frequency is 300KHZ)

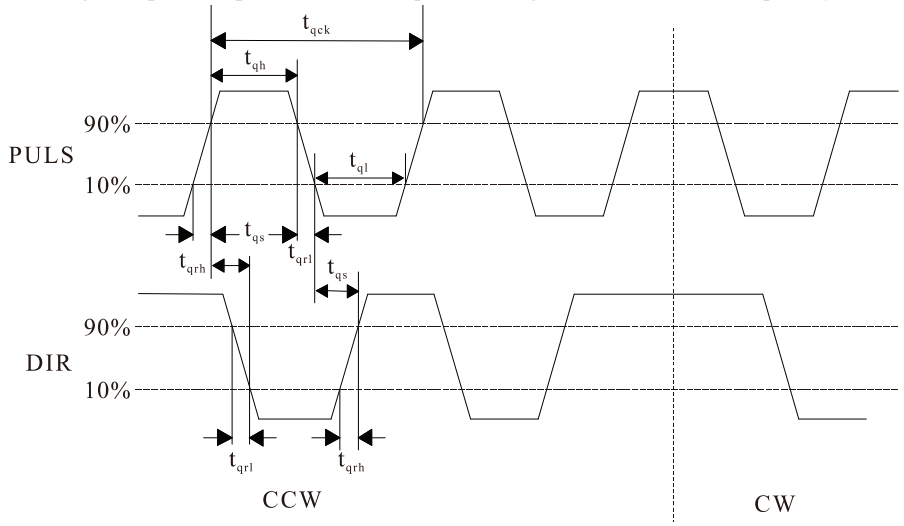


Diagram 4.13: Two phase orthogonal pulse input interface sequence diagram

4.7 Analog command input port explanation

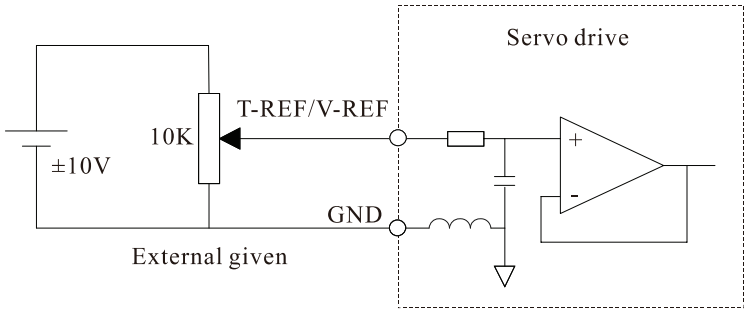


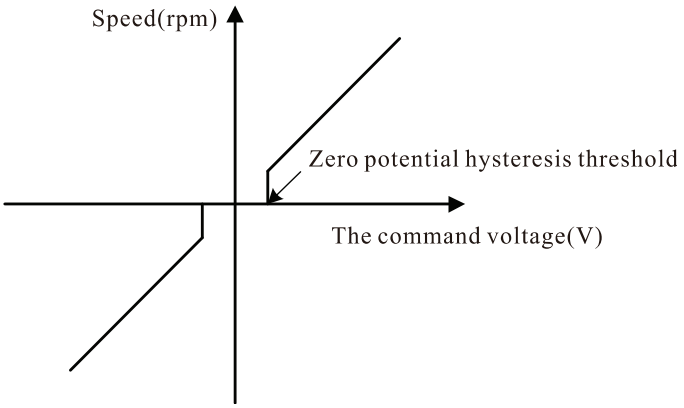
Diagram 4.14: Analog Input Interface

- Analog input voltage range is -10V~+10V, and the driver may be damaged if the voltage is 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. In analog speed and analog torque modes, when the given analog voltage is zero, generally there exists common ground earth voltage difference, use zero drift compensation can eliminate the voltage difference. When zero fine-tuning amounts are over, analog quantity corresponding to the range may shorten. Adjusting ways can be auto-compensation as well as manual compensation.

(1) Auto-compensation: enter menu "A[U]-", select "A[U]-SPd", press "SET", wait to display "donE/FInISh", servo driver will automatically write compensation value to "P[n]-043" (analog speed mode), "P[n]-045"(analog torque mode), then enter menu "E[E]-", select "E[E]-SEt" and save the parameter.

2. Manual compensation: The drivers enable makes the motor run in the analog speed mode. Enter into "d[P]-" menu, select "d[P]-CS" and note down the value of the offset under this speed command. Then change the value of parameter "P[n]-043". Under torque command mode, please check the value of "d[P]-Ct" the torque command offset. Revise the value of parameter "P[n]-045" manually. This operation is same with analog speed mode.

3. To ensure the motor steady stop without rotation, it can be realized by set analog speed reference zero hysteresis thresholds (parameter "P[n]-044") when the analog input is 0V under analog speed mode. When the analog speed input is less than the pre-set value, the speed command is 0 and the motor locks. It needs to set analog torque reference zero hysteresis thresholds (parameter "P[n]-046"). The operation is same with analog speed mode. It shows as following figure:



4.7.2 Analog output interface principle

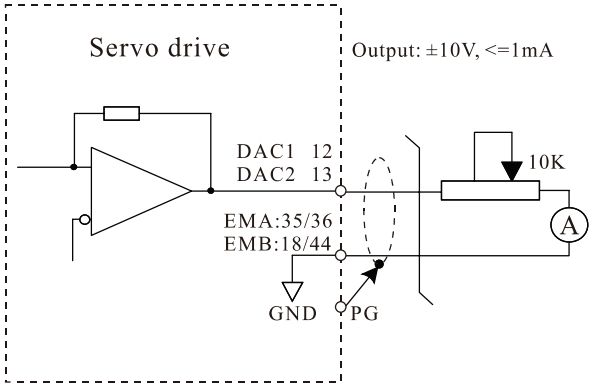


Diagram 4-15 Analog input interface

Related parameters setting refer to chapter 7.

4.8 Encoder signal input and output ports and explanations

4.8.1 Encoder signal output CN2 port and explanation.

For incremental encoder, position output signals EXTA+/EXTA-, EXTB+/EXTB-, EXTZ+/EXTZ- use differential output way. The wiring schematic diagram of position signal outputted from CN2 is as follows:

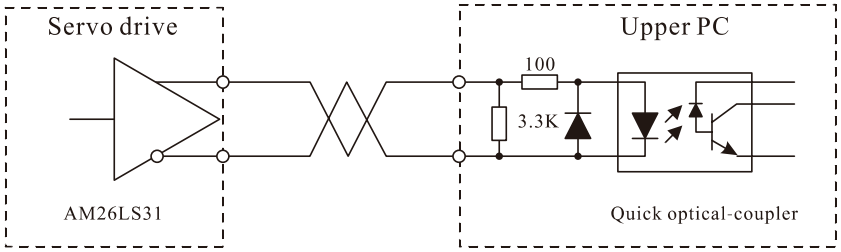


Diagram 4.16 Position Feedback Pulse Optical-coupler Connection

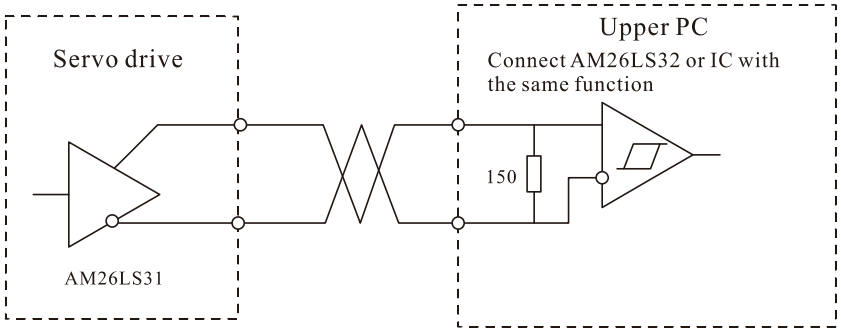


Diagram 4.17 Position Feedback Pulse Differential Connection

4.8.2 Encoder signal input CN1 port and explanation.

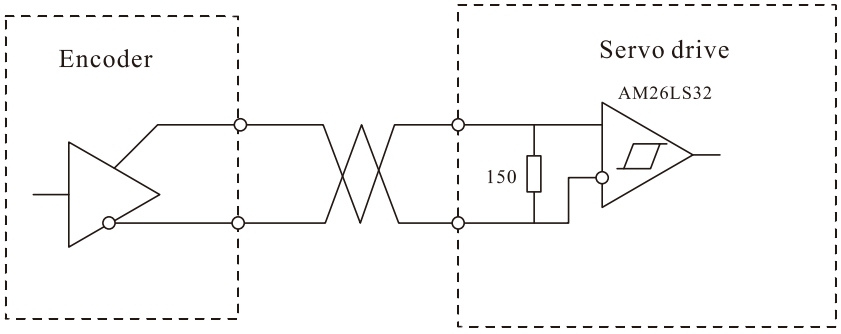


Diagram 4.18: Encoder signal connecting port

5. Panel and Operation

5.1 Overview

The EMA servo driver panel is made up of 5 bits 8-segment LED digital tube and the EMB servo driver panel is made up of 6 bits 8-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 diagram 5.1 shows the driver's operation panel.

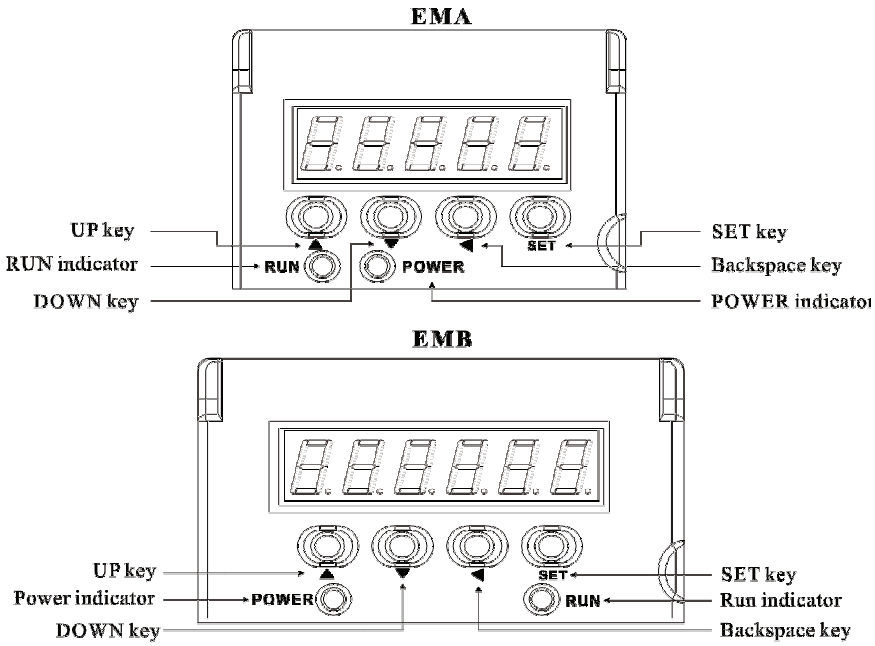


Diagram 5.1: EMA and EMB operation panel

The specific function of each part is illustrated as follows:

Name	Function	
Display	**EMA:** 5-digit LED display panel	**EMB:** 6-digit LED display panel
	Digital panel is used for displaying monitoring value, setting value, parameter value and alarm information.	
▲ key	Switch menu, parameter number or modification of numerical value	
▼ key	Switch menu, parameter number or modification of numerical value	
◀ key	Return to upper layer menu, or cancel operation.	
SET key	Enter the next layer menu, or input confirmed.	
POWER indicator	To show whether there is electricity in the main circuit, light's on means YES	
RUN indicator	To show whether the driver enables, light's on means YES	

5.2 Menu structure

The driver's operation adopts multilayer menu structure, and the first layer is main menu, including six submenus of fundamental function. The projects and block diagram for operation are shown in diagram 5.2.

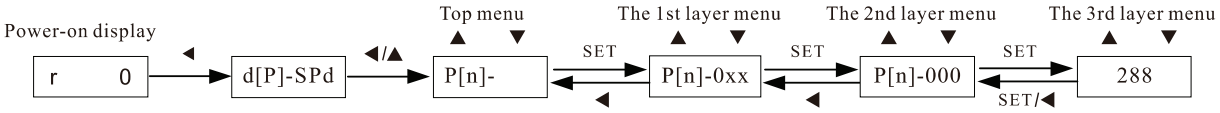


Diagram 5.2: Menu operation diagram

Explanation: In the third layer's menu, users can return to the second layer's menu by pressing "◀" key or "SET" key. The difference: Press the "SET" key to confirm the change of parameter's value, while the "◀"

key cancel the change.

5.2.1 Monitoring menu mode

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 "P[n]-003").

Users can also select "d[P]-" in the first layer's menu, and press "SET" key to enter monitoring mode. Under this mode, there are 26 monitoring items for users' choosing by "▲" key or "▼" key, and when press "SET" key once the driver will display specific monitoring value.

The following diagram shows each monitoring item.

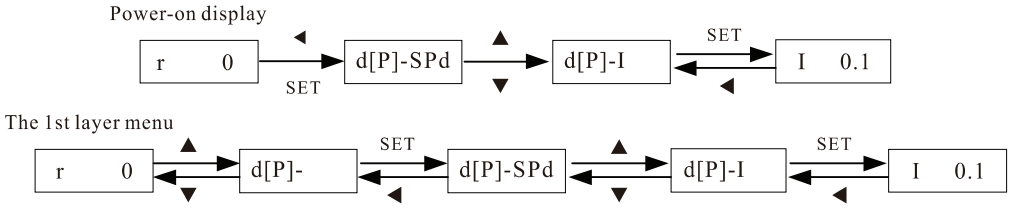
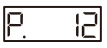


Diagram 5.3: Operation diagram of monitoring mode

Instructions to some items in the "d[P]-" menu group:

1.Current position feedback by motor encoder is composed of "d[P]-PoS. " and "d[P]-PoS" . For example, The value of "d[P]-PoS". is  ,and value of "d[P]-PoS" is  , the current position pulse is calculated as following:

 x 100000 +  = 4578810/1245806 pulse

Position command and position deviation similar.

2. Position command pulse "d[P]-Cpo" is the value of input pulse magnified by electronic gear ratio.

3. Current control mode "d[P]-Cnt" displays:

- Positional control mode;
- Speed control mode;
- Sr trial run mode;
- JOG trial run mode;
- Analog speed control mode;
- Torque control mode;
- Open-loop operation mode.

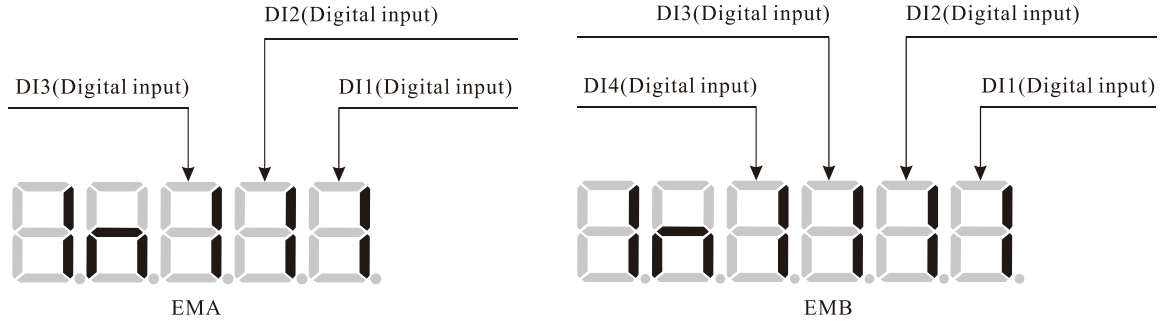
4. If display numbers go up to 5/6 digits(EMA for 5 digits, EMB for 6 digits) (e.g. -12345), it will not display prompting character.

5. Position command pulse frequency "d[P]-Frq" 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.

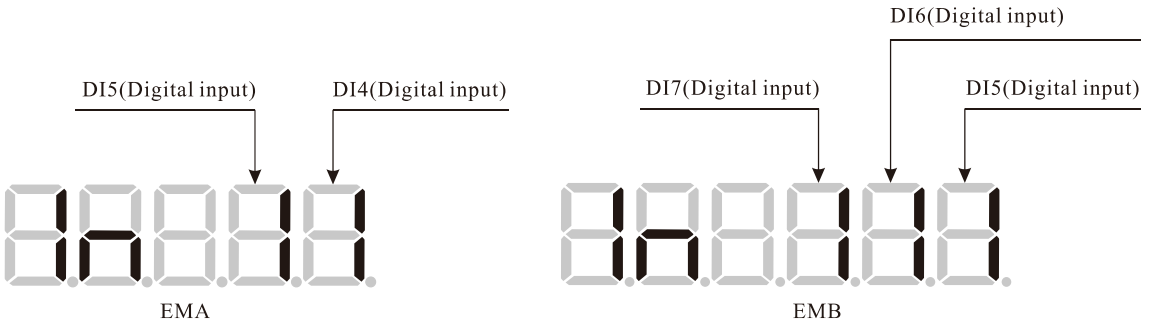
6. Alarm code displays "d[P]-Err". For the specific meaning of alarm codes, please read chapter 8.

7. Digital input port (DIn) high status "d[P]-InH" and low status "d[P]-InL" display as follows. Input port (DIn) functions can be customized. (1-Invalid; 0-Valid.)

Digital tube definition of "d[P]-InL":

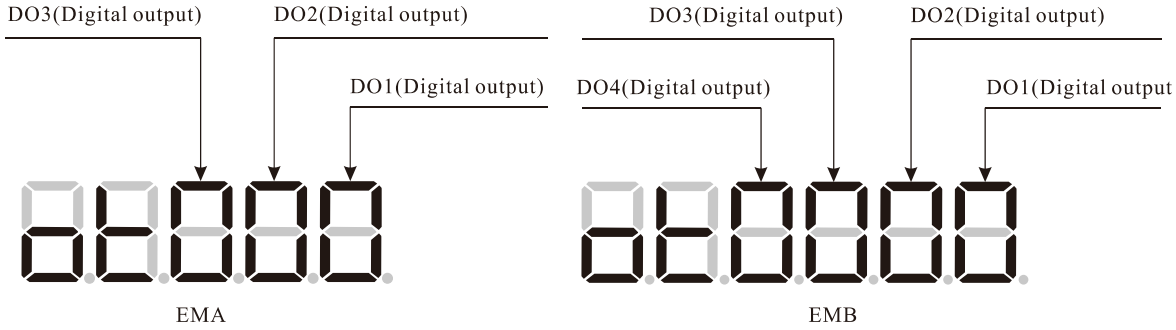


Digital tube definition of "d[P]-InH":



8: Digital output port (DOn) status as shown below. Output port (DOn) functions can be customized. (1-Invalid;0-Valid.)

Digital tube definition of "d[P]-oUt":



Display of the encoder UVW status "d[P]-Cod": Each signal corresponding to a digital tube display, the digital tube is 0 means the terminal is OFF (digital signal 0), while the digital tube is 1 means the terminal is ON (digital signal 1). The detailed correspondence is shown as following table:

Show Item		Binary bit		Meaning
EMA	EMB	EMA	EMB	
d-Cod	dP-Cod	Cd□□□0	Cd□□□□0	Encoder U phase
Encoder U, V, W input signal		Cd□□0□	Cd□□□0□	Encoder V phase
		Cd0□□□	Cd□0□□□	Encoder W phase

5.2.2 Parametrs program mode(P-)

Select "P[n]-" in main menu, and press "SET" key to enter parameter setting mode. "▲" key or "▼" are used to increase/decrease the value of the parameter. Press and hold the "SET" key for 3 seconds to confirm the change of parameter's value, while the "◀" key cancel the change.

e.g. Set the value of P[n]-005 to 180,as follows.

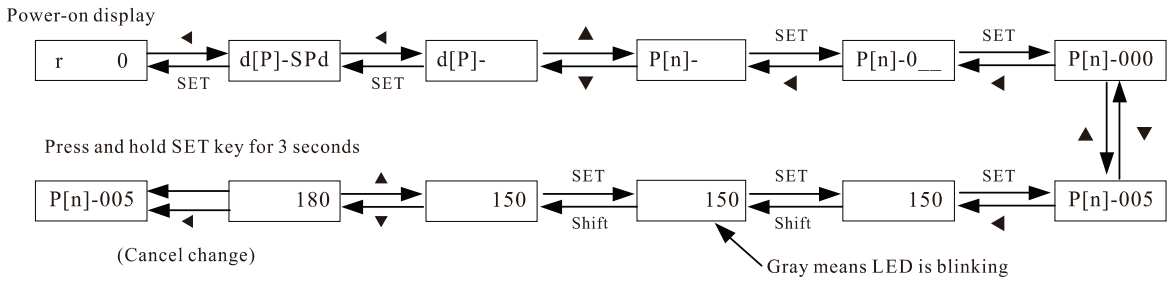


Diagram 5.4: Diagram of parameter setting

Note: "P[n]-0_ _" segment parameters are password-protected. User password is 288. Correct password can access the segment parameters.

5.2.3 Special function menu

This menu includes save parameters, recover defaults, Sr control, JOG control, analog zero drift compensation and historical alarm. Refer to chapter 7.2.

6. Communication Functions

6.1 ModBus communication overview

Servo driver provides RS485, RS232 and CAN three communication interfaces, adopt international standard ModBus communication protocol. User can realize asynchronous serial half-duplex communication with 32 sets servo drivers at the same time by RS485. It can realize below functions:

- Read-write servo driver functional parameters.
- Monitoring servo driver working condition.
- Control servo driver operation.

6.2 ModBus communication protocol

6.2.1 Communication mode

ModBus communication provides two kinds of mode: ASCII(American Standard Code for Information Interchange)mode, RTU (Remote Terminal Uinit) mode. Selecting communication data format by parameter P[n]-102.

1. RTU mode frame format:

In RTU mode, data frame is divided by more than 3.5 characters, each frame byte interval is no more than 1.5 byte field time, as below structure shows:

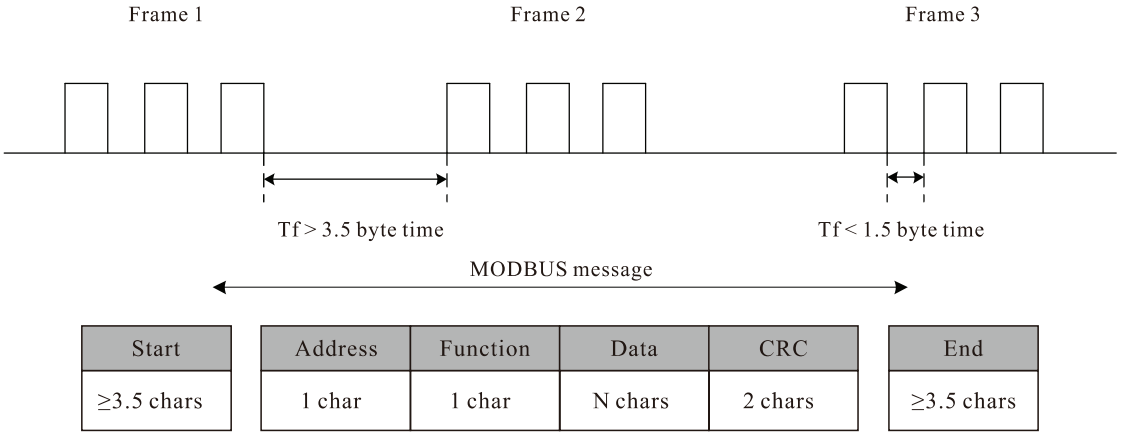


Diagram 6.1: RTU mode frame format

Before frame completes, if two character interval is between 1.5 byte and 3.5 byte transmitting time, servo driver will drop the imperfect message frame, and there is no data feedback, until next 3.5 byte interval (begin anew), and to start receive message frame.

2. ASCII mode frame format:

In ASCII mode, data frame has fixed start bit and stop bit, frame format is as below:

Start	Address	Function	Data	LRC	End
1 char …	2 chars	2 chars	2×N chars	2 chars	2 chars CR, LF

Every byte is formed by 2 characters, for example: 0x12 is presented with ASCII include ‘1’ ASCII code (0x31) and ‘2’ ASCII code (0x32).

Table 6.1 ASCII comparison table

Character	"0"	"1"	"2"	"3"	"4"	"5"	"6"	"7"
Corresponding ASCII code	0x30	0x31	0x32	0x33	0x34	0x35	0x36	0x37
Character	**"8"**	**"9"**	**"A"**	**"B"**	**"C"**	**"D"**	**"E"**	**"F"**
Corresponding ASCII code	0x38	0x39	0x41	0x42	0x43	0x44	0x45	0x46
Character	**":"**	**"CR"**	**"LF"**					
Corresponding ASCII code	0x3A	0x0D	0x0A					

Transmitting decimals will convert to integral number then with 16 system format transmit, for example: the transmitting data 0.10 is 0x0A.

6.2.2 Protocol description

Servo driver support ModBus communication protocol, which can read and write in servo driver parameters. Read code is 0x03; write in code is 0x06.

(1)Read code (0x03)

Item	RTU format	ASCII format
START	≥3.5 bytes free time	Start byte ":", 0x3A
ADDR	Address(parameter P[n]-100), 1 byte	Address: 2 bytes ASCII character
CMD	Command code, 0x03	Command code, 0x30 0x33
DATA1	Read parameter start address, 1 character, high 8 bytes before, low 8 bytes after.	Read parameter start address, 1 character, 4 bytes ASCII characters.
DATA2	Read word number (N≤16), 1 character, high 8 bytes before, low 8 bytes after.	Read word number (N≤16), 1 character, 4 bytes ASCII character.
CRC/LRC	CRC16, low 8 bytes before, high 8 bytes after.	LRC, 2 bytes ASCII characters
END	≥3.5 bytes free time.	Stop byte "CR" "LF", 0x0D 0x0A

Response frame format: Communication process correct will feedback below format frame, if communication is wrong then feedback wrong information (refer below communication wrong dispose).

Item	RTU format	ASCII format
START	≥3.5 bytes free time	Start byte ":", 0x3A
ADDR	Address(parameter P[n]-100), 1 byte	Address: 2 byte ASCII characters
CMD	Command code, 0x03	Command code, 0x30 0x33
DATA LENGTH	Number of bytes, 1 byte is equal to N×2	Number of bytes is equal to N×2, 2 bytes ASCII characters.
DATA	Feedback parameter data, N bytes	Feedback parameter data, N bytes, Nx4 ASCII characters.
CRC/LRC	CRC16, low 8 bytes before, high 8 bytes after	LRC, 2 bytes ASCII characters
END	≥3.5 bytes free time.	Stop byte ‘CR’ ‘LF’, 0x0D 0x0A

(2)Write in code (0x06)

Item	RTU format	ASCII format
START	≥3.5 bytes free time	Start byte ":", 0x3A
ADDR	Address(parameter P[n]-100), 1 byte	Address: 2 bytes ASCII character
CMD	Command code, 0x06	Command code, 0x30 0x36
DATA1	Write in parameter start address, 1 character, high 8 bytes before, low 8 bytes after.	Write in parameter start address, 1 character, 4 byte ASCII character.
DATA2	Write in data (≤16 bytes)	Write in data (≤16 bytes)
CRC/LRC	CRC16, low 8 bytes before, high 8 bytes after	LRC, 2 bytes ASCII character
END	≥3.5 bytes free time.	Stop byte ‘CR’ ‘LF’, 0x0D 0x0A

Response frame format: Write in correct, servo driver feedback and send the same data frame. If communication is wrong, then will feedback wrong information.

(3)Write in code(0x10)

Item	RTU format	ASCII format
START	≥3.5 bytes free time	Start byte ":", 0x3A
ADDR	Address(parameter P[n]-100), 1 byte	Address: 2 bytes ASCII character
CMD	Command code, 0x10	Command code, 0x31 0x30
DATA1	Write parameters start address,1 word.The high-order byte is appended first, followed by the low-order byte.	Write parameters start address, 4 chars.
DATA2	The number of writing data words (N≤16), 1 word. The high - order byte is appended first,followed by the low - order byte.	The number of writing data words , 4 chars.
DATA3	The number of writing data bytes (≤2×N), 1 char.	The number of writing data bytes , 2 chars.
DATAn	Parameter Values. (N≤16)	Parameter Values.
CRC/LRC	CRC16, low 8 bytes before, high 8 bytes after	LRC, 2 bytes ASCII character
END	≥3.5 bytes free time.	Stop byte 'CR' 'LF', 0x0D 0x0A

(4)Communication wrong dispose

Communication wrong response frame format:

Item	RTU format	ASCII format
START	≥3.5 bytes free time	Start byte ':', 0x3A
ADDR	Address(parameter P-100), 1 byte	Address: 2 byte ASCII characters
CMD	Command code, 0x83 or 0x86	Command code, 0x38 0x33 or 0x38 0x36
ERROR CODE	Error code, 1 byte	Error code, 2bytes ASCII characters.
CRC/LRC	CRC16, low 8bytes before, high 8 bytes after	LRC, 2 bytes ASCII characters
END	≥3.5 bytes free time.	Stop byte 'CR' 'LF', 0x0D 0x0A

Wrong code explanation:

Wrong code	Explanation
0x01	CRC/LRC verify incorrect.
0x02	Communication data odd-even verify incorrect.
0x03	Command code incorrect, not 0x03/0x06/0x10.
0x04	Read, write in data is over range.
0x05	Send out illegal data address
0x06	Slaver drive is busy, when data to EEPROM, parameter can't be revised.
0x07	Frame length incorrect
0x08	Parameters is protected by password, can't revised or address is over range.
0x09	The number of writing data words greater than 16.
0x0A	The number of reading data words less than 1 or greater than 16.

(5) Special communication address

Address	Definitions	Write	Read
0x1000	Save parameter	1:Start. **Note:**Write other values return an error message.	1:Operatiing. 2:Success. 3:Failure.
0x1001	Recover defaults	1:Start. **Note:**Write other values return an error message.	1:Operatiing. 2:Success. 3:Failure.
0x1002	Sr trial run	Write the address, make servo drive switch to Sr control mode. And the motor speed is the value send by master.	Return the speed of Sr mode.

Address	Definitions	Write	Read
0x1003	JOG trial run	Write the address,make servo drive switch to JOG control mode. 0:Stop servo drive. 1:Make the servo drive run in CW. 2:Make the servo drive run in CCW.	0:Stop. 1:Run in CW. 2:Run in CCW。
0x1004	Analog speed zero drift compensation	1:Start. **Note:**Write other values return an error message.	1:Operatiing. 2:Success. 3:Failure.
0x1005	Analog torque zero drift compensation	1:Start. **Note:**Write other values return an error message.	1:Operatiing. 2:Success. 3:Failure.
0x1007	Historical alarm information	Read-only.	Returns historical alarm information.

(6)ModBus communication parameters read and write in examples

(1) Read parameters

For example: Servo drive parameters P[n]-004=1, P[n]-005=150 (communication address refer to chapter7.1), read these two parameters value message format:

RTU:

Sending message: 0x01 0x03 0x00 0x04 0x00 0x02 0x85 0xCA

Correct response: 0x01 0x03 0x04 0x00 0x01 0x00 0x96 0x2B 0x9D

Incorrect response: 0x01 0x83 0x01 0x80 0xF0 (0x01: transmitting data odd-even verify incorrect).

ASCII (Start byte: 0x3A end byte: 0x0D 0x0A):

Sending message: 0x3A 0x30 0x31 0x30 0x33 0x30 0x30 0x30 0x34 0x30 0x30 0x30 0x32 0x46 0x36 0x0D 0x0A

Correct response: 0x3A 0x30 0x31 0x30 0x33 0x30 0x34 0x30 0x30 0x30 0x31 0x30 0x30 0x39 0x36 0x36 0x31 0x0D 0x0A

Incorrect response: 0x3A 0x30 0x31 0x38 0x33 0x30 0x31 0x37 0x42 0x0D 0x0A ("0x30 0x31" ->0x01: (transmitting data odd-even verify incorrect).

(2) Write in parameters

For example: Revise parameter P[n]-200=100, write in this parameter message format (communication address refers to chapter7.1):

RTU:

Sending message: 0x01 0x06 0x02 0x00 0x00 0x64 0x89 0x99

Correct response: 0x01 0x06 0x02 0x00 0x00 0x64 0x89 0x99

Incorrect response: 0x01 0x86 0x02 0xC3 0xA1 (0x02: CRC verify incorrect)

ASCII (Start byte: 0x3A End byte: 0x0D 0x0A):

Sending message: 0x3A 0x30 0x31 0x30 0x36 0x30 0x32 0x30 0x30 0x30 0x30 0x36 0x34 0x39 0x33 0x0D 0x0A

Correct response: 0x3A 0x30 0x31 0x30 0x36 0x30 0x32 0x30 0x30 0x30 0x30 0x36 0x34 0x39 0x33 0x0D 0x0A

Incorrect response: 0x3A 0x30 0x31 0x38 0x36 0x30 0x32 0x37 0x37 0x0D 0x0A ("0x30 0x32" -> 0x02: LRC verify incorrect).

Notes:

1. Above examples, illustrated by P[n]-100=1, means station address is 0x01.

2. Monitor parameters in d[P]- menu are parameters for read only, communication address: 0x0400 ~0x0416.

6.2.3 Verification

1. CRC verification

RTU mode adopts CRC (Cyclical Redundancy Check) verify method. When servo driver receives a new message frame, it will verify whether this address is in conformity with local address, if not, it will not accept. After receiving a whole set of message frame, then servo driver conducts CRC verify, all binary bytes will conduct CRC verify except the start, end and odd-even of every byte.

$$G(x) = x^{16}+x^{15}+x^{2}+1$$

The C programming language to generate CRC value of computing method as following:

```
unsigned char* ParaData;
unsigned char DataLen;
unsigned int CRCdat(unsigned char* ParaData, unsigned char DataLen)
{
   int i;
   unsigned int CRC_reg=0xffff;
   while(DataLen--)
   {
     CRC_reg^=*ParaDate++;
     for(i=0;i<8;i++)
     {
        if(CRC_reg&0x01) CRC_reg=(CRC_reg>>1)^0xa001;
        else CRC_reg=CRC_reg>>1;
     }
   }
   Return CRC_reg;
}
```

2. LRC verify

ASCII mode adopts LRC (Longitudinal Redundancy Check) verify method. LRC verify is no-carry plus from ADDR to the last data (not include start and end bytes), only reserve low 8 bytes of the final result, exclude the excess (for example: 0x78+0xA2=0x1A), then calculate the complement of two (such as LRC code is 0xE6), then gets LRC verify value.

7. Parameters and Functions

7.1 Parameters list

The defaults in the following table apply to EMM-130 motor (P[n]-001=42). Different model of motors have different parameter values. If there are any differences, please take the display value of servo driver as the standard. "P[n]-0_ _" segment parameters are password-protected. User password is "P[n]-000=288". Correct password can access the segment parameters. Symbols of parameters table are described below:

"☆":Indicates the parameter value can be changed while the servo drive is running or stopping.

"★":Changes the value of the parameter need to save to non-volatile memory,and re-power.

"●":Read-only parameter, cannot be changed.

"*" : Factory parameter, prohibit users to operate

"▲":Special function parameter.

Code	Address	Name	Range	Default	Unit	property
Special Function Parameter Group						
E[E]-SEt	0x1000	Save parameters	---	---	---	▲
E[E]-dEF	0x1001	Recover defaults	---	---	---	▲
S[r]-	0x1002	Sr trail run	---	---	---	▲
J[r]-	0x1003	JOG trail run	---	---	---	▲
A[U]-SPd	0x1004	Analog speed zero drift compensation	---	---	---	▲
A[U]-trq	0x1005	Analog torque zero drift compensation	---	---	---	▲
C[O]-rdy	0x1006	Factory parameter	---	---	---	*
F[n]-Err	0x1007	Historical alarms	---	---	---	●
Monitoring Group						
d[P]-SPd	0x2000	Motor speed	---	---	rpm	●
d[P]-PoS	0x2001	Present position low 5 bits	---	---	pulse	●
d[P]-PoS.	0x2002	Present position high 5 bits	---	---	$x10^5$pulse	●
d[P]-CPo	0x2003	Present command low 5 bits	---		pulse	●
d[P]-CPo.	0x2004	Present command high 5 bits	---		$x10^5$pulse	●
d[P]-EPo	0x2005	Position deviation low 5bits	---		pulse	●
d[P]-EPo.	0x2006	Position deviation high 5bits	---	---	$x10^5$pulse	●
d[P]-Trq	0x2007	Motor torque	---	---	%	●
d[P]-I	0x2008	Motor current	---	---	A	●
d[P]-InH	0x2009	Digital input status of DI4~DI5[DI5~DI7]	---	---	---	●
d[P]-InL	0x200A	Digital input status of DI1~DI3[DI1~DI4]	---	---	---	●
d[P]-oUt	0x200B	Digital output status of DO1~DO3[DO1~DO4]	---	---	---	●
d[P]-Cnt	0x200C	Control mode	---	---	---	●
d[P]-Frq	0x200D	Position command pulse frequency	---	---	KHz	●
d[P]-CS	0x200E	Speed command	---	---	rpm	●
d[P]-Ct	0x200F	Torque command	---	---	%	●
d[P]-Apo	0x2010	Encoder position	---	---	pulse	●
d[P]-Cod	0x2011	Encoder U,V,W signals	---	---	---	●
d[P]-Id	0x2012	FPGA software version	---	---	---	●
d[P]-Err	0x2013	Alarm code	---	---	---	●

Code	Address	Name	Range	Default	Unit	property
d[P]-CCr	0x2014	Reserved	---	---	---	●
d[P]-Cr	0x2015	Reserved	---	---	---	●
d[P]-rES	0x2016	Reserved	---	---	---	●
d[P]-ALE	0x2017	Absolute encoder inner alarms	---	---	---	●
d[P]-Abr	0x2018	Absolute encoder laps information	---	---	r	●
d[P]-tn	0x2019	Reserved	---	---	---	●
d[P]-UdC	0x201A	Reserved	---	---	---	●
Parameters of group P[n]-0_ _						
P[n]-000	0x0000	Password	0~9999	288	---	☆
P[n]-001	0x0001	Motor model	0~103	34[42]	---	★
P[n]-002	0x0002	Software version (read-only)	---	---	---	●
P[n]-003	0x0003	Initial display content	0~26	0	---	★
P[n]-004	0x0004	Control mode selection	0~10	0	---	☆
P[n]-005	0x0005	Speed proportional gain	5~1000	150	Hz	☆
P[n]-006	0x0006	Speed integral time constant	1~1000	30	ms	☆
P[n]-007	0x0007	Torque command filter	0~500	100	---	☆
P[n]-008	0x0008	Speed feedback filter	1~500	100	---	☆
P[n]-009	0x0009	Position proportional gain	1~2000	40	1/S	☆
P[n]-010	0x000A	Position feed forward gain	0~100	0	%	☆
P[n]-011	0x000B	Position feed forward low pass filter cut-off frequency	1~1200	300	Hz	☆
P[n]-012	0x000C	Electronic Gear Ratio numerator	1~65535	1	pulse	☆
P[n]-013	0x000D	Electronic Gear Ratio denominator	1~65535	1	pulse	☆
P[n]-014	0x000E	Pulse input mode of position command	0~2	0	---	★
P[n]-015	0x000F	Reverse pulse direction of position command	0~1	0	---	☆
P[n]-016	0x0010	Reserved	---	---	---	---
P[n]-017	0x0011	Reserved	---	---	---	---
P[n]-018	0x0012	Reserved	---	---	---	---
P[n]-019	0x0013	Position command smooth filter	0~20000	0	0.1ms	☆
P[n]-020	0x0014	Drive forbid input invalid selection	0~2	1	---	☆
P[n]-021	0x0015	Reserved	---	---	---	---
P[n]-022	0x0016	JOG run speed	0~6000	100	rpm	☆
P[n]-023	0x0017	Maximum speed limit	0~6000	3000 [2500]	rmp	☆
P[n]-024	0x0018	Speed command setting	0~2	1	---	☆
P[n]-025	0x0019	Position command Setting	0~1	1	---	☆
P[n]-026	0x001A	Torque command setting	0~2	0	---	☆
P[n]-027	0x001B	Torque limit mode	0~2	0	---	☆
P[n]-028	0x001C	Speed limit mode	0~2	0	---	☆
P[n]-029	0x001D	Speed command filter	1~100	100	ms	☆
P[n]-030	0x001H	Reserved	---	---	---	---
P[n]-031	0x001F	Analog speed command filter coefficients	1~100	100	---	☆

Code	Address	Name	Range	Default	Unit	property
P[n]-032	0x0020	Analog torque command filter coefficients	1~100	100	---	☆
P[n]-033	0x0021	Processing method of overspeed in torque mode	0~1	0	---	☆
P[n]-034	0x0022	Internal CCW torque limit	0~300	300	%	☆
P[n]-035	0x0023	Internal CW torque limit	-300~0	-300	%	☆
P[n]-036	0x0024	External CCW torque limit	0~300	100	%	☆
P[n]-037	0x0025	External CW torque limit	-300~0	-100	%	☆
P[n]-038	0x0026	Torque limit for speed trial run and JOG trial run	0~300	100	%	☆
P[n]-039	0x0027	Reserved	---	---	---	---
P[n]-040	0x0028	Reserved	---	---	---	---
P[n]-041	0x0029	Analog torque command gain	0~1000	100	---	☆
P[n]-042	0x002A	Speed command direction selection	0~1	0	---	☆
P[n]-043	0x002B	Analog speed command zero drift compensation	-5.000~5.000	0.000	V	★
P[n]-044	0x002C	Analog speed command zero hysteresis thresholds	-5.000~5.000	0.050	V	☆
P[n]-045	0x002D	Analog torque command zero drift compensation	-5.000~5.000	0.000	V	★
P[n]-046	0x002H	Analog torque command zero hysteresis thresholds	-5.000~5.000	0.050	V	☆
P[n]-047	0x002F	Location pulse command control parameters	0~3	0	---	★
P[n]-048	0x0030	Reserved	---	---	---	---
P[n]-049	0x0031	Reserved	---	---	---	---
P[n]-050	0x0032	Encoder type selection	0~4	1[0]	---	★
P[n]-051	0x0033	Analog speed command gain	0~1000	100	---	☆
P[n]-052	0x0034	Torque/speed accelerate time	0~30000	10	100us	☆
P[n]-053	0x0035	Torque/speed decelerate time	0~30000	10	100us	☆
P[n]-054	0x0036	Factory parameters	---	---	---	---
P[n]-055	0x0037	Factory parameters	---	---	---	---
P[n]-056	0x0038	Factory parameters	---	---	---	---
P[n]-057	0x0039	Internal enable	1~3	3	---	☆
Parameters of group P[n]-1_ _						
P[n]-100	0x0100	Slave drive number setting	0~32	1	---	★
P[n]-101	0x0101	MODBUS baud rate setting	0~5	1	bps	★
P[n]-102	0x0102	MODBUS communication data format	0~8	6	---	★
P[n]-103	0x0103	Reserved	---	---	---	---
P[n]-104	0x0104	Communication protocol	0~2	0	---	★
P[n]-105	0x0105	Reserved	---	---	---	---
P[n]-106	0x0106	IO input select	0~127	0	---	☆
P[n]-107	0x0107	Communication response delay	0~32767	0	50us	☆
P[n]-108	0x0108	Reserved	---	---	---	---
P[n]-109	0x0109	DI signal status software control	0~32	1	---	☆
P[n]-110 ~ P[n]-127	0x010A ~ 0x011B	---	---	---	---	---
Parameters of group P[n]-2_ _						

Code	Address	Name	Range	Default	Unit	property
P[n]-200	0x0200	Internal speed 1	-5000~5000	10	rpm	☆
P[n]-201	0x0201	Internal speed 2	-5000~5000	50	rpm	☆
P[n]-202	0x0202	Internal speed 3	-5000~5000	100	rpm	☆
P[n]-203	0x0203	Internal speed 4	-5000~5000	500	rpm	☆
P[n]-204	0x0204	Internal speed 5	-5000~5000	0	rpm	☆
P[n]-205	0x0205	Internal speed 6	-5000~5000	0	rpm	☆
P[n]-206	0x0206	Internal speed 7	-5000~5000	0	rpm	☆
P[n]-207	0x0207	Internal speed 8	-5000~5000	0	rpm	☆
P[n]-208	0x0208	Laps of the 1st inner position command	-32768~32767	10	pulse	☆
P[n]-209	0x0209	Pulses of the 1st inner position command	-32768~32767	0	pulse	☆
P[n]-210	0x020A	Speed of the 1st inner position command	0~5000	100	rpm	☆
P[n]-211	0x020B	Acc/Dec time of the 1st inner position command	0~30000	100	ms	☆
P[n]-212	0x020C	Pause time of the 1st inner position command	0~30000	100	6ms	☆
P[n]-213	0x020D	Laps of the 2nd inner position command	-32768~32767	50	pulse	☆
P[n]-214	0x020E	Pulses of the 2ndinner position command	-32768~32767	0	pulse	☆
P[n]-215	0x020F	Speed of the 2nd inner position command	0~5000	100	rpm	☆
P[n]-216	0x0210	Acc/Dec time of the 2nd inner position command	0~30000	100	ms	☆
P[n]-217	0x0211	Pause time of the 2nd inner position command	0~30000	100	6ms	☆
P[n]-218	0x0212	Laps of the 3rd inner position command	-32768~32767	100	pulse	☆
P[n]-219	0x0213	Pulses of the 3rd inner position command	-32768~32767	0	pulse	☆
P[n]-220	0x0214	Speed of the 3rd inner position command	0~5000	500	rpm	☆
P[n]-221	0x0215	Acc/Dec time of the 3rd inner position command	0~30000	100	ms	☆
P[n]-222	0x0216	Pause time of the 3rd inner position command	0~30000	100	6ms	☆
P[n]-223	0x0217	Laps of the 4th inner position command	-32768~32767	55	pulse	☆
P[n]-224	0x0218	Pulses of the 4th inner position command	-32768~32767	0	pulse	☆
P[n]-225	0x0219	Speed of the 4th inner position command	0~5000	1000	rpm	☆
P[n]-226	0x021A	Acc/Dec time of the 4th inner position command	0~30000	100	ms	☆
P[n]-227	0x021B	Pause time of the 4th inner position command	0~30000	100	6ms	☆
P[n]-228	0x021C	Laps of the 5th inner position command	-32768~32767	60	pulse	☆
P[n]-229	0x021D	Pulses of the 5th inner position command	-32768~32767	0	pulse	☆
P[n]-230	0x021E	Speed of the 5th inner position command	0~5000	1200	rpm	☆

Code	Address	Name	Range	Default	Unit	property
P[n]-231	0x021F	Acc/Dec time of the 5th inner position command	0~30000	100	ms	☆
P[n]-232	0x0220	Pause time of the 5th inner position command	0~30000	100	6ms	☆
P[n]-233	0x0221	Laps of the 6th inner position command	-32768~32767	0	pulse	☆
P[n]-234	0x0222	Pulses of the 6th inner position command	-32768~32767	0	pulse	☆
P[n]-235	0x0223	Speed of the 6th inner position command	0~5000	0	rpm	☆
P[n]-236	0x0224	Acc/Dec time of the 6th inner position command	0~30000	100	ms	☆
P[n]-237	0x0225	Pause time of the 6th inner position command	0~30000	100	6ms	☆
P[n]-238	0x0226	Laps of the 7th inner position command	-32768~32767	0	pulse	☆
P[n]-239	0x0227	Pulses of the 7th inner position command	-32768~32767	0	pulse	☆
P[n]-240	0x0228	Speed of the 7th inner position command	0~5000	0	rpm	☆
P[n]-241	0x0229	Acc/Dec time of the 7th inner position command	0~30000	100	ms	☆
P[n]-242	0x022A	Pause time of the 7th inner position command	0~30000	100	6ms	☆
P[n]-243	0x022B	Laps of the 8th inner position command	-32768~32767	0	pulse	☆
P[n]-244	0x022C	Pulses of the 8th inner position command	-32768~32767	0	pulse	☆
P[n]-245	0x022D	Speed of the 8th inner position command	0~5000	0	rpm	☆
P[n]-246	0x022E	Acc/Dec time of the 8th inner position command	0~30000	100	ms	☆
P[n]-247	0x022F	Pause time of the 8th inner position command	0~30000	100	6ms	☆
P[n]-248	0x0230	Internal position command mode	0~3	0	---	☆
P[n]-249	0x0231	Running mode of inner position control	0~3	0	---	☆
P[n]-250	0x0232	Pause mode of inner position control	0~1	1	---	☆
P[n]-251	0x0233	Number of segments of inner position	1~8	1	---	☆
P[n]-252	0x0234	Torque arrival signal filter time	0~6000	100	10ms	☆
P[n]-253	0x0235	Undervoltage alarm filter time	0~32767	400	ms	☆
P[n]-254	0x0236	Range of positioning completion	0~32767	100	pulse	☆
P[n]-255	0x0237	Detection range of position deviation alarm	0~30000	400	pulse	☆
P[n]-256	0x0238	Speed arrival signal threshold	-5000~5000	500	rpm	☆
P[n]-257	0x0239	Detection range of overspeed	0~6000	0	rpm	☆
P[n]-258	0x023A	Servo on delay time	0~32767	0	0.1s	☆
P[n]-259	0x023B	Torque arrival signal threshold	0~300	100	%	☆
P[n]-260	0x023C	Internal torque 1	-300.00~300.00	100.00	%	☆
P[n]-261	0x023D	Internal torque 2	-300.00~300.00	100.00	%	☆

Code	Address	Name	Range	Default	Unit	property
P[n]-262	0x023E	Internal torque 3	-300.00~300.00	100.00	%	☆
P[n]-263	0x023F	Internal torque 4	-300.00~300.00	100.00	%	☆
P[n]-264	0x0240	Alarm clear restrictions	0~20	5	---	★
P[n]-265	0x0241	Reserved	---	---	---	---
P[n]-266	0x0242	Reserved	---	---	---	---
P[n]-267	0x0243	Reserved	---	---	---	---
P[n]-268	0x0244	Torque command direction	0~1	0	---	☆
P[n]-269	0x0245	Torque acceleration/ deceleration time	0~16000	10	0.1ms	☆
P[n]-270	0x0246	Reserved	---	---	---	---
P[n]-271	0x0247	Speed limit of torque mode	0~3000	1000	rpm	☆
P[n]-272	0x0248	In torque mode the permitted time for overspeed	0~10000	5000	0.1ms	☆
P[n]-273	0x0249	Zero speed	0~3000	10	rpm	☆
P[n]-274	0x024A	Zero speed hysteresis	0~1000	10	rpm	☆
P[n]-275	0x024B	Zero speed clamp mode	0~2	0	---	☆
P[n]-276	0x024C	Zero speed clamping position offset laps	-32768~32767	0	pulse	☆
P[n]-277	0x024D	Zero speed clamping position offset pulses	-32768~32767	0	pulse	☆
Parameters of group P[n]-3_ _						
P[n]-300	0x0300	Digital input DI filter time	0~100	0	---	☆
P[n]-301	0x0301	Digital input DI1 function	0~27	1	---	☆
P[n]-302	0x0302	Digital input DI2 function	0~27	2	---	☆
P[n]-303	0x0303	Digital input DI3 function	0~27	3	---	☆
P[n]-304	0x0304	Digital input DI4 function	0~27	4	---	☆
P[n]-305	0x0305	Digital input DI5 function	0~27	5	---	☆
Pn-306	0x0306	Digital input DI6 function	0~27	6	---	☆
Pn-307	0x0307	Digital input DI7 function	0~27	7	---	☆
P[n]-308	0x0308	Reserved	0~27	8	---	☆
P[n]-309	0x0309	Digital output DO1 function	0~8	1	---	☆
P[n]-310	0x030A	Digital output DO2 function	0~8	2	---	☆
P[n]-311	0x030B	Digital output DO3 function	0~8	3	---	☆
Pn-312	0x030C	Digital output DO4 function	0~8	4	---	☆
P[n]-313	0x030D	Digital input take the low to reverse [DI1~DI4]	0~15	0	---	☆
P[n]-314	0x030E	Digital input take the high to reverse [DI5~DI7]	0~15	0	---	☆
P[n]-315	0x030F	Digital output DO to reverse	0~15	0	---	☆
P[n]-316	0x0310	Factory parameters	---	---	---	---
P[n]-317	0x0311	Reserved	---	---	---	☆
P[n]-318	0x0312	Zero speed detection point of electromagnetic brake	0~5000	15	rpm	☆
P[n]-319	0x0313	Electromagnetic brake delay time when the motor is stationary	0~30000	0	ms	☆
P[n]-320	0x0314	Electromagnetic brake delay time when the motor is running	0~30000	500	ms	☆
P[n]-321	0x0315	Electromagnetic brake operation speed when the motor is running	0~5000	100	rpm	☆

Code	Address	Name	Range	Default	Unit	property
P[n]-322	0x0316	Position feedback pulse division numerator	1~32767	1	pulse	☆
P[n]-323	0x0317	Position feedback pulse division denominator	1~32767	1	pulse	☆
P[n]-324	0x0318	The width of Z pulse	0~127	0	50us	★
P[n]-325	0x0319	Reverse position feedback pulse	0~1	0	---	☆
P[n]-326	0x031A	The 2nd electronic gear ratio numerator	1~32767	1	pulse	☆
P[n]-327	0x031B	The 3rd electronic gear ratio numerator	1~32767	1	pulse	☆
P[n]-328	0x031C	The 4th electronic gear ratio numerator	1~32767	1	pulse	☆
P[n]-329	0x031D	Reserved	---	---	---	---
P[n]-330	0x031E	Reserved	---	---	---	---
P[n]-331	0x031F	Reserved	---	---	---	---
P[n]-332	0x0320	Homing startup mode	0~2	0	---	★
P[n]-333	0x0321	The homing reference point	0~3	0	---	☆
P-334	0x0322	Running mode after find the homing reference point	0~1	0	---	☆
P[n]-335	0x0323	Offset laps of homing	-3000~3000	0	pulse	☆
P[n]-336	0x0324	Offset pulses of homing	-10000~10000	0	pulse	☆
P[n]-337	0x0325	The 1st homing speed	-5000~5000	500	rpm	☆
P[n]-338	0x0326	The 2nd homing speed	-5000~5000	50	rpm	☆
P[n]-339	0x0327	Acceleration time of homing	0~10000	0	0.1ms	☆
P[n]-340	0x0328	Deceleration time of homing	0~10000	0	0.1ms	☆
P[n]-341	0x0329	Homing time limit	0~300	30.0	s	☆
P[n]-342	0x032A	Reserved	---	---	---	---
P[n]-343	0x032B	Reserved	---	---	---	---
P[n]-344	0x032C	Function of analog output (DAC1)	0~3	2	---	★
P[n]-345	0x032D	Proportional of analog output (DAC1)	-100~100	100	---	☆
P[n]-346	0x032E	Function of analog output (DAC2)	0~3	2	---	★
P[n]-347	0x032F	Proportional of analog output (DAC2)	-100~100	100	---	☆

7.2 Parameters function explanations

0 section parameters:

Code	Name	Description
E[E]-SEt	Save parameters	Save the current parameter values to non-volatile memory, for avoiding losing parameters because of power-off. Operation Instruction: Enter into the menu group of "E[E]-" and select "E[E]- SEt", press "SET" key. If "donE/FInISh" is shown on nixie tube means the driver's parameters have been saved,while if "Error" is shown, means failure.

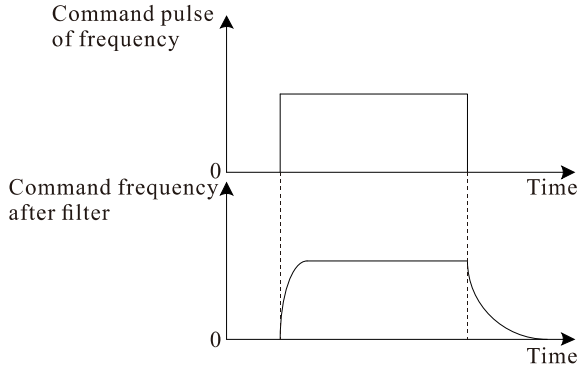
Code	Name	Description
E[E]-dEF	Recover defaults	Recover parameters of parameter table and non-volatile memory to its defaults from factory. Operation Instruction of recover defaults: Set motor model parameter "Pn-001" according to the motor adapter table (Appendix). Enter into the "E[E]-" menu group and select "EE-dEF", press "SET" key until display "StArt". If operation succeeds, "donE/FInISh" will show in 1~3 seconds, power on again.
S[r]-	Sr trail run	Set parameter of "P[n]-004" to 2 to select speed trial run mode.Enter into menu of "S[r]-",press "SET" key. Set speed command by "▲" and "▼",motor will rotate at the set speed. Positive means motor rotates in the direction of CCW, while negative means in the direction of CW. Minimum given speed is 1rpm.  Command add and subtract
J[r]-	JOG trail run	Set parameter of "Pn-004" to 3 to select JOG trial run mode. Modify parameter "P[n]-022", and set suitable JOG speed. Enter into menu of "J[r]-", the nixie tube will display "J[r] - 120", the numerical part of which is speed value set by parameter "P[n]-022",At the moment, pressing "▲" key and hold, motor will rotate in the direction of CCW at constant setting speed. Release the button, motor will be in the state of zero-speed locked. While pressing "▼" key and hold, motor will rotate in the direction of CW at constant setting speed. Release the button, motor will be in the state of zero-speed locked.
A[U]-SPd	Analog speed zero drift compensation	In the analog speed control mode, even if the analog command voltage is 0V,sometimes motor still rotates at tiny speed, because of common ground voltage difference. It can be compensated automatically. Operation: Enter into menu of "AU-". Choose the submenu of "AU-SPd", and press "SET" key, until "donE/FInISh" is displayed on nixie tube, compensation value will be write to parameter "P[n]-043".Then save parameter values to non-volatile memory.
A[U]-trq	Analog torque zero drift compensation	In the analog torque control mode, even if the analog command voltage is 0V, sometimes motor still rotates at tiny speed, because of common ground voltage difference. It can be compensated automatically. Operation: Enter into menu of "A[U]-". Choose the submenu of "A[U]-trq", and press "SET" key, until "donE/FInISh" is displayed on nixie tube, compensation value will be write to parameter "P[n]-045".Then save parameter values to non-volatile memory.
F[n]-Err	Historical alarms	The parameter stores the last five alarms. Enter into menu of "F[n]-", choose the submenu of "Fn- Err",press "SET" key, the nixie tube will display alarm code. Switching alarm code by "▲" and "▼".

Parameter of group P[n]-0_ _

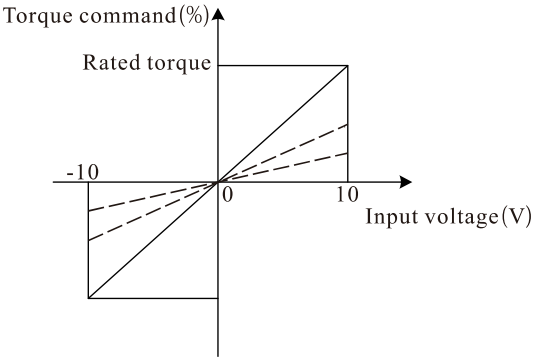
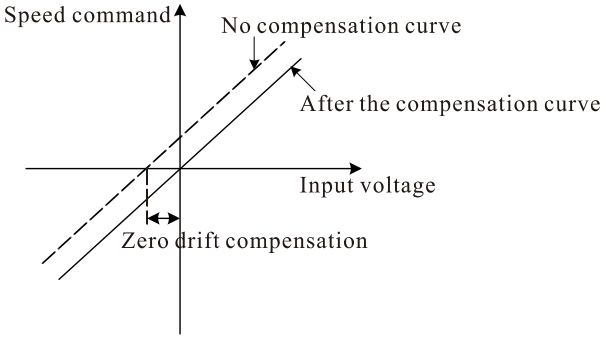
Code	Name	Description
P[n]-000	Password	User password is 288 which can modify all parameters of group 0.The wrong password can not visit those parameters.
P[n]-001	Motor model	Set the corresponding motor model code according to the motor adaptation table (Appendix), and it can be used to recover the default settings of the correlated parameters.
P[n]-002	Software version (read-only)	The version code for the driver software, it is read-only parameter which can't be modified.

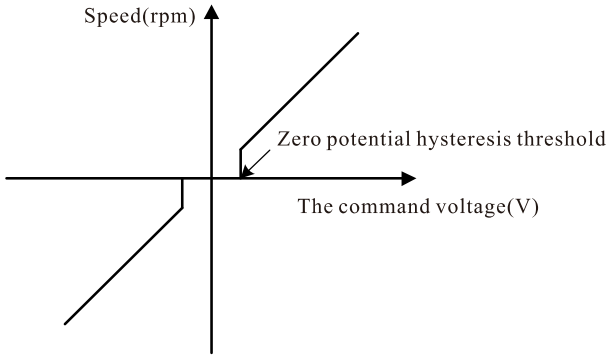
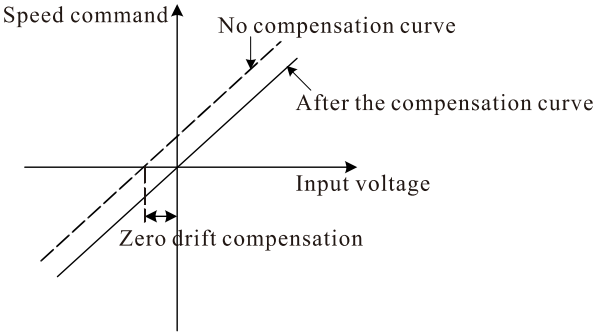
<table>
<tr><th>Code</th><th>Name</th><th>Description</th></tr>
<tr><td>P[n]-003</td><td>Initial display content</td><td>Parameter function: select the initial display contents when power-on:
<table>
<tr><td>0: Motor running speed</td><td>13: Position command pulse frequency.</td></tr>
<tr><td>1: Present position low 5 bit.</td><td>14: Speed command</td></tr>
<tr><td>2: Present position high 5 bit.</td><td>15: Torque command</td></tr>
<tr><td>3: Position command low 5bit</td><td>16: Encoder position</td></tr>
<tr><td>4: Position command high 5 bit</td><td>17: Encoder U,V,W signal</td></tr>
<tr><td>5: Position deviation low 5 bit</td><td>18: FPGA software version.</td></tr>
<tr><td>6: Position deviation high 5 bit</td><td>19: Alarm code</td></tr>
<tr><td>7: Motor torque</td><td>20: Reserved</td></tr>
<tr><td>8: Motor current</td><td>21: Reserved</td></tr>
<tr><td>9: Digital input status of DI4~DI5[DI5~DI7].</td><td>22: Encoder zero calibration (EMA: Reserved)</td></tr>
<tr><td>10: Digital input status of DI1~DI3[DI1~DI4].</td><td>23: Absolute encoder internal alarm</td></tr>
<tr><td>11: Digital output status.</td><td>24: Many circle absolute value encoder internal alarm</td></tr>
<tr><td>12: Control mode</td><td></td></tr>
</table></td></tr>
<tr><td>P[n]-004</td><td>Control mode selection</td><td>Used to set control mode. (If the setting value is 8, 9 or 10, refer to the CMODE signal in chapter 7.3.)
<table>
<tr><td>0: Position control mode</td><td>6: Torque control mode.</td></tr>
<tr><td>1: Speed control mode.</td><td>7: Open-loop control mode.</td></tr>
<tr><td>2: Sr trail run mode.</td><td>8: Position/speed mode.</td></tr>
<tr><td>3: JOG trail run mode.</td><td>9: Speed/torque mode.</td></tr>
<tr><td>4: Reserved</td><td>10: Torque/position mode.</td></tr>
<tr><td>5: Analog speed control mode</td><td></td></tr>
</table></td></tr>
<tr><td>P[n]-005</td><td>Speed proportional gain</td><td>● The higher the speed proportional gain is, the greater the stiffness is, and the faster the speed response is. But if it’s over high, it may lead to big noise and vibration.
● Under the condition of not shocking the system, set the value relatively large as possible.</td></tr>
<tr><td>P[n]-006</td><td>Speed integral time constant</td><td>● It is the integral time constant for the speed regulator. The lower the value sets, the faster the integral speed is, and the greater the stiffness is. But if it’s too large, noise and vibration will easily generate.
● Under the condition of not shocking the system, reduce the value as possible.</td></tr>
<tr><td>P[n]-007</td><td>Torque command filter</td><td>● 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.</td></tr>
</table>

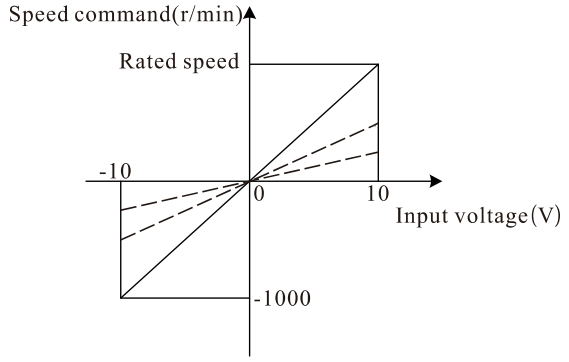
Code	Name	Description
P[n]-008	Speed feedback filter	● Set the features of torque command filter, which can restrain resonance produced by torque fluctuations. (motor generates shake and sharp noise) ● If the motor generates shake and sharp noise, reduce the parameter value. ● The smaller the value is, 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.
P[n]-009	Position proportional gain	The proportional gain of position loop adjuster. The larger the value is, the higher the gain proportion is, the larger the stiffness is, and the smaller the position tracking error is. But too large value may produce vibration and overstrike.
P[n]-010	Position feed forward gain	● Feedback 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 0 at any command pulse frequency. ● If the feedback forward gain of position loop is too large, the system position loop will be unstable and easy to produce shakes. Generally, the position loop feed forward gain is 0.
P[n]-011	Position feed forward low pass filter cut-off frequency	The cut-off frequency of position loop feedback forward low pass filter. It is used to increase the stability of compounding position control.
P[n]-012	Electronic Gear Ratio numerator	Take incremental encoder as example: ● Under position control mode, take fractional frequency or frequency doubling to match with various pulse sources conveniently and get the proper pulse resolution ratio which users demand. ● P×G=N×C×4 P: Input command pulse N: Motor rotation rpm G: Electronic gear ratio $G = \frac{P[n]-012}{P[n]-013}$ C: Optical-electricity encoder line number per rotation, this system C=2500. ● The recommended range is: 1/50≤G≤50.
P[n]-013	Electronic Gear Ratio denominator	
P[n]-014	Pulse input mode of position command	Set input way of position command pulse: 0: Pulse +code 1: CCW pulse/CW pulse 2: Two phase orthogonal pulse input
P[n]-015	Reverse pulse direction of position command	Set the direction of position command: 0: Normal 1: Reverse the direction of position command pulse

<table>
<tr><th>Code</th><th>Name</th><th>Description</th></tr>
<tr><td>P[n]-019</td><td>Position command smooth filter</td><td>To do smooth filtering to command pulse, with the exponential style of acceleration and deceleration.
The filter will not lose input pulse, but the command may be lagged.
The filter is used:
1. Upper controller doesn’t have acceleration or deceleration features.
2. Electronic gear radio is relatively large (>10)
3. Command frequency is relatively low
4. Jump of jitter when motor runs
The filter is out of use when this parameter is set to be zero.
 
</td></tr>
<tr><td>P[n]-020</td><td>Drive forbid input invalid selection</td><td>It is set as follows:
0: CCW, CW input forbid is valid.
1: CCW, CW input forbid is invalid.
2: Factory parameters.</td></tr>
<tr><td>P[n]-022</td><td>JOG run speed</td><td>It is used to set the value of JOG speed.</td></tr>
<tr><td>P[n]-023</td><td>Maximum speed limit</td><td>● 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.</td></tr>
<tr><td>P[n]-024</td><td>Speed command setting</td><td>0:Analog speed mode
1 :Internal speed mode. Select respective internal speed by signals SC1,SC2 and SC3.
<table>
<tr><th>SC3</th><th>SC2</th><th>SC1</th><th>Speed command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>Internal speed 1: P[n]-200</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>Internal speed 2: P[n]-201</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>Internal speed 3: P[n]-202</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>Internal speed 4: P[n]-203</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>Internal speed 5: P[n]-204</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>Internal speed 6: P[n]-205</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>Internal speed 7: P[n]-206</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>Internal speed 8: P[n]-207</td></tr>
</table>
2: Internal speed+Analog speed mode.
<table>
<tr><th>SC3</th><th>SC2</th><th>SC1</th><th>Speed command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>Analog speed command input</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>Internal speed 2: P[n]-201</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>Internal speed 3: P[n]-202</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>Internal speed 4: P[n]-203</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>Internal speed 5: P[n]-204</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>Internal speed 6: P[n]-205</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>Internal speed 7: P[n]-206</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>Internal speed 8: P[n]-207</td></tr>
</table></td></tr>
<tr><td>P[n]-025</td><td>Position command setting</td><td>0: Pulse input position control.
1: Internal position control.</td></tr>
</table>

<table>
<tr><th>Code</th><th>Name</th><th>Description</th></tr>
<tr><td>P[n]-026</td><td>Torque command setting</td><td>0: Analog torque mode.
1: Internal torque mode. Select internal torque command through TRQ1 and TRQ2
<table>
<tr><th>TRQ2</th><th>TRQ1</th><th>Torque command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Internal torque 1: P[n]-260</td></tr>
<tr><td>OFF</td><td>ON</td><td>Internal torque 2: P[n]-261</td></tr>
<tr><td>ON</td><td>OFF</td><td>Internal torque 3: P[n]-262</td></tr>
<tr><td>ON</td><td>ON</td><td>Internal torque 4: P[n]-263</td></tr>
</table>
2: Internal torque+analog torque mode.
<table>
<tr><th>TRQ2</th><th>TRQ1</th><th>Torque command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Analog torque command input</td></tr>
<tr><td>OFF</td><td>ON</td><td>Internal torque 2: P[n]-261</td></tr>
<tr><td>ON</td><td>OFF</td><td>Internal torque 3: P[n]-262</td></tr>
<tr><td>ON</td><td>ON</td><td>Internal torque 4: P[n]-263</td></tr>
</table></td></tr>
<tr><td>P[n]-027</td><td>Torque limit mode</td><td>0: Basic limit. Whether the external CCW/CW torque limit is valid decided by signals TCCW and TCW.In the Sr and JOG mode, it also be limited by P[n]-038.
<table>
<tr><td>TCCW=ON: Limited by P[n]-034 and P[n]-036.
TCCW=OFF: Limited by P[n]-034.</td><td>TCW=ON: Limited by P[n]-035 and P[n]-037.
TCW=OF: Limited by P[n]-035.</td></tr>
</table>
1: Basic limit +Analog torque limit.
2: Basic limit +Internal torque limit. Select internal torque through TRQ1 and TRQ2.
Note: A plurality of limit occurs , the final limit value is the minimum. The limit of P[n]-034 and P[n]-035 are effective at any time.
If the limit value exceeds the maximum allowable torque, the actual torque is limited to a maximum torque.</td></tr>
<tr><td>P[n]-028</td><td>Speed limit mode</td><td>Set the speed limit mode in torque control mode.
0: Basic limit. Parameter Pn-023 as the limit.
1: Basic limit + Analog speed limit.
2: Basic limit +Internal speed limit. Select internal speed through SC1,SC2 and SC3.</td></tr>
<tr><td>P[n]-029</td><td>Speed command filter</td><td>● Set the features of speed command filter.
● If the motor generates vibration and noise, please reduce the parameter value.
● The smaller the value is, the lower the cut-off frequency is, the lower the noise is. If the load inertia is too big, reduce the parameter value properly. If the value is too small, the response will slow down and cause instability.
● To the contrary, the larger the value is, the higher the cut-off frequency is, the faster the response is. If you need relatively higher machinery stiffness, increase the setting value properly.</td></tr>
<tr><td>P[n]-031</td><td>Analog speed command filter coefficients</td><td>To the analog speed command low-pass filtering, smooth command to avoid interference. The larger the parameter value, the stronger the filtering effect.</td></tr>
<tr><td>P[n]-032</td><td>Analog torque command</td><td>To the analog torque command low-pass filtering, smooth command to avoid interference. The larger the parameter value, the stronger the filtering effect.</td></tr>
<tr><td>P[n]-033</td><td>Processing method of overspeed in torque mode</td><td>It is used to set the processing method when exceeding the limiting speed in torque mode.
0: Motor speed is controlled at speed limit value.
1: Alarm (Err7) if overspeed.</td></tr>
</table>

Code	Name	Description
P[n]-034	Internal CCW torque limit	● 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.
P[n]-035	Internal CW torque limit	
P[n]-036	External CCW torque limit	● 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.
P[n]-037	External CW torque limit	
P[n]-038	Torque limit for speed trial run and JOG trial run	● 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.
P[n]-041	Analog torque command gain	Set analog torque proportional relations between command voltage and actual torque command. Analog input range -10V~10V, setting 100%, 10V input voltage corresponding to rated torque. 
P[n]-042	Speed command direction selection	0: Speed direction is control by CINV. 1: Speed direction is control by the combination of SDIR2 and SDIR1.
P[n]-043	Analog speed command zero drift compensation	● When input speed command is zero, change this parameter can eliminate speed command analog slip. ● By A[U]-SPd can realize auto compensation. ● Manual compensation: Enable servo motor, motor operating in analog torque mode. Check value d[P]-CS, according to d[P]-CS value switch to voltage manual revise P[n]-043 parameter. 

<table>
<tr><th>Code</th><th>Name</th><th>Description</th></tr>
<tr><td>P[n]-044</td><td>Analog speed command zero hysteresis thresholds</td><td>Set the threshold of analog input. If the analog input is smaller than the parameter value, the motor will be locked.
 
</td></tr>
<tr><td>P[n]-045</td><td>Analog torque command zero drift compensation</td><td>● When input torque command is zero, change this parameter can eliminate speed command analog slip.
● By A[U]-trq can realize auto compensation.
● Manual compensation: Enable servo motor, motor operating in analog torque mode. Check value d[P]-Ct, according to d[P]-Ct value switch to voltage manual revise P[n]-045 parameter.
 
</td></tr>
<tr><td>P[n]-046</td><td>Analog torque command zero hysteresis thresholds</td><td>In analog torque mode, set analog torque command input zero offset compensation value. When analog torque input small than set value, torque command value is zero (refer to P-044).</td></tr>
<tr><td>P[n]-047</td><td>Location pulse command control parameters</td><td>Set the phase of PULS and DIR signals.
<table>
<tr><th>P[n]-047</th><th>PULSE</th><th>DIR</th></tr>
<tr><td>0</td><td>In phase</td><td>In phase</td></tr>
<tr><td>1</td><td>Out of phase</td><td>In phase</td></tr>
<tr><td>2</td><td>In phase</td><td>Out of phase</td></tr>
<tr><td>3</td><td>Out of phase</td><td>Out of phase</td></tr>
</table></td></tr>
<tr><td>P[n]-050</td><td>Encoder type selection</td><td>Encoder model selection as following:
0: Incremental encoder
1: TAMAGAWA wire-saving encoder
2: Reserved
3: Absolute encoder
4: Resolver</td></tr>
</table>

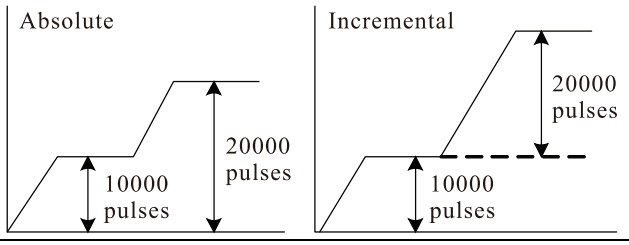
<table>
<tr><th>Code</th><th>Name</th><th>Description</th></tr>
<tr><td>P[n]-051</td><td>Analog speed command gain</td><td>● Set the ratio between speed command voltage and motor actual revolving speed.
● Analog input value: -10V~10V. Set 100%, 10V voltage input corresponding to rated speed.
 
</td></tr>
<tr><td>P[n]-052</td><td>Torque/speed accelerate time</td><td rowspan="2">Accelerate/Decelerate time of torque/speed control mode.</td></tr>
<tr><td>P[n]-053</td><td>Torque/speed decelerate time</td></tr>
<tr><td>P[n]-057</td><td>Internal enable</td><td>Parameter meanings:
P[n]-057=3: only if SV_EN is ON, the motor can be compelled to enable. P[n]-057=2: software compels to enable.</td></tr>
</table>

Parameter of group P[n]-1_ _

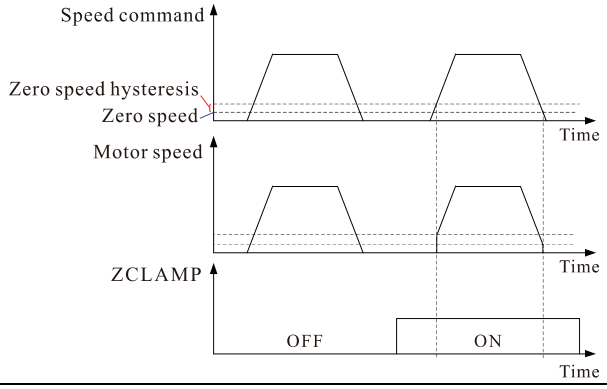
<table>
<tr><th>Code</th><th>Name</th><th>Description</th></tr>
<tr><td>P[n]-100</td><td>Slave drive number setting</td><td>Set this drive address, 0 is broadcast address, drive received data, but no feedback</td></tr>
<tr><td>P[n]-101</td><td>MODBUS baud rate setting</td><td>Modbus communication baud ratio selection:
<table>
<tr><td>0: 4800bps</td><td>1: 9600bps</td><td>2: 19200bps</td></tr>
<tr><td>3: 38400bps</td><td>4: 57600bps</td><td>5: 115200bps</td></tr>
</table></td></tr>
<tr><td>P[n]-102</td><td>MODBUS communication data format</td><td>Communication data format selection:
0: 7-N-2(ASCII), 7 bits data, no parity bit, 2 bits stop bit
1: 7-E-1(ASCII), 7 bits data, even parity bit, 1 bit stop bit
2: 7-O-1(ASCII), 7 bits data, odd parity bit, 1 bit stop bit
3: 8-N-2(ASCII), 8 bits data, no parity bit, 2 bits stop bit
4: 8-E-1(ASCII), 8 bits data, even parity bit, 1 bit stop bit
5: 8-O-1(ASCII), 8 bits data, odd parity bit, 1 bit stop bit
6: 8-N-2(RTU), 8 bits data, no parity bit, 2 bits stop bit
7: 8-E-1(RTU), 8 bits data, even parity bit, 1 bit stop bit
8: 8-O-1(RTU), 8 bits data, odd parity bit, 1 bit stop bit</td></tr>
<tr><td>P[n]-104</td><td>Communication protocol</td><td>P[n]-104=0: Standard MODBUS communication protocol.</td></tr>
<tr><td>P[n]-106</td><td>IO input select</td><td>Bit-controlling P[n]-106= bit6×64+bit5×32+ bit4×16+bit3×8+bit2×4 +bit1×2+bit0, bit0~bit6 separately corresponding to DI1~DI7:
0: IO signal input from external terminal.
1: IO signal input from software
<table>
<tr><td></td><td>bit6</td><td>bit5</td><td>bit4</td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr>
<tr><td></td><td>DI7</td><td>DI6</td><td>DI5</td><td>DI4</td><td>DI3</td><td>DI2</td><td>DI1</td></tr>
<tr><td>P[n]-106 (DI1 state is controlled by P[n]-109)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
</table>
P[n]-106(DI1 signal input from software.).</td></tr>
</table>

<table>
<tr><th>Code</th><th>Name</th><th>Description</th></tr>
<tr><td>P[n]-107</td><td>Communication response delay</td><td>Driver receives upper computer data, delay output responding data time.</td></tr>
<tr><td>P[n]-109</td><td>Slave drive number setting</td><td>Bit-controlling P[n]-106= bit6×64+bit5×32+ bit4×16+bit3×8+bit2×4 +bit1×2+bit0. When IO input select software input, the relative position of the parameter is digital input signal (refer to P[n]-106).
<table>
<tr><td></td><td>bit6</td><td>bit5</td><td>bit4</td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr>
<tr><td></td><td>DI7</td><td>DI6</td><td>DI5</td><td>DI4</td><td>DI3</td><td>DI2</td><td>DI1</td></tr>
<tr><td>P[n]-106 (DI1 state is controlled by P[n]-109)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>bit0 of "Pn-109") (The status of DI1 is 0) (x=0 or 1)</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>0</td></tr>
</table></td></tr>
</table>

Parameter of group P[n]-2_ _

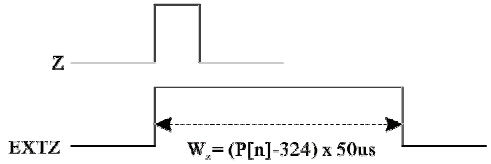
<table>
<tr><th>Code</th><th>Name</th><th>Description</th></tr>
<tr><td>P[n]-200</td><td>Internal speed 1</td><td rowspan="8">In internal speed mode, SC1, SC2, SC3 to choose internal running speed, it needs to define input IO port separately input SC1, SC2, SC3 signal (refer to P[n]-301~P[n]-307 and Chapter7.3).</td></tr>
<tr><td>P[n]-201</td><td>Internal speed 2</td></tr>
<tr><td>P[n]-202</td><td>Internal speed 3</td></tr>
<tr><td>P[n]-203</td><td>Internal speed 4</td></tr>
<tr><td>P[n]-204</td><td>Internal speed 5</td></tr>
<tr><td>P[n]-205</td><td>Internal speed 6</td></tr>
<tr><td>P[n]-206</td><td>Internal speed 7</td></tr>
<tr><td>P[n]-207</td><td>Internal speed 8</td></tr>
<tr><td>P[n]-208</td><td>Laps of the 1st inner position command</td><td rowspan="2">In inner position control mode, the parameters is used for setting the 1st position command. The calculation method of position pluses is set by parameter P[n]-248.In inner position control mode, select respective inner position by signals SP1 ,SP2 and SP3.</td></tr>
<tr><td>P[n]-209</td><td>Pulses of the 1st inner position command</td></tr>
<tr><td>P[n]-210</td><td>Speed of the 1st inner position command</td><td>The motor speed when running the first position command.</td></tr>
<tr><td>P[n]-211</td><td>Acc/Dec time of the 1st inner position command</td><td>The acceleration/deceleration time when running the first position command.</td></tr>
<tr><td>P[n]-212</td><td>Pause time of the 1st inner position command</td><td>The pause time when running the first position command.</td></tr>
<tr><td>P[n]-213
~
P[n]-247</td><td>Internal position 2
~
Internal position 8</td><td>Refer to parameters P[n]-208 ~ P[n]-212.</td></tr>
<tr><td>P[n]-248</td><td>Internal position command mode</td><td>0: Absolute position. (Laps×10000+ Pulses)
1: Incremental position.(Laps×10000+ Pulses)
2: 32-bit absolute position. (Laps×65536+ Pulses)
3: 32-bit Incremental position.(Laps×65536+ Pulses)
The difference of absolute and incremental:
 
</td></tr>
</table>

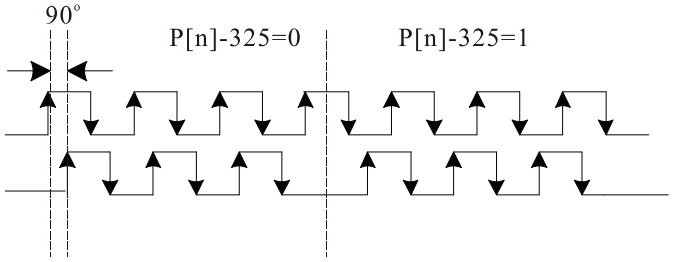
Code	Name	Description
P[n]-249	Running mode of inner position control	0: When CNTR signal is detected a valid jump, servo drive runs once with the number of the position segment set by P[n]-251,and finally stopped at the first location. 1: In this mode, if the signal CNTR is valid, the drive will always loop runs with the number of the position segment set by P[n]-251 until CNTR becomes invalid. 2: In this mode, SP1, SP2 and SP3 are set to specify the running position, the falling edge of signal CNTR start running. This mode does not controlled by P[n]-251. 3: If SP3 signal is detected a valid jump, servo drive runs to the first location; SP2 signal is detected a valid jump, servo drive runs to the previous location, if it is the first location, stop here; SP1 signal is detected a valid jump, servo drive runs to the next location, if it is the last location, stop here.
P[n]-250	Pause mode of inner position control	0: When inner position running is suspended and started again, the servo drive will continue running remaining position pluses. 1: When inner position running is suspended and started again, the servo drive will back to the first position. **Note:** This parameter is used to P[n]-249=0 and P[n]-249=1.
P[n]-251	Number of segments of inner position	In inner position control mode, the parameter is use for setting the number of running position segments.(Refer to parameter P[n]-249.)
P[n]-252	Torque arrival signal filter time	In torque control mode, when the motor torque exceeds the value of P[n]-259,and maintains a certain time set by P[n]-252, the signal state of SV_S is ON, else SV_T is OFF.
P[n]-253	Undervoltage alarm filter time	When undervoltage signal is detected, servo driver output alarm signal after specified time is delayed.
P[n]-254	Range of positioning completion	In the position control mode, servo driver output positioning completion signal "SV_F" when the position deviation is equal to or less than the value of P[n]-254.
P[n]-255	Detection range of position deviation alarm	● In position control mode, servo driver will output the alarm signal (Err8) when the position deviation is equal to or greater than the value of P[n]-255. ● It will do not alarm when the parameter's value is 0.
P[n]-256	Speed arrival signal threshold	● No relation with rotation direction. Comparator has hysteresis effect. ● In speed control mode, if motor speed exceeds this value, the signal "SV_S"is ON, otherwise OFF.
P[n]-257	Detection range of overspeed	● In speed control mode, When the speed deviation surpasses this parameter value, the servo drive will release overspeed alarm signal.(Err7). ● It will not alarm when the parameter's value is 0.
P[n]-258	Servo on delay time	Delay time from receiving the enable signal to enable the drive.
P[n]-259	Torque arrival signal threshold	In torque control mode, if motor torque exceeds this value, the signal "SV_T" is ON, otherwise OFF.
P[n]-260	Internal torque 1	In internal torque control mode, select respective internal torque command by signals TRQ1 and TRQ2. (Refer to chapter 7.3)
P[n]-261	Internal torque 2	
P[n]-262	Internal torque 3	
P[n]-263	Internal torque 4	
P[n]-264	Alarm clear restrictions	Set the number of alarm clearance. Signal RSTSV is used to clear alarms, however, if the number of operations exceed the value of P[n]-264, the alarm can not be cleared. (Notice：Parts of the alarms can be cleared.)
P[n]-268	Torque command direction	0: Normal. 1: Inverse.

Code	Name	Description
P[n]-269	Torque acceleration/ deceleration time	Torque acceleration/deceleration time.
P[n]-271	Speed limit of torque mode	Set the speed limit of servo motor of torque control mode.The actual value of the speed limit is the smaller of P[n]-271 and P[n]-023.
P[n]-272	In torque mode the permitted time for overspeed	In torque mode, the parameter is used to set the permitted time of exceeding the speed limit.
P[n]-273	Zero speed	Conditions of zero speed clamp: 1.In the speed control mode. 2.The signal ZCLMP is valid (ON). 3.The motor speed less than the zero speed value (P[n]-273). 
P[n]-274	Zero speed hysteresis	Comparator has hysteresis characteristics, if the speed is clamped,the drive will exit the clamp when motor speed greater than the value of P[n]-273 + P[n]-274.
P[n]-275	Zero speed clamp mode	0: After zero speed clamp is valid, the motor speed is forced to 0,it still in speed control mode, and the motor can be rotated by external force. 1: Motor is fixed in the instant of zero speed clamp, then the drive switch to position control mode, if motor be rotated because of external force, it will back to the fixed position. 2:In this mode, if zero speed clamp is valid ,the stop position of motor is respect to the Z pulse, the position is controlled by parameters P[n]-276 and P[n]-277. Drive switch to position control mode, if motor be rotated because of external force, it will back to the fixed position.(Refer to parameters P[n]-276 and P[n]-277.)
P[n]-276	Zero speed clamping position offset laps	These parameters are used to zero speed clamp function. The offset pulses is respect to the Z pulse. Offset pulses = P[n]-276×10000+ P[n]-277. Set value is positive, motor rotate in CCW. Set value is negative, motor rotate in CW.
P[n]-277	Zero speed clamping position offset pulses	

Parameter of group P[n]-3_ _

Code	Name	Description
P[n]-300	Digital input DI filter time	When environmental noise is loud, improve set value can increase reliability. If the value is too big, it will affect responding time.
P[n]-301 ~ P[n]-307	Digital input DIn function	Digital input IO function setting, refer to chapter 7.3, set to 0 there is no function.
P[n]-309 ~ P[n]-312	Digital output DOn function	Digital output IO function setting, refer to chapter 7.4, set to 0 there is no function.

<table>
<tr><th>Code</th><th>Name</th><th>Description</th></tr>
<tr><td>P[n]-313</td><td>Digital input take the low to reverse (DI1~DI4)</td><td>Binary system display, position corresponding, relevant position is 1 contrary:
<table>
<tr><td></td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr>
<tr><td></td><td>DI4</td><td>DI3</td><td>DI2</td><td>DI1</td></tr>
<tr><td>DI1 DI2 contrary</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
</table></td></tr>
<tr><td>P[n]-314</td><td>Digital input take the high to reverse (DI5[DI5~DI7])</td><td>Binary system display, position corresponding, relevant position is 1 negation:
<table>
<tr><td></td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr>
<tr><td></td><td>Reserved</td><td>Reserved [DI7]</td><td>Reserved [DI6]</td><td>DI5</td></tr>
<tr><td>DI5 negation</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
</table></td></tr>
<tr><td>P[n]-315</td><td>Digital output DO to reverse</td><td>Binary system display, position corresponding, relevant position is 1 negation:
<table>
<tr><td></td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr>
<tr><td></td><td>Reserved[DI4]</td><td>DI3</td><td>DI2</td><td>DI1</td></tr>
<tr><td>DI2 negation</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
</table></td></tr>
<tr><td>P[n]-318</td><td>Zero speed detection point of electromagnetic brake</td><td>This parameter only use for electromagnetic brake sequence judge, when motor running speed (irrelevant to direction) lower than the set parameter, motor speed is regard to zero, motor stop running. (refer to chapter 7.3, BRK signal output)</td></tr>
<tr><td>P[n]-319</td><td>Electromagnetic brake delay time when the motor is stationary</td><td>● When system from enable state to not enable or alarming, define the delay time motor quiescent period (motor speed<P[n]-318) from electromagnetic brake (DO output terminal BRK OFF) to motor currency cut out.
● Cutting the currency after the brake reliable stop, to avoid motor infinitesimal displacement or dropping. Parameter should not smaller than mechanical brake delay time.
● Relevant sequence refer to chapter 7.3, BRK signal output.</td></tr>
<tr><td>P[n]-320</td><td>Electromagnetic brake delay time when the motor is running</td><td rowspan="2">● When system from enable state to not enable or alarming, define the delay time motor quiescent period (motor speed>=P[n]-318) from electromagnetic brake (DO output terminal BRK OFF) to motor currency cut out.
● The parameter lets motor decelerate from high speed rotating to low speed, then braking, avoid damage brake.
● Actual move time is P[n]-320 or motor decelerate to P[n]-321 needed time, take the lower one.
● Relevant sequence refer to chapter 7.3, BRK signal output.</td></tr>
<tr><td>P[n]-321</td><td>Electromagnetic brake operation speed when the motor is running</td></tr>
<tr><td>P[n]-322</td><td>Position feedback pulse division numerator</td><td rowspan="2">Take incremental photoelectricity encoder as an example:
Position feedback pulse output frequency dividing ratio, when P[n]-322>P[n]-323, according to 1:1 frequency demultiplication output.
Encoder feedback pulse electronic gear ratio $=\frac{M}{N}=\frac{P[n]-322}{P[n]-323}$, take 2500 line code wheel as an example, $\frac{M}{N}=\frac{2000}{2500}$, means motor rotate one circle, driver output 2000 pulse.</td></tr>
<tr><td>P[n]-323</td><td>Position feedback pulse division denominator</td></tr>
<tr><td>P[n]-324</td><td>The width of Z pulse</td><td>Set null pulse width, null pulse width decrease when motor speed increase, adjust null pulse width according to actual running state, convenient to match various upper computers.
 
</td></tr>
</table>

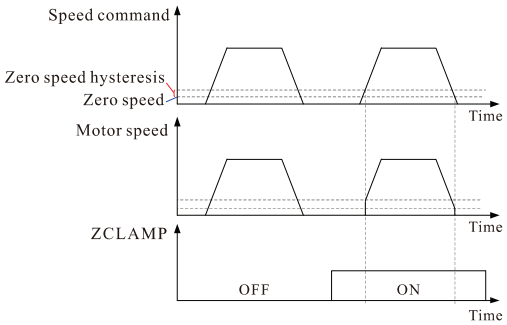
Code	Name	Description
P[n]-325	Reverse position feedback pulse	Position feedback pulse direction: 0: CN1 position feedback output signal EXTA,EXTB phase relation invariant; 1: CN1 position feedback output signal EXTA, EXTB phase relation negation. 
P[n]-326	The 2nd electronic gear ratio numerator	Parameter description refer to P[n]-012 and P[n]-013.The selection of electronic gear ratio by input IO signals GEAR1 and GEAR2. (Refer to chapter 7.3.)
P[n]-327	The 3rd electronic gear ratio numerator	
P[n]-328	The 4th electronic gear ratio numerator	
P[n]-332	Homing startup mode	0: Close homing function. 1: Start homing when the servo drive is powered on and enabled for the first time. 2: Start homing by IO signal "SHOM".
P[n]-333	The homing reference point	0: Motor rotates in the direction of CW, and the signal CCWI as the homing reference point. 1: Motor rotates in the direction of CCW, and the signal CWI as the homing reference point. 2: Motor rotates in the direction of CW, and the signal ORGP as the homing reference point. 3: Motor rotates in the direction of CCW, and the signal ORGP as the homing reference point.
P-334	Running mode after find the homing reference point	0: After find the homing reference point ,reverse to find the Z pulse. 1: After find the homing reference point ,in the same direction to find the Z pulse. **Note:** ● If CCWI and CWI signals as the homing reference point, drive will reverse to find Z pulse regardless of the value of the parameter. ● When reverse to find Z pulse, if the homing reference point signal is still valid, drive does not detect Z pulse until the signal is invalid.
P[n]-335	Offset laps of homing	These parameters are used to homing function. The offset pulses is respect to the Z pulse. If P[n]-248=0 or P[n]-248=1: Offset pulses = Pn-335×10000+ Pn-336. If P[n]-248=2 or P[n]-248=3: Offset pulses = Pn-335×65536+ Pn-336. Motor rotates in the direction of CW, after find the Z pulse: (1) Set value is positive, motor rotate in CCW. (2) Set value is negative, motor rotate in CW. Motor rotates in the direction of CCW, after find the Z pulse: (1) Set value is positive, motor rotate in CW. (2) Set value is negative, motor rotate in CCW.
P[n]-336	Offset pulses of homing	
P[n]-337	The 1st homing speed	The motor speed of looking for the homing reference point.
P[n]-338	The 2nd homing speed	The parameter is used to set motor speed of finding Z pulse after finding the homing reference point.
P[n]-339	Acceleration time of homing	Acceleration/Deceleration time of homing.

Code	Name	Description
P[n]-340	Deceleration time of homing	Acceleration/Deceleration time of homing.
P[n]-341	Homing time limit	If within the time set by the parameter P[n]-341 , homing operation is not completed , output alarm signal (Err24)
P[n]-344	Function of analog output (DAC1)	P[n]-344=0: Motor speed(+/-10 V/Rated speed) P[n]-344=1: Motor torque (+/-10 V/Rated torque) P[n]-344=2: Speed command(+/-10 V/ Rated speed) P[n]-344=3: Torque command (+/-10 V/ Rated torque) e.g.: P[n]-344= 0 (DAC1 output motor speed), voltage of DAC1 is V1, $\text{Motor speed} = (\text{Rated speed} \times \frac{V1}{10}) \times \frac{P[n]-345}{100}$
P[n]-345	Proportional of analog output (DAC1)	
P[n]-346	Function of analog output (DAC2)	P[n]-346=0: Motor speed(+/-10 V/Rated speed) P[n]-346=1: Motor torque (+/-10 V/Rated torque) P[n]-346=2: Speed command(+/-10 V/ Rated speed) P[n]-346=3: Torque command (+/-10 V/ Rated torque) e.g.: P[n]-346= 0 (DAC2 output motor speed), voltage of DAC2 is V2, $\text{Motor speed} = (\text{Rated speed} \times \frac{V2}{10}) \times \frac{P[n]-347}{100}$
P[n]-347	Proportional of analog output (DAC2)	

7.3 Digital input DI function definition

Note: Digital input DI state expressive methods.

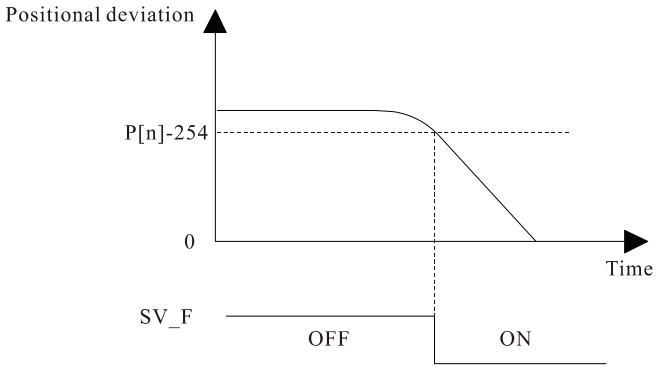
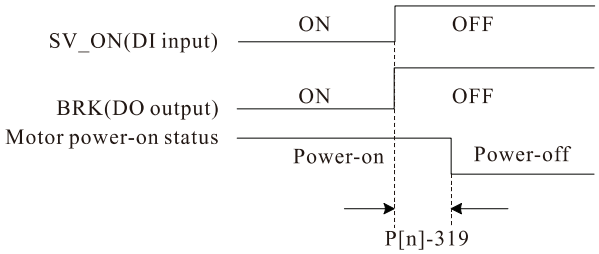
OFF: On-off state is disconnect circuit ON: On-off state is connect circuit

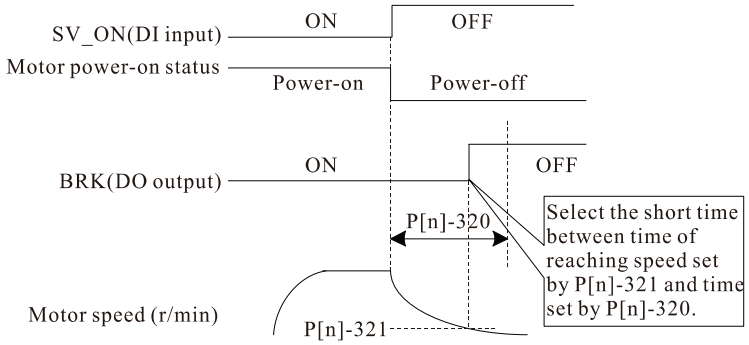
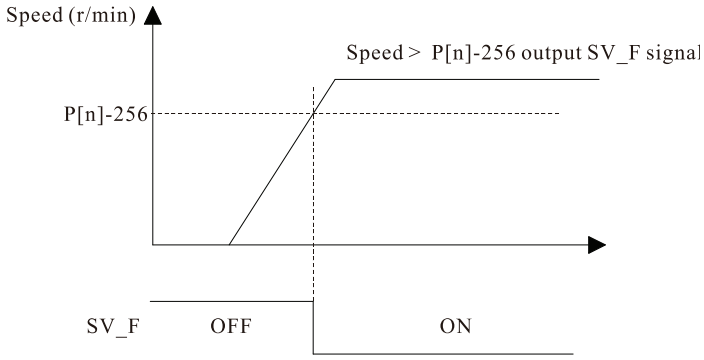
Set value	Symbol	Function description
1	SV_ON	Servo motor enable: when this signal connected, servo motor enabled.
2	RSTSV	Alarms clear. Parts of alarms are cleared when RSTSV signal is ON. (The alarms can be cleared are Err7, Err8, Err9, Err14, Err15, Err16, Err18 and Err24.)
3	CCWI	CCWL, P[n]-020=0 drive limit is invalid, servo motor reverse running, Err15 alarm when it detected CCWI signal is ON. P[n]-020=1, CCWL input is invalid.
4	CWI	CWL, P[n]-020=0 CCWL is valid, servo motor reverse running, Err15 alarm when it detecting CWI signal is ON. P[n]-020=1, CWL input is invalid.
5	PECLR	Deviations counter clear, use this function in position control, zero clear driver position deviation counter.
6	PINH	Pulse command prohibit, in position control prohibit command pulse input counter. When using this function, even there is command pulse input will not count, and lock the servo driver meanwhile.
7	ZCLAMP	Zero speed clamp: In speed control mode, when the speed command is less than a certain speed (the speed set by parameter P[n]-273), you can make the motor stop and servo lock through the function of ' zero speed clamp '. if the speed is clamped, the drive will exit the clamp when motor speed greater than the value of P[n]-273 + P[n]-274.(Refer to parameters P[n]-273~P[n]-277.) 

<table>
<tr><th>Set value</th><th>Symbol</th><th>Function description</th></tr>
<tr><td>8</td><td>TCCW</td><td>CCW torque limit, forward running torque limit.</td></tr>
<tr><td>9</td><td>TCW</td><td>CW torque limit, reverse running torque limit.</td></tr>
<tr><td>10</td><td>CMODE</td><td>Control mode switch
<table>
<tr><td rowspan="2">P[n]-004</td><td colspan="2">The state of CMODE</td></tr>
<tr><td>ON</td><td>OFF</td></tr>
<tr><td>8</td><td>Speed control mode</td><td>Position control mode</td></tr>
<tr><td>9</td><td>Torque control mode</td><td>Speed control mode</td></tr>
<tr><td>10</td><td>Torque control mode</td><td>Position control mode</td></tr>
</table></td></tr>
<tr><td>11</td><td>SP1</td><td rowspan="3">Internal position selection
<table>
<tr><th>SP3</th><th>SP2</th><th>SP1</th><th>Position command</th><th>Speed</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>P[n]-208, P[n]-209</td><td>P[n]-210</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>P[n]-213, P[n]-214</td><td>P[n]-215</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>P[n]-218, P[n]-219</td><td>P[n]-220</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>P[n]-223, P[n]-224</td><td>P[n]-225</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>P[n]-228, P[n]-229</td><td>P[n]-230</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>P[n]-233, P[n]-234</td><td>P[n]-235</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>P[n]-238, P[n]-239</td><td>P[n]-240</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>P[n]-243, P[n]-244</td><td>P[n]-245</td></tr>
</table></td></tr>
<tr><td>12</td><td>SP2</td></tr>
<tr><td>13</td><td>SP3</td></tr>
<tr><td>14</td><td>SC1</td><td rowspan="3">Internal speed selection (1-8)
<table>
<tr><th>SC3</th><th>SC2</th><th>SC1</th><th>Speed command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>Internal speed 1: P[n]-200</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>Internal speed 2: P[n]-201</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>Internal speed 3: P[n]-202</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>Internal speed 4: P[n]-203</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>Internal speed 5: P[n]-204</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>Internal speed 6: P[n]-205</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>Internal speed 7: P[n]-206</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>Internal speed 8: P[n]-207</td></tr>
</table></td></tr>
<tr><td>15</td><td>SC2</td></tr>
<tr><td>16</td><td>SC3</td></tr>
<tr><td>17</td><td>TRQ1</td><td rowspan="2">Internal torque selection (1-4)
<table>
<tr><th>TRQ2</th><th>TRQ1</th><th>Torque command</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Internal torque 1: P[n]-260</td></tr>
<tr><td>OFF</td><td>ON</td><td>Internal torque 2: P[n]-261</td></tr>
<tr><td>ON</td><td>OFF</td><td>Internal torque 3: P[n]-262</td></tr>
<tr><td>ON</td><td>ON</td><td>Internal torque 4: P[n]-263</td></tr>
</table></td></tr>
<tr><td>18</td><td>TRQ2</td></tr>
<tr><td>19</td><td>GEAR1</td><td rowspan="2">Electronic gear ratio select (1-4)
<table>
<tr><th>GEAR2</th><th>GEAR1</th><th>Gear ratio</th></tr>
<tr><td>OFF</td><td>OFF</td><td>P[n]-012/P[n]-013</td></tr>
<tr><td>OFF</td><td>ON</td><td>P[n]-326/P[n]-013</td></tr>
<tr><td>ON</td><td>OFF</td><td>P[n]-327/P[n]-013</td></tr>
<tr><td>ON</td><td>ON</td><td>P[n]-328/P[n]-013</td></tr>
</table></td></tr>
<tr><td>20</td><td>GEAR2</td></tr>
<tr><td>21</td><td>SDIR1</td><td rowspan="2">Speed running direction select:
When P[n]-042=0, CINV controls speed direction;
When P[n]-042=1, SDIR2 and SDIR1 together control speed direction.
<table>
<tr><th>SDIR2</th><th>SDIR1</th><th>Motor control</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Motor lock</td></tr>
<tr><td>OFF</td><td>ON</td><td>Motor forward running</td></tr>
<tr><td>ON</td><td>OFF</td><td>Motor reverse running</td></tr>
<tr><td>ON</td><td>ON</td><td>Motor lock</td></tr>
</table></td></tr>
<tr><td>22</td><td>SDIR2</td></tr>
</table>

Set value	Symbol	Function description
23	CINV	Speed command reverse. When P[n]-042=0, CINV controls speed direction, speed running is according to set direction when OFF, speed running is according to set reverse direction when ON. When P[n]-042=1, SDIR2 and SDIR1 together control speed direction.
24	EMGS	Emergency stop. When the signal connected, servo driver stops working.
25	SHOM	Launch the origin back.
26	ORGP	Origin back reference.
27	CNTR	Internal position running start signal, refer to SP1, SP2, SP3 explanation.

7.4 Digital output DO function definition

Set value	Symbol	Function description
1	SV_RY	Servo ready signal, when servo driver main power on, no alarm output, send out the signal within 1.5s.
2	ALM	Alarm output signal, when driver "d[P]-Err" file display alarming, output signal ON.
3	SV_F	Positioning complete signal, in position mode, position deviation left pulse less or equal to P[n]-254 sets value, output signal ON. **Note:** "P[n]-254" parameter set doesn't affect servo motor final position precision. When position deviation pulse more than "P[n]-255" parameter, servo driver output position overproof alarm Err8. 
4	BRK	Electromagnetic brake, mechanical band-type brake. When servo motor stops (servo motor running speed < P[n]-318) action sequence diagram:  2. When servo motor running (servo motor running speed ≥ P[n]-318) action sequence diagram:

Set value	Symbol	Function description
		
5	SV_S	Speed arrive signal, in speed mode, when motor actual rotating speed is over P[n]-256 sets value, output signal ON. 
6	SV_T	Torque arrival signal. In torque control mode, when motor speed exceeds the value of P[n]-259, the signal state of SV_T is ON.
7	HOME	The homing completion signal.
8	ZPS	Zero speed signal. When motor running speed low than zero speed check point, driver output ON signal, otherwise output OFF signal.

8. Alarm and Troubleshooting

8.1 Alarm causes and solving

 : **Normal**

 **: IPM protection**

Alarm Causes	Alarm Solving
Driver abnormal	Please contact manufacturer
Alarm during running:	
Parameter setting is abnormal.	Correctly reset parameter settings
Driver temperature is too high.	Please replace the motor and driver for bulky ones.
Be disturbed.	Bad grounding.
Alarm during Starting to stop:	
The load inertia is too large or the acceleration and deceleration time is too short.	Decrease load inertia; Increase acceleration and deceleration time of upper controller.

 **: Over current**

Alarm Causes	Alarm Solving
Alarm after servo on. Driver output short circuit.	Eliminate short circuit.
Alarm during running:	
Motor oscillation.	Correctly reset parameter settings
Load current is too large.	Please change for high-capacity driver.
Motor isolation is broken.	Please replace the motor.
Alarm during Starting to stop:	
The load inertia is too large or the acceleration and deceleration time is too short.	Decrease load inertia; Increase acceleration and deceleration time of upper controller.

 **: Under voltage**

Alarm Causes	Alarm Solving
Alarm during power on:	
Alarm during power on, circuit board fault.	Please contact manufacturer
Alarm during power on, there is no input voltage source for main circuit.	Reconfirm the power supply.
Alarm during running:	
Alarm during running, electric network voltage is low.	Measure the electric network voltage.

 **: Overvoltage**

Alarm Causes	Alarm Solving
Alarm during power on:	
Alarm during power on, circuit board fault.	Please contact manufacturer.
Alarm during running:	
Brake resistor does not work.	Brake resistor wire break; Brake transistor is broken; Brake resistor is broken.
Brake resistor capacity is too small.	Please change for high-capacity brake resistor.
Alarm during power on, overhigh voltage of power supply.	Please check power supply. Change driver.

Err 5: No current in analog channel A

Alarm Causes	Alarm Solving
Alarm during power on:	
Circuit board fault.	Please contact manufacturer.
Alarm during running:	
Circuit board fault.	Please contact manufacturer.

Err 6: No current in analog channel B

Alarm Causes	Alarm Solving
Alarm during power on:	
±12V power supply fault.	Please contact manufacturer.
Alarm during running:	
±12V power supply fault.	Please contact manufacturer.

Err 7: Over speed

Alarm Causes	Alarm Solving
Alarm during power on:	
Circuit board fault.	Please contact manufacturer.
Encoder fault.	Please replace the motor.
Alarm during running:	
Input command pulse frequency is too high.	Setting input pulse correctly
Bad encoder cable.	Please change encoder cable.
Acceleration and 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.
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.

Err 8: Position excessive deviation

Alarm Causes	Alarm Solving
Alarm during power on:	
Circuit board fault.	Please contact manufacturer.
Encoder fault.	Please replace the motor.
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 cable.
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: Torque command exceed limit.

Alarm Causes	Alarm Solving
Alarm during running:	
Torque command exceed limit of time is greater than the allowed time.	Adjust torque command.
Parameter setting is not reasonable.	Adjust parameters.

 : **FPGA chip fault**

Alarm Causes	Alarm Solving
Alarm during power on:	
Chip data-processing transmission fault.	Power-on afresh.
Chip or circuit board fault.	Please contact manufacturer.

 : **Encoder fault**

Alarm Causes	Alarm Solving
Alarm during power on:	
Bad connection of encoder's wiring.	Reconnect encoder cable well.
Encoder cable fault.	Change encoder cable.
Motor encoder fault.	Please replace the motor.
Circuit fault of driver encoder.	Please contact manufacturer.
Alarm during running:	
The encoder's plug gets loose because of mechanical vibration, for it is not screwed well.	Reconnect encoder line 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 cable fault.	Change encoder cable.
Motor encoder fault.	Please replace the motor.
Circuit fault of driver encoder.	Please contact manufacturer.

 : **Encoder signal transmission fault.**

Alarm Causes	Alarm Solving
Alarm during running:	
Bad connection of encoder's wiring.	Reconnect encoder cable well.
Encoder cable suffers from interference.	Shorten encoder cable as far as possible, and undertake shielding measures.
Encoder fault.	Please replace the motor.

 : **Z pulse lose**

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

 : **Driver module overheat protection**

Alarm Causes	Alarm Solving
Alarm during power on:	
Circuit board fault.	Please replace the driver
Unreasonable parameters setting.	Adjust parameters Correctly.
Motor exceed the rated torque running for a long time	Check load or replace high-power driver and motor.
Alarm during running:	
The load is too big	Please replace larger-power driver and motor
Fan can't work	The fan is damaged, change the driver.

Err 15: Drive overload protection

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

Err 16: Software over current

Alarm Causes	Alarm Solving
Alarm during running:	
Drive instantaneous current is too big	Please contact manufacturer

Er-17: Overload.

Alarm Causes	Alarm Solving
Alarm during power on:	
Circuit board fault.	Please replace the driver
Alarm during running:	
Motor exceed the rated torque running for a long time	Check load. Reduce start-stop frequency. Reduce the torque limit value. Change for high-power motor and driver.
Motor shock.	Adjust gain. Increase the acc/dec time. Reduce the load inertia.
U、V、W break or encoder wrong wiring.	Check wire.

Err 18: Overload.

Alarm Causes	Alarm Solving
Alarm during power on:	
Circuit board fault.	Please replace the driver
Alarm during running:	
Braking resistor wiring fault	Check wire.
Brake resistor does not work.	Change brake resistor.
Brake resistor capacity is too small.	Reduce start-stop frequency. Increase the acc/dec time. Reduce the load inertia. Change for high-power motor and driver.
The main circuit power supply is too high.	The main circuit power supply is too high.

Err24: Overload.

Alarm Causes	Alarm Solving
Alarm during running:	
Cannot fine the homing reference point	Check the signal of homing is normal or not.
Unreasonable parameter setting.	Adjust parameters.

Notice: If there is different alarm code from the above table, please contact the manufacturer.

9. Running and Debug

According to operation steps in EMHEATER 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:

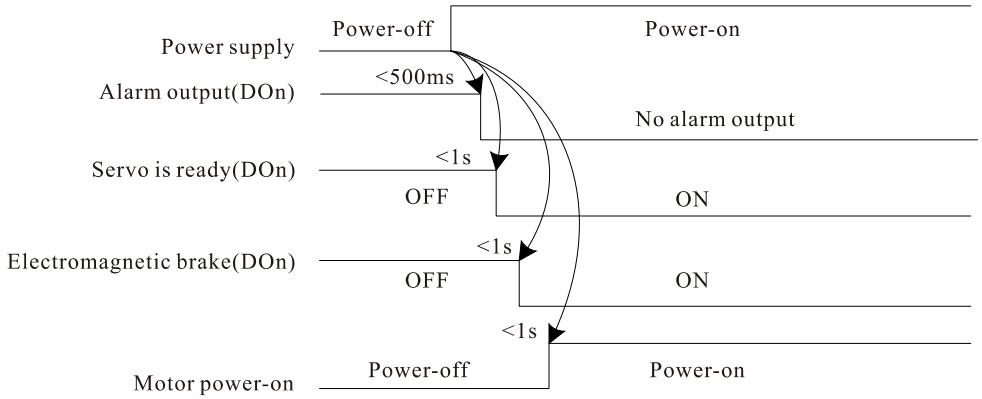
1. Wiring and inspection;
2. Powering on the driver, parameter tuning;
3. Running without load operation;
4. Control function tuning.

9.1 Servo driver power on

9.1.1 Inspect before power on

- Whether servo driver and servo motor matches with each other.
- R, S, T and U, V, W, can't connect reverse, can't lose connected.
- Whether input voltage is single phase 220V or three phase 220V.
- Whether the encoder terminal is connect well.
- Whether servo motor and servo driver are well-grounded.

9.1.2 Confirm power on sequence.



IO input user-defined EMA by parameters P-301~P-305, EMB by parameter Pn-301~Pn-307. IO output user-defined EMA by parameters P-309~P-311, EMB by parameter Pn-309~Pn-312 (refer to chapter7).

9.2 Running without load operation

9.2.1 Trial speed operation (Panel operation refer to chapter 5)

1. Set parameter of P[n]-004="2" to select speed trial run control mode. Enter into menu of "S[r]-", servo drive displays "S 0".
2. Press "▲" key to increase speed command, then enter into "d[P]-SPd" submenu to observe whether the actual rotate speed of motor is the setting velocity.
3. Press "▼" key to decrease speed command to a negative, then enter into "d[P]-SPd" submenu to observe whether the actual rotate speed of motor is the setting velocity.

9.2.2 JOG trial running (Panel operation refer to chapter 5)

1. Modify parameter "P[n]-022" to suitable JOG speed. Set parameter of "P[n]-004"=3 to select JOG trial run control mode. Enter into menu of "Jr-". Servo drive displays "J 0".

2. Press "▲" key and hold, motor will rotate in the direction of CCW at the speed of "P[n]-022". Release the key, motor will be in the state of zero-speed locked.
3. Press "▼" key and hold, motor will rotate in the direction of CW at the speed of "P[n]-022". Release the key, motor will be in the state of zero-speed locked.

9.3 Control function debugging

There are two ways to enable the servo drive:

1. The first, it can be reached by external digital IO input terminal (DIn), For example set parameter P[n]-301=1, DI1 input the servo on signal.
2. Second, it can be inner compelled by setting P[n]-057 = 2.

9.3.1 Position control

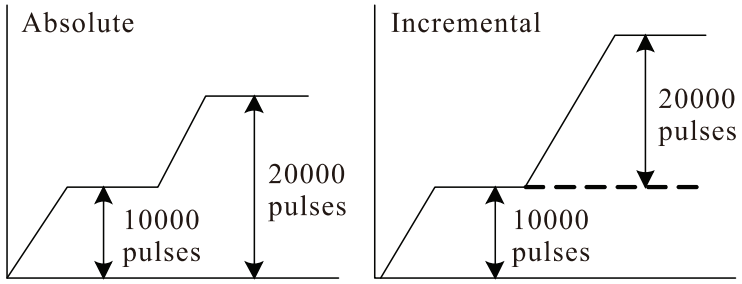
In the position control mode, the position command can be gived by external terminal or parameters. Measuring the power supply of R,S,T(3-phase 220V or 1-phase 220V) is normal or not before wiring, Make sure there are no problems connect the power cord and power on. Reference to the motor adapter table (Appendix) modifies the parameter of "Pn-001" as the corresponding motor model code. Enter into the menu group of "E[E]-"and select "E[E]-dEF", press ‘SET’ key. If "done/FInISh" is shown on nixie tube means the driver’s parameters have been recovered to factory defaults, Power-off. Wiring correct, and no-load test first.

1. Internal position control:

(1) Set parameters of "P[n]-004=0" and "P[n]-025=1" to select internal position control mode.

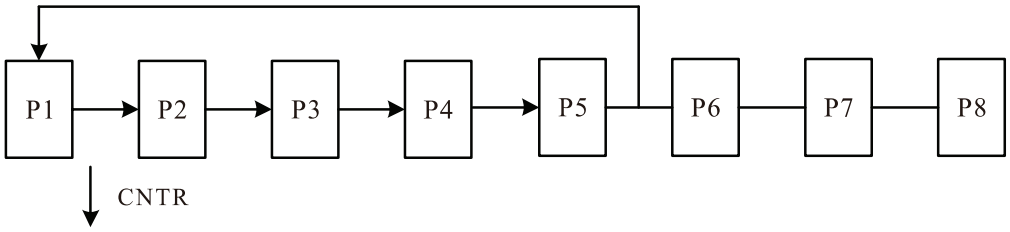
(2) Operating instructions:

① The position command is supplied by parameters (P[n]-208,P[n]-209)~(P[n]-243,P[n]-244). Set the position command calculation according to parameter P[n]-248,difference is shown below.(e.g.: P1=10000，P2=20000.)



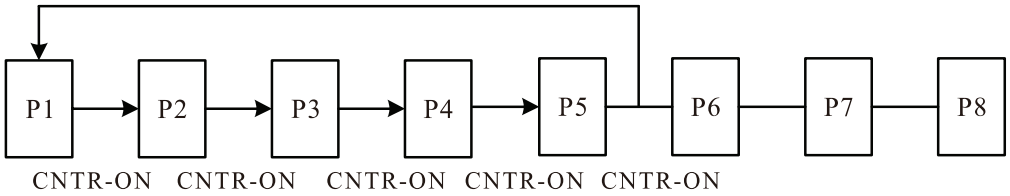
② Select the running mode of internal position control by parameter P[n]-249:

a. P[n]-249=0,P[n]-251=5: When CNTR signal is detected a valid jump,servo drive runs once with the number of the position segment set by P[n]-251,and finally stopped at the first location,and output positioning completed signal. It should be noted, the CNTR trigger signal is valid only when the positioning is completed, otherwise the signal CNTR will not be response.



b. Pn-249=1,P[n]-251=6: In this mode,the drive will always loop runs with the number of the position

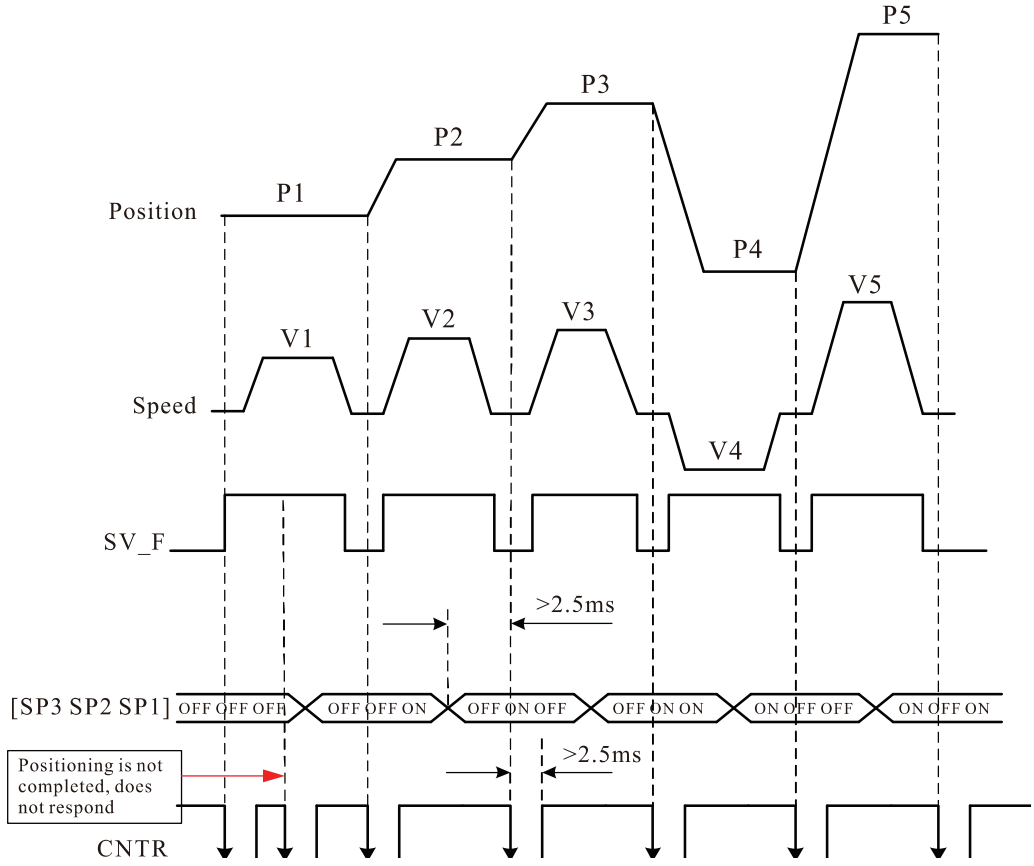
segment set by P[n]-251 until CNTR becomes invalid.



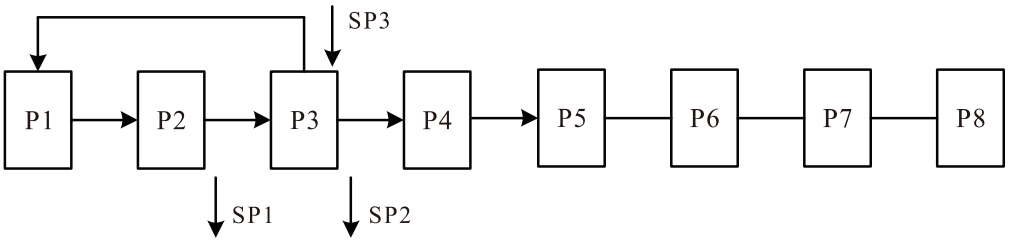
c. P[n]-249=2: In this mode, SP1, SP2 and SP3 are set to specify the running position, the falling edge of signal CNTR start running.

e.g.: [SP3, SP2 ,SP1] = [OFF,OFF,OFF], CNTR signal input falling edge,then the drive runs with the position command set by parameters Pn-208 and P[n]-209, and positioning complete signal output when the position command is finished.

SP3	SP2	SP1	CNTR	Position command	Speed
OFF	OFF	OFF	↓	P[n]-208, P[n]-209	P[n]-210
OFF	OFF	ON	↓	P[n]-213, P[n]-214	P[n]-215
OFF	ON	OFF	↓	P[n]-218, P[n]-219	P[n]-220
OFF	ON	ON	↓	P[n]-223, P[n]-214	P[n]-225
ON	OFF	OFF	↓	P[n]-228, P[n]-229	P[n]-230
ON	OFF	ON	↓	P[n]-233, P[n]-234	P[n]-235
ON	ON	OFF	↓	P[n]-238, P[n]-239	P[n]-240
ON	ON	ON	↓	P[n]-243, P[n]-244	P[n]-245



d. P[n]-249=3(P[n]-251=5,Current position is P3): SP3 signal is detected a valid jump, servo drive runs to the first location; SP2 signal is detected a valid jump, servo drive runs to the previous location, if it is the first location, stop here; SP1 signal is detected a valid jump, servo drive runs to the next location, if it is the last location, stop here.



(3) Several key parameters associated with internal position control mode: P[n]-004, P[n]-005, P[n]-006, P[n]-009, P[n]-010, P[n]-025, P[n]-208~P[n]-251, P[n]-301~P[n]-307 (Refer to chapter 7). Set the parameter values correct after power on. If there is no problem enable the drive, and give position command by changing the status of signals CNTR,SP1,SP2 and SP3. Observe the dynamic effect of motor and adjust gain for reasonable value.

9.3.2 Speed control

In the speed control mode, the speed command can be gived by analog input or parameters. Measuring the power supply of R,S,T(3-phase 220V or 1-phase 220V) is normal or not before wiring, Make sure there are no problems connect the power cord and power on. Reference to the motor adapter table (Appendix) modifies the parameter of "P[n]-001" as the corresponding motor model code. Enter into the menu group of "E[E]-" and select "E[E]-dEF", press "SET" key. If "donE/FInISh" is shown on nixie tube means the driver's parameters have been recovered to factory defaults, Power-off. Wiring correct, and no-load test first.

1.Internal speed control

(1) Set parameter of "P[n]-004=1" and "P[n]-024=1" to select internal speed control mode.

(2) Operating instructions:

① The speed command is supplied by parameters P[n]-200~ P[n]-207.

② Set parameters of "P[n]-302=14", "P[n]-303=15" and "P[n]-304=16" which define DI2,DI3 and DI4 input functions for SC1, SC2 and SC3. Select respective internal speed command by signals SC1,SC2 and SC3.The corresponding relationship is as follows. (Refer to chapter 7.3.)

Note: OFF-The switch status is opened. ON-The switch status is turned.

SC3	SC2	SC1	Position command
OFF	OFF	OFF	Internal speed 1: P[n]-201
OFF	OFF	ON	Internal speed 2: P[n]-201
OFF	ON	OFF	Internal speed 3: P[n]-202
OFF	ON	ON	Internal speed 4: P[n]-203
ON	OFF	OFF	Internal speed 5: P[n]-204
ON	OFF	ON	Internal speed 6: P[n]-205
ON	ON	OFF	Internal speed 7: P[n]-206
ON	ON	ON	Internal speed 8: P[n]-207

③ Several key parameters associated with internal speed control mode: P[n]-004, P[n]-005, P[n]-006, P[n]-024, P[n]-042, P[n]-052, P[n]-053, P[n]-200~P[n]-207, P[n]-301~P[n]-307 (Refer to chapter 7). Set the parameter values correct after power on. If there is no problem enable the drive, and give speed command by changing the status of signals SC1,SC2 and SC3. Observe the dynamic effect of motor and adjust gain for reasonable value.

2. Analog speed control mode

(1) Set parameters of "P[n]-004=1" and "P[n]-024=0" to select analog speed control mode.

(2) Several key parameters associated with internal speed control mode: P[n]-004, P[n]-005, P[n]-006, P[n]-024, P[n]-031, P[n]-042, P[n]-043, P[n]-051, P[n]-052, P[n]-053 (Refer to chapter 7). Set the

parameter values correct after power on. If there is no problem enable the drive. Wait for the "RUN" indicator light up, perform automatic zero drift compensation operation: Enter into menu of "A[U]-". Choose the submenu of "A[U]-SPd", and press "SET" key, until "donE/FInISh" is displayed on nixie tube, compensation value will be write to parameter "P[n]-043".Upper control output analog instruction to drive after the above steps are completed. Observe the dynamic effect of motor and adjust gain for reasonable value.

9.3.3 Torque control

In the torque control mode, the torque command can be gived by analog input or parameters. Measuring the power supply of R,S,T(3-phase 220V or 1-phase 220V) is normal or not before wiring, Make sure there are no problems connect the power cord and power on. Reference to the motor adapter table (Appendix) modifies the parameter of "P[n]-001" as the corresponding motor model code. Enter into the menu group of "E[E]-" and select "E[E]-dEF", press "SET" key. If "donE/FInISh" is shown on nixie tube means the driver's parameters have been recovered to factory defaults, Power-off. Wiring correct, and no-load test first.

1. Internal torque control

(1) Set parameters of "P[n]-004=6" and "P[n]-026=1" to select internal torque control mode.

(2) Operating instructions：

① The torque command is supplied by parameters P[n]-260~ P[n]-263.

② Set parameters of "P[n]-302=17" and "P[n]-303=18" which define DI2,DI3 input functions for TRQ1 and TRQ2.Select respective internal torque command by signals TRQ1 and TRQ2.The corresponding relationship is as follows. (Refer to chapter 7.3.)

Note: OFF-The switch status is opened. ON-The switch status is turned

TRQ2	TRQ1	Torque command
OFF	OFF	Internal torque 1: P[n]-260
OFF	OFF	Internal torque 2: P[n]-261
OFF	ON	Internal torque 3: P[n]-262
OFF	ON	Internal torque 4: P[n]-263

③ Several key parameters associated with internal torque control mode: P[n]-004, P[n]-026, P[n]-033, P[n]-260~P[n]-263, P[n]-268, P[n]-269, P[n]-271, P[n]-272, P[n]-301~P[n]-307 (Refer to chapter 7). Set the parameter values correct after power on. If there is no problem enable the drive, and give torque command by changing the status of signals TRQ1 and TRQ2. Observe the dynamic effect of motor and adjust gain for reasonable value.

2.Analog torque control

(1) Set parameters of "P[n]-004=6" and "P[n]-026=0" to select analog torque control mode.

(2) Several key parameters associated with analog torque control mode: P[n]-004, P[n]-026, P[n]-033, P[n]-041, P[n]-045, P[n]-268, P[n]-269, P[n]-271, P[n]-272 (Refer to chapter 7). Set the parameter values correct after power on. If there is no problem enable the drive. Wait for the "RUN " indicator light up, perform automatic zero drift compensation operation: Enter into menu of "A[U]-",choose the submenu of "A[U]-trq", and press "SET" key, until "donE/FInISh" is displayed on nixie tube, compensation value will be write to parameter "Pn-045". Upper control output analog instruction to drive after the above steps are completed. Observe the dynamic effect of motor and adjust gain for reasonable value.

10. Servo Motor Introduction

10. 1 Nameplate and model introduction

10.1.1: Nameplate introduction

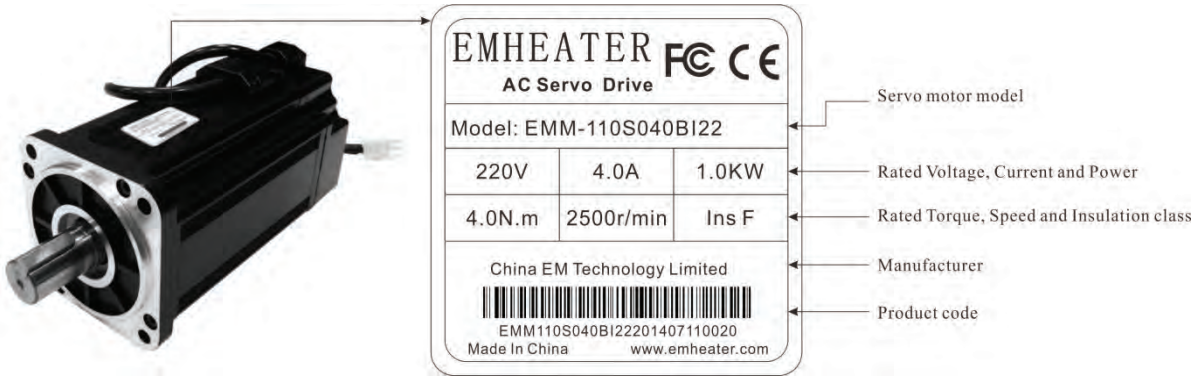


Diagram 10.1 Servo motor's nameplate introduction

10.1.2 Mode introduction

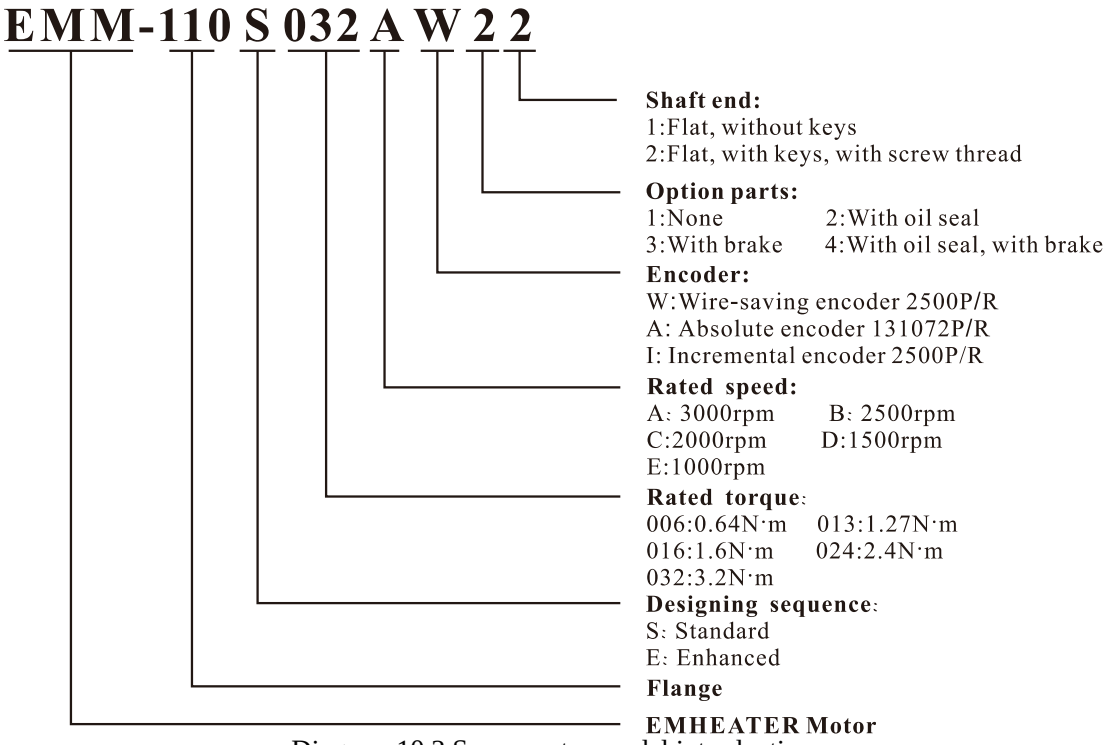


Diagram 10.2 Servo motor model introduction

10.2 Names of motor’s parts

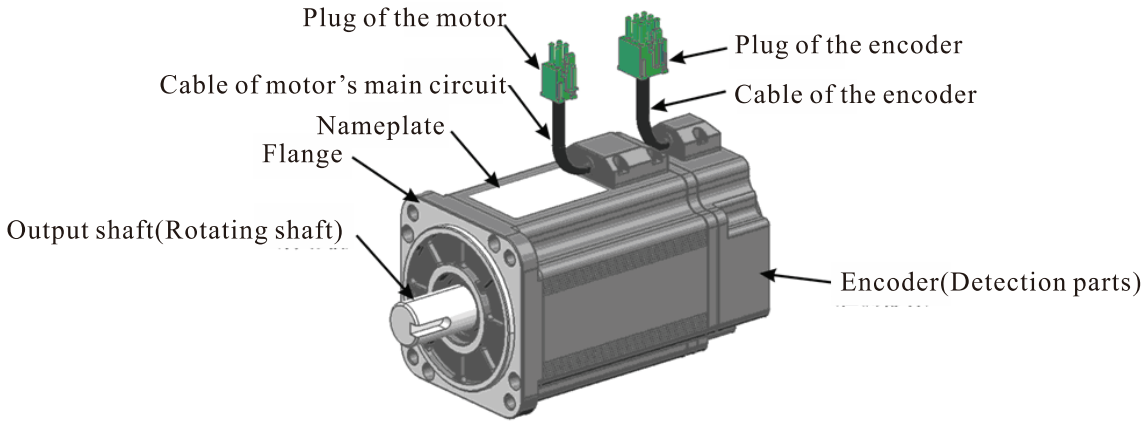
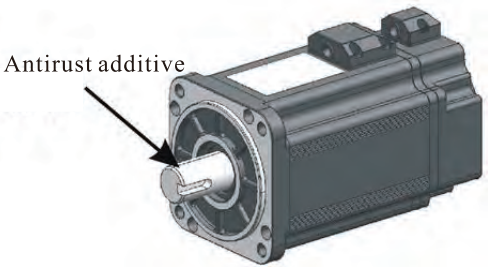


Diagram 10.3: Names of motor's parts

10.3 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.



10.3.1 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 ^{o}C ~40 ^{o}C.
- Storage temperature: -40^{o}C~50 ^{o}C.
- The relative humidity keeps in the limits of 30%~95%RH; no dewing.
- Be convenient for examining and clearing.

10.3.2 Installation dimension

1: EMM 60 and 80 series

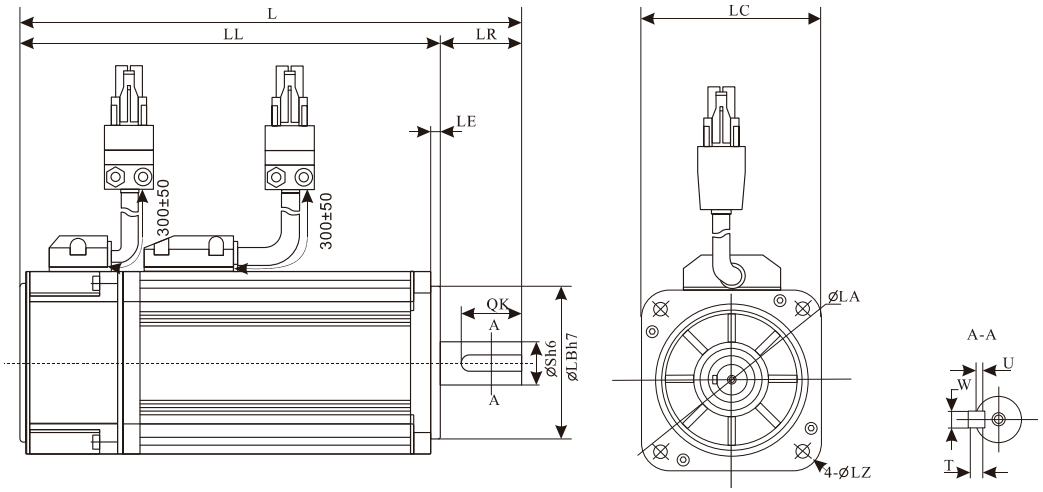


Diagram 10.4: EMM 60 and 80 series servo motor installation dimension

Servo motor model		EMM-60S		EMM-80S		
		006A	013A	016A	024A	032A
Rated output power	W	200	400	500	750	1000
Rated torque	N·m	0.64	1.27	1.6	2.4	3.2
Max. torque	N·m	1.92	3.81	4.8	7.2	9.6
Rated current	A	1.5	2.5	3.0	4.0	5.2
Max. current	A	4.5	7.5	9.0	12.0	15.6
Rated speed	r/min	3000				
Max. speed	r/min	4500				
Moment of inertia	$x10^{-4}Kg·m^2$	0.19(0.26)	0.33(0.40)	1.09(1.29)	1.24(1.44)	1.59(1.79)
Encoder	Stand	Incremental encoder 2500P/R				
Insulation class		F				
Ambient temperature		0~45 °C (No freezing)				
Ambient humidity		30~95%RH(Non-dewing)				
Protection		IP65(Except for shaft opening and connectors)				
L		140(180)	165(205)	158(201)	173(216)	193(236)
LL		110(150)	135(175)	123(166)	138(181)	158(201)
LR		30	30	35	35	35
LE		3	3	3	3	3
LC		60	60	80	80	80
LA		70	70	90	90	90
LB		50	50	70	70	70
LZ		5	5	6	6	6
S		14	14	19	19	19
QK		20	20	25	25	25
W		5	5	6	6	6
T		5	5	6	6	6
U		3	3	3.5	3.5	3.5

Remark: The size in bracket is for servo motor with braking

2: EMM 110 and 130 series

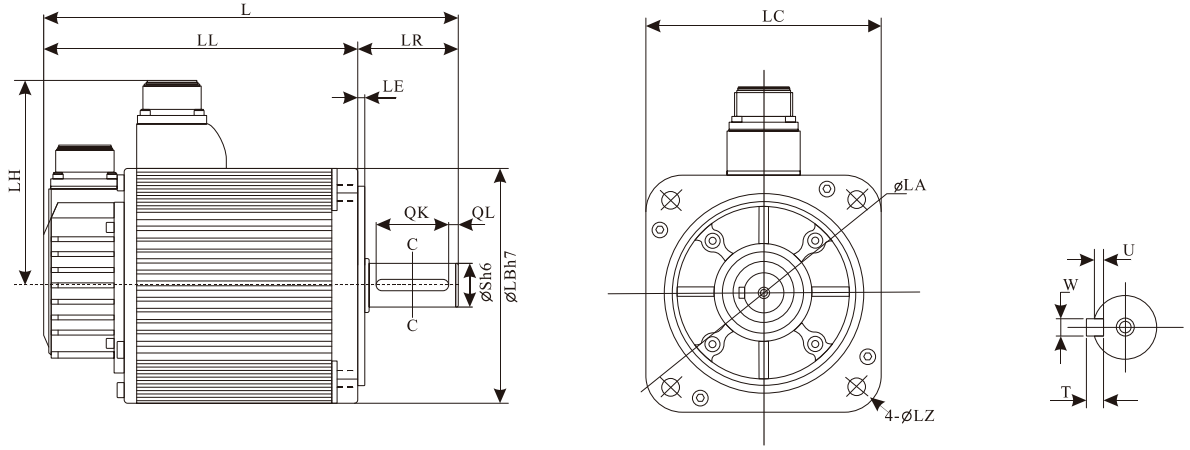


Diagram 10.5: EMM 110and 130 series servo motor installation dimension

Servo motor model		EMM-110S		EMM-130S					
		040B	060B	040B	050B	060B	060E	075B	075C
Rated output power	W	1.0	1.57	1.0	1.3	1.57	0.63	1.96	1.57
Rated torque	N·m	4.0	6.0	4.0	5.0	6.0	6.0	7.5	7.5
Max. torque	N·m	12	18	12	15	18	18	22.5	22.5
Rated current	A	4.0	6.0	4.2	5.0	6.2	3.6	7.8	6.5
Max. current	A	12	18	12.6	15	18.6	10.8	23.4	19.5
Rated speed	r/min	2500					1000	2500	2000
Max. speed	r/min	3200					1500	3200	2500

Servo motor model		EMM-110S		EMM-130S					
		040B	060B	040B	050B	060B	060E	075B	075C
Moment of inertia	x10^{-4}Kg·m^2	5.4 (6.0)	7.5 (8.1)	8.9 (9.5)	9.7 (10.3)	12.4 (13.0)	12.4 (13.0)	17.2 (17.8)	17.2 (17.8)
Encoder	Standard	Incremental encoder 2500P/R							
Insulation class		F							
Ambient temperature		0~45 °C (No freezing)							
Ambient humidity		20~80%RH(Non-dewing)							
Protection		IP65(Except for shaft opening and connectors)							
L		238 (293)	278 (333)	215 (267)	221 (273)	231 (283)	231 (283)	251 (303)	251 (303)
LL		185 (240)	225 (280)	159 (211)	165 (217)	175 (227)	175 (227)	195 (247)	195 (247)
LH		99	99	113	113	113	113	113	113
LR		53	53	56	56	56	56	56	56
LE		5	5	4	4	4	4	4	4
LC		110	110	130	130	130	130	130	130
LA		130	130	145	145	145	145	145	145
LB		95	95	110	110	110	110	110	110
LZ		8.5	8.5	9	9	9	9	9	9
S		19	19	22	22	22	22	22	22
QK		0	0	7.5	7.5	7.5	7.5	7.5	7.5
W		35	35	35	35	35	35	35	35
T		6	6	6	6	6	6	6	6
U		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5

Servo motor model		EMM-130-S-						
		075E	100B	100C	100D	100E	150C	150D
Rated output power	W	0.79	2.6	2.1	1.57	1.0	3.1	2.35
Rated torque	N·m	7.5	10	10	10	10	15	15
Max. torque	N·m	22.5	20	20	20	20	30	30
Rated current	A	4.5	10.5	9.0	6.5	5.0	11.5	9.0
Max. current	A	13.5	21.0	18	13	10	21	18
Rated speed	r/min	1000	2500	2000	1500	1000	2000	1500
Max. speed	r/min	1500	3200	2500	2000	1500	2400	2000
Moment of inertia	x10^{-4}Kg·m^2	17.2 (17.8)	21.9 (22.5)	21.9 (22.5)	21.9 (22.5)	21.9 (22.5)	28.9 (29.5)	28.9 (29.5)
Encoder	Stand	Incremental encoder 2500P/R						
Insulation class		F						
Ambient temperature		0~45 °C (No freezing)						
Ambient humidity		20~80%RH(Non-dewing)						
Protection		IP65(Except for shaft opening and connectors)						
L		251 (303)	271 (323)	271 (323)	271 (323)	271 (323)	301 (353)	301 (353)
LL		195 (247)	215 (267)	215 (267)	215 (267)	215 (267)	245 (297)	245 (297)
LH		113	113	113	113	113	113	113
LR		56	56	56	56	56	56	56
LE		4	4	4	4	4	4	4
LC		130	130	130	130	130	130	130
LA		145	145	145	145	145	145	145
LB		110	110	110	110	110	110	110
LZ		9	9	9	9	9	9	9
S		22	22	22	22	22	22	22
QK		7.5	7.5	7.5	7.5	7.5	7.5	7.5

Servo motor model	EMM-130-S-						
	075E	100B	100C	100D	100E	150C	150D
W	35	35	35	35	35	35	35
T	6	6	6	6	6	6	6
U	3.5	3.5	3.5	3.5	3.5	3.5	3.5

Remark: The size in bracket is for servo motor with braking

10.3.3 Installation direction

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

10.3.4 Damp proof and dustproof

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

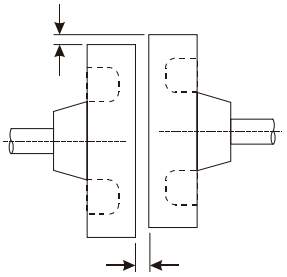
(2) When being used in the place where there is oil-drop dripping to the shaft opening, please appoint servo motor with oil seal. Please make sure the oil level is lower than the oil seal's lip while using, and the oil seal can keep the splashing oil-foam in good condition. When using servo motor above 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.

10.3.5 Coordination with machine

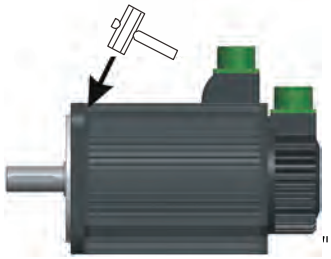
1. When connecting with machine, please use elastic couplings as far as possible, and keep the axle centre of servo motor is in a line with that of mechanical load. The installation of servo motor should meet the demands of concentricity tolerance as the following chart shows.

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

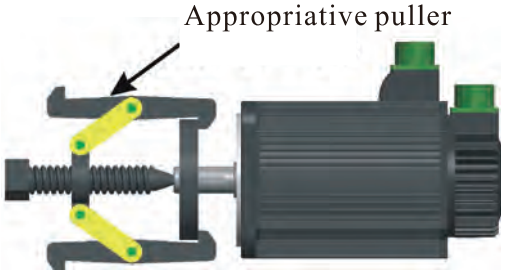


Warning	If the concentricity were out of tolerance, it would cause mechanical vibration which may damage the bearings and encoder.

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 reasons, please knock the front end of flange plate with rubber hammer or plastic hammer as far as possible.



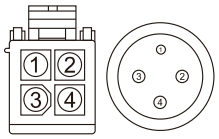
3. For removing wheel and pulley, please use an appropriative puller.



10.4 Servo motor terminal definition and wiring

1: Motor plug terminal (4 cores)

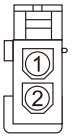
Terminal pins	1	2	3	4
Signal definition	PE	U	V	W



2: Braker connector terminal

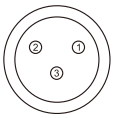
(1) 2 cores terminal signal definition

Terminal pins	1	2
Signal definition	+24V	0V



(2) 3 cores terminal signal definition

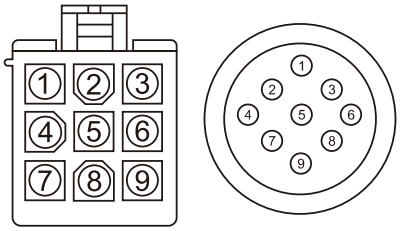
Terminal pins	1	2
Signal definition	+24V	0V



3: Encoder feedback terminal

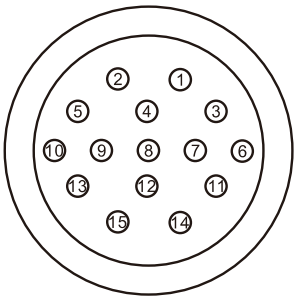
(1) 9 cores terminal signal definition

Terminal pins	Signal definition		
	Wire-saving encoder	Absolute encoder	Resolver
1	FG	FG	FG
2	+5V	+5V	
3	0V	0V	
4	A+		R1
5	B+	SD+	R2
6	Z+	VB+	SIN+
7	A-	VB-	SIN-
8	B-	SD-	COS+
9	Z-		COS-



(2) 15 cores terminal signal definition

Terminal pins	Signal definition		
	Wire-saving encoder	Absolute encoder	Resolver
1	FG	FG	FG
2	+5V	+5V	
3	0V	0V	
4	A+		R1
5	B+	SD+	R2
6	Z+	VB+	SIN+
7	A-	VB-	SIN-
8	B-	SD-	COS+
9	Z-		COS-
10	U+		
11	V+		
12	W+		
13	U-		
14	V-		
15	W-		

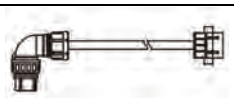
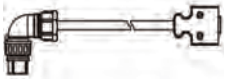


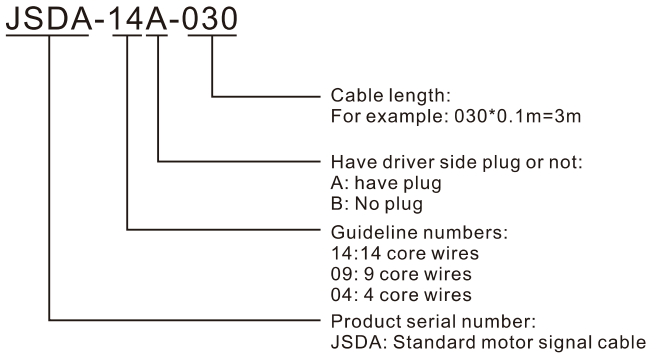
Appendix

1. Adaptation motor table

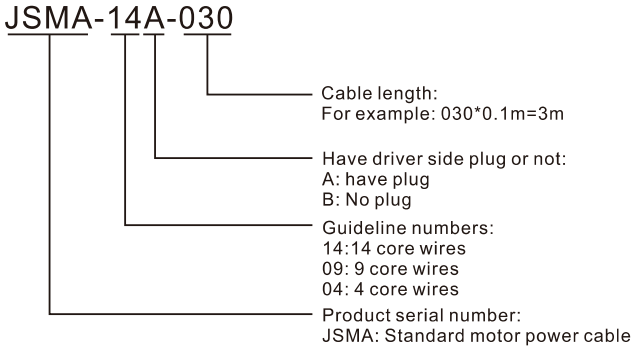
Motor code (P[n]001)	Model	Rated torque(N·m)	Rated speed (rmp)	Rated current (A)	Rated power (KW)	Match to drive
10	EMM-130S075C	7.5	2000	6.5	1.57	EMB-30
11	EMM-130S075B	7.5	2500	7.8	1.96	
12	EMM-130S075A	7.5	3000	8.8	2.36	
13	EMM-130S100D	10	1500	6.5	1.57	
14	EMM-130S100C	10	2000	9.0	2.10	
15	EMM-130S100B	10	2500	10.5	2.60	
16	EMM-130S100A	10	3000	12.5	3.14	
17	EMM-130S150D	15	1500	9.0	2.35	
18	EMM-130S150C	15	2000	11.5	3.10	
22	EMM-130S060E EMM-130E060E	6	1000	3.6	0.63	EMA-10
23	EMM-130S075E	7.5	1000	4.5	0.79	
24	EMM-130S100E	10	1000	5.0	1.00	
30	EMM-60S006A	0.64	3000	1.5	0.20	EMA-05
31	EMM-60S013A	1.27	3000	2.5	0.40	
34	EMM-80S016A	1.6	3000	3.0	0.50	EMA-08
35	EMM-80S024A	2.4	3000	4.0	0.75	
36	EMM-80S032A	3.2	3000	5.2	1.00	
37	EMM-80S038A	3.8	3000	5.0	1.20	
40	EMM-130S040B	4	2500	4.2	1.00	EMA-10 EMB-15
41	EMM-130S050B	5	2500	5.0	1.30	
42	EMM-130S060B	6	2500	6.2	1.57	
50	EMM-110S040B	4	2500	4.2	1.00	
51	EMM-110S040A	4	3000	4.6	1.26	
52	EMM-110S060B	6	2500	6.4	1.57	
53	EMM-110S060A	6	3000	7.5	1.89	
61	EMM-130S050A	5	3000	6.8	1.57	
62	EMM-130S060A	6	3000	7.3	1.88	
43	EMM-130S075C	7.5	2000	6.5	1.57	EMB-25
44	EMM-130S100C	10	2000	9.0	2.10	
45	EMM-130S100D	10	1500	6.5	1.57	
46	EMM-130S150D	15	1500	9.0	2.35	
47	EMM-130S075B	7.5	2500	7.8	1.96	
48	EMM-130S100B	10	2500	10.5	2.60	
49	EMM-130S150C	15	2000	11.5	3.10	

2. Standard motor cable model

Model	Specification	Model	Specification
Power cable			
JSMA-04A□□□		JSMB-04A□□□	
JSMA-04B□□□		JSMB-04B□□□	
JSMC-04A□□□		JSMD-04A□□□	
JSMC-04B□□□		JSMD-04B□□□	
Signal cable			
JSDA-14A□□□		JSDB-09B□□□	
JSDA-14B□□□		JSDC-09A□□□	
JSDB-09A□□□		JSDC-09B□□□	
Encoder cable		**Resolver cable**	
JSAB-09A□□□		JSRA-09A□□□	
JSAC-09A□□□		JSRA-09B□□□	



Motor signal (Encoder) cable model introduction



Motor power cable model introduction